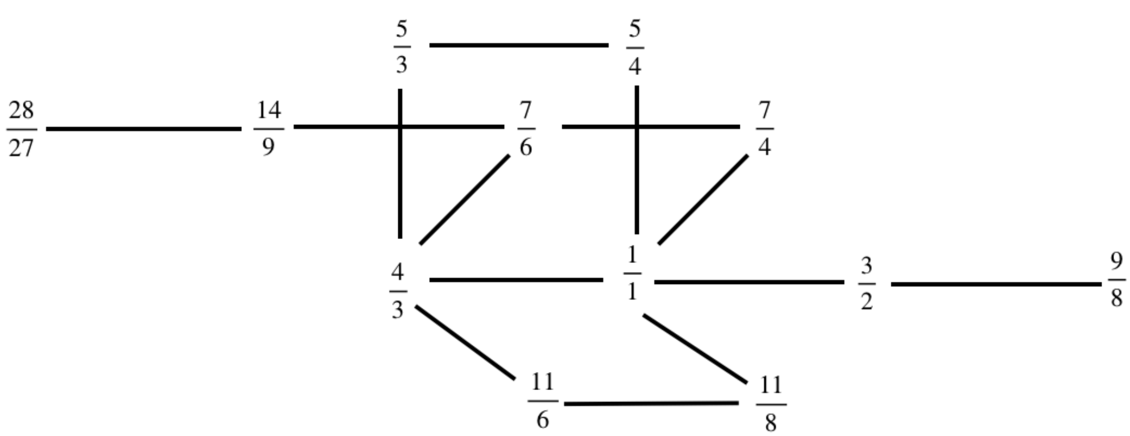
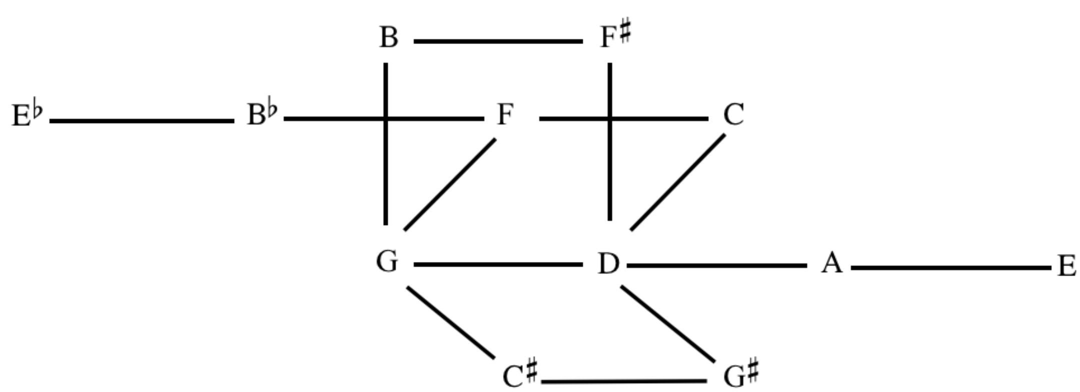
Some Scale Resources of the Harrison-Slye Tuning for the Resophonic Guitar
by Jarrad Powell

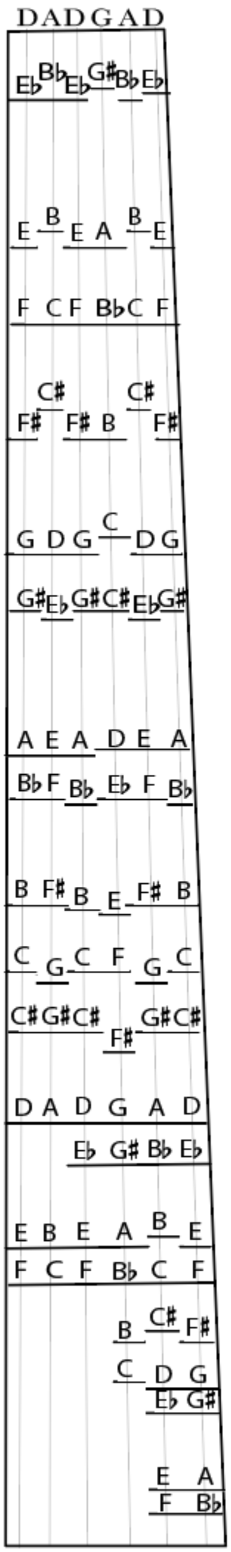
The creation of the Harrison-Slye tuning for reso-phonic guitar was inspired by Lou Harrison for the composition of his piece *Scenes from Nek Chand* (2001-02). Harrison's primary scale resource for his composition was the scale consisting of partials 6–12 in the harmonic series, producing the 6-tone scale 1/1, 7/6, 4/3, 3/2, 5/3, 11/6. In turn, Wiliam Slye and Bill Alves were called upon to suggest the intervals to be used to fill out the remaining six available pitches in the twelve pitch system. For additional information about this piece and the Harrison-Slye tuning visit the website of Bill Alves at billalves.com, or see Giacomo Fiore's 2013 dissertation from the University of California, Santa Cruz, *The Just Intonation Guitar Works of Lou Harrison, James Tenney, and Larry Polansky.*

In David Doty's 2006 chord atlas for the Harrison-Slye tuning he defined a lattice diagram representative of the harmonic space of the tuning. He chose D as the 1/1 because of the primary tuning for the instrument, which is D-A-D-G-A-D (Harrison's original 8-series scale was taken from the harmonic series based on G as the fundamental). David has thoroughly documented in his atlas over 700 chord voicings for the guitar that are available with this tuning.

Below are two lattice diagrams of the harmonic space of the tuning. The first one shows the ratios relative to 1/1 (D). The second diagram shows the letter names of the notes that correspond to the ratios in this tuning.







In addition to the lattice diagrams, I have provided a fingerboard diagram of the guitar neck indicating how the pitches would be arrayed on the neck of the guitar in the D-A-D-G-A-D tuning.

In addition to the chord resources noted by David Doty, the tuning also provides a wealth of scale possibilities in just intonation for melodic exploration. Below I have created a compendium of possible resources for building such scales. I have chosen the ancient method of using the perfect 4th as the building block for scale creation. Common practice is to divide the perfect 4th by inserting one or two tones. Inserting one tone produces *trichords*, which can be combined to create pentatonic scales. Inserting two tones produces *tetrachords*, which can be combined to produce heptatonic scales. These tetrachords or trichords can be combined by *conjunction* (sharing a common tone) or by *disjunction* (separated by a whole step) to create octave scales or for modulation from one tetrachord or trichord to another.

I have first defined the disjunct and conjunct perfect 4ths that define the basis of the tuning. Following that I have listed a catalog of trichords and tetrachords. Obviously many octave scales can be created by choosing a lower trichord or tetrachord and an upper trichord or tetrachord. Modal modulation is also easily available as one might substitute one trichord or tetrachord for another or utilize a mediant trichord or tetrachord, and so forth.

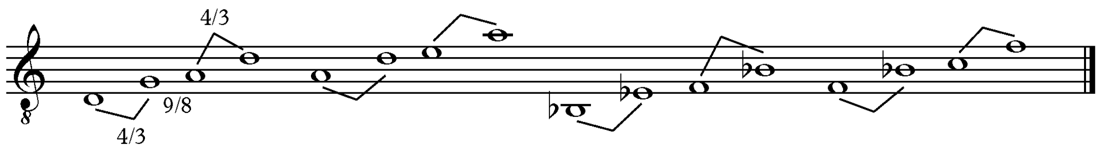
For the sake of organization, I have classified the trichords using a nomenclature borrowed from Japanese music theory. I have used these for the convenience of creating categories and make no claims about the preferred tuning of these trichords in Japanese music. Four genres of trichords exist, depending on the placement of the inner tone: *ryu-kyu, min-yo, ritsu,* and *miyako-bushi*. In the case of the tetrachords, I have borrowed the nomenclature usually associated with Ancient Greek music: *diatonic, chromatic, enharmonic*. The genre is usually defined by the quality of the first descending interval, known as the *characteristic interval.* Once the characteristic interval is established, the remainder (*pyknon*) is further divided by the insertion of another pitch. It is also possible to look at the tetrachord from an ascending point of view, rather than descending, where the larger interval is at the bottom. I have listed such ascending tetrachords as *additional tetrachords,* since we would not normally classify them within the Ancient Greek system. For convenience, I have referred to the unusual tetrachord with the half-steps at the bottom and top and the larger interval in the middle as *Byzantine*. Historically sometimes other adjectives, such as *soft* or *intense*, are added to the names of tetrachord categories to further refine the classification. Tetrachords can also exist on the borders between two genres and hence have intervals that may be ambiguous, depending on melodic context.

Some of these tetrachords have clear historical precedent. Where possible I have labeled these appropriately. We could also look at these scale resources from the perspective of non-western traditions, such as Middle Eastern music (*maqam* and *dastgah*) and Indian music (*melakartas*). In his book *Divisions of the Tetrachord* John Chalmers has made an exhaustive catalog of tetrachords, providing a systematic way of classifying both historical and experimental tetrachords, from *hyperenharmonic* to *diatonic*.

A rich variety of intervallic qualities are represented in the Harrison-Slye tuning: minor seconds from chromatic to diatonic (243/224, 33/32, 28/27, 22/21, 16/15, 15/14), neutral 2nds (12/11, 11/10), major 2nds (10/9, 9/8, 8/7), minor 3rds (7/6, 6/5, 32/27), major thirds (5/4, 9/7, 11/9), and so forth, plus various augmented and diminished intervals. For a list of the successive intervals found in the trichords and tetrachords see the glossary of ratios at the end.

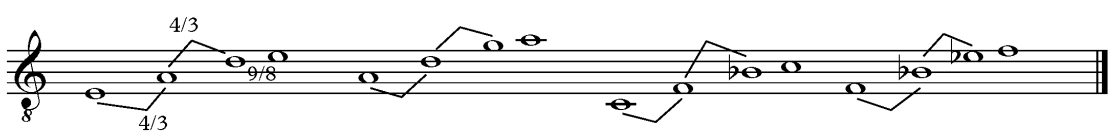
Disjunct Perfect 4ths

D – G   A – D
A – D   E – A
B♭– E♭ F – B♭
F – B♭ C – F



Conjunct Perfect 4ths

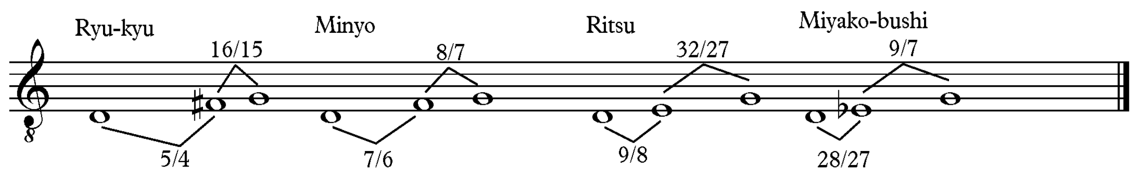
E – A – D+(E)
A – D – G+(A)
C – F – B♭+(C)
F – B♭ – E♭+(F)



D – G

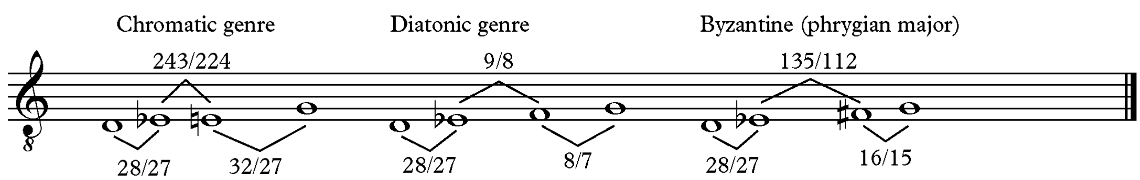
Pentatonic Trichords (D–G)

D ——— F♯-G	Ryu-kyu
D —— F – G	Min-yo (lower trichord of the 6-series tuning for *Scenes from Nek Chand*)
D – E —— G	Ritsu
D-E♭ ——— G	Miyako-bushi



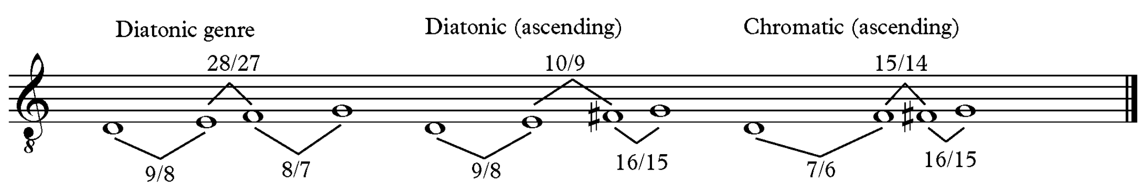
Tetrachords (D–G)

D-E♭-E —— G   Chromatic (Archytas)
D-E♭ — F — G   Diatonic (similar to Archytas' diatonic but with the 9/8 and 8/7 reversed)
D-E♭ —— F♯-G   Byzantine (phrygian major)



Additional Tetrachords (D–G) - an interesting set of tetrachords all with *superparticular ratios*

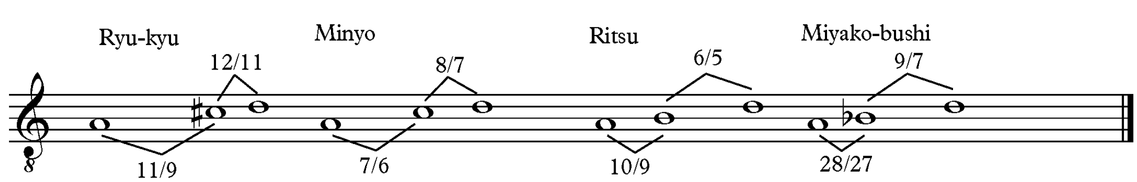
D — E-F —— G   Diatonic (with the small interval in the middle rather than at the bottom creating a "minor" tetrachord – compare to the *diatonic* example above)
D — E — F♯-G   Diatonic (ascending)
D —— F- F♯-G   Chromatic (ascending)



A–D

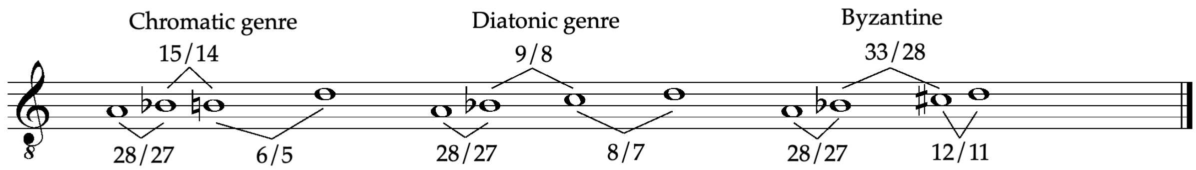
Pentatonic Trichords (A–D)

A —— C♯-D   Ryu-kyu
A —— C – D   Min-yo
A – B —— D   Ritsu
A-B♭ —— D   Miyako-bushi



Tetrachords (A–D)

A-B♭-B —— D   Chromatic (Ptolemy's *soft chromatic*)
A-B♭ — C — D   Diatonic (Archytas)
A-B♭ —— C♯-D   Byzantine (phrygian major)

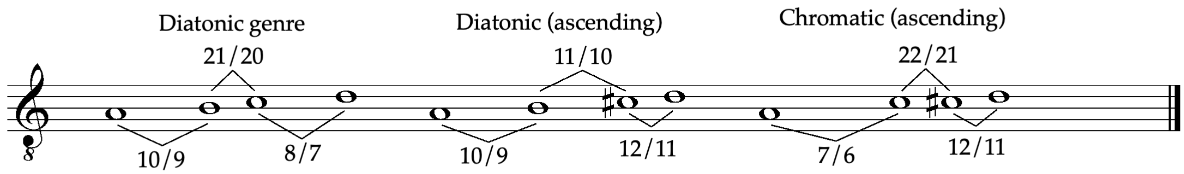


Additional Tetrachords (A–D)

A — B-C —— D Diatonic (another with the small interval in the middle)

A — B — C♯-D Diatonic (superparticular: Ptolemy's *Equable Diatonic* in ascending order; this is the upper tetrachord of the 6-series tuning for *Scenes from Nek Chand*)

A —— C–C♯-D Chromatic (superparticular: ascending)



E–A

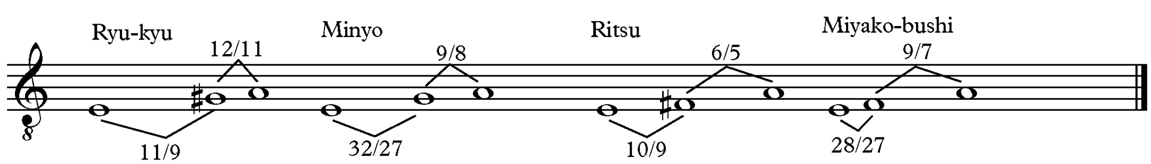
Pentatonic Trichords (E–A)

E ——— G♯-A Ryu-kyu

E —— G —A Min-yo

E – F♯ —— A Ritsu

E-F ——— A Miyako-bushi

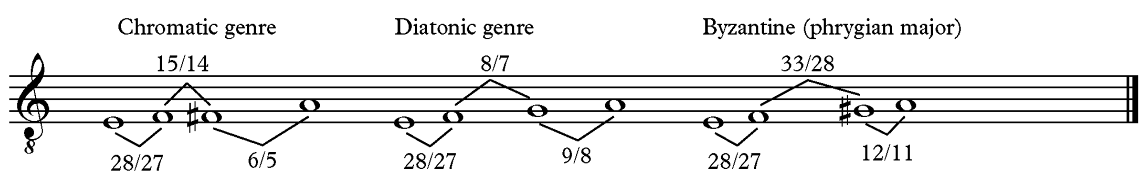


Tetrachords (E–A)

E-F-F♯ —— A Chromatic (Prolemy's *soft chromatic*)

E-F — G — A Diatonic (Archytas)

E-F —— G♯-A Byzantine (phrygian major)

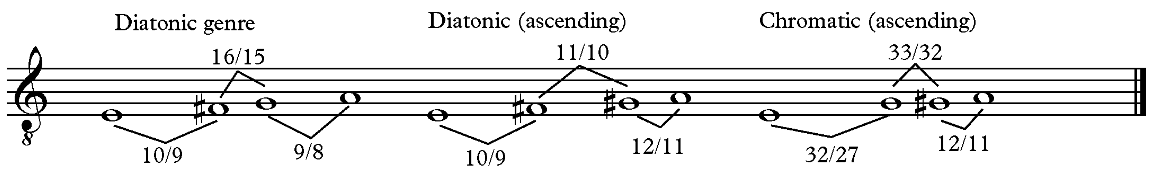


Additional Tetrachords (E–A)

E — F♯-G — A Diatonic (Ptolemy's *diatonic syntonon*, but with 16/15 in the middle)

E — F♯— G♯-A Diatonic (Ptolemy's *equable diatonic* but in ascending order)

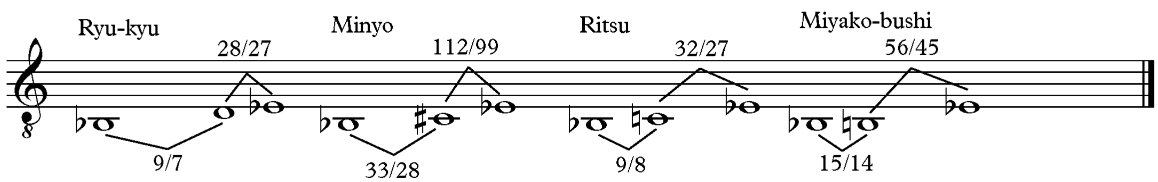
E —— G-G♯-A Chromatic (ascending)



Bb – Eb

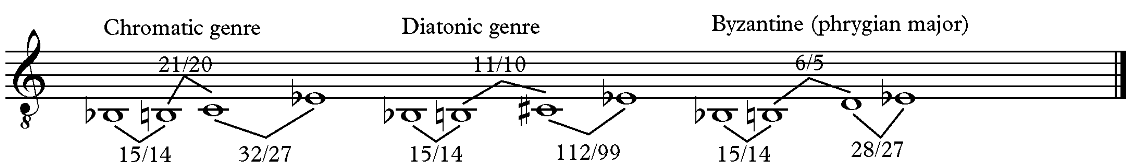
Pentatonic Trichords (Bb–Eb)

B♭ ——— D-E♭ Ryu-kyu
B♭—— C♯—E♭ Min-yo
B♭ – C ——E♭ Ritsu
B♭-B ——— E♭ Miyako-bushi



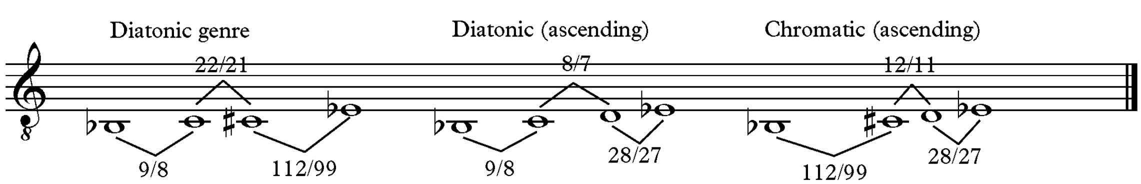
Tetrachords (Bb–Eb)

B♭-B-C ——— E♭ Chromatic
B♭-B —C♯ —E♭ Diatonic
B♭-B ——— D-E♭ Byzantine (phrygian major)



Additional Tetrachords (Bb–Eb)

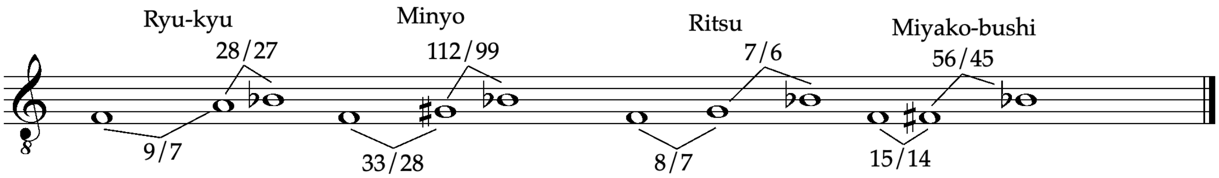
B♭— C-C♯—E♭ Diatonic (another example with the small interval in the middle)
B♭— C — D-E♭ Diatonic (Archytas diatonic in ascending order)
B♭ ——C♯-D-E♭ Chromatic (ascending)



F – Bb

Pentatonic Trichords (F–Bb)

F ——— A-B♭ Ryu-kyu
F —— G♯—B♭ Min-yo
F – G—— B♭ Ritsu
F-F♯ ——B♭ Miyako-bushi

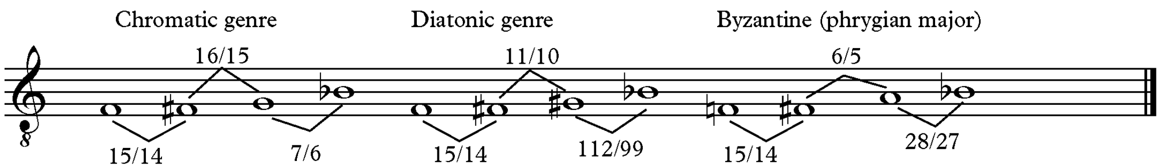


Tetrachords (F–Bb)

F-F♯-G ——B♭ Chromatic

F–F♯– G♯ —B♭ Diatonic

F–F♯——A- B♭ Byzantine (phrygian major)

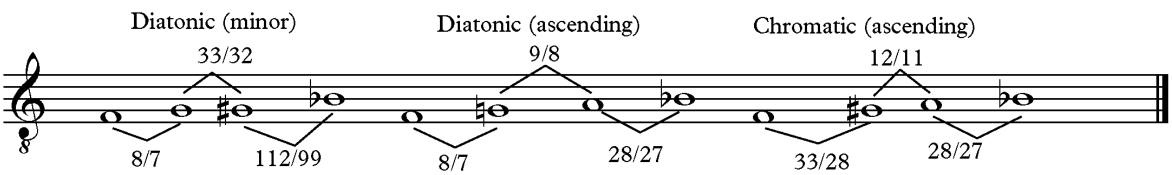


Additional Tetrachords (F–Bb)

F—G-G♯— B♭ Diatonic (minor)

F—G — A- B♭ Diatonic (ascending)

F—— G♯-A-B♭ Chromatic (ascending)



C – F

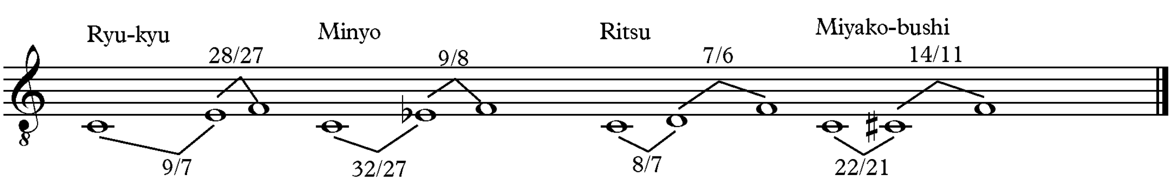
Pentatonic Trichords (C–F)

C————E-F Ryu-kyu

C —— E♭—F Min-yo

C – D ——F Ritsu

C-C♯ —— F Miyako-bushi

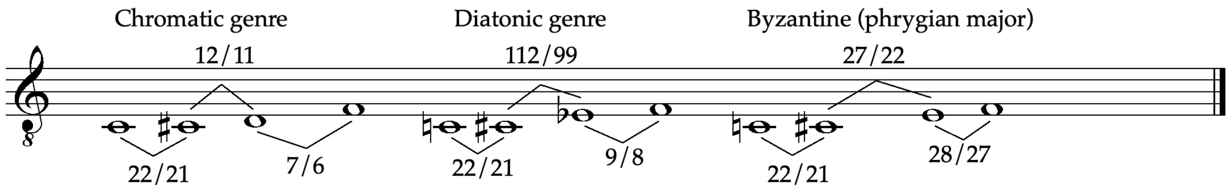


Tetrachords (C–F)

C-C♯-D ——F Chromatic (Ptolemy's *intense chromatic*)

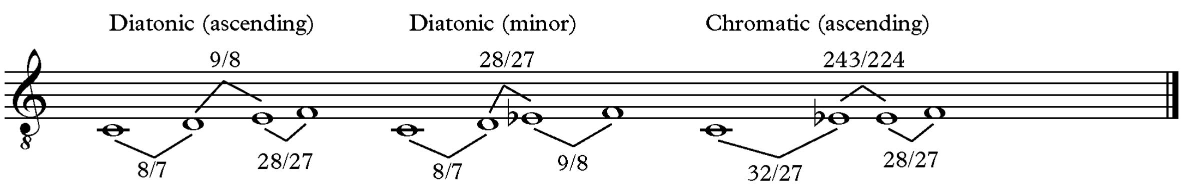
C-C♯—E♭ —F Diatonic

C-C♯——— E-F Byzantine (phrygian major)



Additional Tetrachords (C–F)

C—D ——E-F	Diatonic (ascending)
C—D-E♭ — F	Diatonic (another example with the small interval in the middle)
C ———E♭-E-F	Chromatic (ascending)



Glossary of ratios

(The following are the ratios found as successive intervals in the trichords and tetrachords given above. Thanks to the xen.wiki Gallery of Just Intervals for some of this classification information.)

33/32 - The al-Farabi ***quarter-tone;*** possible melodic interval in the Greek *enharmonic genre*

28/27 - The ***septimal chroma*** or ***septimal third*-tone;** the difference between 15/14 and 10/9, 9/8 and 7/6, 9/7 and 4/3, 3/2 and 14/9, 12/7 and 16/9, and 9/5 and 28/25

22/21 - A ***small semitone*** of about 80.5 cents found in 11-limit Just Intonation; the difference between the 21st and 22nd harmonic partials

21/20 - The ***minor semitone*** or ***large septimal chromatic semitone***; a small semitone of about 85 cents found in 7-limit just intonation, for example, as the difference between 8/7 and 6/5, or between 5/3 and 7/4

16/15 - The ***diatonic semitone,*** or ***major semi-tone***; found in 5-limit Just Intonation

15/14 - The ***septimal diatonic semitone***

243/224 - The ***septimal subtone*** that is a 7/4 below the 3-limit major seventh of 243/128 and is 2.4 cents sharp of 13/12

12/11 - The **undecimal (11-limit) neutral second** or **lesser neutral second;** found between the 11th and 12th partials of the harmonic series

11/10 - The ***large undecimal (11-limit) neutral second*;** found in Ptolemy's Equable Diatonic which divides the tetrachord 12:11:10:9

10/9 - The ***minor tone*** or ***minor whole-step***; found in 5-limit just intonation

9/8 - The ***major tone*** or ***major whole*-step;** found in 3-limit Pythagorean tuning; the octave-reduced 9th harmonic

112/99 - A ***wide 11-limit major tone***; falls between the major tone (9/8) and the septimal major tone (8/7)

8/7 - The ***supermajor second*** or ***septimal whole tone***

7/6 - The ***subminor third*** or ***septimal minor third***

33/28 - The ***augmented second*** falling between the septimal minor third (7/6) and the Pythagorean minor third (32/27)

32/27 - The ***Pythagorean minor third****;* the interval between 9/8 and 4/3 which is found in 3-limit just intonation

6/5 - The classic ***minor third*** in 5-limit Just Intonation, measuring about 315.6 cents

135/112 - The ***large septimal minor third***

11/9 - A ***neutral third*** of about 347.4 cents; found In 11-limit Just Intonation and falls between a major third and minor third; the simplest ratio neutral third in just intonation

27/22 - The ***rastmic neutral third****;* a *rastma* (243/242 or 7.1 cents) sharp of 11/9, and together with 11/9 makes 3/2

56/45 - The ***narrow perde segah****;* a major third associated with Turkish maqam music, it is flatter than 5/4 by *septimal kleisma* of 225/224; 56/45 is the interval between various 7-limit consonances: 5/4 and 14/9, 9/7 and 8/5, 9/8 and 7/5, and 10/7 and 16/9.

14/11 - ***Supermajor third*** in 11-limit just intonation; it is about 417.5¢; sometimes considered a diminished fourth.

9/7 - ***Supermajor third*** or ***septimal major third****;* as a ratio of 9, the 9/7 shares sonority qualities with 9/8 more than 5/4.

NOTE: I began this catalog as a pre-compositional exercise for composing for the Harrison-Slye tuning. I make it public in this form because it may be of some use to other composers who wish to explore the possibilities of this tuning. The current form of the document may be amended as I make corrections or discover new insights into the tuning.

Jarrad Powell (2019)