Meantone Temperament

Meantone temperament is a system of musical tuning designed to improve the consonance of major thirds by slightly narrowing perfect fifths. Unlike just intonation, where fifths are pure, meantone narrows each fifth—such as C to G—by approximately 1/4 of a syntonic comma (about 5.38 cents).

This small adjustment results in major thirds, like C to E, that closely match their just intonation counterparts and sound much smoother than in equal temperament. In fact, a chain of four consecutive meantone fifths—C–G, G–D, D–A, A–E—naturally compresses into a nearly pure major third, producing a resonant and harmonically rich sound in the central keys of the scale.

Characteristics

Compromise Tuning	Improves major thirds by slightly narrowing the fifths.
Regular Temperament	All fifths are adjusted by the same amount (based on the meantone system used).
Harmonic Orientation	Based on consonant thirds rather than pure fifths.
Keyboard Tuning	Favored for instruments like harpsichords, organs, and early pianos.

Advantages

- Produces 8 pure major thirds across a keyboard.
- Excellent for music centered on closely related keys (those with few sharps or flats).
- Better consonance than equal temperament for music that emphasizes triads and stable chords.

Limitations

- In meantone temperament, the unequal spacing of notes creates a very dissonant fifth known as the wolf fifth. This interval limits the number of usable keys.
- Modulating to distant keys introduces noticeable tuning inconsistencies. As a result, meantone temperament is not well suited for highly chromatic or modulatory music.

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Variety of Meantone Temperaments

There is no single "meantone temperament"—many variants exist, each differing in how much the fifths are narrowed and how many usable keys they allow. In this document, we will focus on 55-EDO (Equal Divisions of the Octave) as an example, but other systems will also be included in the comparative table later.

Historical Development of Meantone Temperament

Origins and Motivation

- 15th Century Emergence:
  Meantone temperament developed as a solution to the limitations of Pythagorean tuning, which produced dissonant major thirds.
- Theoretical Foundations:
  Early advocates of meantone temperament sought a system that would produce smoother, more pleasing harmonies, particularly pure major thirds.

Rise in Popularity

- Renaissance and Baroque Usage:
  Meantone temperament became the dominant tuning system for keyboard instruments (e.g., harpsichord, organ) from the early 16th century through the Baroque era.
- Musical Impact:
  Composers favored meantone for its harmonic clarity and expressive capabilities in diatonic (notes of one key) and closely related keys.

Decline

- By the mid-18th century, the growing demands for modulation to distant keys and more harmonically adventurous compositions led to the adoption of equal temperament, which offered key flexibility at the cost of perfect consonance.

Use of Meantone Temperament by Major Composers

Many important composers from the Renaissance and Baroque times used meantone temperament, which helped them create more expressive music in certain keys. Some well-known examples are Claudio Monteverdi (1567–1643), Henry Purcell (1659–1695), and Johann Sebastian Bach (1685–1750).

Mozart's Tuning: 55-EDO and Its Relation to 1/6-Comma Meantone

Historical Context

It is believed that Leopold Mozart taught his son Wolfgang Amadeus Mozart to use a form of meantone tuning, specifically one in which flats are higher in pitch than enharmonic sharps (e.g., A♭ is higher than G♯). Although no exact documentation of the Mozarts' tuning system survives, there are compelling clues drawn from historical sources and treatises.

Clues from Historical Writings

Francesco Tosi (1723)

- In his influential treatise, Tosi described a tuning system equivalent to a form of regular meantone temperament.
- He divided the octave theoretically into 55 equal parts, assigning:
  - A large diatonic semitone = 5/9 of a whole tone
  - A small chromatic semitone = 4/9 of a whole tone
- This system tempers the perfect fifth by approximately 1/6 of a syntonic comma, placing it between 1/4-comma meantone and equal temperament in terms of fifth size.

Leopold Mozart (1756)

- In his *Violinschule* (Violin School), Leopold endorses what we now call extended regular meantone temperament as the correct tuning for the violin.
- He describes that in this system, flats are a comma higher than the corresponding sharps, illustrating a non-equivalence of enharmonic pitches.
- He also notes that keyboard instruments were typically played in a tempered system, but still implies that more natural intervals were used on string instruments.

55-EDO and 1/6-Comma Meantone Construction

55-EDO (Equal Divisions of the Octave) is a tuning system that divides the octave into 55 equal steps. It contains:

- Two distinct semitone sizes (chromatic and diatonic)

- One consistent whole tone
- Fifths tempered by ~1/6 of a syntonic comma (~3.58 cents)

The 1/6-comma meantone is a type of regular meantone temperament where each perfect fifth is narrowed by one-sixth of a syntonic comma. This tuning produces smoother major thirds than equal temperament while allowing for more usable keys than the 1/4-comma meantone. The 55-EDO (Equal Division of the Octave) system closely approximates 1/6-comma meantone, making it an excellent equal-step representation of this tuning.

Implications for Mozart's Music

- Wolfgang Mozart likely composed and played within a tuning framework that reflected these meantone principles, especially in his earlier works and for string instruments.
- The use of enharmonic distinction (A♭ ≠ G♯) and non-equal semitones would have created a subtle but expressive tuning landscape.
- While Wolfgang may have transitioned to well temperament or even early equal temperament later in life, his foundational training was rooted in meantone aesthetics, as outlined by his father.

Different Meantone Tunings: 1/4, 1/5, and 1/6-Comma

Meantone temperaments are defined by how much they temper (narrow) the perfect fifth. This affects the purity of the major third and the number of usable keys before encountering harsh dissonances like the wolf fifth.

Quick Comparison Chart

Tuning Type	Fifth Size	Major Third Quality	Circle of Fifths	Wolf Interval Severity
1/4-comma	~696.58¢	Very pure (≈386¢)	No (breaks after 8 keys)	Severe
1/5-comma	~697.35¢	Fairly pure	Almost closes	Moderate
1/6-comma	~697.80¢	Less pure, better than ET	Yes (12 usable keys)	Mild
Equal Temperament	700.00¢	All equally tempered (400¢)	Fully closes (12 keys)	None, but impure thirds

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How They Sound

¼-Comma Meantone

- Major Thirds: Almost perfectly just (386.3¢) — beautiful, pure harmony.
- Fifths: Noticeably narrow (~696.6¢), somewhat tense.
- Key Range: Only about 8 usable keys; extreme key color and strong tonal contrast.
- Ideal for: Renaissance and early Baroque music (e.g., Sweelinck, early Frescobaldi).

⅕-Comma Meantone

- Major Thirds: Still quite pure, a good compromise.
- Fifths: Less narrow (~697.4¢), more stable.
- Key Range: About 10 keys before hitting the wolf.
- Ideal for: Middle Baroque period — suitable for composers like Froberger, Buxtehude, early Purcell.

⅙-Comma Meantone

- Major Thirds: Slightly sharp (~392¢), but noticeably sweeter than in Equal Temperament.
- Fifths: Barely tempered (~697.8¢), close to ET.
- Key Range: All 12 keys are usable — the circle of fifths closes cleanly.
- Ideal for: Late Baroque and early Classical repertoire, including Bach, Handel, and possibly Mozart.

Comparison Between Meantone Scales

Note	Classic Name	12-EDO Steps	12-EDO Cents	19-EDO Steps	19-EDO Cents	31-EDO Steps	31-EDO Cents	50-EDO Steps	50-EDO Cents
C	Unison	0	0	0	0	0	0	0	0
Cb	Diminished second			1	63.16	1	38.71	2	48
C#	Chromatic semitone	1	100			2	77.42	3	72
Db	Minor second			2	126.32	3	116.13	5	120
D	Whole tone	2	200	3	189.47	5	193.55	8	192
Ebb	Diminished third			4	252.63	6	232.26	10	240
D#	Augmented second	3	300		252.63	7	270.97	11	264
Eb	Minor third			5	315.79	8	309.68	13	312
E	Major third	4	400	6	378.95	10	387.1	16	384
Fb	Diminished fourth			7	442.11	11	425.81	18	432
E#	Augmented third	5	500			12	464.52	19	456
F	Perfect fourth			8	505.26	13	503.23	21	504
F#	Augmented fourth	6	600	9	568.42	15	580.65	24	576
Gb	26			10	631.58	16	619.35	26	624
G	Perfect fifth	7	700	11	694.74	18	696.77	29	696
Abb	Diminished sixth			12	757.89	19	735.48	31	744
G#	Augmented fifth	8	800			20	774.1	32	768
Ab	Minor sixth			13	821.05	21	812.89	34	816
A	Major sixth	9	900	14	884.21	23	890.32	37	888
Bbb	Diminished seventh			15	947.37	24	929.03	39	936
A#	Augmented sixth	10	1000			25	967.74	40	960
Bb	Minor seventh			16	1010.53	26	1006.45	42	1008
B	Major seventh	11	1100	17	1073.68	28	1083.87	45	1080
Cb	Diminished octave			18	1136.84	29	1122.58	47	1128
B#	Augmented seventh	12	1200			30	1161.29	48	1152
C	Octave			19	1200	31	1200	50	1200

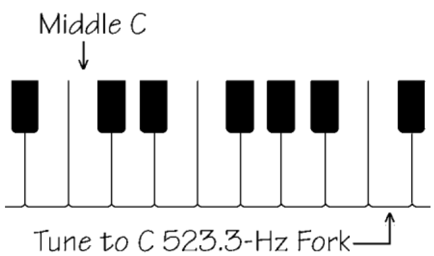
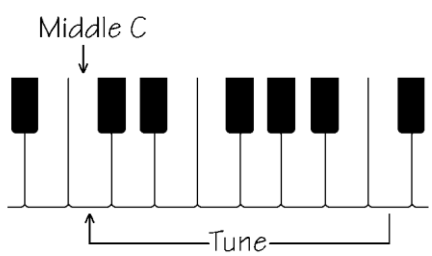
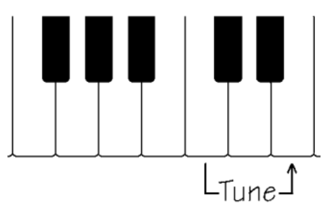
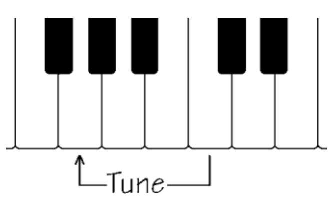
EDO=equal division of octave

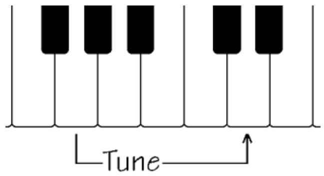
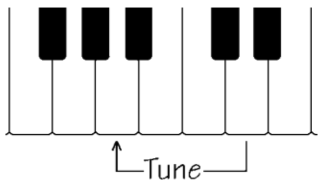
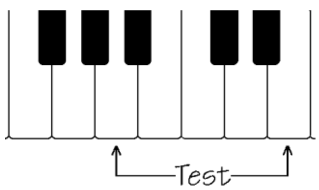
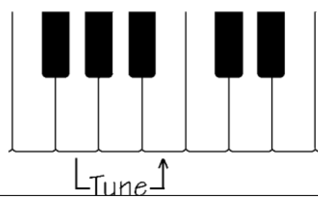
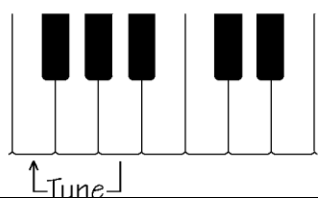
Tuning a Meantone Scale

Two different methods for tuning a meantone scale are presented below. While their descriptions vary, both ultimately achieve the same tuning result.

Method One

The meantone naturals are tuned by tempered fifths and perfect thirds according to the scheme shown in Fig. 7.4. For the beat rates indicated, the superscripts *n* and *w* stand for *narrow* and *wide*, respectively.

A Scheme for Tuning the Temperament Octave in the 1/4-Syntonic-Comma Meantone Temperament			
Step	**View**	**Beat Rate (Hz)**	**Comments**
1		zero	Tune the C above middle C to a 523.3-Hz tuning fork.
2		1.6^{n}	Tune middle C to the C above middle C. This note is tuned sharp by 1.6 beats to achieve the A440-Hz standard.
3		zero	Tune the E above middle C to middle C so that C—E is a perfect (beatless) third.
4		2.4^{w}	Tune the G below middle C to middle C so that G—C is a widened fourth.

5		1.8^{n}	Tune the D above middle C to the G below middle C so that G—D is a narrowed fifth.
6		2.7^{w}	Tune the A below middle C to the D above middle C so that A—D is a widened fourth.
7		2.0^{n}	The fifth A—E should be 2.0 b/s narrow. If not so, adjust the tuning in steps 4–6 above.
8		zero	Tune the B below middle C to the G below middle C so that G—B is a perfect (beatless) third.
9		zero	Tune the F below middle C to the A below middle C so that F—A is a perfect (beatless) third.

Tuning the Meantone Sharps and Flats

The meantone sharps are tuned by perfect thirds according to the scheme shown. The frequencies of the meantone scale for which C4 has a frequency of 261.626 are shown below.

Meantone Sharps	
Tune up a perfect third from:	**to obtain**
D	F♯
A	C
E	G♯
B	D
F♯	A

Meantone Flats	
Tune down a perfect third from:	**to obtain**
D	♭ B♭
G	E♭
C	A♭
F	D♭
B	G♭

Method Two

This is a second example of how to tune a meantone scale,

1. Tune A4 to fork. The number 4 indicates notes in the octave above middle C4.
2. Tune A3 to A4. The number 3 indicates notes in the octave below middle C4.
3. Tune F3 to A3 making a wide 3rd with 3 beats per second.
4. Tune C4 to F3 making a narrow 1/6c 5th beating around 1 beat per socond.
5. Tune D4 to A3 making a wide 1/6c 4th beating around 2 beats per second.
6. Tune G3 to C4 and D4. Make a wide G3C4 1/6c 4th and a narrow G3D4 1/6c 5th.
7. Tune E4 making a narrow 1/6c A3E4 5th. The C4E4 3rd should beat around 4 beats per second.
8. Tune B3 making a wide 1/6c B3E4 4th. The G3B3 3rd should beat around 3⍰ beats per second.
9. Tune C3 to C4 making a good octave with a wide C3F3 4th and a narrow C3G3 5th.
10. Tune D3 to D4 making a good octave with a wide D3G3 4th and a narrow D3A3 5th.
11. Tune E3 to E4 making a good octave with a wide E3A3 4th and a narrow E3B3 5th.
12. Tune F#3 making a wide 1/6c F#3B3 4th. The D3F#3 3rd should beat 2⍰ beats per second.
13. Tune B2 to B3 making a good octave with a wide B2E3 4th and a narrow B2F#3 5th.
14. Tune D#3 to B2 and Eb3 to G3. The B2D#3 3rd should beat 6 beats per second and Eb3G3 should beat 8 beats per second.
15. Tune Bb3 making a wide Eb3Bb3 5th and a narrow F3Bb3 4th.
16. Tune Ab3 making a wide 1/6c Eb3Ab3 4th. E3G#3 3rd beats 8+ beats per second and Ab3C4 3rd beats 10+ beats per second
17. Tune C#4 making a wide F#3C#4 5th and a narrow G#3C#4 4th.
18. Tune Eb4 making a good octave and a narrow Bb3Eb4 4th and a wide Ab3Eb4 5th.
19. Tune F4,F#4,G4,G#4 etc. checking 4ths,5ths and octaves.
20. Tune C#3,Bb2 etc. checking 3rds, 4ths, 5ths and octaves

Resulting Fifth Chain Layout (Simplified)

You now have eight narrow fifths (1/6-comma tempered) and four wide fifths (used to close the circle of fifths):

F — 1/6 — C — 1/6 — G — 1/6 — D — 1/6 — A — 1/6 — E — 1/6 — B — 1/6 — F♯ — * C♯ — * G♯ — 1/6 — E♭ — * B♭ — * F

Legend:
1/6 = 1/6-comma tempered (narrow) fifth
* = Wide fifth (used to complete the circle)

Interpretation

- The first eight fifths (F to F♯) are 1/6-comma meantone tempered, giving you sweet major thirds and a usable range of keys.
- The remaining four fifths (F♯–C♯–G♯–E♭–B♭–F) must be widened unnaturally to complete the circle of fifths.
- The consequence is the appearance of a "wolf interval", typically placed in an unused or remote key, such as G♯–E♭.