

Modes of internal symmetry - taking a closer look at Messiaen's modes of limited transposition

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1 Introduction

Before we start, make sure to get the latest version of this document from <https://github.com/shimpe/mints>. If you are unsure what to do on that page, click "Download ZIP". It will download an archive containing all the files required to recreate this document. In the *out* folder is a document.pdf file which corresponds to the article itself. In the *output* folder are .pdf and .midi files of the modes listed in sections 8, 9, 10, 11, 12, 13 and 14. Feel free to send your questions and remarks with respect to this document to stefaan.himpe@gmail.com. Feel free to report errors, or corrections, additions, to <https://github.com/shimpe/mints/issues>

After reading Olivier Messiaen's book "The technique of my Musical Language" I started wondering how exactly his "modes of limited transposition" create the sound they create. Major questions for me became:

- What is so special about the property of *limited transposition* that makes the music derived from it work so well?
- Is music derived from a random subset of a chromatic scale on some sense "crippled" compared to music written based on Messiaen's modes? Can we find some kind of intuitive explanation why Messiaen's modes work well, arguably better than other non-diatonic modes? Can we use this insight to propose other modes that perhaps do not have limited transposition, but still might result in an interesting, fresh, sound?

I set out to do a series of experiments and came up with some insights that I intend to explain here. I apologize in advance if what I'm about to describe is already well-known and obvious to more informed readers. Please accept that I'm writing this down only to further my own understanding of the matter. I do not claim to have found something new.

2 Symmetry? What symmetry?

Messiaen himself explains how his modes can be thought of as consisting of *symmetrical* groups of notes. The exact nature of this symmetry was not entirely

clear to me. In fact, at first sight it seemed more like repeating patterns than symmetry, and this is what I wanted to clarify.

As a starting point I set out to systematically enumerate all modes derived from a chromatic scale that have intervals symmetrically distributed around the $f\sharp$ (the middle note of the chromatic scale starting on c). Note that during the experiments I don't directly take into account any property of *limited transposition* but I will find back many of Messiaen's modes by considering only symmetry arguments anyway.

2.1 Systematic enumeration

The first thing to explain is how the modes with intervals symmetrically distributed around $f\sharp$ can be systematically enumerated.

I started from a chromatic scale. On that scale I added symbols under each note. Note how the symbols that occur left of $f\sharp$ return later on to the right of $f\sharp$. This is important to keep symmetry of the intervals around $f\sharp$, as will hopefully become clearer in the next step. For now, remember that the symbols under the complete chromatic scale form a *palindrome*, i.e. if you read them left-to-right you get exactly the same sequence of symbols as when you read them right-to-left.



In what follows we will now construct modes by assigning values 0 or 1 to each of the symbols p, q, r, s, t, u, v . A value of 0 indicates that the note to which the symbol is attached is not to be selected from the chromatic scale while constructing a mode. A value of 1 indicates that the notes to which the symbol is attached are to be selected from the chromatic scale.

E.g. if we set $p=1, q=1, r=1, s=1, t=1, u=1, v=1$ we retain all the notes from the chromatic scale and end up with the chromatic scale itself. We can say that the chromatic scale is characterized by a "key" $(p, q, r, s, t, u, v) = (1, 1, 1, 1, 1, 1, 1)$. If we set $p=1, q=0, r=1, s=0, t=0, u=0, v=1$, we end up with a mode that contains the notes $c, d, f\sharp, a\sharp, c'$. This mode is characterized by a key $(p, q, r, s, t, u, v) = (1, 0, 1, 0, 0, 0, 1)$.



This method for constructing modes has some properties:

- Any combination of values 0,1 assigned to all of p, q, r, s, t, u, v results in a mode derived from the chromatic scale with intervals distributed symmetrically around $f\sharp$.

- A different combination of values 0,1 assigned to p, q, r, s, t, u, v results in a different mode. In other words, there are no two different keys (p,q,r,s,t,u,v) that result in the same set of notes selected from the chromatic scale.
- If we look at all possible ways that we can assign 0, 1 to p, q, r, s, t, u, v, we construct all possible subsets of the chromatic scale with intervals distributed symmetrically around f#. In other words, we don't skip any modes symmetrical around f# by using this method.
- All in all, this means that any (p,q,r,s,t,u,v) key uniquely defines one mode with intervals symmetrically distributed around f#.
- There are $2^7 = 128$ different ways to assign the values 0, 1 to the variables p, q, r, s, t, u, v. This means that there are 128 unique modes with symmetrical distribution of intervals around f#. One of those modes is mode 0, which has no notes at all. We don't consider it further.

2.2 Intermezzo: binary numbers

In computer science a key like (0,1,1,0,0,1,0) can be interpreted as a binary number. Each number 1 or 0 is called a "bit". For every binary number, there's an equivalent decimal number and vice versa. In the systematic enumeration of modes in the appendices of this explanation, I use decimal equivalents of binary numbers, because they take much less typesetting space. If you want to make sense of the explanations that follow, it's useful to understand how binary numbers relate to decimal numbers, as explained now:

2.2.1 Conversion from binary number to decimal number

In order to convert from a binary number to a decimal number, one writes powers of two underneath the binary number and then multiplies and adds the results. As an example, consider conversion of number (0,1,1,0,0,1,0) to decimal:

0	1	1	0	0	1	0	← write binary digits
64	32	16	8	4	2	1	← write powers of 2
* ↓	* ↓	* ↓	* ↓	* ↓	* ↓	* ↓	↓ multiply one by one
0	32	16	0	0	2	0	→ sum to get: $32 + 16 + 2 = 50$

Note that if I add extra 0's to the left of a binary number, its value doesn't change. The same is true for a decimal number: if you write 6 or you write 06 you really have the same number.

2.2.2 Conversion from a decimal number to a binary number

In order to convert a decimal number back to a binary number one keeps on dividing the number by 2, and notes down the rest after division. As an example, consider converting 50 back to binary representation:

- We start from 50
- divide 50 by 2 to get 25, with rest after division=0

- divide 25 by 2 to get 12, with rest after division=1
- divide 12 by 2 to get 06, with rest after division=0
- divide 06 by 2 to get 03, with rest after division=0
- divide 03 by 2 to get 01, with rest after division=1
- divide 01 by 2 to get 00, with rest after division=1

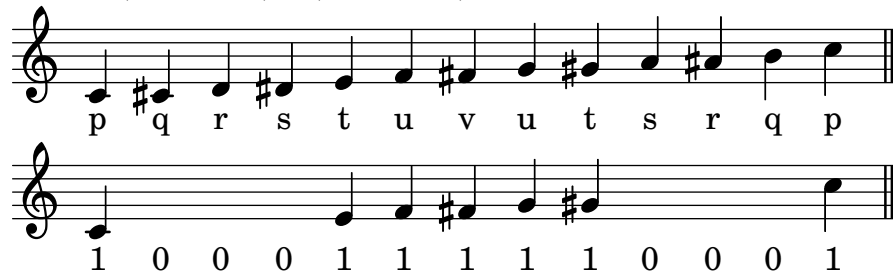
If you now look at the rests after division from bottom to top, you get (1,1,0,0,1,0). Remember from section 2.2.1 that one can add zeros to the left of any number without changing its value. Since we prefer to work with binary numbers (keys) of length 7 (i.e. the number of symbols p, q, \dots, v) we turn the binary number into key (0, 1, 1, 0, 0, 1, 0).

2.2.3 Tip about binary/decimal conversion

Practically all operating systems nowadays have some built-in calculator application that knows how to convert between binary and decimal should you ever need to do so.

3 What's the point? How do these binary numbers help us analyze music?

Using this enumeration method, I listed all the 127 non-empty modes that are symmetrical around $f\#$ as can be seen in section 8. I've sorted the modes by length. Mode 0 with zero notes was left out. Each mode is annotated with a few numbers, e.g. 74:(2)7-71. The number 74 means it's the 74th mode in the list of modes sorted by length. The number (2) means that we're looking at modes with binary symmetry (the mode is divided in two symmetrical parts). The number 7 means that the mode consists of 7 notes, distributed symmetrically around $f\#$. The number 71 is the decimal number that corresponds to the binary key $(p, q, r, s, t, u, v) = (1, 0, 0, 0, 1, 1, 1)$ that uniquely defines the mode:



3.1 The symmetry of Messiaen's modes around $f\#$

A first thing that struck me as interesting is that all of Messiaen's modes can be found back in the list of 127 modes enumerated in section 8 (albeit not always in first transposition, which is caused by our restriction to only look at modes symmetrical around $f\#$, and not to look at modes symmetrical around – say – g .):

- Messiaen's mode 1 corresponds to our mode (2)85 $(p,q,r,s,t,u,v) = (1,0,1,0,1,0,1)$



- Messiaen's mode 2 corresponds to our mode (2)54 $(p,q,r,s,t,u,v) = (0,1,1,0,1,1,0)$



- Messiaen's mode 3 corresponds to our mode (2)93 $(p,q,r,s,t,u,v) = (1,0,1,1,1,0,1)$



- Messiaen's mode 4 corresponds to our mode (2)103 $(p,q,r,s,t,u,v) = (1,1,0,0,1,1,1)$



- Messiaen's mode 5 corresponds to our mode (2)99 $(p,q,r,s,t,u,v) = (1,1,0,0,0,1,1)$



- Messiaen's mode 6 corresponds to our mode (2)107 $(p,q,r,s,t,u,v) = (1,1,0,1,0,1,1)$



- Messiaen's mode 7 corresponds to our mode (2)119 $(p,q,r,s,t,u,v) = (1,1,1,0,1,1,1)$



3.2 More symmetry in Messiaen's modes

Now take a close look at the binary keys for Messiaen's modes. *In all but one of his modes, the binary keys are themselves palindromes*, indicating that not only are the modes symmetrical around f#, but they also have extra internal symmetry around d# (left-hand side of f#) and around a (right-hand side of f#). Having a palindromic key thus implies that there's a second level of symmetrical interval distribution inside the upper and lower halves of the modes.

It would not be correct to say that only modes with palindromic binary keys sound good. Look e.g. at mode of binary internal symmetry number (2)90 $(1,0,1,1,0,1,0)$, which is better known as "c dorian". The binary key is not

palindromic but it does show other extra symmetries in its structure (observe how its binary key becomes a palindrome if you leave out the last 0). Similarly, Messiaen's fourth mode of limited transposition also becomes a palindrome if you leave out the last 1 in its binary key, indicating that it has significant internal symmetries beyond the always present symmetry around f#.

I'd like to speculate here that additional internal symmetries play an important role in making modes (and their "modes") sound good. The human brain is optimized for pattern matching. It is sensitive to symmetries and the listener probably subconsciously picks up the patterns and hears the symmetries present in the intervals that make up the mode. (If that were true, we might even nominate the "Dorian" mode as the most natural of modes based on a diatonic scale.) Modes with extra internal symmetries look like good candidates for harmony and melody experiments.

3.3 Are there any modes with similar internal symmetries that are not Messiaen modes?

3.3.1 Perfect internal symmetry

In section 9 all modes are listed that have palindromic binary keys. Note that almost all of Messiaen's modes appear here in one form or another, and that some modes appear that are not part of Messiaen's musical language. This is because we used *internal symmetry* instead of *limited transposition* as criterion. From these results, it's quite clear that there's a close connection between the two criteria. It's also interesting that a number of (shorter) modes appear which, to the best of my knowledge, were not used directly by Messiaen, but which may be interesting for further harmonic and melodic experiments.

In what follows, remember that the notation "mode (2)x-y" means "a mode with binary symmetry, x notes and key y, where y should be converted to binary to see which notes are present in the mode. Compare the descriptions given here to the modes as listed in section 9.

- Mode (2)02-008 (0,0,0,1,0,0,0) is a ditonic mode. Two notes may be a bit limited for a composition. Interesting though that it is a tritone, which is one of the basic building blocks for Messiaen's musical language.
- Mode (2)04-020 (0,0,1,0,1,0,0) is a tetratonic mode.
- Mode (2)06-028 (0,0,1,1,1,0,0) is a hexatonic mode.
- Mode (2)04-034 (0,1,0,0,0,1,0) is a tetratonic mode. Interesting about this mode is that there's even more symmetry present in the lower and upper half of the binary key. This is a third level of symmetry in the mode.
- Mode (2)06-042 (0,1,0,1,0,1,0) is a hexatonic mode. Interesting about this mode is that there's even more symmetry present in the lower and upper half of the binary key. This is a third level of symmetry in the mode.
- Mode (2)08-054 (0,1,1,0,1,1,0) is an octotonic mode. It's also known as Messiaen's second mode of limited transposition.

- Mode (2)10-062 (0,1,1,1,1,0) is a decatonic mode. This mode is not listed by Messiaen. However, if we extend this mode with a $c\#$ at the right, we get a "mode" of Messiaen's seventh mode of limited transposition built on note d.
- Mode (2)03-065 (1,0,0,0,0,1) is a tritonic mode. It consists of 2 tritones.
- Mode (2)05-073 (1,0,0,1,0,1) is a pentatonic mode.
- Mode (2)07-085 (1,0,1,0,1,0,1) is a heptatonic mode. It's also known as Messiaen's first mode of limited transposition, or as the whole-tone scale. Interesting about this mode is that there's even more symmetry present in the lower and upper half of the binary key. This is a third level of symmetry in the mode.
- Mode (2)09-093 (1,0,1,1,1,0,1) is a nonatonic mode. This is Messiaen's third mode of limited transposition. Interesting about this mode is that there's even more symmetry present in the lower and upper half of the binary key. This is a third level of symmetry in the mode.
- Mode (2)07-099 (1,1,0,0,0,1,1) is a heptatonic mode. This is Messiaen's fifth mode of limited transposition.
- Mode (2)09-107 (1,1,0,1,0,1,1) is a nonatonic mode. This is a "mode" of Messiaen's sixth mode of limited transposition built on note $c\#$.
- Mode (2)11-119 (1,1,1,0,1,1,1) is an undecatonic mode. This is a "mode" of Messiaen's seventh mode of limited transposition built on note b. Interesting about this mode is that there's even more symmetry present in the lower and upper half of the binary key. This is a third level of symmetry in the mode.
- Mode (2)13-127 (1,1,1,1,1,1,1) is the chromatic scale itself. This mode also has a third and even fourth level of symmetry.

3.3.2 Partial internal symmetry

Now follows a list of modes that are partially palindromic as follows: the binary keys of the modes listed here become palindromic if you leave out either the first or last bit. They are listed in musical form in section 10. These form another subset of modes (slightly less "perfect" than the modes in the previous section). Probably some of these modes are better known under other names, and in as far as I was able to recognize them automatically using the scale list from harmonics.com (see the resources in section 7), they are annotated in the sections 20-161 that characterize each mode. The list may contain errors, and in that case the annotated scale names will be wrong... use with care!

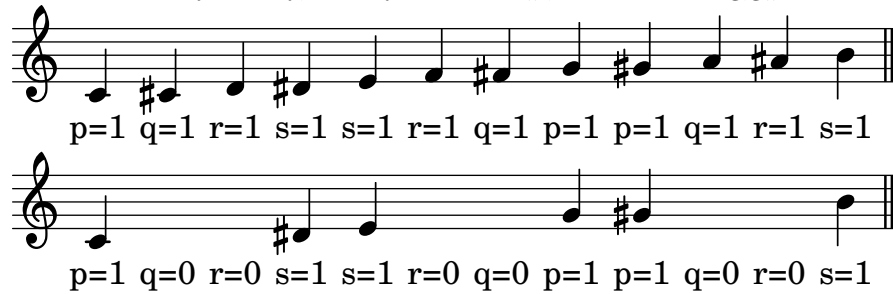
By reducing the constraints on symmetry also other interesting modes can be selected (e.g. modes that are a palindromic if you leave out 2 outer bits), but listing those is left as an exercise to the interested reader.

- (2)001 (0,0,0,0,0,1) is a mode consisting of a single note $f\#$. This is a bit limited to compose with :)
- (2)012 (0,0,0,1,1,0,0) tetratonic

- (2)018 (0,0,1,0,0,1,0) tetratonic
- (2)024 (0,0,1,1,0,0,0) tetratonic
- (2)025 (0,0,1,1,0,0,1) tetratonic. Sounds quite exotic (arabic?).
- (2)030 (0,0,1,1,1,1,0) octatonic
- (2)033 (0,1,0,0,0,0,1) tritonic
- (2)036 (0,1,0,0,1,0,0) tetratonic
- (2)037 (0,1,0,0,1,0,1) pentatonic
- (2)045 (0,1,0,1,1,0,1) heptatonic. This is c# aeolian mode (natural minor diatonic scale).
- (2)051 (0,1,1,0,0,1,1) heptatonic. Sounds quite exotic (arabic?)
- (2)060 (0,1,1,1,1,0,0) octatonic
- (2)061 (0,1,1,1,1,0,1) nonatonic
- (2)063 (0,1,1,1,1,1,1) undecatonic. Like a chromatic scale but without note c.
- (2)064 (1,0,0,0,0,0,0) ditonic. Consists of only notes c.
- (2)066 (1,0,0,0,0,1,0) tetratonic. Consists of the notes of a sus4 chord built on c.
- (2)067 (1,0,0,0,0,1,1) pentatonic.
- (2)076 (1,0,0,1,1,0,0) hexatonic.
- (2)082 (1,0,1,0,0,1,0) hexatonic.
- (2)090 (1,0,1,1,0,1,0) octatonic. This is really just the dorian mode of c.
- (2)091 (1,0,1,1,0,1,1) nonatonic. Like the dorian mode of c but with f# added.
- (2)094 (1,0,1,1,1,1,0) decatonic.
- (2)097 (1,1,0,0,0,0,1) pentatonic.
- (2)102 (1,1,0,0,1,1,0) octatonic. Sounds quite exotic (arabic?).
- (2)103 (1,1,0,0,1,1,1) is the fourth mode of limited transposition of Mes-siaen.
- (2)109 (1,1,0,1,1,0,1) nonatonic. Left halve sounds darker than right halve.
- (2)115 (1,1,1,0,0,1,1) nonatonic.
- (2)126 (1,1,1,1,1,1,0) dodecatonic. Like a chromatic scale, but with f# left out.
- (2)127 (1,1,1,1,1,1,1) is the chromatic scale. This is the only key that also appears in the fully palindromic modes.

4 Ternary symmetries

So far we've only considered symmetries that divide the chromatic scale in a symmetrical left half and a right half. But a chromatic scale consists of 12 half tones, and therefore it can also be divided in groups of 3. The way of working remains more or less the same. First we propose an enumeration scheme. Note that to find ternary symmetries, we leave out the repeated tonic at the end of the mode. We then need a 4-bit binary key. Note how the mode now is divided in three parts $p, q, r, s \rightarrow s, r, q, p \rightarrow p, q, r, s$. This unfolded key (p,q,r,s,s,r,q,p,p,q,r,s) is not a palindrome anymore. This is a fundamentally different form of symmetry, namely between d#,e and between g,g#.



We can now reuse the knowledge we gathered before: given that we use 4-bit binary keys, there must be $2^4 = 16$ such modes (of course mode 0 has no notes, so we don't consider it further). As before we can translate the binary keys to decimal numbers, but the decimal denote a different mode than the same decimal numbers we used while examining binary symmetries. The difference lies in the structure of the unfolded key. In the binary symmetry case we had a key (p,q,r,s,t,u,v) that after unfolding becomes (p,q,r,s,t,u,v,u,t,s,r,q,p). Now in the ternary case we have a key (p,q,r,s) that after unfolding becomes (p,q,r,s,s,r,q,p,p,q,r,s). To distinguish the decimal numbers for modes with binary symmetry from the decimal numbers for modes with ternary symmetry, we preceded the former ones with (2) and we precede the latter ones with (3).

Also as before we can look for extra symmetries by looking at 4-bit keys that are palindromic. Those non-empty keys are:

- mode (3)6 (0110): a hexatonic mode
- mode (3)9 (1001): a hexatonic mode (really a transposed "mode" of mode (3)6).
- mode (3)15 (1111): the chromatic scale

Sections 15, 16, 17, 18, 19 list all 16 modes with ternary symmetry.

5 Deriving harmonies from modes of internal symmetry

Another question I was struggling with was why Messiaen chose to build chords based on the interval of a fourth. During my investigation I think I saw a possible explanation as follows:

- Sections 11, 12, 13, 14 systematically list the chords built on the modes of binary internal symmetry by taking notes from consecutive mode (scale) degrees, every third mode degree, every fourth mode degree, every fifth mode degree respectively. Sections 16, 17, 18 and 19 do the same for modes of ternary internal symmetry.
- As is clearly visible, the fewer notes are in a mode that is symmetrical around $f\sharp$, the more widely spaced those notes are (on average).
- In wider spaced modes (many 0's in the binary key), it makes sense to build chords from mode degrees that are close enough to each other.
- In more dense modes (many 1's in the binary key), it makes sense to build chords from mode degrees that are spaced further apart. If we use notes too close together, every chord sounds very dissonant and there's not much room for creating harmonic contrasts.
- Since Messiaen's modes are relatively dense compared to - say - a diatonic scale (Messiaen's modes all have 8 or more notes, whereas a diatonic scale has 7 notes), my guess is that the harmonies as built using every third note sound a bit too harsh, and Messiaen therefore decided to use fourths.

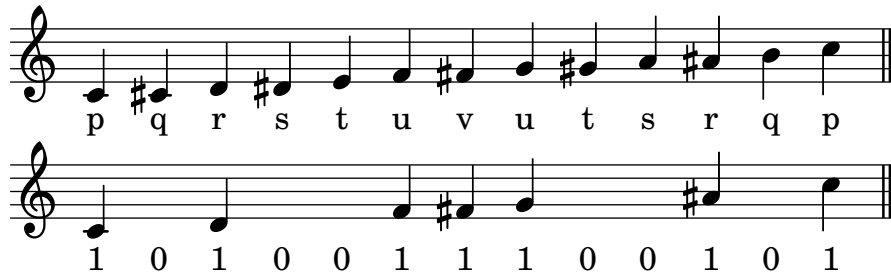
It would seem that when deriving harmonies from a set of notes we want to avoid uneven spreading of intervals over the mode, to avoid ending up with a series of very closely spaced chords, followed by a series of much more widely spaced chords. In other words: a mode that consists of a left part with many half tones, and a right part with many whole tones will tend to result in much more dissonant chords derived from that left part, and much more open sounding chords derived from the right part. Can the binary keys can help us see in which modes the intervals are better spread out than in other modes?

5.1 From binary key to intervals in symmetric modes

First we can convert the binary keys back to intervals between successive notes in the mode. Doing so is simple once we think back of what the binary keys really mean: each 1 or 0 is an inclusion respectively exclusion of a particular note from the chromatic scale built on c . We can find back the intervals in the mode as follows:

- Write down the binary key (p,q,r,s,t,u,v) and unfold it to form the complete mode: $(p,q,r,s,t,u,v,u,t,s,r,q,p)$. Or in the case of a ternary symmetrical mode, take the key (p,q,r,s) and unfold it to $(p,q,r,s,s,r,q,p,p,q,r,s)$.
- Now each time count the number of 0's between successive 1's. Each count is one less than the number of half steps in the interval.

An abstract description like the above begs for an example. Let's take mode 83:



Number (2)83 in binary is (1,0,1,0,0,1,1). After unfolding we get (1,0,1,0,0,1,1,1,0,0,1,0,1) (see music example). Now we count zeros between successive 1's. We find 1 zero, 2 zeros, 0 zeros, 0 zeros, 2 zeros, 1 zero:

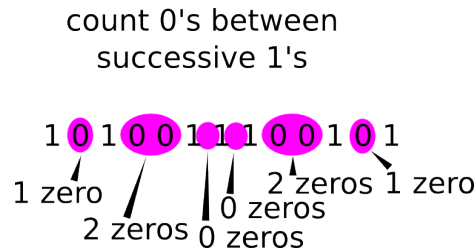


Figure 1: Turning binary keys back into intervals

If we count zero 0's, then the interval between successive notes is $1/2$ tone. If we count one 0, the interval is 1 tone. In general, if z is the number of zeros we counted, the number of half tones in the interval is $h = (z + 1)$. And then the number of tones in the interval is $t = h/2 = (z + 1)/2$. In the case of mode (2)83, we apply this formula as follows:

- we counted 0's between successive 1's: (1,2,0,0,2,1).
- we apply the formula: $((1+1)/2, (2+1)/2, (0+1)/2, (0+1)/2, (2+1)/2, (1+1)/2) = (1, 1.5, 0.5, 0.5, 1.5, 1)$.
- so we have a mode with intervals 1 tone, 1.5 tones, 0.5 tones, 0.5 tones, 1.5 tones, 1 tone
- we double check with the musical example and see indeed that $c \rightarrow d = 1$ tone, $d \rightarrow f = 1.5$ tones, $f \rightarrow f\# = 0.5$ tones, $f\# \rightarrow g = 0.5$ tones, $g \rightarrow a\# = 1.5$ tones, $a\# \rightarrow c = 1$ tone

5.2 Ideal interval size. Avoiding clusters and gaps

Intuitively, when one wants to derive harmonies by stacking notes from every n -th scale degree, one could decide to avoid too small intervals (clusters) and too large intervals (gaps), e.g. to avoid a concentration of too dissonant chords on one side of the scale. For this reason it's useful to think about what intervals one reasonably can expect to occur in a mode.

Suppose you create a mode of only 2 different notes. These 2 notes have to span an octave, i.e. 12 half tones. To have maximal spreading of the notes over the mode one should have intervals between the notes of 6 half tones ($c \rightarrow f\#$).

The interval ($f\# \rightarrow c$) closes the construction by repeating the first note c , so this second " c " it is not a "third note" in our mode. More general, for n notes spanning an octave (12 half tones), the ideal interval has $12/n$ half tones.

Suppose this assumption makes sense, then in an octotonic scale (8 distinct notes) the ideal interval between notes is $12/8 = 1.5$ half tones. There's one problem with this: 1.5 half tones leads to microtonal music. If we don't want to go there, we need to do the next best thing: round to multiples of 1. We can't round all 1.5 half tone intervals to 2 half tone intervals because then we end up with way too many half tones to fit in an octave. Similarly we can't round all 1.5 intervals down to 1 because then we end up with too few half tones to span the octave. We can however approximate this 1.5 by alternating between rounding 1.5 up to 2 and rounding 1.5 down to 1 to get the following configuration of half tone intervals: (1,2,1,2,1,2,1,2) which nicely adds up to $1 + 2 + 1 + 2 + 1 + 2 + 1 + 2 = 12$ half tones over 8 notes. But now look closely at what we really constructed...

We find Messiaen's second mode of limited transposition! Even though I didn't present a rigorous mathematical proof here, I hope it is clear that Messiaen's second mode of limited transposition is a best possible approximation of evenly spread intervals in an octotonic scale (best possible if we don't allow microtonal intervals).¹

When we select modes for our own compositions, we may want to pay some attention to avoiding clusters and gaps in the intervals that lie between the notes in the modes we select. An interval G can be named a "gap" if it has more half tones than the ideal interval rounded up, and an interval C can be named a "cluster" if it has less half tones than the ideal interval rounded down. In all this, the ideal interval is itself a function of the number of notes in the mode. Summarizing:

- The ideal interval $I(n)$ in a mode is $I(n) = 12/n$ where n is the number of distinct notes in the mode.
- An interval G is a gap if $B > \lceil I(n) \rceil$. (The symbols \lceil and \rceil should be read as "round up")
- An interval C is a cluster if $S < \lfloor I(n) \rfloor$. (The symbols \lfloor and \rfloor should be read as "round down")

6 Conclusions

To summarize:

- First we systematically listed all modes with internal symmetry around $f\#$ derived from a chromatic scale. We found that there are 127 non-empty such modes.
- Then, we saw how all of Messiaen's modes are part of this list of 127 modes, meaning that they at least have some symmetry in interval distribution.
- After that, we noticed how all but one of the Messiaen modes contain extra symmetries in the lower half and upper half of the mode (palindromic

¹This makes me wonder how octotonic scales sound if we do allow microtonal intervals.

keys). We listed all modes that have both symmetry around $f\#$ and the extra symmetries in the lower half and upper half of the mode, and discovered some potentially interesting modes not directly used by Messiaen (with fewer notes). Even though we didn't care about the property of *limited transposition*, by just considering symmetry arguments we arrived at a very similar set of modes.

- We continued by looking for other forms of symmetry and looked in detail at ternary symmetries yielding different set of modes.
- While doing so, we also formulated a possible explanation for why Messiaen may have chosen to build his chords using fourths, and we speculated about how internal symmetry and even spreading of intervals may contribute to make Messiaen's modes work better than other, randomly chosen, modes.
- In the reference sections 20 - 161 we list all the modes examined in this document and create a detailed passport, which can be used while exploring its musical possibilities.

7 Some resources

While investigating I made extensive use of Jackson Hardaker's Messiaen mode visualizer: <http://messiaen.jacksonhardaker.com/>

I also extensively used the list of scales found at <http://www.harmonics.com/scales/>

The complete code required to reproduce the experiments and the text in this document (together with midi files for the listed modes and chords in the following sections) can be found online at <https://github.com/shimpe/mints>. To recreate this document you need at the very least the following free software:

- python 2.x
- lilypond
- LaTeX
- a .pdf viewer (I used okular, but any viewer should do).

The provided build script is written in bash. For windows or other systems, you may need to translate to an appropriate format.

Feel free to send your questions and remarks with respect to this document to stefaan.himpe@gmail.com. Feel free to report errors, or corrections, additions, to <https://github.com/shimpe/mints/issues>

8 All modes with binary internal symmetry around f#, ordered by length

Piano

1:(2)1-1 2:(2)2-2 3:(2)2-4 4:(2)2-8 5:(2)2-16 6:(2)2-32 7:(2)2-64 8:(2)3-3 9:(2)3-5 10:(2)3-9 11:(2)3-17 12:(2)3-33 13:(2)3-65 14:(2)4-6 15:(2)4-10 16:(2)4-12 17:(2)4-18 18:(2)4-20 19:(2)4-24 20:(2)4-34 21:(2)4-36 22:(2)4-40 23:(2)4-48 24:(2)4-66 25:(2)4-68 26:(2)4-72 27:(2)4-80 28:(2)4-96 29:(2)5-7 30:(2)5-11 31:(2)5-13 32:(2)5-19 33:(2)5-21 34:(2)5-25 35:(2)5-35 36:(2)5-37 37:(2)5-41 38:(2)5-49 39:(2)5-67 40:(2)5-69 41:(2)5-73 42:(2)5-81 43:(2)5-97 44:(2)6-14 45:(2)6-22 46:(2)6-26 47:(2)6-28 48:(2)6-38 49:(2)6-42 50:(2)6-44 51:(2)6-50 52:(2)6-52 53:(2)6-56 54:(2)6-70 55:(2)6-74 56:(2)6-76 57:(2)6-82 58:(2)6-84 59:(2)6-88 60:(2)6-98 61:(2)6-100 62:(2)6-104 63:(2)6-112 64:(2)7-15 65:(2)7-23 66:(2)7-27 67:(2)7-29 68:(2)7-39 69:(2)7-43 70:(2)7-45 71:(2)7-51 72:(2)7-53 73:(2)7-57 74:(2)7-71 75:(2)7-75 76:(2)7-77 77:(2)7-83 78:(2)7-85 79:(2)7-89

80:(2)7-99 81:(2)7-101 82:(2)7-105 83:(2)7-113

84:(2)8-30 85:(2)8-46 86:(2)8-54 87:(2)8-58

88:(2)8-60 89:(2)8-78 90:(2)8-86 91:(2)8-90

92:(2)8-92 93:(2)8-102 94:(2)8-106 95:(2)8-108

96:(2)8-114 97:(2)8-116 98:(2)8-120 99:(2)9-31

100:(2)9-47 101:(2)9-55 102:(2)9-59

103:(2)9-61 104:(2)9-79 105:(2)9-87

106:(2)9-91 107:(2)9-93 108:(2)9-103

109:(2)9-107 110:(2)9-109 111:(2)9-115 112:(2)9-117

113:(2)9-121 114:(2)10-62 115:(2)10-94

116:(2)10-110 117:(2)10-118 118:(2)10-122

119:(2)10-124 120:(2)11-63 121:(2)11-95

122:(2)11-111 123:(2)11-119 124:(2)11-123

125:(2)11-125 126:(2)12-126 127:(2)13-127

9 All modes of binary internal symmetry with palindromic keys

Piano

1:(2)2-8 2:(2)4-20 3:(2)6-28 4:(2)4-34 5:(2)6-42

6:(2)8-54 7:(2)10-62 8:(2)3-65 9:(2)5-73

10:(2)7-85 11:(2)9-93 12:(2)7-99 13:(2)9-107

14:(2)11-119 15:(2)13-127

10 All modes of binary internal symmetry with partially palindromic keys

Piano

1:(2)1-1 2:(2)4-12 3:(2)4-18 4:(2)4-24 5:(2)5-25 6:(2)8-30

7:(2)3-33 8:(2)4-36 9:(2)5-37 10:(2)7-45 11:(2)7-51

12:(2)8-60 13:(2)9-61 14:(2)11-63 15:(2)2-64

16:(2)4-66 17:(2)5-67 18:(2)6-76 19:(2)6-82 20:(2)8-90

21:(2)9-91 22:(2)10-94 23:(2)5-97 24:(2)8-102

25:(2)9-103 26:(2)9-109 27:(2)9-115

28:(2)12-126 29:(2)13-127

11 All chords built by stacking every second note from the modes of internal binary symmetry

Piano

1:(2)1-1 2:(2)2-2 3:(2)2-4 4:(2)2-8 5:(2)2-16 6:(2)2-32 7:(2)2-64 8:(2)3-3

9:(2)3-5 10:(2)3-9 11:(2)3-17 12:(2)3-33 13:(2)3-65 14:(2)4-6

15:(2)4-10 16:(2)4-12 17:(2)4-18 18:(2)4-20 19:(2)4-24

20:(2)4-34 21:(2)4-36 22:(2)4-40 23:(2)4-48 24:(2)4-66

25:(2)4-68 26:(2)4-72 27:(2)4-80 28:(2)4-96 29:(2)5-7

30:(2)5-11 31:(2)5-13 32:(2)5-19 33:(2)5-21

34:(2)5-25 35:(2)5-35 36:(2)5-37

37:(2)5-41 38:(2)5-49 39:(2)5-67 40:(2)5-69

41:(2)5-73 42:(2)5-81 43:(2)5-97 44:(2)6-14

45:(2)6-22 46:(2)6-26 47:(2)6-28

48:(2)6-38 49:(2)6-42 50:(2)6-44

51:(2)6-50 52:(2)6-52 53:(2)6-56

54:(2)6-70 55:(2)6-74 56:(2)6-76

57:(2)6-82 58:(2)6-84 59:(2)6-88

60:(2)6-98 61:(2)6-100 62:(2)6-104

63:(2)6-112 64:(2)7-15 65:(2)7-23

66:(2)7-27 67:(2)7-29

68:(2)7-39 69:(2)7-43

70:(2)7-45 71:(2)7-51

72:(2)7-53 73:(2)7-57

74:(2)7-71 75:(2)7-75 76:(2)7-77

77:(2)7-83 78:(2)7-85 79:(2)7-89

80:(2)7-99 81:(2)7-101 82:(2)7-105

83:(2)7-113 84:(2)8-30

85:(2)8-46 86:(2)8-54

87:(2)8-58 88:(2)8-60

89:(2)8-78 90:(2)8-86

91:(2)8-90

92:(2)8-92

93:(2)8-102

94:(2)8-106

95:(2)8-108

96:(2)8-114

97:(2)8-116

98:(2)8-120

99:(2)9-31

100:(2)9-47

101:(2)9-55

102:(2)9-59

103:(2)9-61

104:(2)9-79

105:(2)9-87

106:(2)9-91

107:(2)9-93

108:(2)9-103

109:(2)9-107

110:(2)9-109

111:(2)9-115

112:(2)9-117

113:(2)9-121

114:(2)10-62

115:(2)10-94

116:(2)10-110

117:(2)10-118

118:(2)10-122

119:(2)10-124

120:(2)11-63

121:(2)11-95

122:(2)11-111

123:(2)11-119

124:(2)11-123

125:(2)11-125

126:(2)12-126

127:(2)13-127

12 All chords built by stacking every third note from the modes of internal binary symmetry

Piano

1:(2)1-1 2:(2)2-2 3:(2)2-4 4:(2)2-8 5:(2)2-16 6:(2)2-32 7:(2)2-64 8:(2)3-3 9:(2)3-5 10:(2)3-9

11:(2)3-17 12:(2)3-33 13:(2)3-65 14:(2)4-6 15:(2)4-10 16:(2)4-12 17:(2)4-18

18:(2)4-20 19:(2)4-24 20:(2)4-34 21:(2)4-36 22:(2)4-40 23:(2)4-48

24:(2)4-66 25:(2)4-68 26:(2)4-72 27:(2)4-80 28:(2)4-96 29:(2)5-7

30:(2)5-11 31:(2)5-13 32:(2)5-19 33:(2)5-21

34:(2)5-25 35:(2)5-35 36:(2)5-37 37:(2)5-41

38:(2)5-49 39:(2)5-67 40:(2)5-69 41:(2)5-73 42:(2)5-81

43:(2)5-97 44:(2)6-14 45:(2)6-22 46:(2)6-26

47:(2)6-28 48:(2)6-38 49:(2)6-42 50:(2)6-44

51:(2)6-50 52:(2)6-52 53:(2)6-56 54:(2)6-70

55:(2)6-74 56:(2)6-76 57:(2)6-82 58:(2)6-84

59:(2)6-88 60:(2)6-98 61:(2)6-100 62:(2)6-104

63:(2)6-112 64:(2)7-15 65:(2)7-23

66:(2)7-27 67:(2)7-29 68:(2)7-39

69:(2)7-43 70:(2)7-45 71:(2)7-51

72:(2)7-53 73:(2)7-57 74:(2)7-71

75:(2)7-75 76:(2)7-77 77:(2)7-83

78:(2)7-85 79:(2)7-89 80:(2)7-99

81:(2)7-101 82:(2)7-105 83:(2)7-113

84:(2)8-30 85:(2)8-46 86:(2)8-54

87:(2)8-58 88:(2)8-60 89:(2)8-78

90:(2)8-86 91:(2)8-90 92:(2)8-92

93:(2)8-102 94:(2)8-106 95:(2)8-108

96:(2)8-114 97:(2)8-116 98:(2)8-120

99:(2)9-31 100:(2)9-47

101:(2)9-55 102:(2)9-59

103:(2)9-61 104:(2)9-79

105:(2)9-87

106:(2)9-91

107:(2)9-93

108:(2)9-103

109:(2)9-107

110:(2)9-109

111:(2)9-115

112:(2)9-117

113:(2)9-121

114:(2)10-62

115:(2)10-94

116:(2)10-110

117:(2)10-118

118:(2)10-122

119:(2)10-124

120:(2)11-63

121:(2)11-95

122:(2)11-111

123:(2)11-119

124:(2)11-123

125:(2)11-125

126:(2)12-126

127:(2)13-127

13 All chords built by stacking every fourth note from the modes of internal binary symmetry

Piano

1:(2)1-1 2:(2)2-2 3:(2)2-4 4:(2)2-8 5:(2)2-16 6:(2)2-32 7:(2)2-64 8:(2)3-3 9:(2)3-5 10:(2)3-9

11:(2)3-17 12:(2)3-33 13:(2)3-65 14:(2)4-6 15:(2)4-10 16:(2)4-12 17:(2)4-18

18:(2)4-20 19:(2)4-24 20:(2)4-34 21:(2)4-36 22:(2)4-40 23:(2)4-48

24:(2)4-66 25:(2)4-68 26:(2)4-72 27:(2)4-80 28:(2)4-96 29:(2)5-7

30:(2)5-11 31:(2)5-13 32:(2)5-19 33:(2)5-21 34:(2)5-25

35:(2)5-35 36:(2)5-37 37:(2)5-41 38:(2)5-49 39:(2)5-67

40:(2)5-69 41:(2)5-73 42:(2)5-81 43:(2)5-97 44:(2)6-14

45:(2)6-22 46:(2)6-26 47:(2)6-28 48:(2)6-38 49:(2)6-42

50:(2)6-44 51:(2)6-50 52:(2)6-52 53:(2)6-56 54:(2)6-70

55:(2)6-74 56:(2)6-76 57:(2)6-82 58:(2)6-84 59:(2)6-88

60:(2)6-98 61:(2)6-100 62:(2)6-104 63:(2)6-112

64:(2)7-15 65:(2)7-23 66:(2)7-27

67:(2)7-29 68:(2)7-39 69:(2)7-43

70:(2)7-45 71:(2)7-51 72:(2)7-53

73:(2)7-57 74:(2)7-71 75:(2)7-75 76:(2)7-77

77:(2)7-83 78:(2)7-85 79:(2)7-89 80:(2)7-99

81:(2)7-101 82:(2)7-105 83:(2)7-113 84:(2)8-30

85:(2)8-46 86:(2)8-54 87:(2)8-58

88:(2)8-60 89:(2)8-78 90:(2)8-86

91:(2)8-90 92:(2)8-92 93:(2)8-102

94:(2)8-106 95:(2)8-108 96:(2)8-114

97:(2)8-116 98:(2)8-120 99:(2)9-31

100:(2)9-47 101:(2)9-55

102:(2)9-59 103:(2)9-61

104:(2)9-79 105:(2)9-87 106:(2)9-91

107:(2)9-93 108:(2)9-103 109:(2)9-107

110:(2)9-109 111:(2)9-115 112:(2)9-117

113:(2)9-121 114:(2)10-62

115:(2)10-94 116:(2)10-110 117:(2)10-118

118:(2)10-122 119:(2)10-124

120:(2)11-63 121:(2)11-95

122:(2)11-111 123:(2)11-119

124:(2)11-123 125:(2)11-125

126:(2)12-126 127:(2)13-127

14 All chords built by stacking every fifth note from the modes of internal binary symmetry

Piano

1:(2)1-1 2:(2)2-2 3:(2)2-4 4:(2)2-8 5:(2)2-16 6:(2)2-32 7:(2)2-64 8:(2)3-3 9:(2)3-5 10:(2)3-9

11:(2)3-17 12:(2)3-33 13:(2)3-65 14:(2)4-6 15:(2)4-10 16:(2)4-12 17:(2)4-18 18:(2)4-30

19:(2)4-24 20:(2)4-34 21:(2)4-36 22:(2)4-40 23:(2)4-48 24:(2)4-66 25:(2)4-68

26:(2)4-72 27:(2)4-80 28:(2)4-96 29:(2)5-7 30:(2)5-11 31:(2)5-13

32:(2)5-19 33:(2)5-21 34:(2)5-25 35:(2)5-35 36:(2)5-37

37:(2)5-41 38:(2)5-49 39:(2)5-67 40:(2)5-69 41:(2)5-73

42:(2)5-81 43:(2)5-97 44:(2)6-14 45:(2)6-22 46:(2)6-26

47:(2)6-28 48:(2)6-38 49:(2)6-42 50:(2)6-44

51:(2)6-50 52:(2)6-52 53:(2)6-56 54:(2)6-70

55:(2)6-74 56:(2)6-76 57:(2)6-82 58:(2)6-84

59:(2)6-88 60:(2)6-98 61:(2)6-100 62:(2)6-104 63:(2)6-112

64:(2)7-15 65:(2)7-23 66:(2)7-27 67:(2)7-29

68:(2)7-39 69:(2)7-43 70:(2)7-45 71:(2)7-51

72:(2)7-53 73:(2)7-57 74:(2)7-71 75:(2)7-75

76:(2)7-77 77:(2)7-83 78:(2)7-85 79:(2)7-89

80:(2)7-99 81:(2)7-101 82:(2)7-105 83:(2)7-113

84:(2)8-30 85:(2)8-46 86:(2)8-54

87:(2)8-58 88:(2)8-60 89:(2)8-78

90:(2)8-86 91:(2)8-90 92:(2)8-92

93:(2)8-102 94:(2)8-106 95:(2)8-108

96:(2)8-114 97:(2)8-116 98:(2)8-120

99:(2)9-31 100:(2)9-47 101:(2)9-55

102:(2)9-59 103:(2)9-61 104:(2)9-79

105:(2)9-87 106:(2)9-91 107:(2)9-93

108:(2)9-103 109:(2)9-107 110:(2)9-109

111:(2)9-115 112:(2)9-117 113:(2)9-121

114:(2)10-62 115:(2)10-94 116:(2)10-110

117:(2)10-118 118:(2)10-122 119:(2)10-124

120:(2)11-63 121:(2)11-95

122:(2)11-111 123:(2)11-119

124:(2)11-123 125:(2)11-125

126:(2)12-126 127:(2)13-127

15 All modes with ternary internal symmetry ordered by length

Piano

1:(3)3-1 2:(3)3-2 3:(3)3-4 4:(3)3-8 5:(3)6-3 6:(3)6-5

7:(3)6-6 8:(3)6-9 9:(3)6-10 10:(3)6-12 11:(3)9-7

12:(3)9-11 13:(3)9-13 14:(3)9-14 15:(3)12-15

16 All chords built by stacking every second note from the modes of ternary internal sym-

Piano

1:(3)3-1 2:(3)3-2 3:(3)3-4 4:(3)3-8 5:(3)6-3

6:(3)6-5 7:(3)6-6

8:(3)6-9 9:(3)6-10

10:(3)6-12 11:(3)9-7

12:(3)9-11 13:(3)9-13

14:(3)9-14 15:(3)12-15

17 All chords built by stacking every third note from the modes of ternary internal symme-

Piano

1:(3)3-1 2:(3)3-2 3:(3)3-4 4:(3)3-8 5:(3)6-3

6:(3)6-5 7:(3)6-6 8:(3)6-9

9:(3)6-10 10:(3)6-12 11:(3)9-7

12:(3)9-11 13:(3)9-13

14:(3)9-14 15:(3)12-15

18 All chords built by stacking every fourth note from the modes of ternary internal symmetry

Piano

1:(3)3-1 2:(3)3-2 3:(3)3-4 4:(3)3-8 5:(3)6-3 6:(3)6-5

7:(3)6-6 8:(3)6-9 9:(3)6-10 10:(3)6-12

11:(3)9-7 12:(3)9-11 13:(3)9-13

14:(3)9-14 15:(3)12-15

19 All chords built by stacking every fifth note from the modes of ternary internal symmetry

Piano

1:(3)3-1 2:(3)3-2 3:(3)3-4 4:(3)3-8 5:(3)6-3 6:(3)6-5

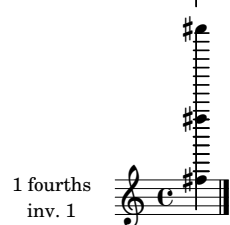
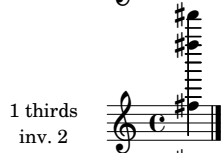
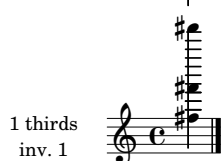
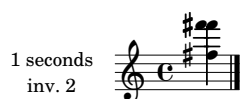
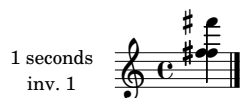
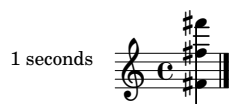
7:(3)6-6 8:(3)6-9 9:(3)6-10 10:(3)6-12

11:(3)9-7 12:(3)9-11 13:(3)9-13

14:(3)9-14 15:(3)12-15

20 Characterizing mode (2)1

Mode (2)1
(binary key: 0000001)



2

1 fourths
inv. 2

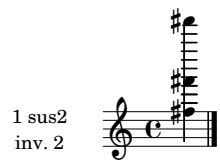
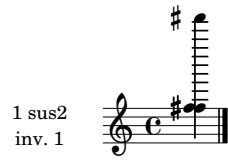
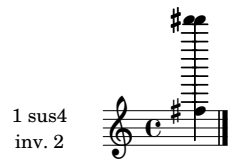
1 fifths

1 fifths
inv. 1

1 fifths
inv. 2

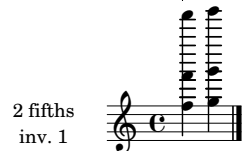
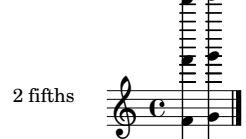
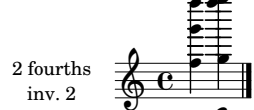
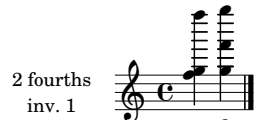
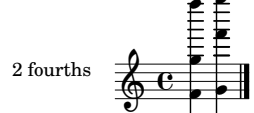
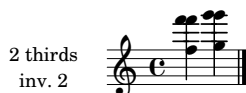
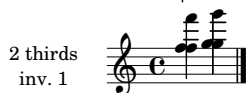
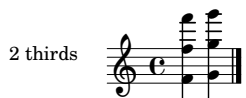
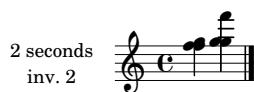
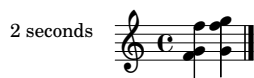
1 sus4

1 sus4
inv. 1

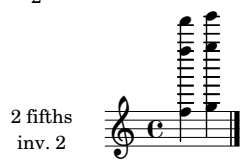


21 Characterizing mode (2)2

Mode (2)2
(binary key: 0000010)





2





22 Characterizing mode (2)3


Mode (2)3
(binary key: 0000011)


3 plain 

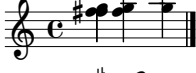
3 seconds 


3 seconds
inv. 1 

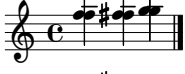
3 seconds
inv. 2 


3 thirds 


3 thirds
inv. 1 


3 thirds
inv. 2 


3 fourths 

3 fourths
inv. 1 

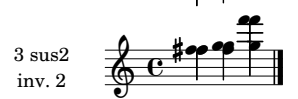
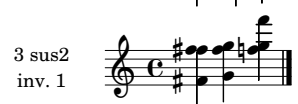
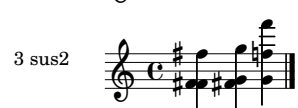
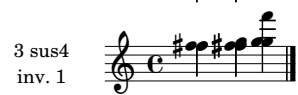
3 fourths
inv. 2 

3 fifths 

3 fifths
inv. 1 

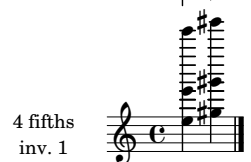
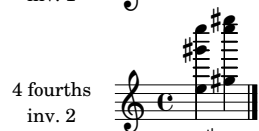
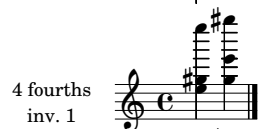
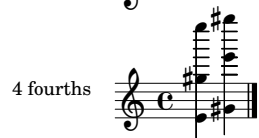
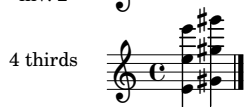
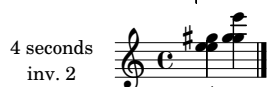
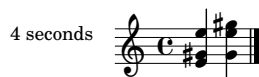
3 fifths
inv. 2 

2



23 Characterizing mode (2)4

Mode (2)4
(binary key: 0000100)



2

4 fifths
inv. 2

4 sus4

4 sus4
inv. 1

4 sus4
inv. 2


4 sus2


4 sus2
inv. 1


4 sus2
inv. 2


24 Characterizing mode (2)5


Mode (2)5
(binary key: 0000101)


5 plain 


5 seconds 


5 seconds
inv. 1 


5 seconds
inv. 2 


5 thirds 


5 thirds
inv. 1 


5 thirds
inv. 2 


5 fourths 

5 fourths
inv. 1 

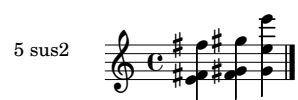
5 fourths
inv. 2 

5 fifths 

5 fifths
inv. 1 


5 fifths
inv. 2 


2





25 Characterizing mode (2)6


Mode (2)6
(binary key: 0000110)

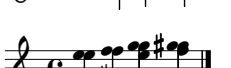
6 plain 

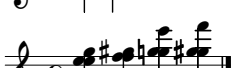
6 seconds 


6 seconds
inv. 1 


6 seconds
inv. 2 

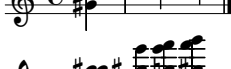
6 thirds 


6 thirds
inv. 1 


6 thirds
inv. 2 


6 fourths 


6 fourths
inv. 1 

6 fourths
inv. 2 

6 fifths 

6 fifths
inv. 1 

6 fifths
inv. 2 

6 sus4 

2

6 sus4
inv. 1

6 sus4
inv. 2


6 sus2

6 sus2
inv. 1

6 sus2
inv. 2


26 Characterizing mode (2)7

Mode (2)7 (binary key: 0000111)

7 plain 

7 seconds 


7 seconds
inv. 1 

7 seconds
inv. 2 

7 thirds 

7 thirds
inv. 1 


7 thirds
inv. 2 

7 fourths 

7 fourths
inv. 1 

7 fourths
inv. 2 

7 fifths 

7 fifths
inv. 1 

7 fifths
inv. 2 

2
7 sus4

7 sus4
inv. 1

7 sus4
inv. 2

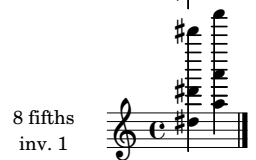
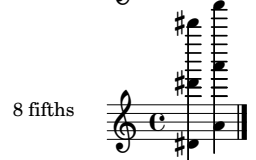
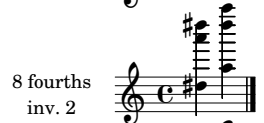
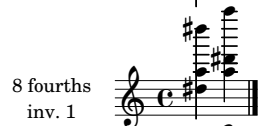
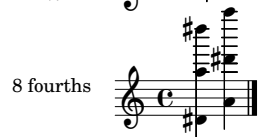
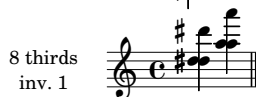
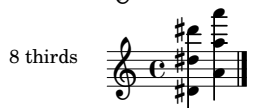
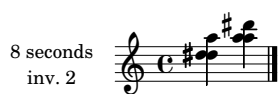
7 sus2

7 sus2
inv. 1

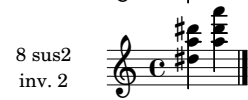
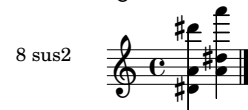
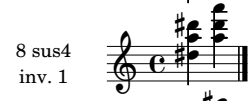
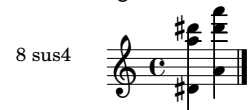
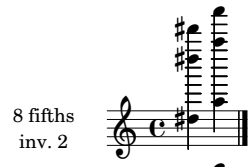
7 sus2
inv. 2

27 Characterizing mode (2)8

Mode (2)8
(binary key: 0001000)

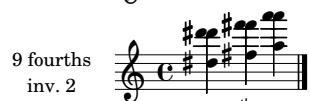


2



28 Characterizing mode (2)9

Mode (2)9 (binary key: 0001001)



2



29 Characterizing mode (2)10

Mode (2)10 (binary key: 0001010)



2

10 sus4

10 sus4
inv. 1

10 sus4
inv. 2


10 sus2


10 sus2
inv. 1


10 sus2
inv. 2


30 Characterizing mode (2)11

Mode (2)11 (binary key: 0001011)


11 plain 


11 seconds 


11 seconds
inv. 1 


11 seconds
inv. 2 


11 thirds 


11 thirds
inv. 1 

11 thirds
inv. 2 


11 fourths 

11 fourths
inv. 1 

11 fourths
inv. 2 

11 fifths 

11 fifths
inv. 1 

11 fifths
inv. 2 

2

11 sus4

11 sus4
inv. 1

11 sus4
inv. 2

11 sus2

11 sus2
inv. 1

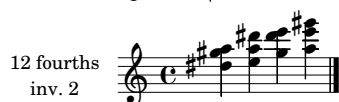
11 sus2
inv. 2

The image displays six musical staves, each representing a different chord voicing. All staves are in treble clef with a common time signature (C). The notes are as follows:

- Staff 1 (11 sus4):** G4, A4, B4, C5, D5, E5.
- Staff 2 (11 sus4 inv. 1):** F#4, G4, A4, B4, C5, D5.
- Staff 3 (11 sus4 inv. 2):** E4, F#4, G4, A4, B4, C5.
- Staff 4 (11 sus2):** G4, A4, B4, C5, D5, E5.
- Staff 5 (11 sus2 inv. 1):** F#4, G4, A4, B4, C5, D5.
- Staff 6 (11 sus2 inv. 2):** E4, F#4, G4, A4, B4, C5.

31 Characterizing mode (2)12

Mode (2)12
(binary key: 0001100)



2

12 sus4

12 sus4
inv. 1

12 sus4
inv. 2


12 sus2


12 sus2
inv. 1


12 sus2
inv. 2


32 Characterizing mode (2)13


Mode (2)13 (binary key: 0001101)


13 plain 


13 seconds 


13 seconds
inv. 1 


13 seconds
inv. 2 


13 thirds 


13 thirds
inv. 1 


13 thirds
inv. 2 


13 fourths 

13 fourths
inv. 1 

13 fourths
inv. 2 

13 fifths 

13 fifths
inv. 1 

13 fifths
inv. 2 

2

13 sus4

13 sus4
inv. 1

13 sus4
inv. 2


13 sus2

13 sus2
inv. 1

13 sus2
inv. 2

33 Characterizing mode (2)14

Mode (2)14 (binary key: 0001110)

14 plain 


14 seconds 


14 seconds
inv. 1 


14 seconds
inv. 2 


14 thirds 

14 thirds
inv. 1 


14 thirds
inv. 2 

14 fourths 

14 fourths
inv. 1 

14 fourths
inv. 2 

14 fifths 

14 fifths
inv. 1 

14 fifths
inv. 2 

2

14 sus4



14 sus4
inv. 1



14 sus4
inv. 2



14 sus2



14 sus2
inv. 1




14 sus2
inv. 2



34 Characterizing mode (2)15

Mode (2)15 (binary key: 0001111)

15 plain 

15 seconds 


15 seconds
inv. 1 

15 seconds
inv. 2 

15 thirds 


15 thirds
inv. 1 

15 thirds
inv. 2 

15 fourths 

15 fourths
inv. 1 

15 fourths
inv. 2 

15 fifths 

15 fifths
inv. 1 

15 fifths
inv. 2 

2

15 sus4



15 sus4

inv. 1



15 sus4

inv. 2



15 sus2



15 sus2

inv. 1



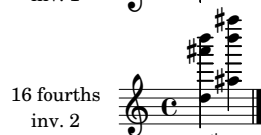
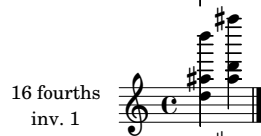
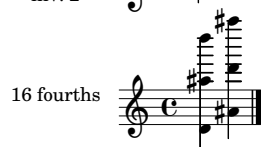
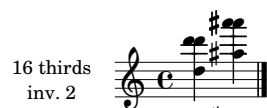
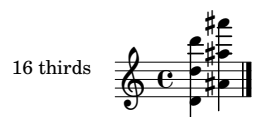
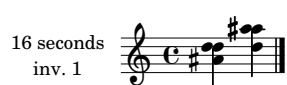
15 sus2

inv. 2

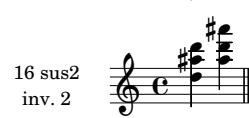
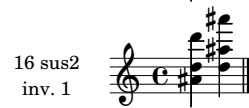
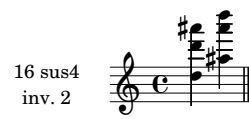
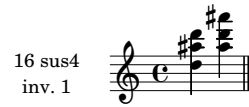
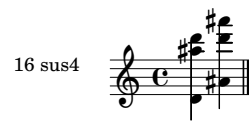
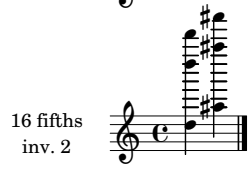
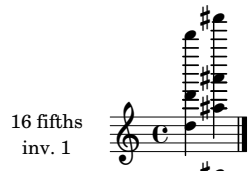


35 Characterizing mode (2)16

Mode (2)16
(binary key: 0010000)

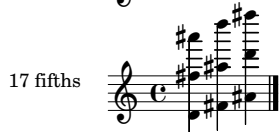


2



36 Characterizing mode (2)17

Mode (2)17
(binary key: 0010001)



2



37 Characterizing mode (2)18

Mode (2)18 (binary key: 0010010)



2

18 sus4

18 sus4
inv. 1

18 sus4
inv. 2

18 sus2

18 sus2
inv. 1

18 sus2
inv. 2

38 Characterizing mode (2)19

Mode (2)19 (binary key: 0010011)

19 plain 

19 seconds 

19 seconds
inv. 1 

19 seconds
inv. 2 

19 thirds 

19 thirds
inv. 1 

19 thirds
inv. 2 

19 fourths 

19 fourths
inv. 1 

19 fourths
inv. 2 

19 fifths 

19 fifths
inv. 1 

19 fifths
inv. 2 

2

19 sus4

19 sus4
inv. 1

19 sus4
inv. 2


19 sus2


19 sus2
inv. 1


19 sus2
inv. 2


39 Characterizing mode (2)20


Mode (2)20 (binary key: 0010100)


20 plain 


20 seconds 


20 seconds
inv. 1 


20 seconds
inv. 2 


20 thirds 


20 thirds
inv. 1 

20 thirds
inv. 2 

20 fourths 

20 fourths
inv. 1 

20 fourths
inv. 2 

20 fifths 

20 fifths
inv. 1 

20 fifths
inv. 2 

2
20 sus4

20 sus4
inv. 1

20 sus4
inv. 2

20 sus2

20 sus2
inv. 1

20 sus2
inv. 2

40 Characterizing mode (2)21

Mode (2)21 (binary key: 0010101)

21 plain 

21 seconds 

21 seconds
inv. 1 

21 seconds
inv. 2 

21 thirds 

21 thirds
inv. 1 

21 thirds
inv. 2 

21 fourths 

21 fourths
inv. 1 

21 fourths
inv. 2 

21 fifths 

21 fifths
inv. 1 

21 fifths
inv. 2 

2

21 sus4

21 sus4
inv. 1

21 sus4
inv. 2

21 sus2

21 sus2
inv. 1


21 sus2
inv. 2


The image displays six musical staves, each representing a different inversion of a triad in the key of D major (two sharps: F# and C#). The staves are arranged vertically and labeled as follows:


- Staff 1:** Labeled "21 sus4". It shows a triad in the first inversion (sus4) with notes D4, F#4, and A4.
- Staff 2:** Labeled "21 sus4 inv. 1". It shows a triad in the second inversion (sus4) with notes F#4, A4, and D5.
- Staff 3:** Labeled "21 sus4 inv. 2". It shows a triad in the third inversion (sus4) with notes A4, D5, and F#5.
- Staff 4:** Labeled "21 sus2". It shows a triad in the fourth inversion (sus2) with notes D4, F#4, and A4.
- Staff 5:** Labeled "21 sus2 inv. 1". It shows a triad in the fifth inversion (sus2) with notes F#4, A4, and D5.
- Staff 6:** Labeled "21 sus2 inv. 2". It shows a triad in the sixth inversion (sus2) with notes A4, D5, and F#5.


41 Characterizing mode (2)22


Mode (2)22 (binary key: 00101110)

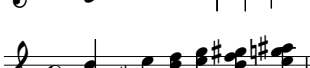
22 plain 


22 seconds 

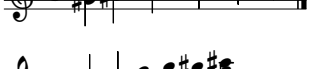
22 seconds
inv. 1 


22 seconds
inv. 2 

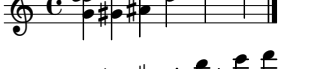
22 thirds 


22 thirds
inv. 1 


22 thirds
inv. 2 


22 fourths 


22 fourths
inv. 1 

22 fourths
inv. 2 

22 fifths 

22 fifths
inv. 1 


22 fifths
inv. 2 

22 sus4 

2


22 sus4

inv. 1




22 sus4

inv. 2




22 sus2




22 sus2

inv. 1




22 sus2


inv. 2





42 Characterizing mode (2)23


Mode (2)23 (binary key: 0010111)


23 plain 


23 seconds 


23 seconds
inv. 1 

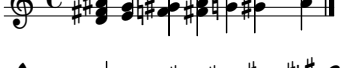
23 seconds
inv. 2 


23 thirds 


23 thirds
inv. 1 


23 thirds
inv. 2 


23 fourths 


23 fourths
inv. 1 

23 fourths
inv. 2 

23 fifths 


23 fifths
inv. 1 

23 fifths
inv. 2 


23 sus4 

2


23 sus4
inv. 1




23 sus4
inv. 2




23 sus2



23 sus2
inv. 1




23 sus2
inv. 2





43 Characterizing mode (2)24


Mode (2)24 (binary key: 0011000)

24 plain 


24 seconds 


24 seconds
inv. 1 


24 seconds
inv. 2 


24 thirds 

24 thirds
inv. 1 


24 thirds
inv. 2 

24 fourths 

24 fourths
inv. 1 

24 fourths
inv. 2 

24 fifths 

24 fifths
inv. 1 

24 fifths
inv. 2 

2

24 sus4

24 sus4
inv. 1

24 sus4
inv. 2

24 sus2

24 sus2
inv. 1

24 sus2
inv. 2

44 Characterizing mode (2)25

Mode (2)25 (binary key: 0011001)

25 plain 


25 seconds 


25 seconds
inv. 1 

25 seconds
inv. 2 


25 thirds 

25 thirds
inv. 1 


25 thirds
inv. 2 


25 fourths 

25 fourths
inv. 1 

25 fourths
inv. 2 

25 fifths 

25 fifths
inv. 1 

25 fifths
inv. 2 

2

25 sus4

25 sus4
inv. 1

25 sus4
inv. 2

25 sus2


25 sus2
inv. 1


25 sus2
inv. 2


The image displays six musical staves, each representing a different chord progression in G major. Each staff contains four measures of music. The chords are: 25 sus4, 25 sus4 inv. 1, 25 sus4 inv. 2, 25 sus2, 25 sus2 inv. 1, and 25 sus2 inv. 2.


45 Characterizing mode (2)26


Mode (2)26 (binary key: 0011010)


26 plain 


26 seconds 


26 seconds
inv. 1 


26 seconds
inv. 2 


26 thirds 


26 thirds
inv. 1 


26 thirds
inv. 2 


26 fourths 

26 fourths
inv. 1 

26 fourths
inv. 2 

26 fifths 

26 fifths
inv. 1 

26 fifths
inv. 2 

2

26 sus4

26 sus4
inv. 1

26 sus4
inv. 2


26 sus2


26 sus2
inv. 1


26 sus2
inv. 2


46 Characterizing mode (2)27


Mode (2)27 (binary key: 0011011)


27 plain 


27 seconds 


27 seconds
inv. 1 


27 seconds
inv. 2 


27 thirds 


27 thirds
inv. 1 


27 thirds
inv. 2 


27 fourths 

27 fourths
inv. 1 

27 fourths
inv. 2 

27 fifths 

27 fifths
inv. 1 

27 fifths
inv. 2 

2

27 sus4

27 sus4
inv. 1

27 sus4
inv. 2


27 sus2


27 sus2
inv. 1


27 sus2
inv. 2


47 Characterizing mode (2)28


Mode (2)28 (binary key: 0011100)


28 plain 


28 seconds 


28 seconds
inv. 1 


28 seconds
inv. 2 


28 thirds 


28 thirds
inv. 1 


28 thirds
inv. 2 


28 fourths 

28 fourths
inv. 1 

28 fourths
inv. 2 

28 fifths 

28 fifths
inv. 1 

28 fifths
inv. 2 

2

28 sus4

28 sus4
inv. 1

28 sus4
inv. 2

28 sus2


28 sus2
inv. 1


28 sus2
inv. 2


The image displays six musical staves, each representing a different voicing for a 28-note scale in C major. The staves are arranged vertically. The first staff is labeled '28 sus4' and shows a sequence of chords: C4-E4-G4, D4-F4-A4, E4-G4-B4, F4-A4-C5, G4-B4-D5, A4-C5-E5, B4-D5-F5, C5-E5-G5, D5-F5-A5, E5-G5-B5, F5-A5-C6, G5-B5-D6, A5-C6-E6, B5-D6-F6, C6-E6-G6, D6-F6-A6, E6-G6-B6, F6-A6-C7, G6-B6-D7, A6-C7-E7, B6-D7-F7, C7-E7-G7, D7-F7-A7, E7-G7-B7, F7-A7-C8, G7-B7-D8, A7-C8-E8, B7-D8-F8, C8-E8-G8, D8-F8-A8, E8-G8-B8, F8-A8-C9, G8-B8-D9, A8-C9-E9, B8-D9-F9, C9-E9-G9, D9-F9-A9, E9-G9-B9, F9-A9-C10, G9-B9-D10, A9-C10-E10, B9-D10-F10, C10-E10-G10, D10-F10-A10, E10-G10-B10, F10-A10-C11, G10-B10-D11, A10-C11-E11, B10-D11-F11, C11-E11-G11, D11-F11-A11, E11-G11-B11, F11-A11-C12, G11-B11-D12, A11-C12-E12, B11-D12-F12, C12-E12-G12, D12-F12-A12, E12-G12-B12, F12-A12-C13, G12-B12-D13, A12-C13-E13, B12-D13-F13, C13-E13-G13, D13-F13-A13, E13-G13-B13, F13-A13-C14, G13-B13-D14, A13-C14-E14, B13-D14-F14, C14-E14-G14, D14-F14-A14, E14-G14-B14, F14-A14-C15, G14-B14-D15, A14-C15-E15, B14-D15-F15, C15-E15-G15, D15-F15-A15, E15-G15-B15, F15-A15-C16, G15-B15-D16, A15-C16-E16, B15-D16-F16, C16-E16-G16, D16-F16-A16, E16-G16-B16, F16-A16-C17, G16-B16-D17, A16-C17-E17, B16-D17-F17, C17-E17-G17, D17-F17-A17, E17-G17-B17, F17-A17-C18, G17-B17-D18, A17-C18-E18, B17-D18-F18, C18-E18-G18, D18-F18-A18, E18-G18-B18, F18-A18-C19, G18-B18-D19, A18-C19-E19, B18-D19-F19, C19-E19-G19, D19-F19-A19, E19-G19-B19, F19-A19-C20, G19-B19-D20, A19-C20-E20, B19-D20-F20, C20-E20-G20, D20-F20-A20, E20-G20-B20, F20-A20-C21, G20-B20-D21, A20-C21-E21, B20-D21-F21, C21-E21-G21, D21-F21-A21, E21-G21-B21, F21-A21-C22, G21-B21-D22, A21-C22-E22, B21-D22-F22, C22-E22-G22, D22-F22-A22, E22-G22-B22, F22-A22-C23, G22-B22-D23, A22-C23-E23, B22-D23-F23, C23-E23-G23, D23-F23-A23, E23-G23-B23, F23-A23-C24, G23-B23-D24, A23-C24-E24, B23-D24-F24, C24-E24-G24, D24-F24-A24, E24-G24-B24, F24-A24-C25, G24-B24-D25, A24-C25-E25, B24-D25-F25, C25-E25-G25, D25-F25-A25, E25-G25-B25, F25-A25-C26, G25-B25-D26, A25-C26-E26, B25-D26-F26, C26-E26-G26, D26-F26-A26, E26-G26-B26, F26-A26-C27, G26-B26-D27, A26-C27-E27, B26-D27-F27, C27-E27-G27, D27-F27-A27, E27-G27-B27, F27-A27-C28, G27-B27-D28, A27-C28-E28, B27-D28-F28, C28-E28-G28, D28-F28-A28, E28-G28-B28, F28-A28-C29, G28-B28-D29, A28-C29-E29, B28-D29-F29, C29-E29-G29, D29-F29-A29, E29-G29-B29, F29-A29-C30, G29-B29-D30, A29-C30-E30, B29-D30-F30, C30-E30-G30, D30-F30-A30, E30-G30-B30, F30-A30-C31, G30-B30-D31, A30-C31-E31, B30-D31-F31, C31-E31-G31, D31-F31-A31, E31-G31-B31, F31-A31-C32, G31-B31-D32, A31-C32-E32, B31-D32-F32, C32-E32-G32, D32-F32-A32, E32-G32-B32, F32-A32-C33, G32-B32-D33, A32-C33-E33, B32-D33-F33, C33-E33-G33, D33-F33-A33, E33-G33-B33, F33-A33-C34, G33-B33-D34, A33-C34-E34, B33-D34-F34, C34-E34-G34, D34-F34-A34, E34-G34-B34, F34-A34-C35, G34-B34-D35, A34-C35-E35, B34-D35-F35, C35-E35-G35, D35-F35-A35, E35-G35-B35, F35-A35-C36, G35-B35-D36, A35-C36-E36, B35-D36-F36, C36-E36-G36, D36-F36-A36, E36-G36-B36, F36-A36-C37, G36-B36-D37, A36-C37-E37, B36-D37-F37, C37-E37-G37, D37-F37-A37, E37-G37-B37, F37-A37-C38, G37-B37-D38, A37-C38-E38, B37-D38-F38, C38-E38-G38, D38-F38-A38, E38-G38-B38, F38-A38-C39, G38-B38-D39, A38-C39-E39, B38-D39-F39, C39-E39-G39, D39-F39-A39, E39-G39-B39, F39-A39-C40, G39-B39-D40, A39-C40-E40, B39-D40-F40, C40-E40-G40, D40-F40-A40, E40-G40-B40, F40-A40-C41, G40-B40-D41, A40-C41-E41, B40-D41-F41, C41-E41-G41, D41-F41-A41, E41-G41-B41, F41-A41-C42, G41-B41-D42, A41-C42-E42, B41-D42-F42, C42-E42-G42, D42-F42-A42, E42-G42-B42, F42-A42-C43, G42-B42-D43, A42-C43-E43, B42-D43-F43, C43-E43-G43, D43-F43-A43, E43-G43-B43, F43-A43-C44, G43-B43-D44, A43-C44-E44, B43-D44-F44, C44-E44-G44, D44-F44-A44, E44-G44-B44, F44-A44-C45, G44-B44-D45, A44-C45-E45, B44-D45-F45, C45-E45-G45, D45-F45-A45, E45-G45-B45, F45-A45-C46, G45-B45-D46, A45-C46-E46, B45-D46-F46, C46-E46-G46, D46-F46-A46, E46-G46-B46, F46-A46-C47, G46-B46-D47, A46-C47-E47, B46-D47-F47, C47-E47-G47, D47-F47-A47, E47-G47-B47, F47-A47-C48, G47-B47-D48, A47-C48-E48, B47-D48-F48, C48-E48-G48, D48-F48-A48, E48-G48-B48, 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A102-C103-E103, B102-D103-F103, C103-E103-G103, D103-F103-A103, E103-G103-B103, F103-A103-C104, G103-B103-D104, A103-C104-E104, B103-D104-F104, C104-E104-G104, D104-F104-A104, E104-G104-B104, F104-A104-C105, G104-B104-D105, A104-C105-E105, B104-D105-F105, C105-E105-G105, D105-F105-A105, E105-G105-B105, F105-A105-C106, G105-B105-D106, A105-C106-E106, B105-D106-F106, C106-E106-G106, D106-F106-A106, E106-G106-B106, F106-A106-C107, G106-B106-D107, A106-C107-E107, B106-D107-F107, C107-E107-G107, D107-F107-A107, E107-G107-B107, F107-A107-C108, G107-B107-D108, A107-C108-E108, B107-D108-F108, C108-E108-G108, D108-F108-A108, E108-G108-B108, F108-A108-C109, G108-B108-D109, A108-C109-E109, B108-D109-F109, C109-E109-G109, D109-F109-A109, E109-G109-B109, F109-A109-C110, G109-B109-D110, A109-C110-E110, B109-D110-F110, C110-E110-G110, D110-F110-A110, E110-G110-B110, F110-A110-C111, G110-B110-D111, A110-C111-E111, B110-D111-F111, C111-E111-G111, D111-F111-A111, E111-G111-B111, F111-A111-C112, G111-B111-D112, A111-C112-E112, B111-D112-F112, C112-E112-G112, D112-F112-A112, E112-G112-B112, F112-A112-C113, G112-B112-D113, A112-C113-E113, B112-D113-F113, C113-E113-G113, D113-F113-A113, E113-G113-B113, F113-A113-C114, G113-B113-D114, A113-C114-E114, B113-D114-F114, C114-E114-G114, D114-F114-A114, E114-G114-B114, F114-A114-C115, G114-B114-D115, A114-C115-E115, B114-D115-F115, C115-E115-G115, D115-F115-A115, E115-G115-B115, F115-A115-C116, G115-B115-D116, A115-C116-E116, B115-D116-F116, C116-E116-G116, D116-F116-A116, E116-G116-B116, F116-A116-C117, G116-B116-D117, A116-C117-E117, B116-D117-F117, C117-E117-G117, D117-F117-A117, E117-G117-B117, F117-A117-C118, G117-B117-D118, A117-C118-E118, B117-D118-F118, C118-E118-G118, D118-F118-A118, E118-G118-B118, F118-A118-C119, G118-B118-D119, A118-C119-E119, B118-D119-F119, C119-E119-G119, D119-F119-A119, E119-G119-B119, F119-A119-C120, G119-B119-D120, A119-C120-E120, B119-D120-F120, C120-E120-G120, D120-F120-A120, E120-G120-B120, 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C147-E147-G147, D147-F147-A147, E147-G147-B147, F147-A147-C148, G147-B147-D148, A147-C148-E148, B147-D148-F148, C148-E148-G148, D148-F148-A148, E148-G148-B148, F148-A148-C149, G148-B148-D149, A148-C149-E149, B148-D149-F149, C149-E149-G149, D149-F149-A149, E149-G149-B149, F149-A149-C150, G149-B149-D150, A149-C150-E150, B149-D150-F150, C150-E150-G150, D150-F150-A150, E150-G150-B150, F150-A150-C151, G150-B150-D151, A150-C151-E151, B150-D151-F151, C151-E151-G151, D151-F151-A151, E151-G151-B151, F151-A151-C152, G151-B151-D152, A151-C152-E152, B151-D152-F152, C152-E152-G152, D152-F152-A152, E152-G152-B152, F152-A152-C153, G152-B152-D153, A152-C153-E153, B152-D153-F153, C153-E153-G153, D153-F153-A153, E153-G153-B153, F153-A153-C154, G153-B153-D154, A153-C154-E154, B153-D154-F154, C154-E154-G154, D154-F154-A154, E154-G154-B154, F154-A154-C155, G154-B154-D155, A154-C155-E155, B154-D155-F155, C155-E155-G155, D155-F155-A155, E155-G155-B155, F155-A155-C156, G155-B155-D156, A155-C156-E156, B155-D156-F156, C156-E156-G156, D156-F156-A156, E156-G156-B156, F156-A156-C157, G156-B156-D157, A156-C157-E157, B156-D157-F157, C157-E157-G157, D157-F157-A157, E157-G157-B157, F157-A157-C158, G157-B157-D158, A157-C158-E158, B157-D158-F158, C158-E158-G158, D158-F158-A158, E158-G158-B158, F158-A158-C159, G158-B158-D159, A158-C159-E159, B158-D159-F159, C159-E159-G159, D159-F159-A159, E159-G159-B159, F159-A159-C160, G159-B159-D160, A159-C160-E160, B159-D160-F160, C160-E160-G160, D160-F160-A160, E160-G160-B160, F160-A160-C161, G160-B160-D161, A160-C161-E161, B160-D161-F161


48 Characterizing mode (2)29


Mode (2)29 (binary key: 0011101)


29 plain 


29 seconds 


29 seconds inv. 1 


29 seconds inv. 2 


29 thirds 


29 thirds inv. 1 


29 thirds inv. 2 


29 fourths 

29 fourths inv. 1 

29 fourths inv. 2 

29 fifths 

29 fifths inv. 1 

29 fifths inv. 2 

2

29 sus4

29 sus4
inv. 1

29 sus4
inv. 2

29 sus2


29 sus2
inv. 1


29 sus2
inv. 2


49 Characterizing mode (2)30


Mode (2)30


(binary key: 00111110)


30 plain 


30 seconds 


30 seconds inv. 1 


30 seconds inv. 2 


30 thirds 

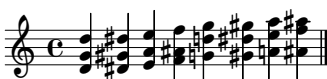
30 thirds inv. 1 


30 thirds inv. 2 


30 fourths 

30 fourths inv. 1 

30 fourths inv. 2 

30 fifths 

30 fifths inv. 1 

30 fifths inv. 2 

2

30 sus4

30 sus4
inv. 1

30 sus4
inv. 2

30 sus2

30 sus2
inv. 1

30 sus2
inv. 2

50 Characterizing mode (2)31

Mode (2)31 (binary key: 0011111)

31 plain 

31 seconds 

31 seconds
inv. 1 

31 seconds
inv. 2 

31 thirds 

31 thirds
inv. 1 

31 thirds
inv. 2 

31 fourths 

31 fourths
inv. 1 

31 fourths
inv. 2 

31 fifths 

31 fifths
inv. 1 

31 fifths
inv. 2 

2

31 sus4

31 sus4
inv. 1

31 sus4
inv. 2

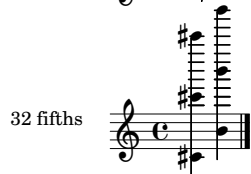
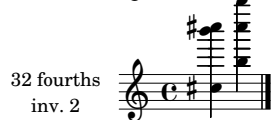
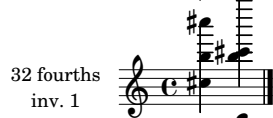
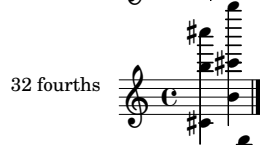
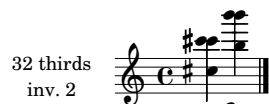
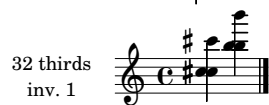
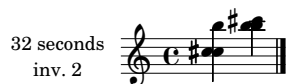
31 sus2

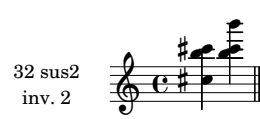
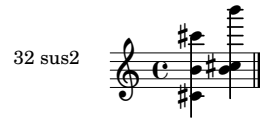
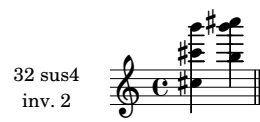
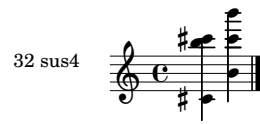
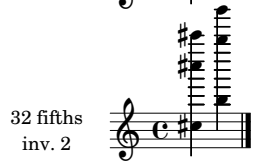
31 sus2
inv. 1

31 sus2
inv. 2

51 Characterizing mode (2)32


Mode (2)32
(binary key: 0100000)







52 Characterizing mode (2)33


Mode (2)33
(binary key: 0100001)


33 plain 

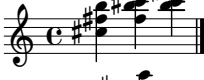
33 seconds 


33 seconds
inv. 1 


33 seconds
inv. 2 

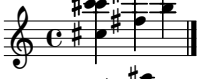
33 thirds 


33 thirds
inv. 1 


33 thirds
inv. 2 


33 fourths 

33 fourths
inv. 1 

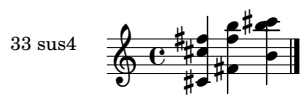
33 fourths
inv. 2 

33 fifths 

33 fifths
inv. 1 


33 fifths
inv. 2 


2





53 Characterizing mode (2)34


Mode (2)34
(binary key: 0100010)


34 plain 


34 seconds 


34 seconds
inv. 1 


34 seconds
inv. 2 


34 thirds 


34 thirds
inv. 1 

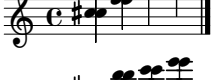
34 thirds
inv. 2 


34 fourths 

34 fourths
inv. 1 

34 fourths
inv. 2 

34 fifths 

34 fifths
inv. 1 

34 fifths
inv. 2 

2

34 sus4

34 sus4
inv. 1

34 sus4
inv. 2


34 sus2


34 sus2
inv. 1


34 sus2
inv. 2


54 Characterizing mode (2)35


Mode (2)35 (binary key: 0100011)


35 plain 


35 seconds 


35 seconds
inv. 1 


35 seconds
inv. 2 


35 thirds 


35 thirds
inv. 1 


35 thirds
inv. 2 


35 fourths 

35 fourths
inv. 1 

35 fourths
inv. 2 

35 fifths 

35 fifths
inv. 1 

35 fifths
inv. 2 

2

35 sus4

35 sus4
inv. 1

35 sus4
inv. 2

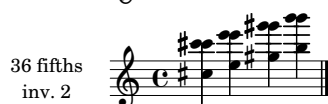
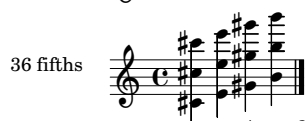
35 sus2

35 sus2
inv. 1

35 sus2
inv. 2

55 Characterizing mode (2)36

Mode (2)36 (binary key: 0100100)



2

36 sus4

36 sus4
inv. 1

36 sus4
inv. 2


36 sus2


36 sus2
inv. 1


36 sus2
inv. 2


56 Characterizing mode (2)37


Mode (2)37 (binary key: 0100101)


37 plain 


37 seconds 


37 seconds
inv. 1 


37 seconds
inv. 2 


37 thirds 


37 thirds
inv. 1 


37 thirds
inv. 2 


37 fourths 

37 fourths
inv. 1 

37 fourths
inv. 2 

37 fifths 

37 fifths
inv. 1 

37 fifths
inv. 2 

2

37 sus4

37 sus4
inv. 1

37 sus4
inv. 2


37 sus2


37 sus2
inv. 1


37 sus2
inv. 2


57 Characterizing mode (2)38


Mode (2)38 (binary key: 0100110)


38 plain 


38 seconds 


38 seconds
inv. 1 


38 seconds
inv. 2 


38 thirds 


38 thirds
inv. 1 


38 thirds
inv. 2 


38 fourths 

38 fourths
inv. 1 

38 fourths
inv. 2 

38 fifths 

38 fifths
inv. 1 

38 fifths
inv. 2 

2

38 sus4

38 sus4
inv. 1

38 sus4
inv. 2


38 sus2


38 sus2
inv. 1


38 sus2
inv. 2


58 Characterizing mode (2)39


Mode (2)39 (binary key: 0100111)


39 plain 


39 seconds 


39 seconds
inv. 1 


39 seconds
inv. 2 


39 thirds 


39 thirds
inv. 1 


39 thirds
inv. 2 


39 fourths 

39 fourths
inv. 1 

39 fourths
inv. 2 

39 fifths 

39 fifths
inv. 1 

39 fifths
inv. 2 

2

39 sus4



39 sus4

inv. 1



39 sus4

inv. 2



39 sus2



39 sus2

inv. 1




39 sus2


inv. 2





59 Characterizing mode (2)40


Mode (2)40 (binary key: 0101000)


40 plain 


40 seconds 


40 seconds
inv. 1 


40 seconds
inv. 2 


40 thirds 


40 thirds
inv. 1 

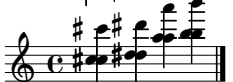
40 thirds
inv. 2 


40 fourths 

40 fourths
inv. 1 

40 fourths
inv. 2 

40 fifths 

40 fifths
inv. 1 

40 fifths
inv. 2 

2

40 sus4

40 sus4
inv. 1

40 sus4
inv. 2


40 sus2


40 sus2
inv. 1


40 sus2
inv. 2


60 Characterizing mode (2)41


Mode (2)41 (binary key: 0101001)


41 plain 


41 seconds 


41 seconds
inv. 1 


41 seconds
inv. 2 


41 thirds 


41 thirds
inv. 1 


41 thirds
inv. 2 


41 fourths 

41 fourths
inv. 1 

41 fourths
inv. 2 


41 fifths 

41 fifths
inv. 1 


41 fifths
inv. 2 

2


41 sus4




41 sus4
inv. 1




41 sus4
inv. 2




41 sus2



41 sus2
inv. 1





41 sus2
inv. 2





61 Characterizing mode (2)42


Mode (2)42 (binary key: 0101010)


42 plain 


42 seconds 


42 seconds
inv. 1 


42 seconds
inv. 2 

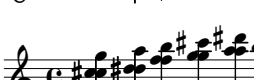
42 thirds 

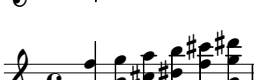
42 thirds
inv. 1 

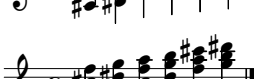
42 thirds
inv. 2 


42 fourths 

42 fourths
inv. 1 

42 fourths
inv. 2 

42 fifths 

42 fifths
inv. 1 

42 fifths
inv. 2 

2
42 sus4

42 sus4
inv. 1

42 sus4
inv. 2


42 sus2


42 sus2
inv. 1


42 sus2
inv. 2


62 Characterizing mode (2)43


Mode (2)43 (binary key: 0101011)


43 plain 


43 seconds 


43 seconds
inv. 1 


43 seconds
inv. 2 


43 thirds 


43 thirds
inv. 1 


43 thirds
inv. 2 


43 fourths 

43 fourths
inv. 1 

43 fourths
inv. 2 

43 fifths 

43 fifths
inv. 1 

43 fifths
inv. 2 

2

43 sus4

43 sus4
inv. 1

43 sus4
inv. 2


43 sus2


43 sus2
inv. 1


43 sus2
inv. 2


63 Characterizing mode (2)44


Mode (2)44 (binary key: 0101100)


44 plain 


44 seconds 


44 seconds
inv. 1 


44 seconds
inv. 2 


44 thirds 


44 thirds
inv. 1 


44 thirds
inv. 2 


44 fourths 

44 fourths
inv. 1 

44 fourths
inv. 2 

44 fifths 

44 fifths
inv. 1 

44 fifths
inv. 2 

2

44 sus4

44 sus4
inv. 1

44 sus4
inv. 2


44 sus2


44 sus2
inv. 1


44 sus2
inv. 2


64 Characterizing mode (2)45


Mode (2)45 (binary key: 0101101)


45 plain 


45 seconds 


45 seconds
inv. 1 


45 seconds
inv. 2 


45 thirds 


45 thirds
inv. 1 


45 thirds
inv. 2 


45 fourths 

45 fourths
inv. 1 

45 fourths
inv. 2 

45 fifths 

45 fifths
inv. 1 

45 fifths
inv. 2 

2

45 sus4

45 sus4
inv. 1

45 sus4
inv. 2

45 sus2


45 sus2
inv. 1


45 sus2
inv. 2


65 Characterizing mode (2)46


Mode (2)46


(binary key: 0101110)


46 plain 


46 seconds 


46 seconds
inv. 1 


46 seconds
inv. 2 


46 thirds 


46 thirds
inv. 1 

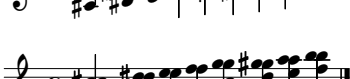
46 thirds
inv. 2 


46 fourths 

46 fourths
inv. 1 

46 fourths
inv. 2 

46 fifths 

46 fifths
inv. 1 

46 fifths
inv. 2 

2

46 sus4

46 sus4
inv. 1

46 sus4
inv. 2


46 sus2


46 sus2
inv. 1


46 sus2
inv. 2


66 Characterizing mode (2)47


Mode (2)47 (binary key: 0101111)


47 plain 


47 seconds 


47 seconds
inv. 1 


47 seconds
inv. 2 


47 thirds 


47 thirds
inv. 1 


47 thirds
inv. 2 


47 fourths 

47 fourths
inv. 1 

47 fourths
inv. 2 

47 fifths 

47 fifths
inv. 1 

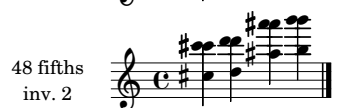
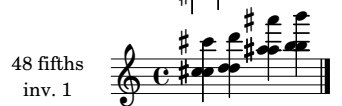
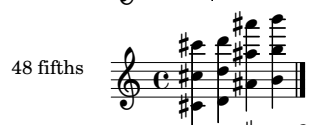
47 fifths
inv. 2 

2



67 Characterizing mode (2)48

Mode (2)48 (binary key: 0110000)



2
48 sus4

48 sus4
inv. 1

48 sus4
inv. 2


48 sus2


48 sus2
inv. 1


48 sus2
inv. 2


68 Characterizing mode (2)49


Mode (2)49 (binary key: 0110001)


49 plain 


49 seconds 


49 seconds
inv. 1 


49 seconds
inv. 2 


49 thirds 


49 thirds
inv. 1 


49 thirds
inv. 2 


49 fourths 

49 fourths
inv. 1 

49 fourths
inv. 2 

49 fifths 

49 fifths
inv. 1 

49 fifths
inv. 2 

2

49 sus4

49 sus4
inv. 1

49 sus4
inv. 2


49 sus2


49 sus2
inv. 1


49 sus2
inv. 2


69 Characterizing mode (2)50


Mode (2)50 (binary key: 0110010)


50 plain 


50 seconds 


50 seconds
inv. 1 


50 seconds
inv. 2 


50 thirds 


50 thirds
inv. 1 


50 thirds
inv. 2 


50 fourths 

50 fourths
inv. 1 

50 fourths
inv. 2 

50 fifths 

50 fifths
inv. 1 

50 fifths
inv. 2 

2

50 sus4

50 sus4
inv. 1

50 sus4
inv. 2

50 sus2

50 sus2
inv. 1


50 sus2
inv. 2


The image displays six musical staves, each representing a different chord voicing. All staves are in treble clef with a key signature of one sharp (F#) and a common time signature (C). The notes are as follows:


- Staff 1 (50 sus4):** Notes are G#4, A4, B4, C5, D5, E5.
- Staff 2 (50 sus4 inv. 1):** Notes are G#4, A4, B4, C5, D5, E5.
- Staff 3 (50 sus4 inv. 2):** Notes are G#4, A4, B4, C5, D5, E5.
- Staff 4 (50 sus2):** Notes are G#4, A4, B4, C5, D5, E5.
- Staff 5 (50 sus2 inv. 1):** Notes are G#4, A4, B4, C5, D5, E5.
- Staff 6 (50 sus2 inv. 2):** Notes are G#4, A4, B4, C5, D5, E5.


70 Characterizing mode (2)51


Mode (2)51 (binary key: 0110011)

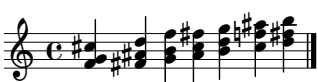
51 plain 


51 seconds 


51 seconds
inv. 1 


51 seconds
inv. 2 


51 thirds 


51 thirds
inv. 1 


51 thirds
inv. 2 


51 fourths 

51 fourths
inv. 1 

51 fourths
inv. 2 

51 fifths 

51 fifths
inv. 1 

51 fifths
inv. 2 

2

51 sus4

51 sus4
inv. 1

51 sus4
inv. 2


51 sus2


51 sus2
inv. 1


51 sus2
inv. 2


71 Characterizing mode (2)52


Mode (2)52 (binary key: 0110100)


52 plain 


52 seconds 


52 seconds
inv. 1 


52 seconds
inv. 2 


52 thirds 


52 thirds
inv. 1 


52 thirds
inv. 2 


52 fourths 

52 fourths
inv. 1 

52 fourths
inv. 2 

52 fifths 

52 fifths
inv. 1 

52 fifths
inv. 2 

2

52 sus4

52 sus4
inv. 1

52 sus4
inv. 2


52 sus2


52 sus2
inv. 1


52 sus2
inv. 2


72 Characterizing mode (2)53


Mode (2)53 (binary key: 0110101)


53 plain 


53 seconds 


53 seconds
inv. 1 


53 seconds
inv. 2 


53 thirds 


53 thirds
inv. 1 


53 thirds
inv. 2 


53 fourths 

53 fourths
inv. 1 

53 fourths
inv. 2 

53 fifths 

53 fifths
inv. 1 

53 fifths
inv. 2 

2

53 sus4

53 sus4
inv. 1

53 sus4
inv. 2

53 sus2

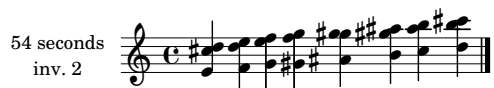
53 sus2
inv. 1

53 sus2
inv. 2

73 Characterizing mode (2)54

Mode (2)54

(binary key: 0110110)



2

54 sus4

54 sus4
inv. 1

54 sus4
inv. 2

54 sus2


54 sus2
inv. 1


54 sus2
inv. 2


74 Characterizing mode (2)55


Mode (2)55


(binary key: 0110111)


55 plain 


55 seconds 


55 seconds
inv. 1 


55 seconds
inv. 2 


55 thirds 


55 thirds
inv. 1 


55 thirds
inv. 2 


55 fourths 

55 fourths
inv. 1 

55 fourths
inv. 2 

55 fifths 

55 fifths
inv. 1 

55 fifths
inv. 2 

2

55 sus4

55 sus4
inv. 1

55 sus4
inv. 2


55 sus2


55 sus2
inv. 1


55 sus2
inv. 2


75 Characterizing mode (2)56


Mode (2)56 (binary key: 0111000)


56 plain 


56 seconds 


56 seconds
inv. 1 


56 seconds
inv. 2 

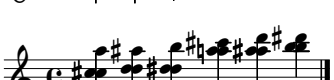
56 thirds 


56 thirds
inv. 1 


56 thirds
inv. 2 


56 fourths 

56 fourths
inv. 1 

56 fourths
inv. 2 

56 fifths 

56 fifths
inv. 1 

56 fifths
inv. 2 

2

56 sus4

56 sus4
inv. 1

56 sus4
inv. 2


56 sus2


56 sus2
inv. 1


56 sus2
inv. 2


76 Characterizing mode (2)57


Mode (2)57 (binary key: 0111001)


57 plain 


57 seconds 


57 seconds
inv. 1 


57 seconds
inv. 2 

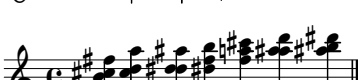
57 thirds 


57 thirds
inv. 1 

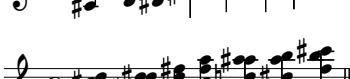
57 thirds
inv. 2 


57 fourths 

57 fourths
inv. 1 

57 fourths
inv. 2 

57 fifths 

57 fifths
inv. 1 

57 fifths
inv. 2 

2

57 sus4

57 sus4
inv. 1

57 sus4
inv. 2


57 sus2


57 sus2
inv. 1


57 sus2
inv. 2


77 Characterizing mode (2)58


Mode (2)58 (binary key: 0111010)


58 plain 


58 seconds 


58 seconds
inv. 1 


58 seconds
inv. 2 


58 thirds 


58 thirds
inv. 1 


58 thirds
inv. 2 


58 fourths 

58 fourths
inv. 1 

58 fourths
inv. 2 

58 fifths 

58 fifths
inv. 1 

58 fifths
inv. 2 

2

58 sus4

58 sus4
inv. 1

58 sus4
inv. 2

58 sus2


58 sus2
inv. 1


58 sus2
inv. 2


78 Characterizing mode (2)59


Mode (2)59


(binary key: 0111011)


59 plain 


59 seconds 


59 seconds inv. 1 


59 seconds inv. 2 

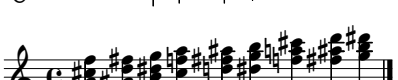
59 thirds 


59 thirds inv. 1 


59 thirds inv. 2 


59 fourths 

59 fourths inv. 1 

59 fourths inv. 2 

59 fifths 

59 fifths inv. 1 

59 fifths inv. 2 


2





79 Characterizing mode (2)60


Mode (2)60


(binary key: 0111100)


60 plain 


60 seconds 


60 seconds inv. 1 


60 seconds inv. 2 


60 thirds 


60 thirds inv. 1 


60 thirds inv. 2 


60 fourths 

60 fourths inv. 1 

60 fourths inv. 2 

60 fifths 

60 fifths inv. 1 

60 fifths inv. 2 

2

60 sus4

60 sus4
inv. 1

60 sus4
inv. 2


60 sus2


60 sus2
inv. 1


60 sus2
inv. 2


80 Characterizing mode (2)61


Mode (2)61 (binary key: 0111101)


61 plain 


61 seconds 


61 seconds
inv. 1 


61 seconds
inv. 2 


61 thirds 


61 thirds
inv. 1 


61 thirds
inv. 2 


61 fourths 

61 fourths
inv. 1 

61 fourths
inv. 2 

61 fifths 

61 fifths
inv. 1 

61 fifths
inv. 2 

2

61 sus4

61 sus4
inv. 1

61 sus4
inv. 2

61 sus2

61 sus2
inv. 1

61 sus2
inv. 2

81 Characterizing mode (2)62

Mode (2)62 (binary key: 0111110)

62 plain

62 seconds

62 seconds
inv. 1

62 seconds
inv. 2

62 thirds

62 thirds
inv. 1

62 thirds
inv. 2

62 fourths

62 fourths
inv. 1

62 fourths
inv. 2

62 fifths

62 fifths
inv. 1

62 fifths
inv. 2

2

62 sus4

62 sus4
inv. 1

62 sus4
inv. 2


62 sus2

62 sus2
inv. 1

62 sus2
inv. 2

82 Characterizing mode (2)63

Mode (2)63 (binary key: 0111111)

63 plain 

63 seconds 

63 seconds inv. 1 

63 seconds inv. 2 

63 thirds 

63 thirds inv. 1 

63 thirds inv. 2 

63 fourths 

63 fourths inv. 1 

63 fourths inv. 2 

63 fifths 

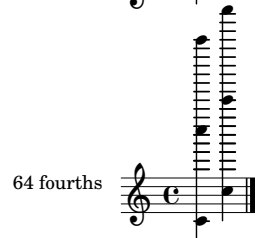
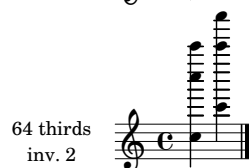
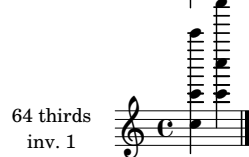
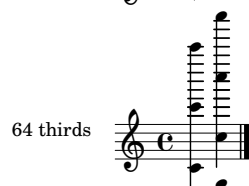
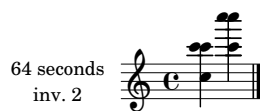
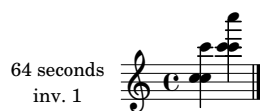
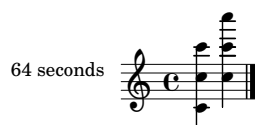
63 fifths inv. 1 

63 fifths inv. 2 

83 Characterizing mode (2)64

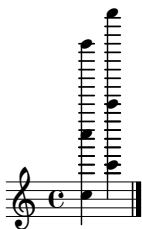
Mode (2)64 (binary key: 1000000)

Unison

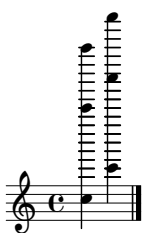


2

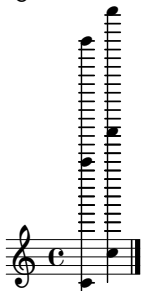
64 fourths
inv. 1



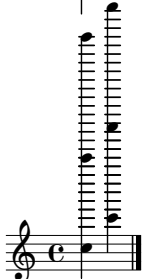
64 fourths
inv. 2



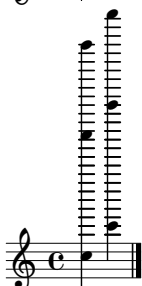
64 fifths

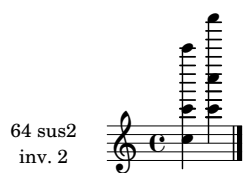
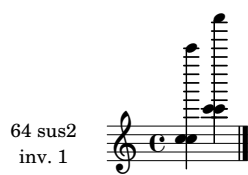
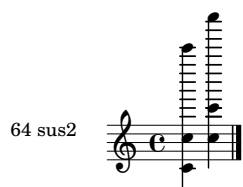
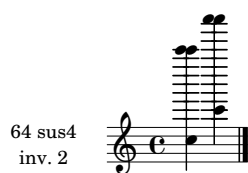
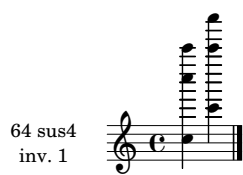


64 fifths
inv. 1



64 fifths
inv. 2




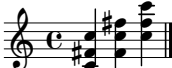



84 Characterizing mode (2)65


Mode (2)65 (binary key: 1000001)


Sharp Fourth
Flat Fifth Interval


65 plain 


65 seconds 


65 seconds
inv. 1 


65 seconds
inv. 2 


65 thirds 


65 thirds
inv. 1 

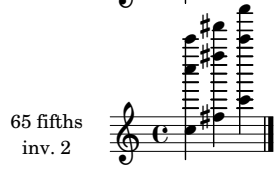
65 thirds
inv. 2 

65 fourths 

65 fourths
inv. 1 

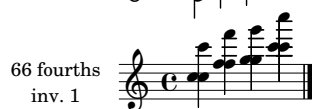
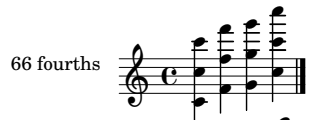
65 fourths
inv. 2 

65 fifths 



85 Characterizing mode (2)66

Mode (2)66
 (binary key: 1000010)
 Raga Sarvarsi (India)



2




86 Characterizing mode (2)67


Mode (2)67


(binary key: 1000011)


Theoretical - No Known Name as 7/4567/2 in 12edo)


Theoretical - No Known Name

67 plain 

67 seconds 

67 seconds
inv. 1 


67 seconds
inv. 2 


67 thirds 

67 thirds
inv. 1 


67 thirds
inv. 2 

67 fourths 

67 fourths
inv. 1 

67 fourths
inv. 2 

67 fifths 

67 fifths
inv. 1 

67 fifths
inv. 2 

2

67 sus4



67 sus4
inv. 1



67 sus4
inv. 2



67 sus2



67 sus2
inv. 1



67 sus2
inv. 2



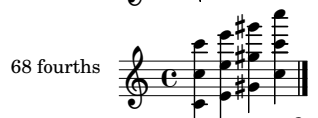
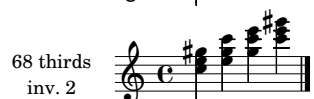
87 Characterizing mode (2)68

Mode (2)68

(binary key: 1000100)

Major Flat 6 (no fifth)

Messiaen 3rd Mode & Augmented Chord
augmented



2

68 fifths
inv. 2

68 sus4

68 sus4
inv. 1

68 sus4
inv. 2


68 sus2


68 sus2
inv. 1


68 sus2
inv. 2


88 Characterizing mode (2)69


Mode (2)69
 (binary key: 1000101)
 Theoretical - No Known Name


69 plain 


69 seconds 


69 seconds
inv. 1 


69 seconds
inv. 2 


69 thirds 


69 thirds
inv. 1 


69 thirds
inv. 2 


69 fourths 

69 fourths
inv. 1 

69 fourths
inv. 2 

69 fifths 

69 fifths
inv. 1 

69 fifths
inv. 2 

2

69 sus4

69 sus4
inv. 1

69 sus4
inv. 2

69 sus2

69 sus2
inv. 1

69 sus2
inv. 2

89 Characterizing mode (2)70

Mode (2)70
(binary key: 1000110)
Raga Zilaf, (India)

70 plain 

70 seconds 

70 seconds
inv. 1 

70 seconds
inv. 2 

70 thirds 

70 thirds
inv. 1 

70 thirds
inv. 2 

70 fourths 

70 fourths
inv. 1 

70 fourths
inv. 2 

70 fifths 

70 fifths
inv. 1 

70 fifths
inv. 2 

2

70 sus4

70 sus4
inv. 1

70 sus4
inv. 2

70 sus2

70 sus2
inv. 1


70 sus2
inv. 2


90 Characterizing mode (2)71


Mode (2)71


(binary key: 1000111)


Theoretical - No Known Name


71 plain 


71 seconds 


71 seconds
inv. 1 


71 seconds
inv. 2 


71 thirds 


71 thirds
inv. 1 


71 thirds
inv. 2 


71 fourths 

71 fourths
inv. 1 

71 fourths
inv. 2 

71 fifths 

71 fifths
inv. 1 

71 fifths
inv. 2 

2

71 sus4

71 sus4
inv. 1

71 sus4
inv. 2

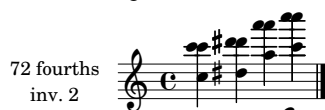
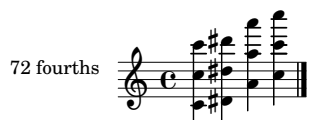
71 sus2

71 sus2
inv. 1

71 sus2
inv. 2

91 Characterizing mode (2)72

Mode (2)72
 (binary key: 1001000)
 Theoretical - No Known Name



2

72 fifths
inv. 2



72 sus4 

[illegible]

72 sus4
inv. 2



72 sus2 

72 sus2
inv. 1

72 sus2
inv. 2



92 Characterizing mode (2)73

Mode (2)73

(binary key: 1001001)


Diminished 7th Chord, 3 Semitones

Messiaen 2nd Mode - Chord Cdim7 (bb7)

Chord Diminished 7th


Theoretical - No Known Name

73 plain 

73 seconds 

73 seconds
inv. 1 

73 seconds
inv. 2 

73 thirds 


73 thirds
inv. 1 


73 thirds
inv. 2 

73 fourths 

73 fourths
inv. 1 

73 fourths
inv. 2 

73 fifths 

73 fifths
inv. 1 

2




93 Characterizing mode (2)74


Mode (2)74


(binary key: 1001010)


Minor 6th Added


Minor Added Sixth Pentatonic


74 plain 

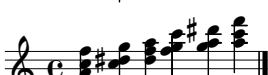
74 seconds 


74 seconds
inv. 1 


74 seconds
inv. 2 


74 thirds 


74 thirds
inv. 1 


74 thirds
inv. 2 


74 fourths 

74 fourths
inv. 1 

74 fourths
inv. 2 

74 fifths 

74 fifths
inv. 1 

74 fifths
inv. 2 

2

74 sus4

74 sus4
inv. 1

74 sus4
inv. 2

74 sus2

74 sus2
inv. 1


74 sus2
inv. 2


94 Characterizing mode (2)75


Mode (2)75


(binary key: 1001011)


Theoretical - No Known Name


75 plain 


75 seconds 


75 seconds
inv. 1 


75 seconds
inv. 2 

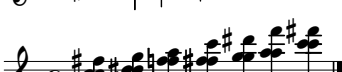
75 thirds 


75 thirds
inv. 1 


75 thirds
inv. 2 


75 fourths 

75 fourths
inv. 1 

75 fourths
inv. 2 

75 fifths 

75 fifths
inv. 1 

75 fifths
inv. 2 

2

75 sus4

75 sus4
inv. 1

75 sus4
inv. 2

75 sus2

75 sus2
inv. 1


75 sus2
inv. 2


95 Characterizing mode (2)76


Mode (2)76


(binary key: 1001100)


Theoretical - No Known Name


76 plain 


76 seconds 


76 seconds
inv. 1 


76 seconds
inv. 2 


76 thirds 


76 thirds
inv. 1 


76 thirds
inv. 2 


76 fourths 

76 fourths
inv. 1 

76 fourths
inv. 2 

76 fifths 

76 fifths
inv. 1 

76 fifths
inv. 2 

2

76 sus4

76 sus4
inv. 1

76 sus4
inv. 2

76 sus2

76 sus2
inv. 1


76 sus2
inv. 2


96 Characterizing mode (2)77


Mode (2)77


(binary key: 1001101)


Theoretical - No Known Name


77 plain 


77 seconds 


77 seconds
inv. 1 

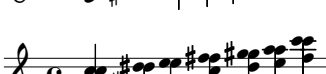
77 seconds
inv. 2 


77 thirds 

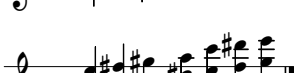
77 thirds
inv. 1 


77 thirds
inv. 2 


77 fourths 

77 fourths
inv. 1 

77 fourths
inv. 2 

77 fifths 

77 fifths
inv. 1 

77 fifths
inv. 2 

2

77 sus4



77 sus4

inv. 1



77 sus4

inv. 2



77 sus2



77 sus2

inv. 1



77 sus2


inv. 2





97 Characterizing mode (2)78


Mode (2)78 (binary key: 1001110)


Mela Yagapriya (India)


78 plain 


78 seconds 


78 seconds
inv. 1 


78 seconds
inv. 2 


78 thirds 


78 thirds
inv. 1 

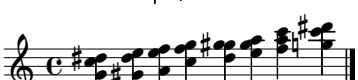
78 thirds
inv. 2 


78 fourths 

78 fourths
inv. 1 

78 fourths
inv. 2 

78 fifths 

78 fifths
inv. 1 

78 fifths
inv. 2 

2

78 sus4

78 sus4
inv. 1

78 sus4
inv. 2

78 sus2

78 sus2
inv. 1

78 sus2
inv. 2

98 Characterizing mode (2)79

Mode (2)79

(binary key: 1001111)

Theoretical - No Known Name



2

79 sus4



79 sus4
inv. 1



79 sus4
inv. 2



79 sus2



79 sus2
inv. 1



79 sus2
inv. 2



99 Characterizing mode (2)80

Mode (2)80
 (binary key: 1010000)
 Theoretical - No Known Name





2



100 Characterizing mode (2)81

Mode (2)81
 (binary key: 1010001)
 Theoretical - No Known Name


81 plain 

81 seconds 

81 seconds
inv. 1 

81 seconds
inv. 2 

81 thirds 

81 thirds
inv. 1 

81 thirds
inv. 2 

81 fourths 

81 fourths
inv. 1 

81 fourths
inv. 2 

81 fifths 

81 fifths
inv. 1 

81 fifths
inv. 2 

2

81 sus4

81 sus4
inv. 1

81 sus4
inv. 2

81 sus2

81 sus2
inv. 1


81 sus2
inv. 2


101 Characterizing mode (2)82


Mode (2)82


(binary key: 1010010)


Egyptian , Suspended Pentatonic


82 plain 


82 seconds 


82 seconds
inv. 1 


82 seconds
inv. 2 


82 thirds 


82 thirds
inv. 1 


82 thirds
inv. 2 


82 fourths 

82 fourths
inv. 1 

82 fourths
inv. 2 

82 fifths 

82 fifths
inv. 1 

82 fifths
inv. 2 

2

82 sus4

82 sus4
inv. 1

82 sus4
inv. 2

82 sus2

82 sus2
inv. 1

82 sus2
inv. 2


The image displays six musical staves, each representing a different inversion of a suspended chord in G major. The notes are G, A, B, C, D, E, and F#. The staves are arranged vertically, with the first staff showing the root position (G, A, B, C, D, E, F#) and the subsequent staves showing the first and second inversions for both the suspended fourth and suspended second chords.


102 Characterizing mode (2)83


Mode (2)83


(binary key: 1010011)


Theoretical - No Known Name


83 plain 


83 seconds 


83 seconds
inv. 1 


83 seconds
inv. 2 

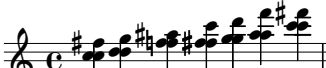
83 thirds 


83 thirds
inv. 1 


83 thirds
inv. 2 


83 fourths 

83 fourths
inv. 1 

83 fourths
inv. 2 

83 fifths 

83 fifths
inv. 1 

83 fifths
inv. 2 

2

83 sus4

83 sus4
inv. 1

83 sus4
inv. 2

83 sus2

83 sus2
inv. 1

83 sus2
inv. 2


The image displays six musical staves, each representing a different chord voicing. The first staff is labeled '83 sus4' and shows a sequence of chords: F#m, G#m, A#m, Bm, C#m, D#m, E#m, and F#m. The second staff is labeled '83 sus4 inv. 1' and shows the same sequence of chords, but with the first inversion. The third staff is labeled '83 sus4 inv. 2' and shows the same sequence of chords, but with the second inversion. The fourth staff is labeled '83 sus2' and shows a sequence of chords: F#m, G#m, A#m, Bm, C#m, D#m, E#m, and F#m. The fifth staff is labeled '83 sus2 inv. 1' and shows the same sequence of chords, but with the first inversion. The sixth staff is labeled '83 sus2 inv. 2' and shows the same sequence of chords, but with the second inversion.


103 Characterizing mode (2)84


Mode (2)84


(binary key: 1010100)


Theoretical - No Known Name


84 plain 


84 seconds 


84 seconds
inv. 1 


84 seconds
inv. 2 


84 thirds 


84 thirds
inv. 1 


84 thirds
inv. 2 


84 fourths 

84 fourths
inv. 1 

84 fourths
inv. 2 

84 fifths 

84 fifths
inv. 1 

84 fifths
inv. 2 

2

84 sus4

84 sus4
inv. 1

84 sus4
inv. 2

84 sus2

84 sus2
inv. 1

84 sus2
inv. 2

104 Characterizing mode (2)85

Mode (2)85

(binary key: 1010101)

Whole-Tone, Anhemitonic Hexatonic (as whole tone in 12edo) Auxillary Augmented, Messiaen 1st Mode

Raga Gopriya (India) Anhemitonic Hexatonic

Whole tone alternate

whole tone #'s in 12edo)

whole tone b's in 12edo)



2

85 fifths
inv. 2



85 sus4



85 sus4
inv. 1



85 sus4
inv. 2



85 sus2



85 sus2
inv. 1



85 sus2
inv. 2



105 Characterizing mode (2)86

Mode (2)86

(binary key: 1010110)

Major Minor, Hindu bVI & bVII

Mela Carukesi (India) Raga Tarangini (India)



2

86 sus4

86 sus4
inv. 1

86 sus4
inv. 2

86 sus2

86 sus2
inv. 1


86 sus2
inv. 2


106 Characterizing mode (2)87


Mode (2)87


(binary key: 1010111)


Theoretical - No Known Name


87 plain 


87 seconds 


87 seconds
inv. 1 


87 seconds
inv. 2 


87 thirds 


87 thirds
inv. 1 


87 thirds
inv. 2 


87 fourths 

87 fourths
inv. 1 

87 fourths
inv. 2 

87 fifths 

87 fifths
inv. 1 

87 fifths
inv. 2 

2

87 sus4

87 sus4
inv. 1

87 sus4
inv. 2

87 sus2

87 sus2
inv. 1


87 sus2
inv. 2


107 Characterizing mode (2)88


Mode (2)88


(binary key: 1011000)


Theoretical - No Known Name


88 plain 


88 seconds 


88 seconds
inv. 1 


88 seconds
inv. 2 


88 thirds 


88 thirds
inv. 1 


88 thirds
inv. 2 


88 fourths 

88 fourths
inv. 1 

88 fourths
inv. 2 

88 fifths 

88 fifths
inv. 1 

88 fifths
inv. 2 

2

88 sus4



88 sus4
inv. 1



88 sus4
inv. 2



88 sus2



88 sus2
inv. 1



88 sus2
inv. 2





108 Characterizing mode (2)89


Mode (2)89


(binary key: 1011001)


Theoretical - No Known Name


89 plain 


89 seconds 


89 seconds
inv. 1 


89 seconds
inv. 2 


89 thirds 


89 thirds
inv. 1 


89 thirds
inv. 2 


89 fourths 

89 fourths
inv. 1 

89 fourths
inv. 2 

89 fifths 

89 fifths
inv. 1 

89 fifths
inv. 2 

2

89 sus4

89 sus4
inv. 1

89 sus4
inv. 2

89 sus2

89 sus2
inv. 1

89 sus2
inv. 2

109 Characterizing mode (2)90

Mode (2)90

(binary key: 1011010)

Dorian, Kafi D to C asc. naturals

Chord Cm69sus4 - Eskimo Heptatonic (N. America) Kafi Thaat (India), Embulum (Sumerian)

90 plain



90 seconds



90 seconds
inv. 1



90 seconds
inv. 2



90 thirds



90 thirds
inv. 1



90 thirds
inv. 2



90 fourths



90 fourths
inv. 1



90 fourths
inv. 2



90 fifths



90 fifths
inv. 1



90 fifths
inv. 2



2

90 sus4

90 sus4
inv. 1

90 sus4
inv. 2

90 sus2

90 sus2
inv. 1

90 sus2
inv. 2


The image displays six musical staves, each representing a different voicing of a 90-degree suspended chord in C major. The chords are as follows:


- 90 sus4:** C4, E4, G4, A4
- 90 sus4 inv. 1:** E4, G4, A4, C5
- 90 sus4 inv. 2:** G4, A4, C5, E5
- 90 sus2:** C4, E4, F4, G4
- 90 sus2 inv. 1:** E4, F4, G4, A4
- 90 sus2 inv. 2:** F4, G4, A4, B4


110 Characterizing mode (2)91


Mode (2)91 (binary key: 1011011)


Blues Octatonic


91 plain 


91 seconds 


91 seconds
inv. 1 


91 seconds
inv. 2 


91 thirds 

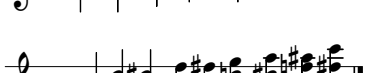
91 thirds
inv. 1 


91 thirds
inv. 2 


91 fourths 

91 fourths
inv. 1 

91 fourths
inv. 2 

91 fifths 

91 fifths
inv. 1 

91 fifths
inv. 2 

2

91 sus4

91 sus4
inv. 1

91 sus4
inv. 2

91 sus2

91 sus2
inv. 1

91 sus2
inv. 2

111 Characterizing mode (2)92

Mode (2)92

(binary key: 1011100)

Theoretical - No Known Name



2

92 sus4

92 sus4
inv. 1

92 sus4
inv. 2

92 sus2

92 sus2
inv. 1

92 sus2
inv. 2


The image displays six musical staves, each representing a different chord progression in G major (one sharp). The first staff, labeled '92 sus4', shows a sequence of chords: G2sus4, A2sus4, B2sus4, C3sus4, D3sus4, E3sus4, F#3sus4, and G3sus4. The second staff, '92 sus4 inv. 1', shows the first inversion of these chords. The third staff, '92 sus4 inv. 2', shows the second inversion. The fourth staff, '92 sus2', shows a sequence of chords: G2sus2, A2sus2, B2sus2, C3sus2, D3sus2, E3sus2, F#3sus2, and G3sus2. The fifth staff, '92 sus2 inv. 1', shows the first inversion of these chords. The sixth staff, '92 sus2 inv. 2', shows the second inversion. Each staff begins with a treble clef and a common time signature 'C'.


112 Characterizing mode (2)93


Mode (2)93


(binary key: 1011101)


Theoretical - No Known Name


93 plain 


93 seconds 


93 seconds inv. 1 


93 seconds inv. 2 


93 thirds 


93 thirds inv. 1 


93 thirds inv. 2 


93 fourths 

93 fourths inv. 1 

93 fourths inv. 2 

93 fifths 

93 fifths inv. 1 

93 fifths inv. 2 

2

93 sus4

93 sus4
inv. 1

93 sus4
inv. 2

93 sus2

93 sus2
inv. 1


93 sus2
inv. 2


The image displays six musical staves, each representing a different chord voicing for the 93rd degree of the scale. The staves are arranged vertically. The first staff is labeled '93 sus4' and shows a triad of notes. The second staff is labeled '93 sus4 inv. 1' and shows the first inversion of the triad. The third staff is labeled '93 sus4 inv. 2' and shows the second inversion of the triad. The fourth staff is labeled '93 sus2' and shows a dyad of notes. The fifth staff is labeled '93 sus2 inv. 1' and shows the first inversion of the dyad. The sixth staff is labeled '93 sus2 inv. 2' and shows the second inversion of the dyad. Each staff begins with a treble clef and a common time signature 'C'. The notes are written in a specific key signature, with sharps and naturals indicating the pitch classes.


113 Characterizing mode (2)94


Mode (2)94 (binary key: 1011110)


Houseini (Greece)


94 plain 


94 seconds 


94 seconds
inv. 1 


94 seconds
inv. 2 


94 thirds 


94 thirds
inv. 1 


94 thirds
inv. 2 


94 fourths 

94 fourths
inv. 1 

94 fourths
inv. 2 

94 fifths 

94 fifths
inv. 1 

94 fifths
inv. 2 

94 sus4



114 Characterizing mode (2)95

Mode (2)95

(binary key: 1011111)

Theoretical - No Known Name

95 plain



95 seconds



95 seconds
inv. 1



95 seconds
inv. 2



95 thirds



95 thirds
inv. 1



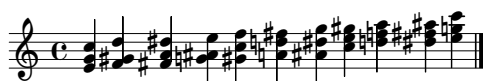
95 thirds
inv. 2



95 fourths



95 fourths
inv. 1



95 fourths
inv. 2



95 fifths



95 fifths
inv. 1



95 fifths
inv. 2



2

95 sus4



95 sus4

inv. 1



95 sus4

inv. 2



95 sus2



95 sus2

inv. 1




95 sus2


inv. 2





115 Characterizing mode (2)96


Mode (2)96
(binary key: 1100000)
Theoretical - No Known Name

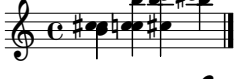
96 plain 


96 seconds 


96 seconds
inv. 1 


96 seconds
inv. 2 

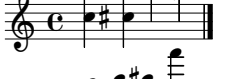
96 thirds 


96 thirds
inv. 1 


96 thirds
inv. 2 

96 fourths 

96 fourths
inv. 1 

96 fourths
inv. 2 

96 fifths 

96 fifths
inv. 1 

2



116 Characterizing mode (2)97


Mode (2)97

(binary key: 1100001)

Theoretical - No Known Name (as 7/4567/8 in 12edo)

Theoretical - No Known Name

97 plain 

97 seconds 

97 seconds
inv. 1 

97 seconds
inv. 2 

97 thirds 

97 thirds
inv. 1 

97 thirds
inv. 2 

97 fourths 

97 fourths
inv. 1 

97 fourths
inv. 2 

97 fifths 

97 fifths
inv. 1 


97 fifths
inv. 2 


2





117 Characterizing mode (2)98


Mode (2)98
(binary key: 1100010)
Raga Gauri (India)


98 plain 


98 seconds 


98 seconds
inv. 1 


98 seconds
inv. 2 


98 thirds 


98 thirds
inv. 1 


98 thirds
inv. 2 


98 fourths 

98 fourths
inv. 1 

98 fourths
inv. 2 

98 fifths 

98 fifths
inv. 1 

98 fifths
inv. 2 

2

98 sus4

98 sus4
inv. 1

98 sus4
inv. 2

98 sus2


98 sus2
inv. 1


98 sus2
inv. 2


118 Characterizing mode (2)99


Mode (2)99 (binary key: 1100011)


Messiaen Mode 5
respelling
Mode 5


99 plain 


99 seconds 


99 seconds
inv. 1 


99 seconds
inv. 2 


99 thirds 


99 thirds
inv. 1 


99 thirds
inv. 2 


99 fourths 

99 fourths
inv. 1 

99 fourths
inv. 2 

99 fifths 

99 fifths
inv. 1 

99 fifths
inv. 2 

2

99 sus4

99 sus4
inv. 1

99 sus4
inv. 2

99 sus2

99 sus2
inv. 1


99 sus2
inv. 2


119 Characterizing mode (2)100


Mode (2)100


(binary key: 1100100)


Theoretical - No Known Name


100 plain 


100 seconds 


100 seconds
inv. 1 


100 seconds
inv. 2 


100 thirds 

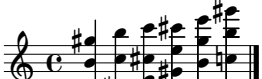
100 thirds
inv. 1 


100 thirds
inv. 2 


100 fourths 

100 fourths
inv. 1 

100 fourths
inv. 2 

100 fifths 

100 fifths
inv. 1 

100 fifths
inv. 2 

2

100 sus4

100 sus4
inv. 1

100 sus4
inv. 2

100 sus2

100 sus2
inv. 1


100 sus2
inv. 2


120 Characterizing mode (2)101


Mode (2)101


(binary key: 1100101)


Theoretical - No Known Name


101 plain 


101 seconds 


101 seconds
inv. 1 


101 seconds
inv. 2 


101 thirds 


101 thirds
inv. 1 


101 thirds
inv. 2 


101 fourths 

101 fourths
inv. 1 

101 fourths
inv. 2 

101 fifths 

101 fifths
inv. 1 

101 fifths
inv. 2 

2




121 Characterizing mode (2)102


Mode (2)102


(binary key: 1100110)


Hungarian Folk or Byzantine Major Gypsy


Bhairav Thaata (India) Mela Mayamalavagaula (India) Raga Paraj (India) Hitzazkiar (Greece)


102 plain 


102 seconds 


102 seconds inv. 1 


102 seconds inv. 2 


102 thirds 


102 thirds inv. 1 


102 thirds inv. 2 


102 fourths 

102 fourths inv. 1 

102 fourths inv. 2 

102 fifths 

102 fifths inv. 1 

102 fifths inv. 2 

2

102 sus4

102 sus4
inv. 1

102 sus4
inv. 2

102 sus2

102 sus2
inv. 1


102 sus2
inv. 2


122 Characterizing mode (2)103


Mode (2)103


(binary key: 1100111)


Raga Ramkali (India)


103 plain 


103 seconds 


103 seconds
inv. 1 


103 seconds
inv. 2 


103 thirds 


103 thirds
inv. 1 

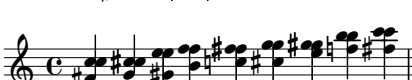
103 thirds
inv. 2 


103 fourths 

103 fourths
inv. 1 

103 fourths
inv. 2 

103 fifths 

103 fifths
inv. 1 

103 fifths
inv. 2 

2

103 sus4

103 sus4
inv. 1

103 sus4
inv. 2

103 sus2

103 sus2
inv. 1


103 sus2
inv. 2


123 Characterizing mode (2)104


Mode (2)104


(binary key: 1101000)


Theoretical - No Known Name


104 plain 


104 seconds 


104 seconds
inv. 1 


104 seconds
inv. 2 


104 thirds 


104 thirds
inv. 1 


104 thirds
inv. 2 


104 fourths 

104 fourths
inv. 1 

104 fourths
inv. 2 

104 fifths 

104 fifths
inv. 1 

104 fifths
inv. 2 

2

104 sus4

104 sus4
inv. 1

104 sus4
inv. 2

104 sus2

104 sus2
inv. 1


104 sus2
inv. 2


124 Characterizing mode (2)105


Mode (2)105


(binary key: 1101001)


Theoretical - No Known Name


105 plain 


105 seconds 


105 seconds
inv. 1 


105 seconds
inv. 2 


105 thirds 


105 thirds
inv. 1 

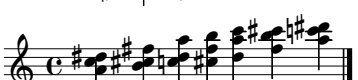
105 thirds
inv. 2 


105 fourths 

105 fourths
inv. 1 

105 fourths
inv. 2 

105 fifths 

105 fifths
inv. 1 

105 fifths
inv. 2 

2

105 sus4

105 sus4
inv. 1

105 sus4
inv. 2

105 sus2

105 sus2
inv. 1

105 sus2
inv. 2

The image displays six musical staves, each representing a different voicing of a 105 interval. The first staff is labeled '2' and '105 sus4'. The second staff is labeled '105 sus4 inv. 1'. The third staff is labeled '105 sus4 inv. 2'. The fourth staff is labeled '105 sus2'. The fifth staff is labeled '105 sus2 inv. 1'. The sixth staff is labeled '105 sus2 inv. 2'. Each staff contains a sequence of notes and chords in a specific voicing, with a final double bar line.

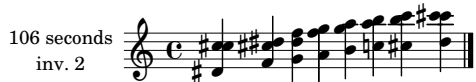
125 Characterizing mode (2)106

Mode (2)106

(binary key: 1101010)

Neapolitan Major

Mela Kokilapriya (India) Raga Kokilaravam (India)



2

106 sus4

106 sus4
inv. 1

106 sus4
inv. 2

106 sus2

106 sus2
inv. 1

106 sus2
inv. 2

126 Characterizing mode (2)107


Mode (2)107

(binary key: 1101011)


Messiaen 3 according to Brown

Messiaen 6th mode From Groves start B


107 plain




107 seconds




107 seconds
inv. 1




107 seconds
inv. 2




107 thirds



107 thirds
inv. 1




107 thirds
inv. 2




107 fourths




107 fourths
inv. 1




107 fourths
inv. 2




107 fifths



107 fifths
inv. 1



107 fifths
inv. 2



2

107 sus4

107 sus4
inv. 1

107 sus4
inv. 2

107 sus2

107 sus2
inv. 1

107 sus2
inv. 2

The image displays six musical staves, each representing a different voicing of a suspended chord in the key of G major (one sharp). The first staff shows a standard sus4 chord. The second and third staves show the first and second inversions of the sus4 chord, respectively. The fourth staff shows a sus2 chord. The fifth and sixth staves show the first and second inversions of the sus2 chord, respectively. Each staff begins with a treble clef and a common time signature (C).

127 Characterizing mode (2)108

Mode (2)108

(binary key: 1101100)

Theoretical - No Known Name



2

108 sus4



108 sus4

inv. 1



108 sus4

inv. 2



108 sus2



108 sus2

inv. 1



108 sus2

inv. 2



128 Characterizing mode (2)109

Mode (2)109


(binary key: 1101101)


Magen Abot


Magen Abot (Israel) all sharp


Magen Abot (Israel) all flat


Magen Abot (3b 2#)


109 plain 


109 seconds 


109 seconds
inv. 1 


109 seconds
inv. 2 


109 thirds 


109 thirds
inv. 1 


109 thirds
inv. 2 

109 fourths 

109 fourths
inv. 1 

109 fourths
inv. 2 

109 fifths 

109 fifths
inv. 1 



129 Characterizing mode (2)110


Mode (2)110


(binary key: 1101110)


Genus Chromaticum


Genus Chromaticum (3#'s)


Genus Chromaticum (6b's)


110 plain 


110 seconds 


110 seconds
inv. 1 


110 seconds
inv. 2 


110 thirds 


110 thirds
inv. 1 


110 thirds
inv. 2 


110 fourths 

110 fourths
inv. 1 

110 fourths
inv. 2 

110 fifths 

110 fifths
inv. 1 

110 fifths
inv. 2 

2

110 sus4

110 sus4
inv. 1

110 sus4
inv. 2

110 sus2

110 sus2
inv. 1

110 sus2
inv. 2

130 Characterizing mode (2)111

Mode (2)111

(binary key: 1101111)

Theoretical - No Known Name

111 plain 

111 seconds 

111 seconds
inv. 1 

111 seconds
inv. 2 

111 thirds 

111 thirds
inv. 1 

111 thirds
inv. 2 

111 fourths 

111 fourths
inv. 1 

111 fourths
inv. 2 

111 fifths 

111 fifths
inv. 1 

111 fifths
inv. 2 

2

111 sus4

111 sus4
inv. 1

111 sus4
inv. 2

111 sus2

111 sus2
inv. 1

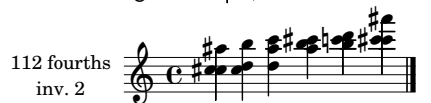
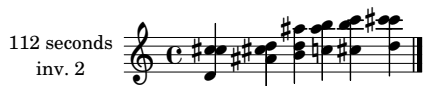
111 sus2
inv. 2

131 Characterizing mode (2)112

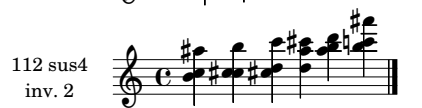
Mode (2)112

(binary key: 1110000)

Theoretical - No Known Name



2





132 Characterizing mode (2)113


Mode (2)113


(binary key: 1110001)


Theoretical - No Known Name

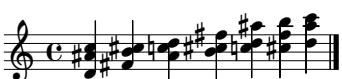
113 plain 


113 seconds 


113 seconds
inv. 1 


113 seconds
inv. 2 


113 thirds 


113 thirds
inv. 1 

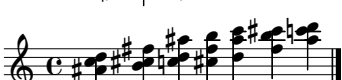
113 thirds
inv. 2 


113 fourths 

113 fourths
inv. 1 

113 fourths
inv. 2 


113 fifths 

113 fifths
inv. 1 


113 fifths
inv. 2 

2


113 sus4




113 sus4
inv. 1




113 sus4
inv. 2




113 sus2



113 sus2
inv. 1



113 sus2
inv. 2




The image displays six musical staves, each representing a different voicing of a triad. The first staff is labeled '113 sus4' and shows a triad in C major (C4, E4, G4) with the G4 note sustained. The second staff is labeled '113 sus4 inv. 1' and shows the first inversion (E4, G4, C5) with the C5 note sustained. The third staff is labeled '113 sus4 inv. 2' and shows the second inversion (G4, C5, E5) with the E5 note sustained. The fourth staff is labeled '113 sus2' and shows a triad in C major (C4, E4, G4) with the E4 note sustained. The fifth staff is labeled '113 sus2 inv. 1' and shows the first inversion (E4, G4, C5) with the G4 note sustained. The sixth staff is labeled '113 sus2 inv. 2' and shows the second inversion (G4, C5, E5) with the C5 note sustained. All staves are in treble clef and common time (C).


133 Characterizing mode (2)114

Mode (2)114

(binary key: 1110010)


Mela Tanarupi (India)


114 plain 


114 seconds 


114 seconds
inv. 1 


114 seconds
inv. 2 


114 thirds 


114 thirds
inv. 1 

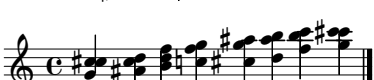
114 thirds
inv. 2 


114 fourths 

114 fourths
inv. 1 

114 fourths
inv. 2 

114 fifths 

114 fifths
inv. 1 

114 fifths
inv. 2 

2

114 sus4

114 sus4
inv. 1

114 sus4
inv. 2

114 sus2

114 sus2
inv. 1


114 sus2
inv. 2


134 Characterizing mode (2)115


Mode (2)115


(binary key: 1110011)


Theoretical - No Known Name


115 plain 


115 seconds 


115 seconds
inv. 1 


115 seconds
inv. 2 


115 thirds 


115 thirds
inv. 1 


115 thirds
inv. 2 


115 fourths 

115 fourths
inv. 1 

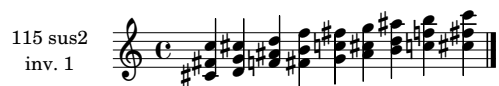
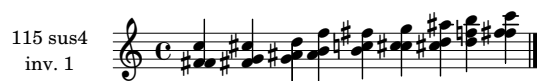
115 fourths
inv. 2 

115 fifths 

115 fifths
inv. 1 

115 fifths
inv. 2 

2





135 Characterizing mode (2)116


Mode (2)116


(binary key: 1110100)


Theoretical - No Known Name


116 plain 


116 seconds 


116 seconds
inv. 1 


116 seconds
inv. 2 


116 thirds 


116 thirds
inv. 1 

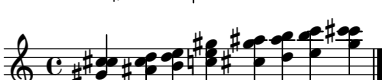
116 thirds
inv. 2 


116 fourths 

116 fourths
inv. 1 

116 fourths
inv. 2 

116 fifths 

116 fifths
inv. 1 

116 fifths
inv. 2 

2

116 sus4



116 sus4

inv. 1



116 sus4

inv. 2



116 sus2



116 sus2

inv. 1



116 sus2

inv. 2



136 Characterizing mode (2)117

Mode (2)117

(binary key: 1110101)

Theoretical - No Known Name



2





137 Characterizing mode (2)118


Mode (2)118


(binary key: 1110110)


Theoretical - No Known Name


118 plain 


118 seconds 


118 seconds inv. 1 


118 seconds inv. 2 


118 thirds 


118 thirds inv. 1 


118 thirds inv. 2 


118 fourths 

118 fourths inv. 1 

118 fourths inv. 2 

118 fifths 

118 fifths inv. 1 

118 fifths inv. 2 

2



138 Characterizing mode (2)119

Mode (2)119

(binary key: 1110111)

Symmetrical Decatonic

119 plain 

119 seconds 

119 seconds
inv. 1 

119 seconds
inv. 2 

119 thirds 

119 thirds
inv. 1 

119 thirds
inv. 2 

119 fourths 

119 fourths
inv. 1 

119 fourths
inv. 2 

119 fifths 

119 fifths
inv. 1 

119 fifths
inv. 2 

2

119 sus4



119 sus4
inv. 1



119 sus4
inv. 2



119 sus2



119 sus2
inv. 1



119 sus2
inv. 2





139 Characterizing mode (2)120


Mode (2)120


(binary key: 1111000)


Theoretical - No Known Name


120 plain 


120 seconds 


120 seconds
inv. 1 


120 seconds
inv. 2 


120 thirds 


120 thirds
inv. 1 

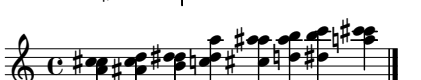
120 thirds
inv. 2 


120 fourths 

120 fourths
inv. 1 

120 fourths
inv. 2 

120 fifths 

120 fifths
inv. 1 

120 fifths
inv. 2 

2

120 sus4

120 sus4
inv. 1

120 sus4
inv. 2

120 sus2

120 sus2
inv. 1


120 sus2
inv. 2


140 Characterizing mode (2)121


Mode (2)121


(binary key: 1111001)


Theoretical - No Known Name


121 plain 


121 seconds 


121 seconds inv. 1 


121 seconds inv. 2 


121 thirds 


121 thirds inv. 1 


121 thirds inv. 2 


121 fourths 

121 fourths inv. 1 

121 fourths inv. 2 

121 fifths 

121 fifths inv. 1 

121 fifths inv. 2 

121 sus4



121 sus4

121 sus2




121 sus2


141 Characterizing mode (2)122

Mode (2)122


(binary key: 1111010)


Theoretical - No Known Name

122 plain 

122 seconds 

122 seconds inv. 1 


122 seconds inv. 2 


122 thirds 

122 thirds inv. 1 


122 thirds inv. 2 

122 fourths 

122 fourths inv. 1 

122 fourths inv. 2 

122 fifths 

122 fifths inv. 1 

122 fifths inv. 2 

2

122 sus4



122 sus4
inv. 1



122 sus4
inv. 2



122 sus2



122 sus2
inv. 1



122 sus2
inv. 2



142 Characterizing mode (2)123

Mode (2)123

(binary key: 1111011)

Theoretical - No Known Name

123 plain 

123 seconds 

123 seconds inv. 1 

123 seconds inv. 2 

123 thirds 

123 thirds inv. 1 

123 thirds inv. 2 

123 fourths 

123 fourths inv. 1 

123 fourths inv. 2 

123 fifths 

123 fifths inv. 1 

123 fifths inv. 2 

2

123 sus4

123 sus4
inv. 1

123 sus4
inv. 2

123 sus2

123 sus2
inv. 1

123 sus2
inv. 2

143 Characterizing mode (2)124

Mode (2)124

(binary key: 1111100)


Theoretical - No Known Name

124 plain 

124 seconds 

124 seconds inv. 1 

124 seconds inv. 2 

124 thirds 

124 thirds inv. 1 

124 thirds inv. 2 

124 fourths 

124 fourths inv. 1 

124 fourths inv. 2 

124 fifths 

124 fifths inv. 1 

124 fifths inv. 2 

124 sus4



144 Characterizing mode (2)125

Mode (2)125

(binary key: 1111101)

Theoretical - No Known Name 8b's

Theoretical - No Known Name 5#'s

125 plain 

125 seconds 

125 seconds inv. 1 

125 seconds inv. 2 

125 thirds 

125 thirds inv. 1 

125 thirds inv. 2 

125 fourths 

125 fourths inv. 1 

125 fourths inv. 2 

125 fifths 

125 fifths inv. 1 

125 fifths inv. 2 

2

125 sus4



145 Characterizing mode (2)126

Mode (2)126

(binary key: 1111110)

All except F# - 4#

126 plain

2

126 sus4



126 sus4

inv. 1



126 sus4

inv. 2



126 sus2



126 sus2

inv. 1



126 sus2

inv. 2




146 Characterizing mode (2)127


Mode (2)127


(binary key: 1111111)


Chromatic scale


127 plain 


127 seconds 


127 seconds inv. 1 


127 seconds inv. 2 


127 thirds 

127 thirds inv. 1 


127 thirds inv. 2 


127 fourths 

127 fourths inv. 1 

127 fourths inv. 2 

127 fifths 

127 fifths inv. 1 

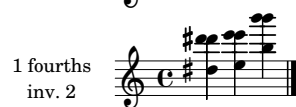
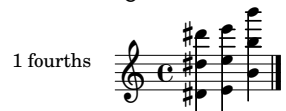
127 fifths inv. 2 

2

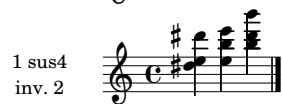


147 Characterizing mode (3)1

Mode (3)1 (binary key: 0001)

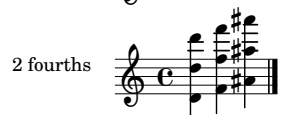


2




148 Characterizing mode (3)2

Mode (3)2 (binary key: 0010)




2


2 sus4




2 sus4
inv. 1




2 sus4
inv. 2




2 sus2



2 sus2
inv. 1





2 sus2
inv. 2





149 Characterizing mode (3)3


Mode (3)3 (binary key: 0011)


3 plain 


3 seconds 


3 seconds
inv. 1 


3 seconds
inv. 2 


3 thirds 


3 thirds
inv. 1 


3 thirds
inv. 2 


3 fourths 

3 fourths
inv. 1 

3 fourths
inv. 2 

3 fifths 

3 fifths
inv. 1 

3 fifths
inv. 2 

2

3 sus4

3 sus4
inv. 1

3 sus4
inv. 2

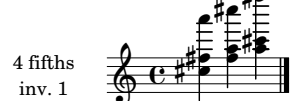
3 sus2

3 sus2
inv. 1

3 sus2
inv. 2

150 Characterizing mode (3)4

Mode (3)4 (binary key: 0100)




2




151 Characterizing mode (3)5

Mode (3)5
(binary key: 0101)


5 plain




5 seconds




5 seconds inv. 1




5 seconds inv. 2




5 thirds




5 thirds inv. 1



5 thirds inv. 2



5 fourths



5 fourths inv. 1

5 fourths inv. 2

5 fifths

5 fifths inv. 1

5 fifths inv. 2

2
5 sus4

5 sus4
inv. 1

5 sus4
inv. 2


5 sus2


5 sus2
inv. 1


5 sus2
inv. 2


152 Characterizing mode (3)6


Mode (3)6 (binary key: 0110)


6 plain 


6 seconds 


6 seconds
inv. 1 


6 seconds
inv. 2 


6 thirds 


6 thirds
inv. 1 


6 thirds
inv. 2 


6 fourths 

6 fourths
inv. 1 

6 fourths
inv. 2 

6 fifths 

6 fifths
inv. 1 

6 fifths
inv. 2 

2

6 sus4

6 sus4
inv. 1

6 sus4
inv. 2


6 sus2


6 sus2
inv. 1


6 sus2
inv. 2


153 Characterizing mode (3)7


Mode (3)7 (binary key: 0111)


7 plain 


7 seconds 


7 seconds
inv. 1 


7 seconds
inv. 2 

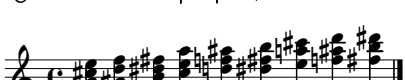
7 thirds 


7 thirds
inv. 1 


7 thirds
inv. 2 


7 fourths 

7 fourths
inv. 1 

7 fourths
inv. 2 

7 fifths 

7 fifths
inv. 1 

7 fifths
inv. 2 

2

7 sus4

7 sus4
inv. 1

7 sus4
inv. 2

7 sus2

7 sus2
inv. 1

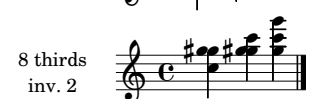
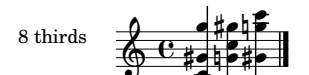
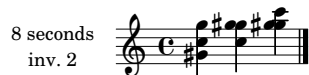
7 sus2
inv. 2

154 Characterizing mode (3)8

Mode (3)8

(binary key: 1000)

Theoretical - No Known Name



2

8 sus4

8 sus4
inv. 1

8 sus4
inv. 2

8 sus2

8 sus2
inv. 1


8 sus2
inv. 2


155 Characterizing mode (3)9


Mode (3)9


(binary key: 1001)


Augmented, Messiaen Truncated Mode 3 2457Inverse
genus tertium Raga Devamani


9 plain 


9 seconds 


9 seconds
inv. 1 


9 seconds
inv. 2 


9 thirds 


9 thirds
inv. 1 


9 thirds
inv. 2 

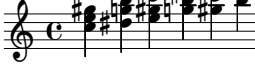
9 fourths 

9 fourths
inv. 1 

9 fourths
inv. 2 

9 fifths 

9 fifths
inv. 1 

9 fifths
inv. 2 

2

9 sus4

9 sus4
inv. 1

9 sus4
inv. 2

9 sus2
inv. 1

9 sus2
inv. 2

156 Characterizing mode (3)10

Mode (3)10

(binary key: 1010)

Raga Navamanohari (India)

10 plain 

10 seconds 

10 seconds
inv. 1 

10 seconds
inv. 2 

10 thirds 

10 thirds
inv. 1 

10 thirds
inv. 2 

10 fourths 

10 fourths
inv. 1 

10 fourths
inv. 2 

10 fifths 

10 fifths
inv. 1 

10 fifths
inv. 2 

2

10 sus4

10 sus4
inv. 1

10 sus4
inv. 2

10 sus2

10 sus2
inv. 1


10 sus2
inv. 2


157 Characterizing mode (3)11


Mode (3)11


(binary key: 1011)


Theoretical - No Known Name


11 plain 


11 seconds 


11 seconds inv. 1 


11 seconds inv. 2 


11 thirds 


11 thirds inv. 1 


11 thirds inv. 2 


11 fourths 

11 fourths inv. 1 

11 fourths inv. 2 

11 fifths 

11 fifths inv. 1 

11 fifths inv. 2 

2

11 sus4

11 sus4
inv. 1

11 sus4
inv. 2

11 sus2

11 sus2
inv. 1


11 sus2
inv. 2


158 Characterizing mode (3)12


Mode (3)12


(binary key: 1100)


Theoretical - No Known Name


12 plain 


12 seconds 


12 seconds
inv. 1 


12 seconds
inv. 2 


12 thirds 


12 thirds
inv. 1 


12 thirds
inv. 2 


12 fourths 

12 fourths
inv. 1 

12 fourths
inv. 2 

12 fifths 

12 fifths
inv. 1 

12 fifths
inv. 2 

2

12 sus4

12 sus4
inv. 1

12 sus4
inv. 2

12 sus2

12 sus2
inv. 1


12 sus2
inv. 2


159 Characterizing mode (3)13


Mode (3)13


(binary key: 1101)


Theoretical - No Known Name


13 plain 


13 seconds 


13 seconds
inv. 1 


13 seconds
inv. 2 


13 thirds 


13 thirds
inv. 1 


13 thirds
inv. 2 


13 fourths 

13 fourths
inv. 1 

13 fourths
inv. 2 

13 fifths 

13 fifths
inv. 1 

13 fifths
inv. 2 

2

13 sus4

13 sus4
inv. 1

13 sus4
inv. 2

13 sus2

13 sus2
inv. 1


13 sus2
inv. 2


160 Characterizing mode (3)14


Mode (3)14


(binary key: 1110)


Theoretical - No Known Name


14 plain 


14 seconds 


14 seconds inv. 1 


14 seconds inv. 2 


14 thirds 


14 thirds inv. 1 


14 thirds inv. 2 


14 fourths 

14 fourths inv. 1 

14 fourths inv. 2 

14 fifths 

14 fifths inv. 1 

14 fifths inv. 2 

2

14 sus4

14 sus4
inv. 1

14 sus4
inv. 2

14 sus2

14 sus2
inv. 1

14 sus2
inv. 2

161 Characterizing mode (3)15

Mode (3)15 (binary key: 1111)

Chromatic scale

15 plain 

15 seconds 

15 seconds inv. 1 

15 seconds inv. 2 

15 thirds 

15 thirds inv. 1 

15 thirds inv. 2 

15 fourths 

15 fourths inv. 1 

15 fourths inv. 2 

15 fifths 

15 fifths inv. 1 

15 fifths inv. 2 

15 sus4

