

THE BITONAL SCALE SYSTEM

- a draft for a modal-harmonic system

The concept to be presented here is an arrangement of scales that I have called «*bitonal scales*». As the name indicates, it is based on a combination of two (or more) scales. The development of the idea has come out of three main inspirations:

1. My studies of modal scale theory in Indian music and the maqam system of the Near- and Middle East.
2. Modal theory from the 20th Century, most notably from the works by Olivier Messiaen, Arnold Schönberg, Paul Hindemith, Vincent Persichetti and Béla Bartók.
3. Modal theory commonly used by jazz players in improvisation over chords and chord sequences.

CONSTRUCTION

The scales are arranged in thirds, not in seconds which is the normal, diatonic arrangement of a scale. Arranged in thirds, a scale will stretch over two octaves. If we give each scale step a number after the interval it represents from the root, a C major scale will have the following layout:

C(1) D(2) E(3) F(4) G(5) A(6) B(7)

Arranged in thirds, the interval numbers will include the higher extensions above the octave, which is commonly used in chord symbols:

C(1) E(3) G(5) B(7) D'(9) F'(11) A'(13)



(B major = black, C major = white)

The «*bitonal scale*» can be a combination of any two scales. When combining two identical scales of different transposition a minor 2nd apart (*B major* and *C major* in this example), we get the «*bitonal leading note scale*». This combination of scales gives no coinciding notes through the two octaves. Instead, each interval number in *B major* becomes an ascending leading note (semitone) to the same interval number in *C major*, and the *C major* interval becomes a descending leading note to the coinciding *B major* interval number.

basic triads with leading notes(ascending)

25 C G F

28 Em Dm Am B \emptyset

basic triads with leading notes(descending)

32 B F \sharp E

35 E \flat m C \sharp m G \sharp m B $\flat\emptyset$

ALTERNATE OCTAVES

Since we are converting two (or more) one-octave scales into one two-octave scale, the octave of where to start each scale is not given. With a combination of two scales, we get two different scale designs by having the root of each scale in *a)* the same octave and *b)* different octaves.

a)



b)



If there are more than two scales involved in the construction, even more possible octave combinations occur.

As a general rule, I will choose a construction where as few notes as possible coincide between the scales combined. This is a way of getting a diatonic layout to the constructed scale. By combining scales with many coinciding notes in the same octave, the result will be a more arpeggiated layout. However, the octave option is there, and can be used when such a layout is favoured.

TYPES OF SCALES

Any kind of scale can of course be combined with any other type of scale. Any number of scales can be combined, and in any transposition. Therefore, it will be useful to point out some main groups of bitonal scales¹:

1a. Combination of two identical scales in different transpositions (hereunder the *bitonal leading note scale*).

1b. Combination of three or more identical scales in different transpositions.

(The more notes, the closer we get to chromaticism. Several scales combined is probably most effective with fewer notes in the scale, as in penta- or hexatonics.)

2a. Combination of two different scales in the same transposition (from the same root).

2b. Combination of three or more different scales in the same transposition.

3a. Combination of two different scales in different transposition.

3b. Combination of three or more different scales in different transposition.

¹ Persichetti also uses the term *polymodal* for the combination of different modes on the same or different tonal centers. A combination of two transpositions of the same mode, as in the *bitonal leading note scale*, is polytonal, but not polymodal. See *Persichetti 1961, pp. 38-39*.

Examples:

1a



1b



2a



2b



3a

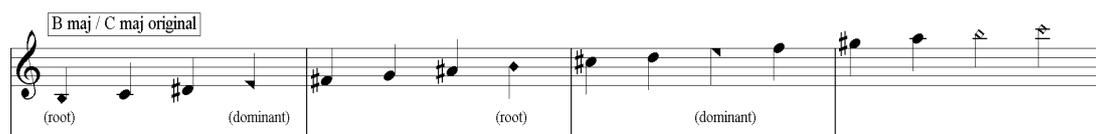


3b



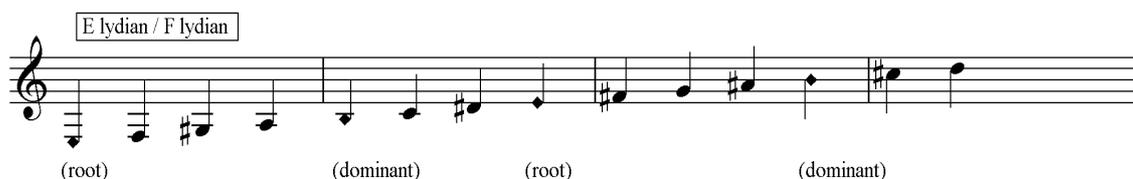
PERFECT OCTAVES AND ROOTS

The intervallic construction of the lower octave of the scale will be different than the higher octave, and very few perfect octaves (repetition of a note in the octave above or below) will occur. Where they do occur, a tonal centre is formed, or a key centre for the scale. These can be graded as the *root* (*primary key centre*) and *dominant* (*secondary key centre*) of the scale, as shown in the example. We will see that it is not given that the starting note of the scale is the actual root.



The example defines the key centres of the *B major / C major bitonal leading note scale* as the notes *B* and *E*. Even though the scale is constructed of two equal scales from *B* and *C*, the note *B* attracts attention as a key centre because it is repeated in the octave. The *C*, not repeated in the octave, loses its importance as a root, and takes the position as a less important 2nd interval of the scale. Only the lower of the two roots from the original scales *B major* and *C major* becomes a key centre in this leading note scale.

In the *B / C major bitonal leading note scale*, the two key centres *B* and *E* makes the interval of a perfect fourth. The dominant effect is stronger if we use the *E* as root, and let *B* form the dominant on the interval of a perfect fifth. This points towards the realisation that the basic scale of the construction is actually *E / F lydian*, and that the *B / C major* is actually the 5th degree of the *E / F lydian* (see *Mother scales*; next page). It is easy to draw lines to theorists from Paul Hindemith to George Russell, who claim that the lydian (augmented) 4th is a purer interval than the perfect 4th, as it is closer to the natural overtones.



MOTHER SCALES AND SCALE FAMILIES

This is the «*B lydian b7 / C lydian b7 bitonal leading note scale*»:

B C D# E **F#** G **A** Bb C# D' E# **F#** G# A' (B' C')

In this scale, the perfect octave interval is represented by the notes F# and A, which therefore form the key centres of the scale. If we decide F# as the root, we determine the *mother scale* of this construction to be the *F# / G melodic minor*, to which the *B / C lydian b7* is the 4th degree. As shown in the introduction, the 4th degree of a one-octave scale equals the 11th degree of a two-octave scale.

F# melodic minor

One-octave(diatonic): F#(1) G#(2) A(3) **B(4)** C#(5) D#(6) E#(7) F#

Two-octave (thirds): F#(1) A(3) C#(5) E#(7) G#(9) **B'(11)** D#(13)

The construction *B / C lydian b7 bitonal leading note scale* is the same as *F# / G melodic minor leading note scale* by the octave interval forming the key centre. Although the *lydian b7 bitonal leading note scale* is a fully valid scale in itself, it belongs to the family of the melodic minor leading note scale.

If we use the secondary key centre as a root, we get the scale of the 3rd degree of the F# / G melodic minor, from A / Bb.

The scale is recognizable as a *lydian#5*:

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

Scale families appear the same in one-octave scales (diatonic) as in two-octave scales (thirds).

Some examples are:

–**The major family** (may be interpreted as *the lydian family*, as shown above):

Major(1st degree) Dorian(2nd or 9th degree) Phrygian(3rd degree) Lydian(4th or 11th degree)

Mixolydian(5th degree) Natural Minor(6th or 13th degree) Locrian(7th degree)

–**The melodic minor family**: Dorian b2(2nd degree), Lydian #5(3rd degree), Lydian b7(4th degree),

Mixolydian b6(5th degree), Dorian b5(6th degree), Super locrian(7th degree)

SCALE CHARACTERISTICS

Octave to octave

There are many ways of defining or categorising the characteristics of each scale. One that will be significant for aural perception, is the one-octave scale that is found between the perfect octaves that form the primary and secondary key centres.

Returning to the *B / C major leading note scale*, the octave intervals of the key centre notes form each their one-octave scale.

17 common scale extracts

E gipsy minor (B root) B harmonic minor (E root) B minor b6 A gipsy minor (E root)

Often, these one-octave scales will be recognisable as common scales, as in the example above. The recognition of these scales is insignificant to the theoretical explanation of the bitonal scale, but can nevertheless provide a suggestion towards the construction of the scale and the sounding qualities it possesses.

Tetrachords

Based on the knowledge of tetrachords, another system appears out of defining each tetrachord within the two-octave scale construction.

First, a short introduction to tetrachords:

«Traditionally, a tetrachord is a series of four tones filling in the interval of a perfect fourth, a 4:3 frequency proportion. In modern usage a tetrachord is any four-note segment of a scale or tone row.» (- *Wikipedia*)

There are four different categories of tetrachords in use in the Bitonal Scale System. Category 1 and 2 are part of the traditional definition of a tetrachord, while category 3 and 4 are my additions based on a modern understanding of the tetrachord.

1. *Diatonic* – constructed of two major 2nds and one minor 2nd to form the range of a perfect 4th.
2. *Chromatic* – constructed of one minor 3rd and two minor 2nds to form the range of a perfect 4th.
3. *Mediantic* – constructed of two minor 2nds and one major 2nd to form the range of a major 3rd.
(The chromatic construction of four semitones forming the range of a minor 3rd also belongs to this category, but is omitted here because it is insignificant in this context).
4. *Tritonal* – constructed of a minor 3rd, a major 2nd and a minor 2nd to form the range of a tritone.

In category 1, 2 and 3, three different permutations are available. Category 4 has six possible permutations.

The image displays four musical staves, each representing a different category of tetrachord. Each staff contains three examples of the category, labeled D1-D3, C1-C3, M1-M3, and T1-T6 respectively. The notes are written in treble clef on a five-line staff. The Diatonic category (D1-D3) shows intervals of two major seconds and one minor second. The Chromatic category (C1-C3) shows intervals of one minor third and two minor seconds. The Mediantic category (M1-M3) shows intervals of two minor seconds and one major second. The Tritonal category (T1-T6) shows intervals of one minor third, one major second, and one minor second in various permutations.

In a bitonal scale, tetrachords are defined by the key centres of the scale. When tetrachords on the key centres are established, one can locate the other tetrachords involved in the scale. In this way we get a row of tetrachords which together constitute the leading note scale.

On each starting note of a tetrachord, a *tonal centre* is formed. In practical use of the tetrachord approach to leading note scales, the internal tetrachord formula is what defines the bitonal scale. The bitonal scale is the resulting outcome of the tetrachords employed. The *skeleton* of the bitonal scale is defined by the tonal centres of the tetrachords which it is constructed from.

Each tetrachord could be substituted by any permutation from its own category. As long as the tonal centres of the tetrachord construction are preserved, the skeleton (tetrachord tonal centres) of the bitonal scale will remain the same.

Original, with tetrachords

E Lydian / F Lydian

(C2)..... (C2)..... (T4)..... (D2).....

(root) (dominant) (root) (dominant) (root)

By use of tetrachord permutation, the bitonal scale can be turned into a variety of *permuted bitonal scales*. Here's one example:

E Lydian / F Lydian (Permuted)

(C3)..... (C1)..... (T2)..... (D1).....

(root) (dominant) (root) (dominant) (root)

In this *E lydian/F lydian* tetrachord design, we find that the 2nd tetrachord (*from B*) is *disjunct* in its relation to the first tetrachord, and *conjunct* in its relation to the 3rd tetrachord (*from E'*). If the tetrachord approach is detached from the principle of following the key centres, the variation of conjunct and disjunct tetrachords will give a range of possible designs.

Maqam scale systems

The maqam system is a basic element in music from the Near- and Middle East and North Africa², and has similarities to the Greek tetrachords. It is of particular interest to me as being one of the main inspirations in the discovery of the bitonal scale system. A few terms and concepts need a brief explanation here³:

Jinz is the Arabic term for tetrachord. The word means *gender*, and is commonly used to describe character, not only of music, but anything that can be said to possess character. There are other words with related musical meaning, including a plural form and names for cells of three or five notes. To limit the amount of terms here, I will include all these in the term *jinz*.

² The common term «*Arabic music*» is imprecise, and therefore avoided here. The music tradition based on maqam is spread widely over several regions, continents and cultures. I will therefore avoid geographical, ethnographical or religious connections here by simply calling it *the maqam system*.

³ This presentation of Arabic musical terms will not be just to their use in maqam tradition and Arabic language. They are presented here to give only a brief knowledge, with the purpose of serving the content of this thesis.

5 consecutive Hijaz (*conjunct*)

= B whole tone / C whole tone

At the root of every new *jinz*, a secondary root for the bitonal scale is added. This becomes the *skeleton* of the scale, in the same manner as with tetrachords.

4 consecutive Bayat + Hijaz (*conjunct*) (key centers/skeleton)

An aural analysis of a melody from a bitonal scale may lead to other constructional results. By terms of the *maqam* tradition, which is traditionally aurally rooted, this would probably make the most truthful analysis. The following is a melody from my composition «*Sema Suite for Sufi Spinning, Part 3*», Mini Macro Ensemble, 2008. It is based on the B / C major bitonal leading note scale. By aural analysis of the melody I find that the actual root of this melody is D' . A «*maqam-like*» construction is formed by locating the different *jinz*. In the first section of this melody (bar 1-20) there is a *nekriz* from D' , and another *nekriz* from A' . The second part of the melody descends to a *b hijaz*, through $F\#$ *hijaz*, B *nahawand* and E *nekriz*. These *jinz* are derived from an aural definition of tonal centres, rather than the theoretical definition of key centres as explained under *Perfect octaves and roots* (p. 38)

Audio Example No. 1: Sema Suite for Sufi Spinning, Part 3.

(s. sax + violin)

7

13

19 (viola + dbl. bs.)

25 (cello + dbl. bs.)

31

36

39

Nekriz on D

Nekriz on A

Nekriz on D

Nekriz on D

Hijaz on F#

Nahawand on B

Hijaz on F#

Nahawand on B

Nekriz on E

Nahawand on B

Nekriz on E

Hijaz on B

THE SISTER SCALE

As a compositional tool, the bitonal scale can be analysed with the *modus quaternion*⁶, where the retrograde inversion appears as the only valid variant. Retrograde is skipped, because it only means displaying the scale in descending mode. Inversion is skipped because this means displaying the retrograde inversion in a descending mode. The retrograde inversion will therefore be the *sister scale* of the original. In this case, the *Bb / B phrygian* is the sister scale of the *B / C major*.

⁶ The term *modus quaternion* relates to the system initially developed by Arnold Schönberg for deriving forms from twelve-tone series. See *Smith-Brindle 1966, pp. 21-22*.

The image shows two musical staves. The top staff is labeled "B maj / C maj original" and contains a single melodic line in treble clef. It is divided into four measures, with the first and third measures labeled "(root)" and the second and fourth measures labeled "(dominant)". The notes are: B2, C3, D3, E3 (root); F#3, G#3, A3, B3 (dominant); C4, D4, E4, F#4 (root); G#4, A4, B4, C5 (dominant). The bottom staff is labeled "5 Retrograde inversion = Bb phryg / B phryg" and contains two staves (treble and bass clef). The treble staff has four measures labeled "(root)", "(dominant)", "(root)", and "(dominant)". The notes are: B2, C3, D3, E3 (root); F#3, G#3, A3, B3 (dominant); C4, D4, E4, F#4 (root); G#4, A4, B4, C5 (dominant). The bass staff contains the notes: B1, C2, D2, E2 (root); F#2, G#2, A2, B2 (dominant); C3, D3, E3, F#3 (root); G#3, A3, B3, C4 (dominant).

The key centres of the *Bb / B phrygian bitonal leading note scale* are *B* and *F#*. I choose *B* as the primary key centre (root) and *F#* as the secondary key centre (dominant). This means that this scale is in root position (1st degree). However, it differs from the *B / C major* in that the root is not the first note of the scale. This difference can be addressed by the terms *lower root* and *upper root*.

The sister scale (retrograde inversion) of the *Bb / B phrygian* will be the *A / Bb major*. The continuation of this way of thinking will result in a bigger system of related scales. This will be a project in the continuation of the development of the bitonal scale theory. As with our common church modes, a system with retrograde inversions of modes on all scale degrees will result in a system of modes identical to the original, but in a different transposition. By using the same process on the sister scale, a whole system of a *scale family tree* may be developed.

CHORDS

In essence, the bitonal scale system is a modal setup, and will perhaps work best in a melodic-modal rather than a melodic-harmonic layout. However, in order to use the system of bitonal scales in my composing, it is useful to look into the harmonic possibilities.

To begin with, I will build chord structures on thirds, ending up with a mix of the basic chords of *C* and *B major*.

9 Chords on thirds

B^A C^A E^bm⁷ Em⁷ F[#]7 G⁷ B^bo A^o C[#]m⁷ Dm⁷ E^A F^A G[#]m⁷ Am⁷

Each of these chords bear only the characteristics of one of the tonalities C major or B major. The colour of the *B / C major bitonal leading note scale* does not come out until you blend chords from the two tonalities. This is achieved simply by putting chords on top of each other as polychords:

Dm⁷/B^A B^bm^{b5}/C E^A/Em⁷

If we build a chord of fourths (three scale steps in the bitonal scale), we will get a mix of notes from the two tonalities. In this way, the fourth-built chord can express the colour of the *B / C major leading note scale* in isolation.

13 Chords on fourths (3 scale steps)

B^A C^A E^bm⁷ Em⁷ F[#]7 G⁷ B^bo A^o C[#]m⁷ Dm⁷ E^A F^A G[#]m⁷ Am⁷

A more flexible method would be to build chords more freely, choosing the characteristics of the respective chords from a number of options. The following is a diagram of available options, and a list of the available common four-note chords in B / C major, shown as chord symbols.

B major / C major Bitonal leading note scale**Chord diagram**

Root	type	7 th	min.alt's	possible alt's	bitonal triad
B	Ma	Δ	13	#5 #9 #11 #13	Bb/B
C	Ma / mi	Δ / b	13	b5 b9 b13	C#/C
D#	Ma / mi	Δ / b	13	#5 b9 #11 b13	E/Eb Dm/Ebm
E	mi	b	13	b5 b9 b11 b13 b15	Fm/Em
F#	Ma	Δ / b	13	#5 #9 #11 #13	F/F#
G	Ma / mi	b	13	b5 b9 b13 b15	Ab/G
A#	Ma / mi	Δ / b	13	b5 b9 b13 b15	B/Bb
B'	mi	b	b5 b9 b13	b5 b9 b11 #12 b13 b15	Amb5/Bmb5 Cmb5/Bmb5
C#	Ma / mi	Δ / b	13	#9 #11 #13	C/C#
D'	mi	b	13	b5 b9 #10 b13	Cm/Dm Cmb5/Dmb5 Eb/Dm(b5)
E'	Ma	Δ	#11	#5 #9 #11 #13	Eb/E
F'	Ma / mi	Δ / b	13	b5 b9 #11 b13 b15	F#/F
G#	Ma / mi	Δ / b	13	#5 #9 #11 b13	G/Ab
A'	mi	b	b13	b5 b9 #10 b13 b15	Gm/Am Bbm/Am Gmb5/Amb5 Bbmb5/Amb5

BΔ BΔ#5
 C7 C7b5 CΔ Cδb5 Cm7 Cm7b5 CmΔ CmΔb5
 Eb7 Eb7#5 EbΔ EbΔ#5 Ebm7 EbmΔ
 Em7 Em7b5
 F#7 F#7#5 F#Δ F#Δ#5 F#7sus4
 G7 G7b5 Gm7 Gm7b5
 Bb7 Bb7b5 BbΔ BbΔb5 Bbm7 Bbm7b5 BbmΔ BbmΔb5
 Bm7b5
 C#7 C#7#5 C#Δ C#Δ#5 C#m7 C#mΔ
 Dm7 Dm7b5
 EΔ EΔ#5
 F7 F7b5 FΔ FΔb5 Fm7 Fm7b5 FmΔb5
 Ab7 Ab7#5 AbΔ AbΔ#5 Abm7 AbmΔ
 Am7 Am7b5

SCALES WITH THREE OR MORE SCALE-COMBINATIONS

So far, I have only gone half-deep in the investigation of the bitonal leading note scales, where two identical scales a semi-tone apart are combined. I will therefore, for now, only give a brief example of a *tritonal* scale, which combines three scales. A general term for combinations of three or more scales will be *polytonal* scales.⁷

⁷ According to *Persichetti 1961, p. 255*, the term *polytonal* refers to «a procedure where two or more keys are combined simultaneously». To achieve nuance, I have chosen to distinguish the combination of two keys as *bitonal*, and combinations of three or more keys as *polytonal*.

C / Eb / A major bitonal scale.



based on



Chords on thirds (with higher extensions)



PRACTICAL USE

As will be shown in the following section of this thesis, the bitonal scale system has come to use both in my composing and in my improvising. However, the way to practical mastery of this theory proves to be a long one. It will still take years of practice and experience to reach a level of mastery where I can fully make use of the material presented here. My aims to master this in improvisation will require a level of awareness that allows an intuitive and instinctive access to the material. To reach such awareness, I must work to get my aural and theoretical skills at an equal level. Being a tonal language free of idioms and fundamentally different from our traditional perception of tonality by the omittance of the octave interval, it will be a long run which at this moment of writing has only just started. However, I already experience the impact of the language I am developing, and I believe that it will be nurtured and crystallised through practice and experience.