Bach's *Well-Tempered Clavier*… for unequal temperament

Unequal temperament:

The distances between the notes do not have to be all the same, when we play through all the available levers on a keyboard instrument.

On pianos and most organs we are
accustomed to having all the spacing the same:
C, C#, D, D#, E, F, F#, G, G#, A, A#, B, C
all have the same pitch distances between them.
That's "the chromatic scale",
and we expect it to be completely symmetrical.

Unequal temperament:

“The chromatic scale”:

C, C#, D, D#, E, F, F#, G, G#, A, A#, B, C

That list leaves out all the flats. It also leaves out all the double sharps, double flats, and the weird notes such as Fb, E#, B#, and Cb.

They don’t have separate levers to play them on the keyboard, so they maybe aren’t important? Maybe don’t exist?

They are all important, too, and we will come back to them.

Why use unequal temperaments on harpsichords and organs?

- Better resonance and projection of the instrument
- It compensates for the inability to play dynamic contrasts from note to note
- The melodic and harmonic tensions inspire sensitive players to listen closely, and to shape the musical delivery with appropriate expression
- Differences among the keys help to sustain the listener's interest during a composition, and to provide contrasts during a concert or church service

Why use unequal temperaments on harpsichords and organs?

- It makes the instrument seem “alive”, not merely like a box full of levers
- The keys and scales used most frequently can be better in tune than equal temperament allows
- Good unequal temperaments are easier and much faster to set up than equal temperament is
- The blend with other instruments and voices can be more harmonious
- Historical accuracy: play older compositions in the temperament style for which the music was originally conceived, if this information is reasonably knowable

Competing styles of keyboard temperament

- Pythagorean (before the 17th century)
- Just intonation (15th century forward)
- Equal temperament (16th century forward, but not a universal "standard" until the 20th)
- Quasi-equal (18th century forward)
- Meantone or "regular" systems (16th-19th centuries)
- Modified meantone, "circulating“, "irregular“, "ordinary" (17th-19thcenturies) …“well-tempered”
- Split keys (15th century forward)

Competing styles of keyboard temperament

This presentation is mostly about
"modified meantone", "circulating",
"irregular", "ordinary",
"well-tempered" systems.

We will also have to look at Pythagorean, meantone, and equal temperaments a bit.

(To understand deliberate irregularity, we have to know what's regular: evenness.)

Why are the “modified meantone”, “circulating”, “irregular”, “ordinary”, “well-tempered” systems not widely understood?

Why the “modified meantone”, “circulating”, “irregular”, “ordinary”, “well-tempered” systems aren’t widely understood

- There are too many names; people get easily confused.
- What, there’s more than one way to tune a harpsichord?! Beyond “in tune” vs “out of tune”??!
- History books and reference materials ignore their existence as anything more than a passing curiosity, or a quaint conceit of 18th to 20th century math-heads.
- The role of “progress”: equal temperament eventually replaced these nuances, so equal must be categorically “better”.
- “Well-tempered” and “equally-tempered” are supposedly the same thing, especially with regard to Bach (BUT: if he had really wanted equal, he could have said so, clearly!).
- “Well temperament” isn’t grammatically correct English! The Germans properly called them “good temperaments”.

Why the “modified meantone”, “circulating”, “irregular”, “ordinary”, “well-tempered” systems aren’t widely understood

- This is about RELATIONSHIPS among the intervals; not a wholesale tuning of the whole instrument to some higher or lower pitch standard. (Temperament is independent of choosing “440” or “415” or “Verdi pitch” or something else….)
- This is about handling ALL the notes that normally occur in tonal music: **ALL the sharps** (F#, C#, G#, D#, A#, E#, B#, Fx, Cx, Gx, …), **ALL the flats** (Bb, Eb, Ab, Db, Gb, Cb, Fb, Bbb, Ebb, …), and **ALL the naturals** (F, C, G, D, A, E, B).
- We must understand that sharps and flats are different from one another, in musical function and sometimes also in absolute pitch, to see why all this is important. Equal temperament has conditioned us to ignore all those distinctions. So has 20th century music theory.
- Many of the “well-tempered” systems don’t really solve the problems of D#, A#, E#, B#, or Db, Gb, Cb, Fb; they merely make them less obviously objectionable. Throw up the hands in defeat, with this “cul-de-sac of a topic”, and yield to equal’s blandness….
- Many musicians, especially keyboard players, don’t have the inclination or experience to consider subtle intonation as a useful musical device.

Why the “modified meantone”, “circulating”, “irregular”, “ordinary”, “well-tempered” systems aren’t widely understood

- Ignorance about inequality or “irregularity” being a musical virtue, instead of a liability. (Since the Industrial Revolution, we all like interchangeable parts and standardization, right? Progress is regularity? Regularity is good health?)
- All the “well-tempered” systems allegedly sound basically the same as one another, varying only in degree of smoothness, right? Wrong!
- They are mis-perceived as mere approximations of equal temperament for the lazy or incompetent musician/tuner (living or dead); why not do truly equal temperament in today’s wonderful technological age?
- “Most” of them sound like equal temperament done badly, when playing in keys of more than two flats or three sharps…so, why bother exploring them? (The unmusical shape of SOME of them is taken as a flaw of ALL of them, by generalized association.)
- Some of them sound too smooth or bland when playing older music written for regular meantone systems: we might as well really use hard-core regular meantone instead of a halfway or watered-down solution.
- How far back into the 17th century were they common? The music suggests “way back”, while positivistic historians assert “almost none”.

Why the “modified meantone”, “circulating”, “irregular”, “ordinary”, “well-tempered” systems aren’t widely understood

- Temperaments are presented in books as if they are only a bunch of calculated numbers, rather than as a shape that one might mold carefully with hands-on skill (and no numbers). Numbers measuring a result don’t necessarily give an understanding of the *musical relationships* in practice of tonal music.
- Many of the world’s best early-keyboard experts never tune an entire temperament by ear themselves. Whether this is by preference for electronic shortcuts, or lack of self-confidence in getting it “right”, or convenient habit: the hands-on reasoning inside the skill is missing. Calculation done by other people (theorists, or programmers of a device) substitutes for direct understanding. If the experts don’t do it, or “get” tuning as a shape, why should non-experts bother to learn it?
- Published temperaments of the 18th century, such as Neidhardt’s dozens of examples, are mistaken as merely speculative models: as somehow not practically feasible for a tuner to install by ear within a few minutes.
- Composition, performance, improvisation, tuning, and instrument maintenance all used to be part of a single and comprehensive keyboard musicianship. Today, those roles tend to get separated into specialties.

Why the “modified meantone”, “circulating”, “irregular”, “ordinary”, “well-tempered” systems aren’t widely understood

- Most of the chords or scales sound different from one another: varying “brightness”, “mellowness”, “color”, tension, beat speeds, etc. Some musicians and theorists aren’t prepared or willing to deal with this intellectually, even if they might enjoy the musical effects as listeners.
- It seems too complicated to think about or worry about while performing: melodic directions, differently-sized semitones, appoggiaturas, suspensions, complex chords. (But, the good news is: just set it up, listen sensitively, and then react intuitively as an expressive musician. The intellect doesn’t have to be in control!)
- Many musicians and listeners simply CAN’T hear the differences between equal and subtly unequal intonation, so it all seems not worth bothering with. (“All white wines are the same, right?”)
- Some discussions dissolve into irreconcilable differences of taste and preference, and it’s easy to dismiss another person’s perception as only a subjective choice: after all, music is “only” an art, right?
- Pianos and their equal intonation have conditioned us to expect neutrality and consistency as ideals.

Why the “modified meantone”, “circulating”, “irregular”, “ordinary”, “well-tempered” systems aren’t widely understood

- For many musicians, the interpretation of a piece of music is somehow wholly independent of intonation. All the mechanical details of performance are worked out in the practice room, but not bothering to practice IN the temperament that will be used. (Will it suggest changes in any timings, articulations, or fingerings?) Temperament choice is brought in as scarcely important, or under a professional tuner’s control instead of the musician’s…like deciding what to wear at the last minute, where clothes don’t really matter for the job.
- Even among cognoscenti and enthusiasts of tuning, the discussions are reduced to impossibly simplistic and short-sighted levels…ignoring the complex behaviors of notes within tonal music.
  - Go for as many pure 5ths as possible, or for other simple ratios in intervals.
  - Try to establish “proportional beating”, as if that’s important.
  - Merely glance at (or tabulate) the home key signatures across a handful of compositions, to prove something statistically.
  - Try to get a few plain major triads to lock in as beatlessly as possible, and everything else in the music will magically work out well enough….

Why the “modified meantone”, “circulating”, “irregular”, “ordinary”, “well-tempered” systems aren’t widely understood

- Analysts tend to study only the sizes of 5ths or major 3rds and stop there, as if enough data have been collected for the book, article, or online argument. The explanations then aren’t good, because they don’t tell us what tonal music actually does: the ways in which melody and harmony move.
- **Some of the most important facts are overlooked: the scales and the named notes actually used in compositions.** (E minor music really needs a good D# and A#, and often both an F and an E#, even though they’re not in the key signature….)

Before we can tune an instrument,
we have to study
how scales are put together.

Where do we get all our notes:

A, B, C, D, E, F, G,

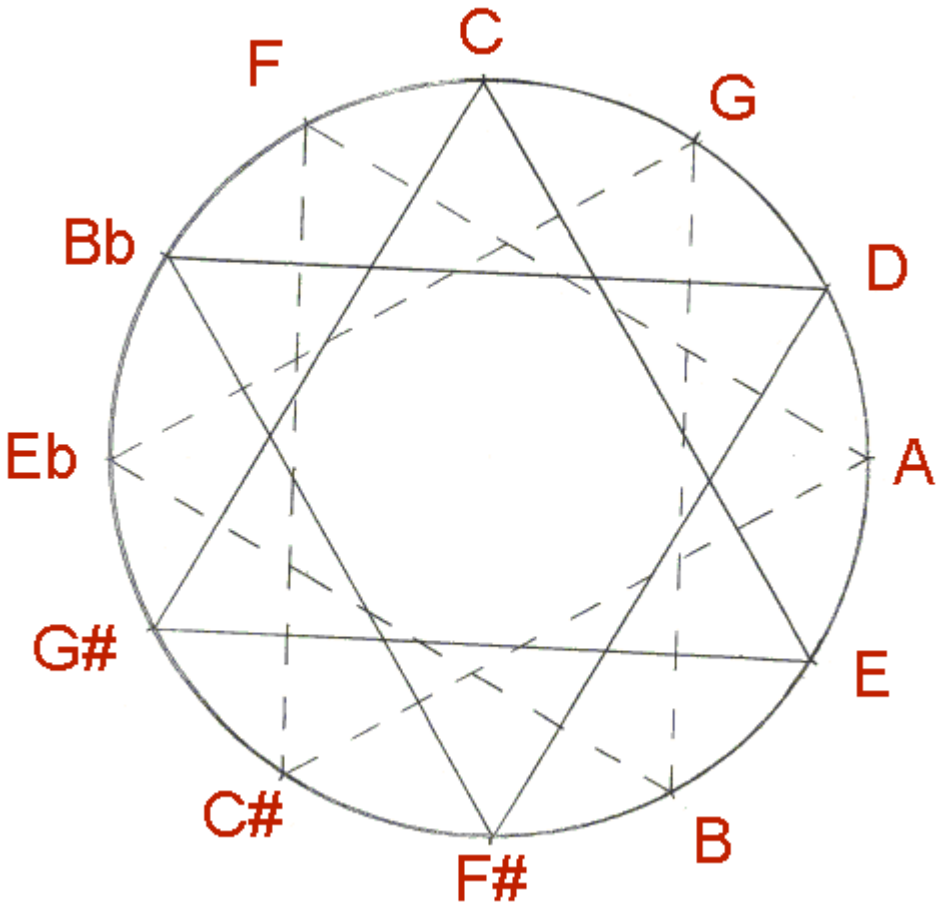
and the sharps and flats?

Notes are all related to one another by 5ths. This is the way scales are generated.

A series of 5ths makes the simplest sequence to tune keyboard instruments by ear. Starting from C, tune G by playing both notes together and adjusting G.

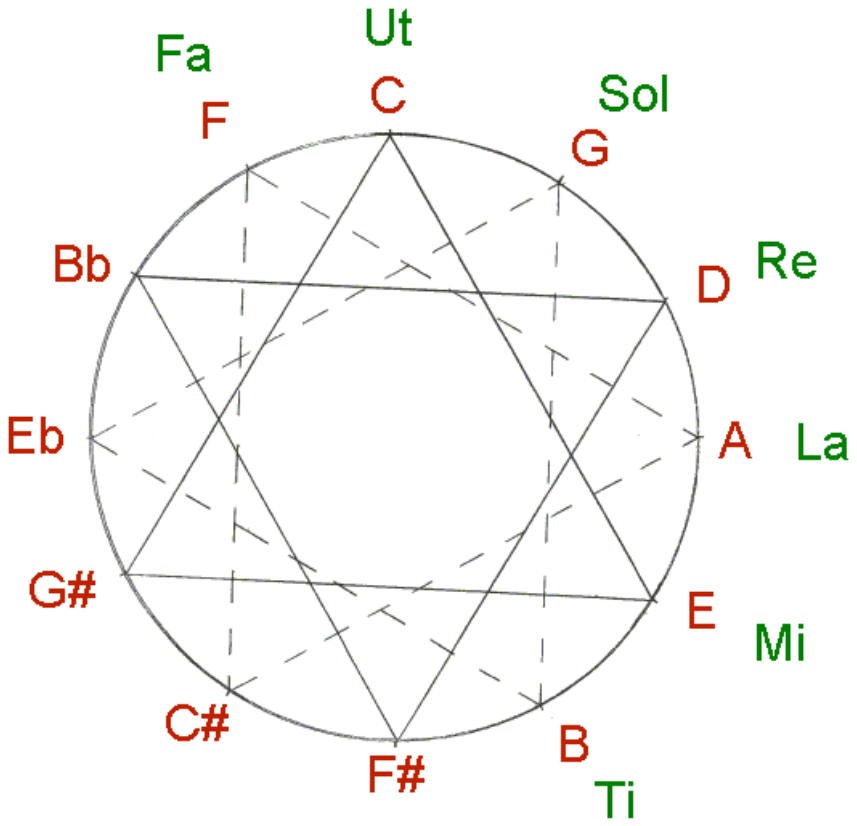
From G, tune D. From D, tune A. From A, tune E; etc. We can copy pure octaves to keep the notes within a manageable range. We can also tune by 5ths flatward: C-F-Bb-Eb-etc.

NOTE: after we have tuned four 5ths, such as **C-G-D-A-E**, we can test the sound of the resulting major 3rd: **C-E**.



How major scales and modulation work

Each major scale uses seven consecutive notes from the spiral of 5ths: **Fa, Ut, Sol, Re, La, Mi, Ti.**



"Ut" is an older name for the note "Do", the starting note of a major scale. ("Ut, a deer, a female deer…")

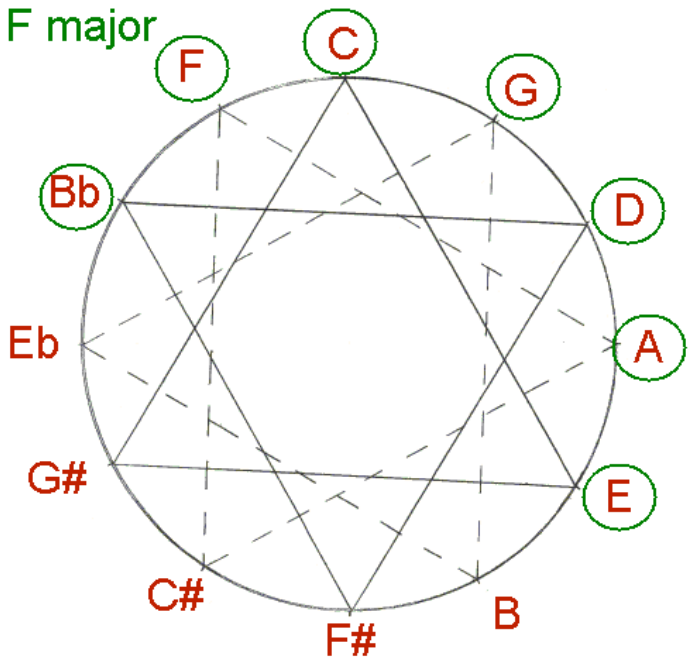
All seven diatonic notes are generated by 5ths: Fa-Ut-Sol-Re-La-Mi-Ti.

Rearrange them as the major scale: Ut-Re-Mi-Fa-Sol-La-Ti.

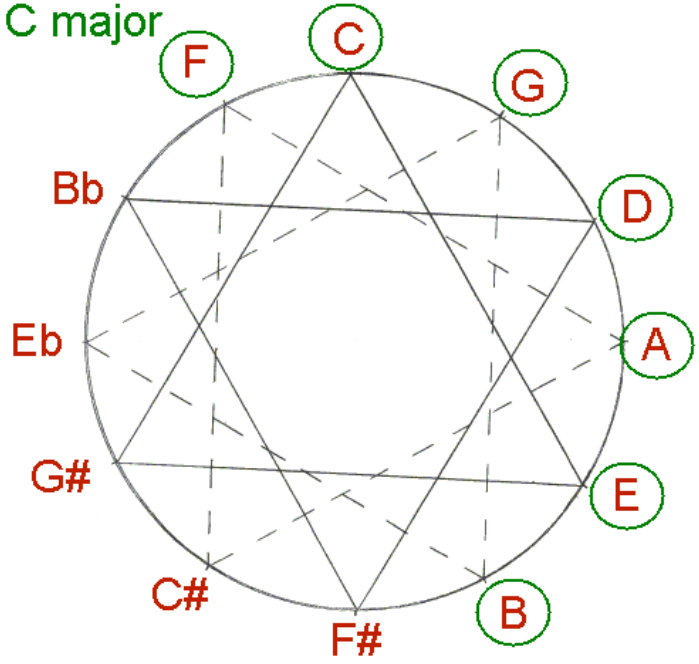
How major scales and modulation work

Fa, Ut, Sol, Re, La, Mi, Ti.

We have each letter name once and only once: an “A something”, a “B something”, a “C something”, etc.



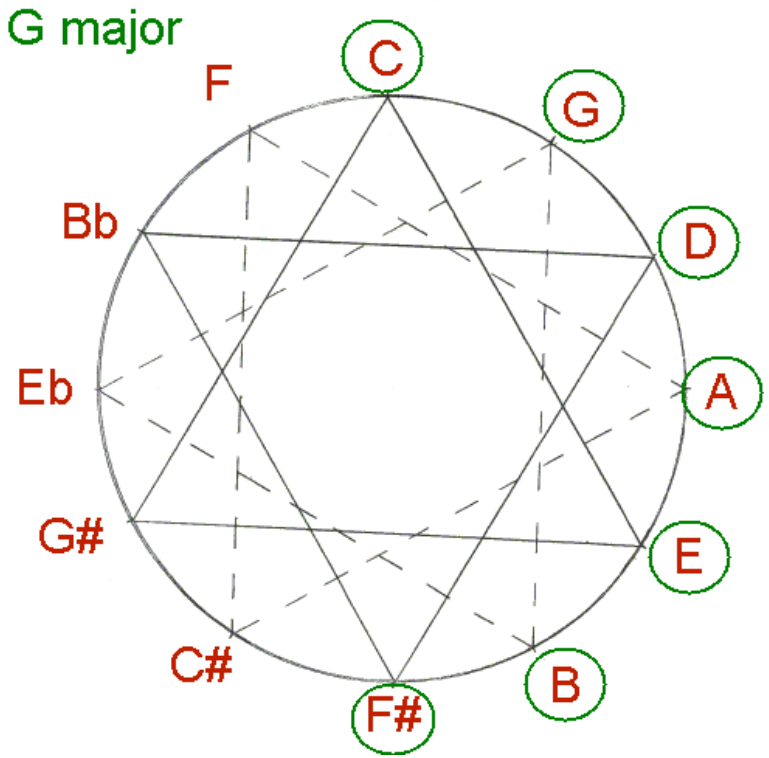
To modulate from F major to C major, stop using Bb and start using B.



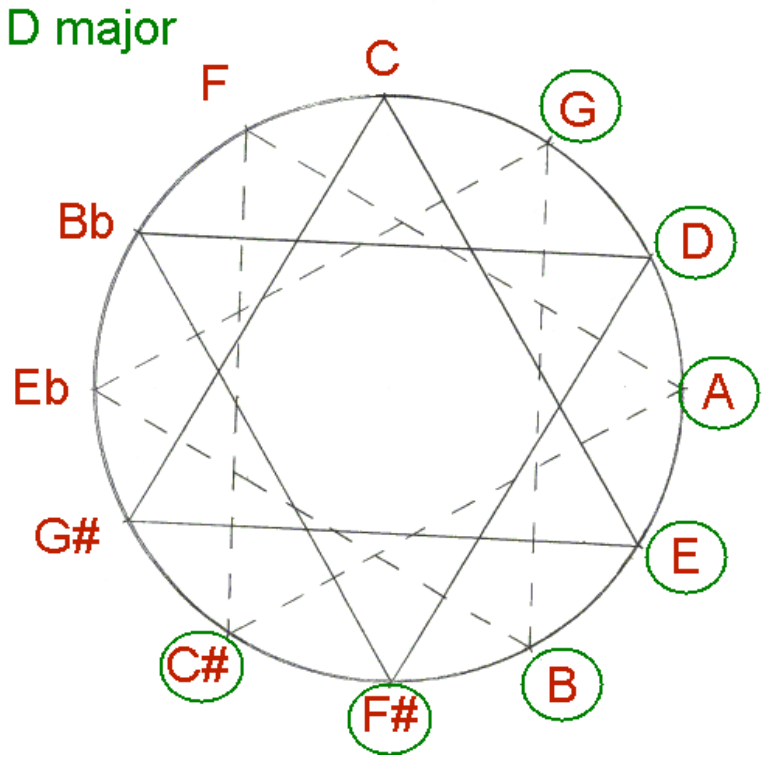
How major scales and modulation work

Modulation: the old Ut becomes the new Fa, or vice versa.
The whole Fa-Ut-Sol-Re-La-Mi-Ti sequence simply rotates to a new position.

To modulate from C major to G major, stop using F and start using F#.

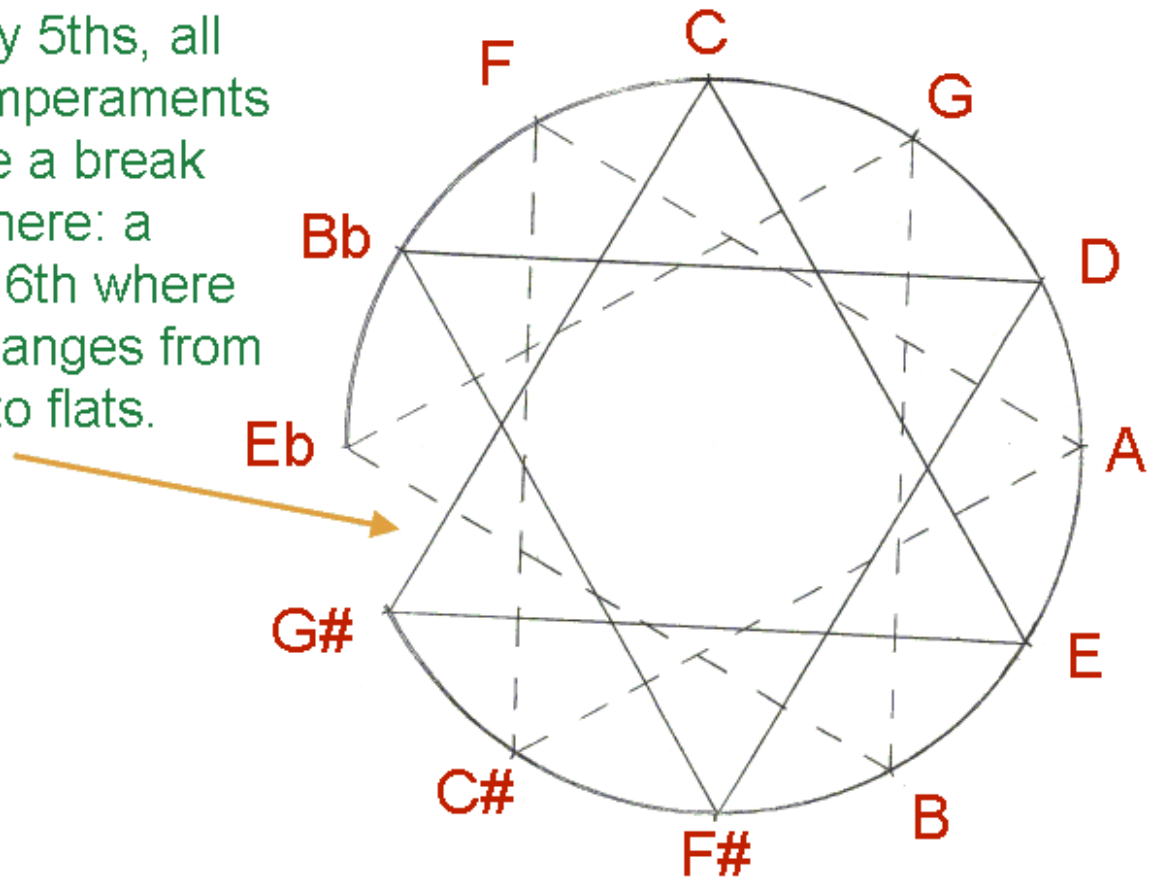


Chromatic change: C# replaces C, but they are both “C something”.



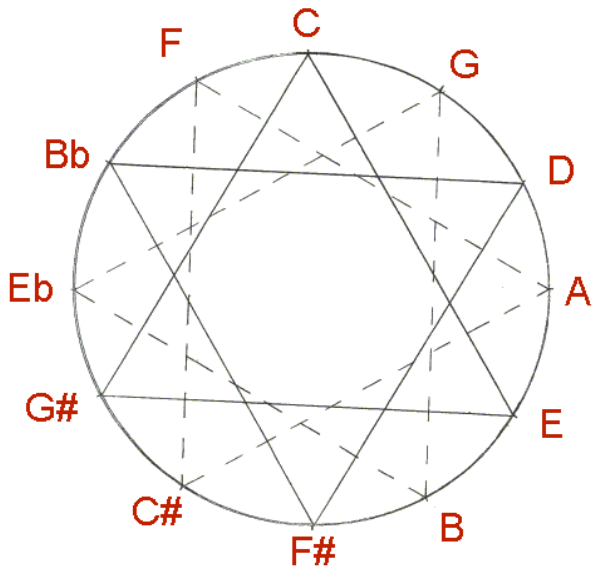
There is always a break where the "circle of 5ths" does not connect.

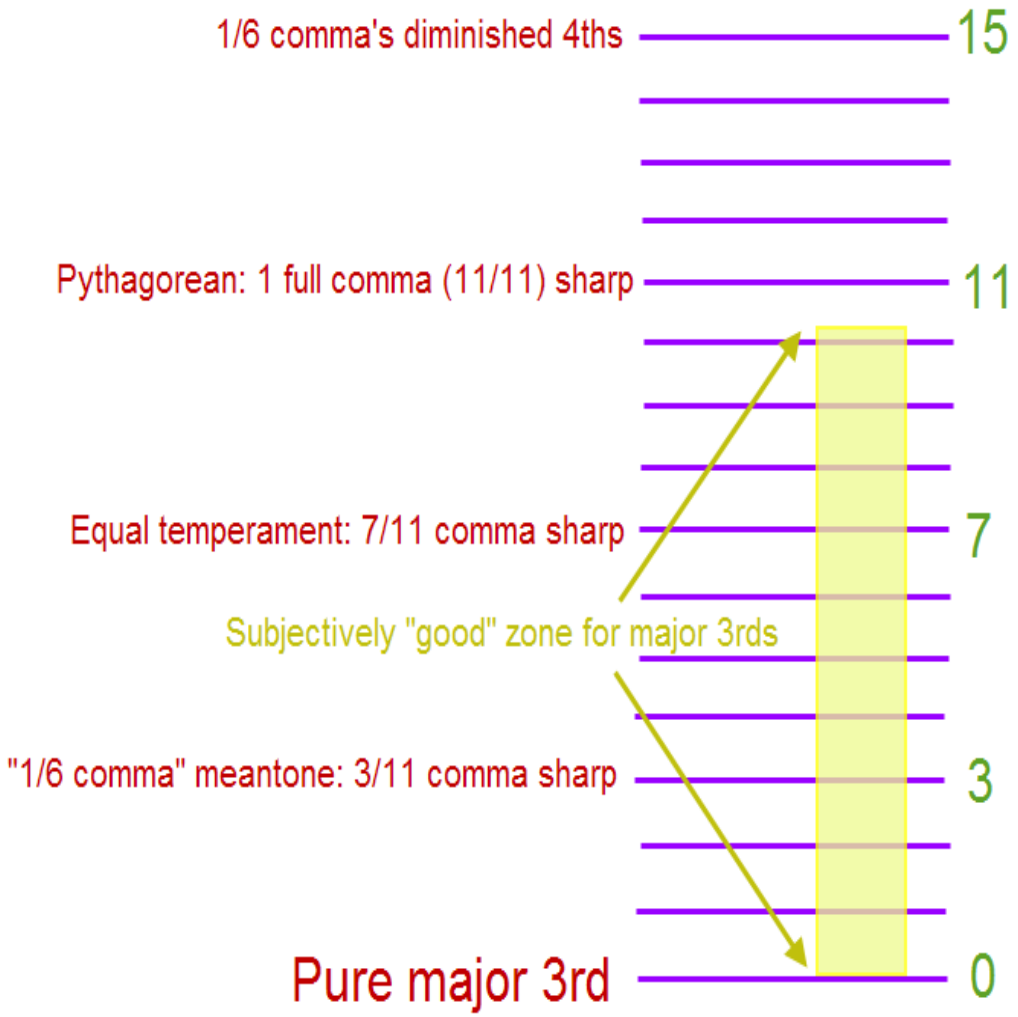
Working by 5ths, all keyboard temperaments must have a break somewhere: a diminished 6th where the name changes from sharps to flats.



If we make the 5ths slightly narrower than pure, it improves the major 3rds.

For example: make each of C-G, G-D, D-A, and A-E narrow to build a good C-E.





Hearing some 5ths (pure or impure) and some major 3rds of various sizes

If two notes are exactly in tune, relative to one another, there is no wobble or "beat" when they are played together.