

In some households you can find a jigsaw puzzle on the go. Visitors can ponder and add a piece or two. In the same spirit I would invite readers to ponder this work in progress which is could also be called "how the major and minor key system came to be written in stone". However, I am using the terms major and minor with great care in this discussion and do not want to apply them to a scale, even if the language seems stilted.

It may be safe to use terms like the "major" scale and the "minor" scale if only two scales could be under discussion (as was the case between 1620 and 1850, the period of "common practice"). But if we want to discuss what went before and after that period and in other regions then we need to be a more specific. Before and after that period there are several "major scales" (i.e. scales using the major 3rd) and several minor ones (i.e. having a minor 3rd). So in this context I prefer Ionian scale rather major scale and Aeolian scale instead of minor scale. These two scales form the duopoly.

Also I will use the term "scale" instead of "mode". Scale is very specific meaning a sequence of steps from a tonic to the octave above. Mode is a more general word meaning "type of behaviour". It is interesting to see how these two words are employed. The word *scale* tends to be used for either of the victorious duopoly, Ionian and Aeolian, while *mode* tends to be used for the also-rans (Dorian, Lydian, Phrygian and Locrian) and for any funny-peculiar, exotic or rustic sounding scale outside the duopoly. Some times "modal" it just means the the leading note is not being used in the harmony, or that the harmony is not based on triads but on chord shapes moving in parallel (such as in Miles Davis' Kind of Blue album) The word *scale* tends to be used once the duopoly is established to refer only to the Ionian and Aeolian. An opposite view is taken by Walter Piston in his book *Harmony* in which he uses the terms *major mode* and *minor mode* instead of the more usual *major scale* and *minor scale*. Also I will try to avoid the terms *key* or *tonality* which tend to be used only for the duopoly scales , rarely for other scales.

Just for the record notes of each scale are shown here as guitar frets, keyboard notes and by interval size.

Scales with the major 3rd (4 frets|)

Ionian	frets 0 2 4 5 7 9 11 12	e.g. white notes from C	1st M2 M3 P4 P5 M6 M7 8ve
Lydian	frets 0 2 4 6 7 9 11 12	e.g. white notes from F	1st M2 M3 Aug4 P5 M6 M7 8ve
Mixolydian	frets 0 2 4 5 7 9 10 12	e.g. white notes from G	1st M2 M3 P4 P5 M6 m7 8ve

Scales with the minor 3rd (3 frets)

Dorian	frets 0 2 3 5 7 9 10 12	e.g. white notes from D	1st M2 m3 P4 P5 M6 m7 8ve
Phrygian	frets 0 1 3 5 7 8 10 12	e.g. white notes from E	1st m2 m3 P4 P5 m6 m7 8ve
Aeolian	frets 0 2 3 5 7 8 10 12	e.g. white notes from A	1st M2 m3 P4 P5 m6 m7 8ve
Locrian	frets 0 1 3 5 6 8 10 12	e.g. white notes from B	1 st m2 m3 P4 dim5 m6 m7 8ve

The Locrian scale (such as white notes from B) contains a diminished 5th rather than a perfect 5th. Consequently it feels unstable and does not offer a conventional V- I cadence.

BRIEF CHRONOLOGY

The timeline goes something like this :

Triads come into use around 1450 particularly in England and become adopted on the continent.

Equal temperament is widely used on lutes , citterns and guitars from 1550 and probably earlier.

There are reports of some organs being tuned in equal temperament before this date. It may have been first "set in stone" on the fixed metal frets of fully chromatic citterns which were being made around 1550.

In the decades around 1550 scales are tending to polarise into those that use the major 3rd (particularly Ionian and Myxolydian) and those that use the minor third (particularly Dorian and Aeolian). The Lydian scale and Phrygian scale have dropped out of favour perhaps because they are unable to offer IV V I at cadences.

Aeolian ousts Dorian as the minor scale of choice and Ionian ousts Myxolydian as the major scale of choice. This seems to click into place around 1620. No single composer seems responsible for this shift. As listeners narrowed their expectations to this duopoly so composers could lead them more quickly through various Ionian and Aeolian scales. Such rapid modulations became a feature of the new duopoly.

Bach systematises the key signature system in his first and second books of preludes and fugues (1722 and 1744), banishing the Dorian scale from written music, and establishing the Aeolian scale as "the" minor scale. The major 6th is a dependant accidental only permitted if the major 7th is already used. The Dorian was regarded as first among scales in Renaissance theory and so it took a major work like Bach's 48 Preludes and Fugues to dislodge it. During the transition period the Aeolian is often written as Dorian with the minor sixth written as accidental.

COMMENTARY: The physical constraints of the lute, viol and cittern seem to have had an influence on all other instruments in European Music including the voice. Because the fret passes in a straight line over several sets of strings, their tuning separated by a variety of intervals, it had a levelling effect on fret distance. The rule of thumb became let each fret reduce the remain length of string by 1/18 the so-called "rule of 18". This arrives at the octave very slightly flat.

The lute in its heyday was the foremost accompanying instrument for the voice so its physical constraints were effecting the voice, which has no such constraints. Likewise, trombones, the violin family, keyboards and woodwind have no physical pull towards equal temperament but have none the less found the tuning advantageous, even if treated as a norm with room for fine tuning according to context and personal inclination.

The cittern was also used to accompany voices. It was commonly found in barber shops and allowed waiting customers to keep each other entertained. It was also favoured in court music.

The relationship between fretted and unfretted instruments is encapsulated in Peggy Lee's classic recording of "Fever". With pitch support only from the double bass she lifts the tune up in several semitone steps, movements that are unnatural to the voice and double bass would be inconceivable without the fretted instruments example.

Similarly, unaccompanied choirs and string quartets and ensembles use the equal temperament established by the fretted instruments as a norm. and enjoy all the harmonic delights and ambiguities of that norm without being physically constrained to it.

The lute is also notable in that it was usually played from tablature notation in which the fret and string are shown diagrammatically. There is no need to begin the music with a key signature nor to feel bound to the notes of a particular scale. This freedom made it the instrument of experimentation and exploration.

There was a further loosening of ties with notation on the five line staff. The lute was built in various sizes and pitches. The same tablature played on a differently sized lute would be heard at a different pitch.

The duopoly of Ionian and Aeolian seems to have emerged from a complex set of interrelated reasons. Both scales allow tension to be created by their tonics being subjugated as part of the subdominant triads. Yet both allow the tonic to be confirmed in a perfect cadence V I. The Aeolian can increase this tension in another way by subjugating the tonic to be the major third of the submediant triad. The Dorian does not offer this possibility as its submediant triad is diminished.

In *Scales, Modes and Chords by Key Signature* I consider the special properties of the Ionian and Aeolian scales, p.12 (adapted) "They are similar to each other (their tonic triads share two notes: both have perfect 4ths and 5ths which bear triads with perfect 5ths) yet are highly contrasted from each other in the placement of the 3rd, 6th and 7th degrees. In both the 6th and 7th degrees are a perfect 4th and 5th above the 3rd. If the tonics of the major scales are arranged in fifths, Lydian - Ionian - Mixolydian, the centrally placed Ionian becomes the "normal" type to which the others can be changed by a single # or b. likewise the Aeolian sits in the middle of the minor scales, Phrygian - Aeolian - Dorian."

In ancient theory the Dorian was the first among scales and its ousting by the Aeolian is a slow and mysterious process. I wonder where this is expressed in contemporary writings. The Aeolian was adopted with the proviso that the use of the major sixth as an accidental was dependent on the use of the leading note accidental. This proviso makes the Aeolian more limited than the Dorian (which can always have a leading note and minor sixth as accidentals). The top end of the Dorian and Mixolydian i.e. P5 M6 m7 P8, become taboo. This narrowing of possibility and expectation might make rapid modulation between keys easier to effect.

DETAILED CHRONOLOGY

Triads come into use around 1450 particularly in England and become adopted on the continent.

c. 1450 lute tablature is developed, possibly in Germany, indicating that the lute was fretted by this time and frets are shown on artwork of this period.

c. 1450 Lute technique is changing from a plectrum, suggesting a single melodic line, to the use of several fingers enabling chord playing and polyphony.

In 1516 the Swiss poet Glarean observing that two new scales had gained currency, named them Ionian and Aeolian after Greek regions. Prior to that the only scales recognised by music theory were the Dorian, Phrygian, Lydian and Mixolydian. He noted that the Ionian was much used in popular dances.

Equal temperament is widely used on lutes and citterns from 1550 and probably earlier. On the lute the option to adjust frets for specific pieces is always present.

1550 Vincenzo Galilei was a strong advocate of the *rule of 18* method of placing frets whereby one eighteenth is subtracted from the string length. This approximates equal temperament before mathematics is able to express it.

Examples of fully chromatic fixed metal frets are found on citterns made shortly after 1550. Fixed metal frets were particularly suited to its metal strings. While the lute rarely has beyond 8 frets the long neck of the cittern could extend to 17 or 19 frets passing the octave at the 12th fret. Fully chromatic fretting is associated with the Brescian school of instrument making.

In 1567 Giacomo Gorzanis In 1567 the blind visionary lutenist Gorzanis takes a popular chord progression using the minor 3rd associated with the dance *passa e mezzo antico*, and another *passa e mezzo moderno* repeats them on all twelve frets making varied elaborations. This is notated first in tablature and is the earliest manifestation of the emerging duopoly *antico* versus *moderno*.. In minor 3rd pieces are mostly Dorian and the major 3rd pieces are mostly Mixolydian. The work may

never have got to print and exists in a single manuscript.

In 1570 Italian music for fully chromatic fixed fret cittern is published by Phalese and Bellere.

In 1584 Vincenzo Galilei includes a cycle of dances in minor 3rd/major3rd sets in his *Libro d'Intavolatura di Liuto*. The collection only exists in manuscript and appears not to have been printed.

In the decades around 1550 scales are tending to polarise into those that use the major 3rd (particularly Ionian and Mixolydian) and those that use the minor third (particulary Dorian and Aeolian). The Lydian scale and Phrygian scale have dropped out of favour perhaps because they are unable to offer IV V I at cadences, or the 7-6 cadence e.g.(reading notes upwards) dfg falling to b, cegc.

Around 1600 figured bass develops in Italy. Harmony is counted up from a bass note written on the staff. The system dominates harmony and composition until around 1820. Figured bass is easier to visualise on the keyboard than on the fretboard. Lutenists probably experienced cognitive conflict with their tablature visualisations of pitch. The stylistic lead is henceforth taken by the keyboard.

1605 Simon Stevin realising that the decimal point allows us to find any root of any number applied this insight to the placement of frets which he formulated as being based on the *twelfth root of two* which became known as *Equal Temperament*. Galilei's method leaves 0.94444 of the string whereas precise equal temperament leaves 0.94387

Aeolian ousts Dorian as the minor scale of choice and the Ionian ousts Mixolydian as the major scale of choice. This seems to fall into place around 1620. Yet Aeolian scale is still frequently written as the Dorian scale with the sixth degree modified as an accidental. Theory takes some time to catch up with practice.

In 1630 John Wilson included examples of pieces in minor3rd and major 3rd scales on each fret in a collection of 30 Preludes in lute tablature. This exists in a single manuscript. The minor piece is usually presented first. The Ionian has not yet taken precedence over the Aeolian but there are fewer traces of Dorian and Mixolydian.

The victory of the Aeolian is demonstrated in the melodic minor scale which prescribes that the major 6th is no longer an independent scale degree and may only be used as adjunct to the leading note.

Bach systematises the key signature system in his first and second books of preludes and fugues (1722 and 1744) . Prior to this writers had not been consistent in the use of key signature and often wrote music which was effectively Aeolian as if it were Dorian, writing the minor 6th as an accidental. Bach's use of key signatures has now become orthodox. The exception is his choice of C# major with seven sharps in both Book I and II whereas Db with the more economical five flats has become the norm.

The banishment of the Dorian is exemplified by Minuet No 5 by Petzold from the *Clavierbuchlein der Anna Magdalena* Bach a collection compiled by Bach in 1725. The minuet in G minor only has the signature of one flat and is thus Dorian. In editions subsequent to the influence of the 48 Preludes and Fugues a second flat is added to the signature making it Aeolian.

There is much discussion of the true intentions of Bach's in his composition of the *Wohltemperierte Klavier* and the meaning of title (Well-Tempered Clavier). He was obviously aware of many tuning possibilities including equal temperament but left the interpretation of the word *Wohl* up to the player. Some authors take it to mean any temperament that allows the duopoly to function on each semitone step without necessarily being exactly equal.