John's Rules Music

Rules for Music Composition in Alternative Tunings

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Introduction

I began my musical tuning research in 1995 and over the years I have worked out a few rules that I follow when I'm composing. This book describes these rules. I'm not saying that you, the reader, must follow them. These rules are what work for *me*. If you want to try them, great! If you want to do things differently then that is your prerogative and that's fine by me.

Some of my rules are not set in stone. For example early on in my tuning career my maximum tempering or deviation from a just interval was 256/255 (+/-6.7758 cents). In recent years I've been using a more relaxed tempering tolerance of 1024/1019 (+/-8.474 cents).

If you don't understand these terms above I will explain them later.

This book is aimed primarily at people who use alternative tunings, tunings that are different from the standard Western tuning: 12 Tone Equal Temperament (12TET). If you adhere to my rules then 12TET becomes severely limited, regular major and minor chords become illegal as do major thirds and major sixths. So if the tuning you use is 12TET this book is not for you. 19TET (19 equal divisions of the octave) on the other hand is much more versatile when you follow the rules proposed in this book. So is my own Eagle 53 tuning.

Almost all of the ideas in this book have been covered in my earlier books. But I like the idea of all of the more significant ideas collected together in one book, this one.

The ideas and rules I present in this book are according to my current understanding which may be wrong and may change in the future.

A very large part of this book (69%) is the list of intervals I deem to be good over a six octave range. Some might find the list redundant but I think it is significant and I like the idea of it being in print.

Chapter One
Intervals, Tempering and Just Intonation

The distance between two musical notes is called an interval. Consider two musical notes with frequencies of 220Hz and 330Hz each. (Hz means waves per second). How these frequencies relate to each other can be expressed as a ratio: 220/330. Both 220 and 330 are evenly divisible by 110 so 220/330 can be reduced to 2/3. 2 and 3 are small numbers and, in general, the smaller the numbers in a musical ratio the sweeter the sound of the two notes. These notes could be played simultaneously (which corresponds to harmony) or they could be played in sequence (which corresponds to melody). Other examples of strong intervals are: 1/1, 2/1, 4/3, 5/3, 5/4 etc.

Note that conventionally intervals are expressed such that the left hand side (numerator) is equal to or greater than the right hand side (denominator). Doing it this way means that the greater the magnitude of the ratio, the wider the interval. The magnitude of 3/2 is 1.5. The magnitude of 4/3 is 1.3333. 1.5 is greater than 1.333 and 3/2 is wider than 4/3. Intervals with larger numbers on either side are not so sweet. 40/27 is an example of an interval I deem to be sour, both in a melody and a harmony context.

The widths of various intervals could also be expressed in cents. In the standard Western musical tuning (12 Tone Equal Temperament or 12TET for short) the distance between any two adjacent notes is always the same. If the frequency of one note is 'x' then, in 12TET, the frequency of the note just above it is 'x' multiplied by 1.059463. 1.059463 is the 12th root of 2. The 12th root of 2 is an irrational number, you can't express it exactly as an integer ratio.

As I said, the distance between any two adjacent notes in 12TET is always the same and this distance, or interval, is called

a semitone. A standard semitone can be divided into 100 equal parts called cents. So in 12TET two adjacent notes are 100 cents apart. Wider intervals in 12TET are 200 cents, 300 cents, 400 cents etc.

In 12TET, over a one octave range (i.e. between 1/1 and 2/1 or between 0 cents and 1200 cents) there are only two intervals that correspond exactly to a simple ratio and these are 1/1 (0 cents) and 2/1 (1200 cents). In 12 TET the 3/2 interval is 700 cents but a perfectly tuned 3/2 is actually 701.955 cents. So the 3/2 interval in 12TET is slightly out tune (by around 2 cents). This slight mistuning of 3/2 is practically unnoticeable. Other intervals in 12TET however are much more out of tune. The 5/4 interval tuned perfectly is 386.3 cents wide. This is 13.7 cents narrower than the 12TET 5/4 (400 cents). 13.7 cents is a very noticeable mistuning, I currently won't use any interval that is more than +/-8.474 cents away from a pure simple interval.

So 12TET is a compromise system where most of the simple integer ratios are out of tune in varying degrees. I describe my understanding of how 12TET came into being in my book: Eagle 53 My Ultimate Musical Tuning (Third Edition).

Just Intonation

Just Intonation is a term that can be used to describe music that uses only perfectly tuned rational intervals, in particular intervals composed of small numbers (e.g. 5/3 or 7/4). I came up with a formula for calculating how strong or sweet a just interval (or ratio) is. If the interval is n/d (numerator/denominator) then the formula is…

$$2/n + 2/d$$

Why the 2s? Why not use 1/n + 1/d? I assign a single note a strength value of 1.0 exactly. Look at the 5/3 interval. Using the 1/n + 1/d formula 5/3 has a strength value of 1/5 + 1/3 = 0.5333 which is less than 1.0. However, the 5/3 interval sounds

stronger (to me) than a single note (which has a strength value of 1.0). So there is a contradiction here. If I use the 2/n + 2/d formula instead of the 1/n + 1/d formula I get 2/5 + 2/3 = 1.0667 which is greater than 1.0 and is consistent with what my ears are telling me (i.e. that 5/3 sounds stronger than a single note). Also if I plug 5/4 into the 2/n + 2/d formula I get 2/5 + 2/4 = 0.9 which is less then 1.0 and (to me at least) 5/4 sounds weaker than a single note. So I'm sticking with the 2/n + 2/d formula.

After doing some extensive listening tests I decided that in a harmony context (two notes played simultaneously) any interval with a strength value of 0.4 or higher (using my formula) should be acceptable.

Some intervals that I deemed to be sour or weak in a harmony context sounded acceptable in a melody context. This means that the cut off point for melodic intervals should be lower, perhaps 0.2, half of the harmony cut off point (0.4). I did a few listening tests and 0.2 seems reasonable.

Technically any interval described by an integer ratio is just. 3001/2001 is technically a just interval but I consider it to be a slightly mistuned 3/2. I have my own brand of strict just intonation, I'll call it John's Just Intonation or JJI. Any integer ratio (or interval) n/d in a harmony context is JJI (good) if it has a strength value >= 0.4 using the 2/n + 2/d formula. In a melody context any integer ratio (or interval) n/d is JJI (good) if it has a strength value >= 0.2.

45/32 is an interval that many alternative tuning people have come across. 2/45 + 2/32 = 0.10694 which is less than 0.2. So for me this is not a just interval (not strictly just if you see what I mean). 45/32 is close to 7/5 (strength = 0.69) but this doesn't make it just.

It is interesting that some intervals containing very large numbers are good. If n or d is 5 or lower then the other number can be as big as you like and the interval will still be good. Look at the

hypothetical interval x/5 (where x>5). x can be as big as you like and the interval will always have a strength value greater than 0.4. Say x is 1001… 2/1001 + 2/5 = 0.402, a good strictly just interval (or JJI interval).

Some rules… when I am building chords every pair of notes in the chord must be within 8.474 cents of a good just harmony interval. When I am building scales, or melodies in general, every pair of notes must be within 8.474 cents of a good melody interval. I list these good melody and harmony intervals over a six octave range later in this book.

Tempering Tolerance

Tempering means slightly mistuning an interval or note. Tempering can introduce more good intervals into a tuning (a set of musical notes) that may not be just but close enough to just to be usable. Where did my 8.474 cents tempering tolerance come from?

At first I guessed that the tolerance should have something to do with a power of 2. Maybe an integer ratio of n/(n-1) where n is a power of two. As I said, this was just a guess, but I knew it looked cute.

I tested unisons (1/1) that were out of tune by 64/63, 128/127, 256/255 and 512/511. A unison mistuned by 128/127 (13.58 cents) was definitely too out of tune and unpleasant. I tested a unison mistuned by 256/255 (6.7758 cents) and while the mistuning was audible it wasn't too unpleasant. I tested other intervals (such as 3/2) besides the unison as well. So for many years my tempering tolerance was not more than 256/255 (6.7758 cents).

At some point (a year or two ago, 2018 or 2019) I heard some music in 19EDO tuning (19 Equal Divisions of the Octave) and It seemed that the chords (I think they were major) were sweet but the 3/2 intervals (which are a part of major chords) in these chords should be tuned to 694.7 cents (in 19EDO) which is 7.3

cents narrower than a just 3/2. 7.3 cents is outside of the 6.7758 cents tempering tolerance. It could be that some of these chords I heard were not tuned exactly to 19EDO but over the last year or two I have heard several 19EDO pieces where the chords sounded sweet to my ears. So 3/2 is 7.3 cents out of tune in 19EDO but (it seems) it still sounds good. That suggests that a more relaxed tuning tolerance should be acceptable.

My gut feeling was to go from 4 to 5. Here's what I mean… When I was doing listening tests on my formula for harmony intervals I guessed that the cut off point below which an interval is sour should be 0.5 (or one half). Why? Simply because it looked good. But in the end, after some extensive listening tests, I decided on 0.4 as the cut off point. So I went from two quarters (0.5) to two fifths (0.4). I guessed that I should do something similar with my tuning tolerance. 256/255 could be written as 1024/1020. So this is 1024 over 1024 minus 4 which is 1020. Instead of subtracting 4 from 1024 I subtracted 5 to get 1019. And my tempering tolerance went from 1024/1020 to 1024/1019 which is 8.474 cents. Many people reading this may find my reasoning ridiculous but this is how it occurred to me. This is how I think. I did a few listening tests and the 8.474 cents tempering tolerance seems reasonable.

Harmonic Series/Overtones

When a guitar string is struck it produces more than one frequency. There is a fundamental (which is the obvious frequency) but there are overtones sounding as well which are not as loud as the fundamental but are there nonetheless. The fundamental and the overtones can be called harmonics or partials. If the frequency of the fundamental is, say, 100Hz then the frequency of the first overtone (or second harmonic or partial) is 200Hz (twice the fundamental) and the intensity or loudness of this is one half that of the fundamental. The second overtone (or third harmonic or partial) has a frequency of 300Hz (three times the frequency of the fundamental) and the intensity or loudness of this is one third that of the fundamental. And so on. These fundamentals and overtones make a harmonic series and not all instruments have the

same harmonic series. If I remember correctly bells do not have a regular harmonic series like the one described here. Sine wave tones have no overtones at all, just a fundamental. The harmonic series could be expressed as 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 etc. In practice, with guitars or pianos or organs, the overtones are not exactly 2, 3, 4, 5, 6, 7 etc. but are very close to these numbers and how closely the actual partials approximate the ideal partials varies from instrument to instrument.

Chapter Two
Melody, Harmony and Chord Groups

I think that the most common Western musical scale is the Major scale. Do, Re, Mi, Fa, So, La Ti, Do. If the tonic (key note or root note) of the scale is on C then the notes are C, D, E, F, G, A, B and C. These are all on white keys on a piano, no black keys, no sharps or flats. A just major scale looks like:

1/1, 9/8, 5/4, 4/3, 3/2, 5/3, 15/8, 2/1.

My understanding for a long time was that if you stick to the notes in a scale, using notes in lower octaves to mid octaves to higher octaves then you can't go wrong. So pick any scale that sounds nice over a one octave range and if you play notes from the lowest octaves available to the highest octaves available they will always sound good if they belong to the scale. Right? Wrong!

Consider the Melodic Major scale that occurs in my Eagle 53 tuning. The scale is very close to this just scale…

1/1, 9/8, 5/4, 4/3, 3/2, 8/5, 9/5, 2/1

If 1/1 is E then the scale is E, F#, G#, A, B, C, D, E. The distance from any A note to the D note just above it is 521 cents which is within 3 cents of a good just melodic interval (23/17). So this pair of notes is good melodically. Now consider playing a note that is in a range one octave higher than where we started. The distance from any D note to the A note just above it (which is in a higher octave range) is 679 cents which is nowhere near any of my good melodic intervals. So this pair of notes is not good melodically, going from one note to the other will sound sour. I have often tested the 40/27 interval (680 cents approximately) and I definitely don't like it, neither in a melody, nor a harmony, context. So in Eagle 53 going from A up to D is good but going

from D up to A isn't.

I suspect that this problem occurs with many other scales. So here's another rule… when playing melodies over any range (e.g. a grand piano spans 7+octaves) every single note, when paired with every other single note, must be within 8.474 cents of a good melodic interval (these good melodic intervals are listed later).

By the way, the major scale in 12TET contains two intervals that I'm suspicious of: 400 cents (e.g. C up to E) and 900 cents (e.g. C up to A). Neither of these are within 8.474 cents of what I consider to be a good melody (or harmony) interval. 400c is close to 19/15 (409.2 cents) but not close enough. 900 cents is close to 22/13 (910.8 cents) but not close enough.

Using my Eagle 53 tuning I worked out a solution, an alternative to sticking with the notes in a one octave scale that repeat themselves in lower and higher octaves. Forget about harmony and chords for a while, just consider melody. When choosing notes to play, every note chosen must be within 8.474 cents of a good melodic interval when it is paired with every other note chosen. Over a 7 octave range, in the Eagle 53 tuning, there are a lot of good melodic intervals but I have found it is much easier to list only the few sour melodic intervals that occur.

Say you have a Midi keyboard spanning five octaves and it is tuned to my Eagle 53 tuning where E corresponds to 1/1. Choose any note you want to start with. Say you choose an A note in the middle of the keyboard. Put a green sticker on that physical A key (not on all of the A keys, just the one chosen). There are only two notes that do not pair nicely melodically with the A key chosen and they are the D note 7 notes below it and the D note 19 notes below it. So put a red sticker on these two D notes. Green sticker means good and red sticker means bad.

Now choose another note (you cannot choose a note marked with a red sticker). Say it's a C which is three notes above the first A chosen. Put a green sticker on the C key. There is only

one note that does not pair nicely with the C chosen and that is the C# just above it. So put a red sticker on that single C# key.

Keep going until you have all the green keys you want or until every key has either a green sticker or a red sticker on it. Here are the rules for where to place the stickers. Every note chosen should have a green sticker on it and any note to be avoided should have a red sticker on it.

If you choose an A, avoid D 7 notes below it and D 19 notes below it.

If you choose an A#, avoid F 7 notes above it and F 19 notes above it.

B is always good.

If you choose a C, avoid C# 1 note above it.

If you choose a C#, avoid C 1 note below it and F# 7 notes below it and F# 19 notes below it.

If you choose a D, avoid D# 1 note above it and A 7 notes above it and A 19 notes above it.

If you choose a D#, avoid D 1 note below it.

E is always good.

If you choose an F, avoid A# 7 notes below it and and A# 19 notes below it.

If you choose an F#, avoid C# 7 notes above it and C# 19 notes above it.

If you choose a G, avoid G# 1 note above it.

If you choose a G#, avoid G 1 note below it.

You get all the E and B notes for free, they will always be good no matter what other notes you choose.

Again, these rules above apply to my Eagle 53 tuning where 1/1 is on E. They do not apply to most other tunings, including 12TET. With Eagle 53 every melodic interval wider than 1950 cents (3/1 and a bit) will be within 8.474 cents of a good melodic interval. Theoretically sour melodic intervals wider than 1950 cents do exist but thankfully they don't occur in Eagle 53.

So melodically, if you stick to the keys marked with green stickers, you can't play a sour note, it's impossible (if I'm right). With regard to chords, if the chords you play have all their notes on green keys then every chord progression should be good. Great for jazz.

For stringed and fretted instruments (e.g. guitars, banjos, mandolins) you could make a diagram of the fretboard and place your green and red stickers on the diagram accordingly. Guitars and other stringed and fretted instruments need a special fret arrangement to accommodate the Eagle 53 tuning.

It has occurred to me that with strongly rooted chords (contain a 1, 2, 4, 8 or 16, explained below), as long as the root note of the chord is on a green key then perhaps it doesn't matter if some of the other notes are on red keys. Strongly rooted chords could be viewed as "one note" because the root note stands out clearly above the other notes. I'm not sure. If I had to choose I think I would just stick with with the green keys only.

The way the frequencies of the notes in a just or near just chord relate to each other can be expressed as multiple integer ratios. A six note major chord on a guitar looks like 2:3:4:5:6:8. A six note minor chord looks like 10:15:20:24:30:40. I call these IRCs (Integer Representation of a Chord) If the IRC of a chord contains a 1, 2, 4, 8 or 16 then the lowest of these that occurs is the root note of the chord. 1, 2, 4, 8 and 16 are powers of 2, 2 to the power of zero is 1. So with the 2:3:4:5:6:8 chord the root note is the lowest note (the 2). There is no 1, 2, 4, 8 or 16 in the minor chord

(10:15:20:24:30:40). So this chord has no clear root, it is not strongly rooted. Conventional theory would consider the lowest note (10) to be the root of the chord but it's not as clear as a 1, 2, 4, 8 or 16 would be so it is not strongly rooted. I consider chords that are not strongly rooted to be inferior to chords that are.

No matter the tuning you use, Eagle or otherwise, here is my rule for the selection of notes to be used in a melodic context (which could span as much as 7 or more octaves if you like). Every note used, when paired with every other note used, must be within 8.474 cents of any of the good melodic intervals listed in this book (strength value >=0.2).

Strongly rooted scales are a special case. Look at the following 20 note scale.

1:2:3:4:5:6:7:8:9:10:11:12:13:!4:15:16:17:18:19:20

Every note pairs nicely with every other note (I'm talking about melody here, not harmony). This scale and any subset of this scale that contains one or more of 1, 2, 4, 8 or 16 is a good and strongly rooted scale. 32, 64, 128 and higher powers of 2 don't work as roots. You could add numbers higher than 20 as well as long as they pair nicely with the numbers already chosen (see the list of intervals later in this book). There are intervals here that you won't find in Eagle 53 but do occur in other tuning systems. The root of a scale or tonic of a scale have the same meaning for me but I prefer the word root.

A scale can also be viewed as a chord group, especially when the chords are all strongly rooted. Look at the 5:6:8:9:10 scale (or chord group). In Eagle this could be G#, B, E, F#, G#. If you are using strongly rooted chords and their root notes correspond to the notes in the scale then the chord progressions, in any order, should be good. Perhaps a few illegal melodic intervals will occur among notes that are not the root notes of the chords. If I were to be very strict I would reject any progression where one or more illegal melodic intervals occur. The root note of the 5:6:8:9:10 scale is the 8 (E). If the chord you "land" on (the last chord

played in a musical phrase or progression) is on 8 (or E in this example) the progression or phrase will sound resolved. Like hearing the answer to a question or finding a point of rest.

For chord progressions I have two standards: loose and strict.

With the loose version if the root notes of strongly rooted chords all make good melodic intervals when paired with each other then any progression using these strongly rooted chords will be good regardless of how the other notes in the chords relate to each other. If NSR (Not Strongly Rooted) chords are used then *every* note in these chords when paired with every other note in every other chord must make a melodic interval that is within 8.474 cents of any good interval listed in chapter 5.

With the strict version every note in every chord used (strongly rooted chords or otherwise) must belong to the notes chosen at the start (which all pair nicely with each other melodically). Again, in this collection of pitches every note, when paired with every other note must make an interval within 8.474 cents of any of the good melodic intervals (strength>=0.2) listed later in this book.

Between my two recent books: The Eagle 53 Pianist and Eagle 53 Jazz Chords I list 5,749 chords that I consider to be good. The Pianist book lists 2,750 "lush chords" and the Jazz book lists 2,999 jazz chords. A lush chord is strong (overall strength or periodicity value >=0.75) and is strongly rooted (has a 1, 2, 4, 8 or 16 in its IRC). I define a jazz chord as any good chord with an overall strength or periodicity value >=0.4 that is not a lush chord. Some chords with a strength value >=0.75 are not strongly rooted and some strongly rooted chords have an overall strength less than 0.75. These are the jazz chords.

The overall strength (or periodicity) of chords

Just or near just chords can be represented by integer ratios. A six note major chord looks like 2:3:4:5:6:8. The overall strength of any chord that can be represented by integers is the sum of the reciprocals of each integer multiplied by 2. So the overall strength of 2:3:4:5:6:8 is

$$(1/2 + 1/3 + 1/4 + 1/5 + 1/6 + 1/8)x2 = 3.15$$

I won't use chords with an overall strength less than 0.4.

Also every interval in any chord must be within 8.474 cents of what I consider to be a good interval (i.e. any just harmony interval n/d is good if 2/n + 2/d >=0.4).

When I was working out chords for my Eagle 53 Pianist book some apparent anomalies occurred. The IRC for the F#, B, D#, F#, C, D#, F# chord was 6:8:10:12:17:20:24, using my specific programming algorithm. The 6:17 (or 17/6, same thing) is a good harmony interval but 8:17, 10:17, 12:17, 17:20 and 17:24 are not in my list of good harmony intervals. It turns out that if you look at the exact cent values of the notes in each of the dubious intervals the intervals are all within 8.474 cents of a good harmony interval. So the 10:17 interval was composed of D# and C. In Eagle 53 D# is 1087 cents and the C just above it is 2015 cents (in relation to the bottom E which is zero cents). This interval is 928 cents wide and is within 6 cents of 12/7, a good harmony interval.

Should this affect the strength value? Possibly. Where these anomalies occur I think that the true intervals are always stronger then the anomalous ones. If you were to consider the true intervals then the overall strength can only get bigger and not smaller. So if I use the anomalous intervals and the overall periodicity is >=0.4 then I know that the chord is good even though anomalies are there. If I were to consider the true intervals the strength of the chord will never be less than when I use the anomalous intervals, it can only be greater. In other words there is

no need to consider the true intervals as long as the strength value is >=0.4 using the anomalous intervals.

Beating Intervals

When two notes that are close together in frequency (a narrow interval) are played simultaneously (harmony) an unpleasant (to me at least) phenomenon called beating occurs. Beats sound like a wobble or a growl and the frequency of the beats is the frequency of the higher note minus the frequency of the lower note. My current range for significant beating is from 8.5 cents (a unison, 1/1, tempered by 8.5 cents) and 173.9 cents (10/9 tempered flat or narrower by 8.5 cents).

There are no good harmony intervals (strength >=0.4) listed in this book that are within this range but some beating can be heard in the following intervals: 11/6, 13/7, 15/7, 13/6 and 11/5. It turns out that the second harmonic or partial (AKA the first overtone) of the lower notes in these intervals beat significantly against the first harmonic or partial (fundamental) of the higher notes. The partials (or harmonics) described here are between 8.5 cents and 173.9 cents apart, indicating significant beating. If you don't understand these terms do an internet search for "harmonic series" or "overtones". The 173.9 cents is a just 10/9 tempered narrower by 8.5 cents.

As you progress along the harmonic series the harmonics or overtones get progressively fainter (less loud). Currently I don't consider any beating that occurs among the third and subsequent harmonics to be significant. Look at 17/6. 6's third harmonic (18) beats against 17's first harmonic (17) but for me, currently, a third harmonic is too faint to be significant so 17/6 is okay.

So for me 11/6, 13/7, 15/7, 13/6 and 11/5 are illegal in a harmony context (illegal in chords) where the timbre is close to a regular harmonic series. Other intervals have mild beating, see chapter five: Beatless Chords.

Chapter Three
John's Rules Music

Here are the rules that I follow when I'm composing.

1. Choose your notes. For a melodic foundation every note that is going to be used in a piece of music must pair nicely, melodically, with every other note (with one exception, see Rule 3b below). Every possible melodic interval (could be any size from a semitone to 8 octaves) should be within 8.474 cents of any of the good melodic intervals (strength >= 0.2) listed in chapter six. Note that *any* melodic interval wider than 6000 cents (five octaves) will always be good (it will always be within 8.474 cents of a good melodic interval). If you stay within the confines of this set of chosen notes you can't play a sour note in a melody (if I'm right). Note that a scale that works over a one octave range may not work spread over two or more octaves. If you are using my Eagle 53 tuning, where 1/1 is on E, see the rules for choosing and avoiding notes (green and red stickers) a few pages back.

2. Building chords. Every interval in every chord must be within 8.474 cents of a good harmony interval. These good harmony intervals are listed in the next chapter and they all have a strength value >=0.4. Also the overall strength (or periodicity) value of any chord must be >= 0.4. See my formula for calculating the strength values of chords near the end of the last chapter. It seems that *any* harmony interval wider than 7200 cents (six octaves) will always be good (it will always be within 8.474 cents of a good harmony interval). If you are using the Eagle 53 tuning there are 2,750 *lush* chords listed in my Eagle 53 Pianist book and 2,999 jazz chords in my Eagle 53 Jazz Chords book.

3a. Chord progressions Strict. Every single note, in every single chord used, must belong to the set of notes that you chose at the start (see rule 1 above). Put another way, *every* note, in *every* chord used, must pair nicely, melodically, with every note in every other chord used. These melodic intervals must all be within 8.474 cents

of a good melodic interval listed in chapter 5.

3b. Chord Progressions Loose. This is the exception mentioned in rule 1. Any strongly rooted chord (i.e. contains a 1, 2, 4, 8 or 16 in its IRC) can be used as long as the root note is one of the chosen notes described in rule 1. Other notes in the strongly rooted chord may not belong to the set of chosen notes but this may not matter. My reasoning is that strongly rooted chords could be treated as being "one note" because one note in the chord (the root note) stands out clearly above the others. If I had to choose between loose and strict I would go with strict.

I propose two standards for music: JRM strict and JRM loose. So if a piece of music conforms to rules 1, 2, and 3a the music is JRM strict. If a piece of music conforms to rules 1, 2 and 3b the music is JRM loose. JRM is an acronym for John's Rules Music. Music in other tuning systems besides Eagle 53 could be JRM.

So people could ask: is this music JRM? If it is is it strict or loose?

Chapter Four
Eagle 53 Scales

Here are 65 strongly rooted scales that occur in my Eagle 53 tuning. These scales can also be viewed as chord groups. The root notes, or chords, are in [square brackets]. They can be used for simple melodies over a one octave range and landing on the root note will always sound resolved and pleasant. Chord progressions should be good if the chords are strongly rooted and the root notes belong to the scale/chord group. Finishing on the root chord [in square brackets] will sound resolved and pleasant.

E

B, [E], G#, B	**3:4:5:6**
[E], G#, B, E	**4:5:6:8**
G#, B, [E], F#, G#	**5:6:8:9:10**
B, [E], F#, G#, B	**6:8:9:10:12**
[E], F#, G#, B, D#, E	**8:9:10:12:15:16**
F#, G#, B, D#, [E], F#	**9:10:12:15:16:18**
B, D#, [E], F#, G#, B	**12:15:16:18:20:24**

F

C, [F], A, C	**3:4:5:6**
[F], A, C, D#, F	**4:5:6:7:8**
A, C, D#, [F], G, A	**5:6:7:8:9:10**
C, D#, [F], G, A, C	**6:7:8:9:10:12**
D#, [F], G, A, C, D#	**7:8:9:10:12:14**
[F], G, A, C, D#, E, F	**8:9:10:12:14:15:16**
G, A, C, D#, E, [F], G	**9:10:12:14:15:16:18**
A, C, D#, E, [F], G, A	**10:12:14:15:16:18:20**
C, D#, E, [F], G, A, A#, C	**12:14:15:16:18:20:21:24**
D#, E, [F], G, A, A#, C	**14:15:16:18:20:21:24**
D#, E, [F], G, A, A#, C, D#	**14:15:16:18:20:21:24:28**
D#, E, [F], G, A, A#, C#	**14:15:16:18:20:21:25**
D#, E, [F], G, A, A#, C#, D#	**14:15:16:18:20:21:25:28**
E, [F], G, A, A#, C, D#	**15:16:18:20:21:24:28**
[F], G, A, A#, C,	**16:18:20:21:24**

F#
A#, [F#], A# 5:8:10

G
D, [G], B, D 3:4:5:6
[G], B, D, G 4:5:6:8
B, D, [G], B 5:6:8:10
[G], B, D, F#, G 8:10:12:15:16
B, D, F#, [G], B 10:12:15:16:20
D, F#, [G], B, D 12:15:16:20:24

G#
D#, [G#], A#, D# 6:8:9:12
[G#], A#, D#,G# 8:9:12:16
D#, [G#], A, A#, D# 12:16:17:18:24

A
E, [A], C#, E 3:4:5:6
[A], C#, E, A 4:5:6:8
C#, E, [A], B, C# 5:6:8:9:10
E, [A], B, C#, E 6:8:9:10:12
[A], B, C#, E, G#, A 8:9:10:12:15:16
B, C#, E, G#, [A], B 9:10:12:15:16:18
C#, E, G#, [A], B, C# 10:12:15:16:18:20
E, G#, [A], B, C#, E 12:15:16:18:20:24
G#, [A], B, C#, E, G# 15:16:18:20:24:30

B
F#, [B], D#, F# 3:4:5:6
[B], D#, F#, B 4:5:6:8
D#, F#, [B], D# 5:6:8:10
[B], D#, F#, A#, B 8:10:12:15:16
F#, A#, [B], D#, F# 12:15:16:20:24
A#, [B], D#, F#, A# 15:16:20:24:30

C

G, [C], E, G	3:4:5:6
[C], E, G, A#, C	4:5:6:7:8
E, G, A#, [C], E	5:6:7:8:9:10
G, A#, [C], D, E, G	6:7:8:9:10:12
A#, [C], D, E, G, A#	7:8:9:10:12:14
[C], D, E, G, A#, B, C	8:9:10:12:14:15:16
D, E, G, A#, B, [C], D	9:10:12:14:15:16:18
G, A#, B, [C], D, E, G	12:14:15:16:18:20:24
A#, B, [C], D, E, G, A#	14:15:16:18:20:24:28
A#, B, [C], D, E, G#, A#	14:15:16:18:20:25:28
B, [C], D, E, G, A#	15:16:18:20:24:28
B, [C], D, E, G#, A#	15:16:18:20:25:28
[C], D, E, G#	16:18:20:25

C#

G#, [C#], D#, G#	6:8:9:12
[C#], D#, G#, C#	8:9:12:16

D

[D], F, F#, A#	16:19:20:25

D#

A#, [D#], E, A#	12:16:17:24
A#, [D#], A#	3:4:6

Below are 31 scales that are not strongly rooted but contain a 1/1, 4/3, 3/2 and 2/1.

Melodic Major

0	204	385	498	702	815	1019	1200
1/1	9/8	5/4	4/3	3/2	8/5	9/5	2/1
E	F#	G#	A	B	C	D	E

Arabian

0	113	385	498	702	815	1087	1200
1/1	16/15	5/4	4/3	3/2	8/5	15/8	2/1
E	F	G#	A	B	C	D#	E

Neapolitan Major

0	113	317	498	702	883	1087	1200
1/1	16/15	6/5	4/3	3/2	5/3	15/8	2/1
E	F	G	A	B	C#	D#	E

Phrygian

0	113	317	498	702	815	1019	1200
1/1	16/15	6/5	4/3	3/2	8/5	9/5	2/1
E	F	G	A	B	C	D	E

Natural Minor

0	204	317	498	702	815	1019	1200
1/1	9/8	6/5	4/3	3/2	8/5	9/5	2/1
E	F#	G	A	B	C	D	E

Gondolin

0	113	385	498	702	883	1087	1200
1/1	16/15	5/4	4/3	3/2	5/3	15/8	2/1
E	F	G#	A	B	C#	D#	E

Neapolitan Minor

0	113	317	498	702	815	1087	1200
1/1	16/15	6/5	4/3	3/2	8/5	15/8	2/1
E	F	G	A	B	C	D#	E

Harmonic Major

0	204	385	498	702	815	1087	1200
1/1	9/8	5/4	4/3	3/2	8/5	15/8	2/1
E	F#	G#	A	B	C	D#	E

Numenor

0	113	385	498	702	815	1019	1200
1/1	16/15	5/4	4/3	3/2	8/5	9/5	2/1
E	F	G#	A	B	C	D	E

Lorien

0	113	385	498	702	883	1019	1200
1/1	16/15	5/4	4/3	3/2	5/3	9/5	2/1
E	F	G#	A	B	C#	D	E

Harmonic Minor

0	204	317	498	702	815	1087	1200
1/1	9/8	6/5	4/3	3/2	8/5	15/8	2/1
E	F#	G	A	B	C	D#	E

Rivendell

0	113	317	498	702	883	1019	1200
1/1	16/15	6/5	4/3	3/2	5/3	9/5	2/1
E	F	G	A	B	C#	D	E

Major

0	181	385	498	702	883	1087	1200
1/1	10/9	5/4	4/3	3/2	5/3	15/8	2/1
G	A	B	C	D	E	F#	G

Mixolydian

0	181	385	498	702	883	996	1200
1/1	10/9	5/4	4/3	3/2	5/3	16/9	2/1
G	A	B	C	D	E	F	G

Melodic Minor

0	181	272	498	702	883	1087	1200
1/1	10/9	7/6	4/3	3/2	5/3	15/8	2/1
G	A	A#	C	D	E	F#	G

Phrygian

0	113	317	498	702	815	1019	1200
1/1	16/15	6/5	4/3	3/2	8/5	9/5	2/1
G#	A	B	C#	D#	E	F#	G#

Natural Minor

0	204	317	498	702	815	1019	1200
1/1	9/8	6/5	4/3	3/2	8/5	9/5	2/1
G#	A#	B	C#	D#	E	F#	G#

Rivendell

0	113	317	498	702	928	1019	1200
1/1	16/15	6/5	4/3	3/2	12/7	9/5	2/1
G#	A	B	C#	D#	F	F#	G#

Melodic Major

0	181	385	498	702	815	996	1200
1/1	10/9	5/4	4/3	3/2	8/5	16/9	2/1
B	C#	D#	E	F#	G	A	B

Arabian

0	113	385	498	702	815	1087	1200
1/1	16/15	5/4	4/3	3/2	8/5	15/8	2/1
B	C	D#	E	F#	G	A#	B

Neapolitan Major

0	113	317	498	702	883	1087	1200
1/1	16/15	6/5	4/3	3/2	5/3	15/8	2/1
B	C	D	E	F#	G#	A#	B

Major

0	181	385	498	702	883	1087	1200
1/1	10/9	5/4	4/3	3/2	5/3	15/8	2/1
B	C#	D#	E	F#	G#	A#	B

Mixolydian

0	181	385	498	702	883	996	1200
1/1	10/9	5/4	4/3	3/2	5/3	16/9	2/1
B	C#	D#	E	F#	G#	A	B

Gondolin

0	113	385	498	702	883	1087	1200
1/1	16/15	5/4	4/3	3/2	5/3	15/8	2/1
B	C	D#	E	F#	G#	A#	B

Neapolitan Minor

0	113	317	498	702	815	1087	1200
1/1	16/1	6/5	4/3	3/2	8/	15/8	2/1
B	C	D	E	F#	G	A#	B

Harmonic Major

0	181	385	498	702	815	1087	1200
1/1	10/9	5/4	4/3	3/2	8/5	15/8	2/1
B	C#	D#	E	F#	G	A#	B

Numenor

0	113	385	498	702	815	996	1200
1/1	16/15	5/4	4/3	3/2	8/5	16/9	2/1
B	C	D#	E	F#	G	A	B

Lorien

0	113	385	498	702	883	996	1200
1/1	16/15	5/4	4/3	3/2	5/3	16/9	2/1
B	C	D#	E	F#	G#	A	B

Harmonic Minor

0	181	317	498	702	815	1087	1200
1/1	10/9	6/5	4/3	3/2	8/5	15/8	2/1
B	C#	D	E	F#	G	A#	B

Melodic Minor

0	181	317	498	702	883	1087	1200
1/1	10/9	6/5	4/3	3/2	5/3	15/8	2/1
B	C#	D	E	F#	G#	A#	B

The Crow Scale

0	272	385	498	702	883	974	1200
1/1	7/6	5/4	4/3	3/2	5/3	7/4	2/1
C	D#	E	F	G	A	A#	C

Chapter Five
Beatless Chords

For some time I thought that beating began where consonance or concordance ends. The narrowest harmony interval (apart from a unison) that I consider to be legal is 10/9 (182.4 cents). I allow a tempering of +/- 8.5 cents so 173.9 cents is good. Any interval narrower than this (apart from a unison) definitely has too much beating for me.

As I said on page 16 there is also significant beating in intervals where the first overtone of the lower note and the fundamental of the higher note make a narrow interval (between 8.5 cents and 173.8 cents). 11/6, 13/7, 15/7, 13/6 and 11/5 produce too much beating for my taste and I won't use them in harmony (chords). This applies to instruments that produce tones that are close to a regular harmonic series.

A year or two ago I became suspicious of the minor third (6/5) I like 3/2, 4/3 and 5/4 but 6/5 doesn't really cut it for me (in a harmony context, not melody). 6/5 occurs in 2:3:4:5:6:8 major chords and in all minor chords. Almost all of the music I like contains a 6/5 in some or most or all of the chords but, on my Eagle 53 fretted guitar, or on a regular 12TET guitar, the 6/5 interval (on its own) sounds a little bit sour to me. I suspect that as wider intervals get progressively narrower then 377.8 cents is the point where beating starts to be noticeable. 377.8 cents is a just 5/4 (386.3c) tempered narrower by 8.5 cents.

So I now have two thresholds for beating. Intervals between 8.5c and 173.9c are definitely illegal for me and the beating is very obvious and unpleasant. Intervals between 173.9c and 377.8c produce some mild beating but are, perhaps, acceptable. I'm talking about harmony intervals with values >=0.4 using my 2/x + 2/y formula. If I were to 'ban' all intervals narrower than 5/4 then 99.9% of all the music I like would be, by my own standards, unacceptable. So I'm not going to exclude these intervals from my music.

On the other hand, I am a man who is looking for purity in my music. If I *did* exclude these intervals narrower than 5/4, what acceptable chords would be available? Not many. Before I list them look at the 5/3 interval. The first overtone of the 3 (which is

6) beats against the fundamental of the 5 (which is 5), a 6/5 mildly beating interval. So surprisingly, the 5/3 interval has a slight amount of noticeable beating. The second and subsequent overtones are, currently, insignificant for me when evaluating beating, they are too faint. Here are the chords in Eagle 53 that have, for me, no significant beating...

E (1/1) 2:3:4:6:8
F (16/15) 2:3:4:6:8
F# (9/8) 2:4:5:8 or 4:5:8:10:16
G (6/5) 2:3:4:6:8
G# (5/4) 2:3:4:6:8
A (4/3) 2:3:4:6:8
A# (7/5) 7:10:14:20:28 (20/7 ≈ 17/6)
B (3/2) 2:3:4:6:8
C (8/5) 2:3:4:6:8
C# (5/3) 2:3:4:6:8
D (9/5) 2:4:5:8 or 4:5:8:10:16
D# (15/8) 2:3:4:6:8

All of these chords have only two pitch classes but that doesn't bother me. I love these chords. In Eagle 53 all of the intervals in all of the 2:3:4:6:8 chords listed above are within 0.1 cents of just. In Eagle 53 all of the intervals in the 2:4:5:8 and 4:5:8:10:16 chords listed above are within 1.4 cents of just.

These are all playable on a piano style keyboard. On guitars fretted for Eagle 53 most of these chords will be too difficult to play and you will have to omit the top one or two notes.

The scales in chapter four can also be viewed as chord groups. Pick a scale... any chords from the list above (except A#) will sound good in a progression (in any order) if the root notes (in this case the lowest notes) of the chords all conform to the scale. The A# chord above is not strongly rooted which is why it won't work in some progressions.

Chapter Six
Good Harmony and Melody Intervals

Here is a (hopefully) comprehensive list of good just intervals over a six octave range. The ratios on the left are just intervals. The numbers in the middle are the strength values of the intervals using my 2/n + 2/d formula. Any interval with a strength value >= 0.4 is a good interval in a harmony context (two notes played simultaneously). Any interval with a strength value >= 0.2 is a good interval in a melody context (two notes played in sequence). The numbers on the right are the widths of the intervals in cents.

The list applies to instruments with a regular harmonic series as described earlier in this book. Some of the intervals listed may not sound as good on certain instruments that do not produce tones that have a regular harmonic series (or close to it).

This list is the product of years of listening tests done on an electric (not acoustic) keyboard. If I had done my listening tests using physical strings or acoustic instruments I may have arrived at different cut off points but I think that this is unlikely. I'm fairly sure the list is good for all instruments whose tones have a regular harmonic series or close to it.

The following intervals (using a timbre close to a regular harmonic series e.g. guitar, piano or organ) have strength values greater than 0.4 but they produce too much beating for my taste (see page 16)... 11/6, 13/7, 15/7, 13/6 and 11/5. These are, for me, illegal in chords (harmony). Melodically they are fine. They are marked with a *.

mb = mild beating. These intervals are acceptable in a harmony context unless you want pure and beatless intervals and chords.

```
 1/1  – 4.0   –  0.0c
20/19 – 0.205 – 88.801c
19/18 – 0.216 – 93.603c
18/17 – 0.229 – 98.955c
17/16 – 0.243 – 104.96c
16/15 – 0.258 – 111.73c
15/14 – 0.276 – 119.44c
14/13 – 0.297 – 128.3c
13/12 – 0.321 – 138.57c
12/11 – 0.348 – 150.64c
11/10 – 0.382 – 165c
21/19 – 0.201 – 173.27c
10/9  – 0.422 – 182.4c  mb
19/17 – 0.223 – 192.56c
 9/8  – 0.472 – 203.91c mb
17/15 – 0.251 – 216.69c
 8/7  – 0.536 – 231.17c mb
15/13 – 0.287 – 247.74c
 7/6  – 0.619 – 266.87c mb
20/17 – 0.218 – 281.36c
13/11 – 0.336 – 289.21c
19/16 – 0.23  – 297.51c
 6/5  – 0.733 – 315.64c mb
17/14 – 0.261 – 336.13c
11/9  – 0.404 – 347.41c mb
16/13 – 0.279 – 359.47c
21/17 – 0.213 – 365.83c
 5/4  – 0.9   – 386.31c
19/15 – 0.239 – 409.24c
14/11 – 0.325 – 417.51c
 9/7  – 0.508 – 435.08c
22/17 – 0.209 – 446.36c
```

13/10 – 0.354 – 454.21c
17/13 – 0.271 – 464.43c
21/16 – 0.22 – 470.78c
4/3 – 1.17 – 498.04c
23/17 – 0.205 – 523.32c
19/14 – 0.248 – 528.69c
15/11 – 0.315 – 536.95c
11/8 – 0.432 – 551.32c
18/13 – 0.265 – 563.38c
7/5 – 0.686 – 582.51c
24/17 – 0.201 – 597c
17/12 – 0.284 – 603c
10/7 – 0.486 – 617.49c
23/16 – 0.212 – 628.27c
13/9 – 0.376 – 636.62c
16/11 – 0.307 – 648.68c
19/13 – 0.259 – 656.99c
22/15 – 0.224 – 663.05c
3/2 – 1.67 – 701.96c
23/15 – 0.22 – 740.01c
20/13 – 0.254 – 745.79c
17/11 – 0.299 – 753.64c
14/9 – 0.365 – 764.92c
25/16 – 0.205 – 772.63c
11/7 – 0.468 – 782.49c
19/12 – 0.272 – 795.56c
8/5 – 0.65 – 813.69c
21/13 – 0.249 – 830.25c
13/8 – 0.404 – 840.53c mb
18/11 – 0.293 – 852.59c
23/14 – 0.23 – 859.45c
5/3 – 1.07 – 884.36c mb

22/13 – 0.245 – 910.79c
17/10 – 0.318 – 918.64c
12/7 – 0.452 – 933.13c mb
19/11 – 0.287 – 946.2c
26/15 – 0.21 – 952.26c
7/4 – 0.786 – 968.83c mb
23/13 – 0.241 – 987.75c
16/9 – 0.347 – 996.09c
25/14 – 0.223 – 1003.8c
9/5 – 0.622 – 1017.6c mb
20/11 – 0.282 – 1035c
11/6 – 0.515 – 1049.4c * beating
24/13 – 0.237 – 1061.4c
13/7 – 0.44 – 1071.7c * beating
28/15 – 0.205 – 1080.6c
15/8 – 0.383 – 1088.3c
17/9 – 0.34 – 1101c
19/10 – 0.305 – 1111.2c
21/11 – 0.277 – 1119.5c
23/12 – 0.254 – 1126.3c
25/13 – 0.234 – 1132.1c
27/14 – 0.217 – 1137c
29/15 – 0.202 – 1141.3c
2/1 – 3 – 1200c
29/14 – 0.212 – 1260.8c
27/13 – 0.228 – 1265.3c
25/12 – 0.247 – 1270.7c
23/11 – 0.269 – 1277c
21/10 – 0.295 – 1284.5c
19/9 – 0.327 – 1293.6c
17/8 – 0.368 – 1305c
15/7 – 0.419 – 1319.4c * beating

28/13 – 0.225 – 1328.3c
13/6 – 0.487 – 1338.6c ∗ beating
24/11 – 0.265 – 1350.6c
11/5 – 0.582 – 1365c ∗ beating
31/14 – 0.207 – 1376.2c
20/9 – 0.322 – 1382.4c
29/13 – 0.223 – 1389c
9/4 – 0.722 – 1403.9c mb
25/11 – 0.262 – 1421.3c
16/7 – 0.411 – 1431.2c mb
23/10 – 0.287 – 1442c
30/13 – 0.221 – 1447.7c
7/3 – 0.952 – 1466.9c mb
33/14 – 0.203 – 1484.4c
26/11 – 0.259 – 1489.2c
19/8 – 0.355 – 1497.5c
31/13 – 0.218 – 1504.5c
12/5 – 0.567 – 1515.6c mb
29/12 – 0.236 – 1527.6c
17/7 – 0.403 – 1536.1c mb
22/9 – 0.313 – 1547.4c
27/11 – 0.256 – 1554.5c
32/13 – 0.216 – 1559.5c
5/2 – 1.4 – 1586.3c
33/13 – 0.214 – 1612.7c
28/11 – 0.253 – 1617.5c
23/9 – 0.309 – 1624.4c
18/7 – 0.397 – 1635.1c
31/12 – 0.231 – 1643.1c
13/5 – 0.554 – 1654.2c
34/13 – 0.213 – 1664.4c
21/8 – 0.345 – 1670.8c

29/11 – 0.251 – 1678.3c
8/3 – 0.917 – 1698c
35/13 – 0.211 – 1714.6c
27/10 – 0.274 – 1719.6c
19/7 – 0.391 – 1728.7c
30/11 – 0.248 – 1737c
11/4 – 0.682 – 1751.3c
36/13 – 0.209 – 1763.4c
25/9 – 0.302 – 1768.7c
14/5 – 0.543 – 1782.5c
31/11 – 0.246 – 1793.7c
17/6 – 0.451 – 1803c
37/13 – 0.208 – 1810.8c
20/7 – 0.386 – 1817.5c
23/8 – 0.337 – 1828.3c
26/9 – 0.299 – 1836.6c
29/10 – 0.269 – 1843.3c
32/11 – 0.244 – 1848.7c
35/12 – 0.224 – 1853.2c
38/13 – 0.206 – 1857c
3/1 – 2.67 – 1902c
40/13 – 0.204 – 1945.8c
37/12 – 0.221 – 1949.4c
34/11 – 0.241 – 1953.6c
31/10 – 0.265 – 1958.7c
28/9 – 0.294 – 1964.9c
25/8 – 0.33 – 1972.6c
22/7 – 0.377 – 1982.5c
41/13 – 0.203 – 1988.5c
19/6 – 0.439 – 1995.6c
35/11 – 0.239 – 2003.8c
16/5 – 0.525 – 2013.7c

29/9 – 0.291 – 2025.7c
42/13 – 0.201 – 2030.3c
13/4 – 0.654 – 2040.5c
36/11 – 0.237 – 2052.6c
23/7 – 0.373 – 2059.4c
33/10 – 0.261 – 2067c
43/13 – 0.2 – 2071c
10/3 – 0.867 – 2084.4c
37/11 – 0.236 – 2100c
27/8 – 0.324 – 2105.9c
17/5 – 0.518 – 2118.6c
41/12 – 0.215 – 2127.1c
24/7 – 0.369 – 2133.1c
31/9 – 0.287 – 2141.1c
38/11 – 0.234 – 2146.2c
7/2 – 1.29 – 2168.8c
39/11 – 0.233 – 2191.2c
32/9 – 0.285 – 2196.1c
25/7 – 0.366 – 2203.8c
43/12 – 0.213 – 2209.6c
18/5 – 0.511 – 2217.6c
29/8 – 0.319 – 2229.6c
40/11 – 0.232 – 2235c
11/3 – 0.848 – 2249.4c
37/10 – 0.254 – 2265c
26/7 – 0.363 – 2271.7c
41/11 – 0.231 – 2277.7c
15/4 – 0.633 – 2288.3c
34/9 – 0.281 – 2301c
19/5 – 0.505 – 2311.2c
42/11 – 0.229 – 2319.5c
23/6 – 0.42 – 2326.3c

27/7 – 0.36 – 2337c
31/8 – 0.315 – 2345c
35/9 – 0.279 – 2351.2c
39/10 – 0.251 – 2356.2c
43/11 – 0.228 – 2360.2c
47/12 – 0.209 – 2363.6c
4/1 – 2.5 – 2400c
49/12 – 0.207 – 2435.7c
45/11 – 0.226 – 2438.9c
41/10 – 0.249 – 2442.7c
37/9 – 0.276 – 2447.4c
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41/9 – 0.271 – 2625.2c

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37/4 – 0.554 – 3851.3c
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95/9 – 0.243 – 4079.9c
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285/7 – 0.293 – 6417c
163/4 – 0.512 – 6418.5c
367/9 – 0.228 – 6419.7c

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411/10 – 0.205 – 6433.3c
370/9 – 0.228 – 6433.7c
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345/8 – 0.256 – 6516.5c
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392/9 – 0.227 – 6533.7c
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394/9 – 0.227 – 6542.6c

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484/9 – 0.226 – 6898.7c

269/5 – 0.407 – 6899.4c
323/6 – 0.34 – 6900.5c
377/7 – 0.291 – 6901.3c
431/8 – 0.255 – 6901.9c
485/9 – 0.226 – 6902.3c
539/10 – 0.204 – 6902.7c
54/1 – 2.04 – 6905.9c
541/10 – 0.204 – 6909.1c
487/9 – 0.226 – 6909.4c
433/8 – 0.255 – 6909.9c
379/7 – 0.291 – 6910.4c
325/6 – 0.339 – 6911.2c
271/5 – 0.407 – 6912.3c
488/9 – 0.226 – 6913c
217/4 – 0.509 – 6913.9c
380/7 – 0.291 – 6915c
543/10 – 0.204 – 6915.5c
163/3 – 0.679 – 6916.5c
435/8 – 0.255 – 6917.8c
272/5 – 0.407 – 6918.6c
381/7 – 0.291 – 6919.6c
490/9 – 0.226 – 6920.1c
109/2 – 1.02 – 6921.8c
491/9 – 0.226 – 6923.6c
382/7 – 0.291 – 6924.1c
273/5 – 0.407 – 6925c
437/8 – 0.255 – 6925.8c
164/3 – 0.679 – 6927.1c
547/10 – 0.204 – 6928.2c
383/7 – 0.291 – 6928.6c
219/4 – 0.509 – 6929.7c
493/9 – 0.226 – 6930.6c

274/5 – 0.407 – 6931.3c
329/6 – 0.339 – 6932.4c
384/7 – 0.291 – 6933.1c
439/8 – 0.255 – 6933.7c
494/9 – 0.226 – 6934.1c
549/10 – 0.204 – 6934.5c
55/1 – 2.04 – 6937.6c
551/10 – 0.204 – 6940.8c
496/9 – 0.226 – 6941.1c
441/8 – 0.255 – 6941.6c
386/7 – 0.291 – 6942.1c
331/6 – 0.339 – 6942.9c
276/5 – 0.407 – 6943.9c
497/9 – 0.226 – 6944.6c
221/4 – 0.509 – 6945.5c
387/7 – 0.291 – 6946.6c
553/10 – 0.204 – 6947c
166/3 – 0.679 – 6948.1c
443/8 – 0.255 – 6949.4c
277/5 – 0.407 – 6950.2c
388/7 – 0.291 – 6951.1c
499/9 – 0.226 – 6951.6c
111/2 – 1.02 – 6953.3c
500/9 – 0.226 – 6955c
389/7 – 0.291 – 6955.5c
278/5 – 0.407 – 6956.4c
445/8 – 0.254 – 6957.2c
167/3 – 0.679 – 6958.5c
557/10 – 0.204 – 6959.5c
390/7 – 0.291 – 6960c
223/4 – 0.509 – 6961.1c
502/9 – 0.226 – 6961.9c

279/5 – 0.407 – 6962.6c
335/6 – 0.339 – 6963.7c
391/7 – 0.291 – 6964.4c
447/8 – 0.254 – 6965c
503/9 – 0.226 – 6965.4c
559/10 – 0.204 – 6965.7c
56/1 – 2.04 – 6968.8c
561/10 – 0.204 – 6971.9c
505/9 – 0.226 – 6972.3c
449/8 – 0.254 – 6972.7c
393/7 – 0.291 – 6973.2c
337/6 – 0.339 – 6974c
281/5 – 0.407 – 6975c
506/9 – 0.226 – 6975.7c
225/4 – 0.509 – 6976.5c
394/7 – 0.291 – 6977.6c
563/10 – 0.204 – 6978.1c
169/3 – 0.679 – 6979.1c
451/8 – 0.254 – 6980.4c
282/5 – 0.407 – 6981.1c
395/7 – 0.291 – 6982c
508/9 – 0.226 – 6982.5c
113/2 – 1.02 – 6984.2c
509/9 – 0.226 – 6985.9c
396/7 – 0.291 – 6986.4c
283/5 – 0.407 – 6987.3c
453/8 – 0.254 – 6988c
170/3 – 0.678 – 6989.3c
567/10 – 0.204 – 6990.3c
397/7 – 0.291 – 6990.8c
227/4 – 0.509 – 6991.9c
511/9 – 0.226 – 6992.7c

284/5 – 0.407 – 6993.4c
341/6 – 0.339 – 6994.4c
398/7 – 0.291 – 6995.1c
455/8 – 0.254 – 6995.7c
512/9 – 0.226 – 6996.1c
569/10 – 0.204 – 6996.4c
57/1 – 2.04 – 6999.5c
571/10 – 0.204 – 7002.5c
514/9 – 0.226 – 7002.8c
457/8 – 0.254 – 7003.3c
400/7 – 0.291 – 7003.8c
343/6 – 0.339 – 7004.5c
286/5 – 0.407 – 7005.5c
515/9 – 0.226 – 7006.2c
229/4 – 0.509 – 7007c
401/7 – 0.291 – 7008.1c
573/10 – 0.203 – 7008.6c
172/3 – 0.678 – 7009.6c
459/8 – 0.254 – 7010.8c
287/5 – 0.407 – 7011.6c
402/7 – 0.291 – 7012.4c
517/9 – 0.226 – 7012.9c
115/2 – 1.02 – 7014.6c
518/9 – 0.226 – 7016.3c
403/7 – 0.291 – 7016.7c
288/5 – 0.407 – 7017.6c
461/8 – 0.254 – 7018.3c
173/3 – 0.678 – 7019.6c
577/10 – 0.203 – 7020.6c
404/7 – 0.291 – 7021c
231/4 – 0.509 – 7022.1c
520/9 – 0.226 – 7022.9c

289/5 – 0.407 – 7023.6c
347/6 – 0.339 – 7024.6c
405/7 – 0.291 – 7025.3c
463/8 – 0.254 – 7025.8c
521/9 – 0.226 – 7026.3c
579/10 – 0.203 – 7026.6c
 58/1 – 2.03 – 7029.6c
581/10 – 0.203 – 7032.6c
523/9 – 0.226 – 7032.9c
465/8 – 0.254 – 7033.3c
407/7 – 0.291 – 7033.8c
349/6 – 0.339 – 7034.5c
291/5 – 0.407 – 7035.5c
524/9 – 0.226 – 7036.2c
233/4 – 0.509 – 7037c
408/7 – 0.291 – 7038.1c
583/10 – 0.203 – 7038.5c
175/3 – 0.678 – 7039.5c
467/8 – 0.254 – 7040.7c
292/5 – 0.407 – 7041.5c
409/7 – 0.291 – 7042.3c
526/9 – 0.226 – 7042.8c
117/2 – 1.02 – 7044.4c
527/9 – 0.226 – 7046.1c
410/7 – 0.291 – 7046.6c
293/5 – 0.407 – 7047.4c
469/8 – 0.254 – 7048.1c
176/3 – 0.678 – 7049.4c
587/10 – 0.203 – 7050.3c
411/7 – 0.291 – 7050.8c
235/4 – 0.509 – 7051.8c
529/9 – 0.226 – 7052.6c

294/5 – 0.407 – 7053.3c
353/6 – 0.339 – 7054.3c
412/7 – 0.291 – 7055c
471/8 – 0.254 – 7055.5c
530/9 – 0.226 – 7055.9c
589/10 – 0.203 – 7056.2c
59/1 – 2.03 – 7059.2c
591/10 – 0.203 – 7062.1c
532/9 – 0.226 – 7062.4c
473/8 – 0.254 – 7062.8c
414/7 – 0.291 – 7063.4c
355/6 – 0.339 – 7064.1c
296/5 – 0.407 – 7065c
533/9 – 0.226 – 7065.7c
237/4 – 0.508 – 7066.5c
415/7 – 0.291 – 7067.5c
593/10 – 0.203 – 7068c
178/3 – 0.678 – 7068.9c
475/8 – 0.254 – 7070.1c
297/5 – 0.407 – 7070.9c
416/7 – 0.291 – 7071.7c
535/9 – 0.226 – 7072.2c
119/2 – 1.02 – 7073.8c
536/9 – 0.226 – 7075.4c
417/7 – 0.291 – 7075.9c
298/5 – 0.407 – 7076.7c
477/8 – 0.254 – 7077.4c
179/3 – 0.678 – 7078.6c
597/10 – 0.203 – 7079.6c
418/7 – 0.29 – 7080c
239/4 – 0.508 – 7081c
538/9 – 0.226 – 7081.8c

299/5 – 0.407 – 7082.5c
359/6 – 0.339 – 7083.5c
419/7 – 0.29 – 7084.1c
479/8 – 0.254 – 7084.7c
539/9 – 0.226 – 7085.1c
599/10 – 0.203 – 7085.4c
60/1 – 2.03 – 7088.3c
601/10 – 0.203 – 7091.2c
541/9 – 0.226 – 7091.5c
481/8 – 0.254 – 7091.9c
421/7 – 0.29 – 7092.4c
361/6 – 0.339 – 7093.1c
301/5 – 0.407 – 7094c
542/9 – 0.226 – 7094.7c
241/4 – 0.508 – 7095.5c
422/7 – 0.29 – 7096.5c
603/10 – 0.203 – 7096.9c
181/3 – 0.678 – 7097.9c
483/8 – 0.254 – 7099.1c
302/5 – 0.407 – 7099.8c
423/7 – 0.29 – 7100.6c
544/9 – 0.226 – 7101c
121/2 – 1.02 – 7102.6c
545/9 – 0.226 – 7104.2c
424/7 – 0.29 – 7104.7c
303/5 – 0.407 – 7105.5c
485/8 – 0.254 – 7106.2c
182/3 – 0.678 – 7107.4c
607/10 – 0.203 – 7108.3c
425/7 – 0.29 – 7108.8c
243/4 – 0.508 – 7109.8c
547/9 – 0.226 – 7110.6c

304/5 – 0.407 – 7111.2c
365/6 – 0.339 – 7112.1c
426/7 – 0.29 – 7112.8c
487/8 – 0.254 – 7113.3c
548/9 – 0.226 – 7113.7c
609/10 – 0.203 – 7114c
61/1 – 2.03 – 7116.9c
611/10 – 0.203 – 7119.7c
550/9 – 0.226 – 7120c
489/8 – 0.254 – 7120.4c
428/7 – 0.29 – 7120.9c
367/6 – 0.339 – 7121.6c
306/5 – 0.407 – 7122.6c
551/9 – 0.226 – 7123.2c
245/4 – 0.508 – 7124c
429/7 – 0.29 – 7125c
613/10 – 0.203 – 7125.4c
184/3 – 0.678 – 7126.3c
491/8 – 0.254 – 7127.5c
307/5 – 0.407 – 7128.2c
430/7 – 0.29 – 7129c
553/9 – 0.226 – 7129.5c
123/2 – 1.02 – 7131c
554/9 – 0.226 – 7132.6c
431/7 – 0.29 – 7133c
308/5 – 0.406 – 7133.8c
493/8 – 0.254 – 7134.5c
185/3 – 0.677 – 7135.7c
617/10 – 0.203 – 7136.6c
432/7 – 0.29 – 7137c
247/4 – 0.508 – 7138c
556/9 – 0.226 – 7138.8c

309/5 – 0.406 – 7139.4c
371/6 – 0.339 – 7140.4c
433/7 – 0.29 – 7141c
495/8 – 0.254 – 7141.5c
557/9 – 0.226 – 7141.9c
619/10 – 0.203 – 7142.2c
62/1 – 2.03 – 7145c
621/10 – 0.203 – 7147.8c
559/9 – 0.226 – 7148.1c
497/8 – 0.254 – 7148.5c
435/7 – 0.29 – 7149c
373/6 – 0.339 – 7149.7c
311/5 – 0.406 – 7150.6c
560/9 – 0.226 – 7151.2c
249/4 – 0.508 – 7152c
436/7 – 0.29 – 7153c
623/10 – 0.203 – 7153.4c
187/3 – 0.677 – 7154.3c
499/8 – 0.254 – 7155.5c
312/5 – 0.406 – 7156.2c
437/7 – 0.29 – 7157c
562/9 – 0.226 – 7157.4c
125/2 – 1.02 – 7158.9c
563/9 – 0.226 – 7160.5c
438/7 – 0.29 – 7160.9c
313/5 – 0.406 – 7161.7c
501/8 – 0.254 – 7162.4c
188/3 – 0.677 – 7163.6c
627/10 – 0.203 – 7164.5c
439/7 – 0.29 – 7164.9c
251/4 – 0.508 – 7165.9c
565/9 – 0.226 – 7166.6c

314/5 – 0.406 – 7167.2c
377/6 – 0.339 – 7168.1c
440/7 – 0.29 – 7168.8c
503/8 – 0.254 – 7169.3c
566/9 – 0.226 – 7169.7c
629/10 – 0.203 – 7170c
63/1 – 2.03 – 7172.7c
631/10 – 0.203 – 7175.5c
568/9 – 0.226 – 7175.8c
505/8 – 0.254 – 7176.2c
442/7 – 0.29 – 7176.7c
379/6 – 0.339 – 7177.3c
316/5 – 0.406 – 7178.2c
569/9 – 0.226 – 7178.8c
253/4 – 0.508 – 7179.6c
443/7 – 0.29 – 7180.6c
633/10 – 0.203 – 7181c
190/3 – 0.677 – 7181.9c
507/8 – 0.254 – 7183c
317/5 – 0.406 – 7183.7c
444/7 – 0.29 – 7184.5c
571/9 – 0.226 – 7184.9c
127/2 – 1.02 – 7186.4c
572/9 – 0.226 – 7187.9c
445/7 – 0.29 – 7188.4c
318/5 – 0.406 – 7189.1c
509/8 – 0.254 – 7189.8c
191/3 – 0.677 – 7191c
637/10 – 0.203 – 7191.9c
446/7 – 0.29 – 7192.3c
255/4 – 0.508 – 7193.2c
574/9 – 0.226 – 7194c

319/5 – 0.406 – 7194.6c
383/6 – 0.339 – 7195.5c
447/7 – 0.29 – 7196.1c
511/8 – 0.254 – 7196.6c
575/9 – 0.226 – 7197c
639/10 – 0.203 – 7197.3c
64/1 – 2.03 – 7200c
641/10 – 0.203 – 7202.7c
577/9 – 0.226 – 7203c
513/8 – 0.254 – 7203.4c
449/7 – 0.29 – 7203.9c
385/6 – 0.339 – 7204.5c
321/5 – 0.406 – 7205.4c
578/9 – 0.226 – 7206c
257/4 – 0.508 – 7206.7c
450/7 – 0.29 – 7207.7c
643/10 – 0.203 – 7208.1c
193/3 – 0.677 – 7209c
515/8 – 0.254 – 7210.1c
322/5 – 0.406 – 7210.8c

Count = 2196 intervals.

It seems to me that any interval wider than 7,200 cents should be within 8.474 cents of a good harmony or melody interval which means that any harmony or melody interval wider than 7,200 should be good.

Afterword

The high point of my tuning career was finding my Eagle 53 tuning in 2016. I play guitar and Eagle was designed for that instrument. Having looked at Eagle from several different angles over the last four years I think that for my intents and purposes it is unbeatable. By coincidence it has twelve notes per octave (same as 12TET) which makes it easy to play on regular keyboards that can be retuned.

After 21 years of searching for my "ultimate" tuning (Eagle 53) I have since then found that working with only one tuning is a very different experience. I made new discoveries that I would never have made if I was still searching for my ultimate tuning.

The rules in this book are the icing on the cake. Some people might find them too restrictive but I don't. Once you eliminate a few sour notes at the start there are plenty of good melodies and chords available.

Hopefully some people reading this will compose some JRM and I look forward to hearing it. Here are my other books…

Eagle 53 My Ultimate Musical Tuning (Third Edition)

The Eagle 53 Guitarist Lush Chords

The Eagle 53 Guitarist Jazz Chords

The Eagle 53 Pianist

Eagle 53 Jazz Chords (a sequel to the Pianist book)

The Arabian Scale in Eagle 53

Go to my web site for music, photos and more info...

www.johnsmusic7.com

Enjoy the Music

John O'Sullivan

14 August, 2021