LucyScaleDevelopments present:

SCALEMAKING - Analysis, Synthesis, and Coding

This is an extract from ***"Pitch, Pi, and Other Musical Paradoxes, (A Practical Guide To Natural Microtonality)"*** - **ISBN 0-9512879-0-7** by Charles E. H. Lucy copyright 1990 & 1994

You may think of scalemaking as some sort of esoteric musical alchemy. This is near the truth, for as with alchemy the intent may be to transmute something of little value into gold. This may be in the form of a valuable piece of music. The process, like chemistry, may be approached from two opposite directions: starting from an existing scale and by analysis breaking it down to its constituent parts to discover how it works, or by synthesis constructing a scale using some form of recipe.

First a few **definitions**:

A **scale** is a series of notes which are used in a piece of music. These may be identified by their musical names using the letters A through G. Each of these letters may also be followed by any number of sharp or flat symbols. For example the notes **D-E-F-G-A-B-C-D** make a **minor** scale from **D.**

Any scale may be transposed by changing the starting note which will change the other note names and the key signature. If we flatten all the notes of this minor scale from D by one Large interval from D to C, we create a minor scale from C [**C-D-Eb-F-G-A-Bb-C**] and the key signature now has two flats (Bb and Eb). Our two examples here have shown us two minor scales, from D and from C minor, which both use the same mode.

This mode of **L-s-L-L-L-s-L** is known as the Dorian or Kafi mode. (The name is dependent upon whether you are using the English, Greek or Indian names for the mode).

A m**ode** is a sequence of intervals, which may be defined by Large and small intervals. The sequence for the two minor scales used in the examples above are both **L-s-L-L-L-s-L**, which we described as the minor mode. This sequence of intervals added together gives a total of **five Large** and **two small** intervals, which gives us one octave.

We can therefore consider this pattern as circular. That is it ends on the octave note above where it started. Using this same circular sequence we could start it at any point and each of the seven starting points gives us another mode. In this case we can make all the Greek modes using this sequence, which are the basis of Western music and harmony. These seven different notes are contiguous on the spiral of fourths and fifths, and arranged in pitch ascending order, give us a megamode. This is the circular pattern from which the seven Greek modes are derived.

A **megamode** is a circular sequence of intervals from which modes are derived. The megamode of seven contiguous positions on the spiral of fourths and fifths produce all the Greek modes. We could describe this as an expanse of six steps which contains seven notes. There is a comparable megamode of four steps which produces five contiguous notes and generates five pentatonic scales.

To analyse a collection of notes.

1. List all the different notes which are used in the piece regardless of octave.

2. Arrange the note names in order of fourths (flats) in one direction and fifths (sharps) in the other,

leaving blank spaces where notes are missing. [Sequence ascending in fifths is: Bbb Fb Cb Gb Db Ab Eb Bb F C G D A E B F# C# G# D# A# E# B# F## C## etc.] The fifth may be considered as the dominant, and the fourth as the sub-dominant.

3. Count the total number of steps between the fourthmost (flat) and fifthmost (sharp) note. This is the extent of the string, or chain of fourths/fifths (x).

4. List the missing notes. Identify them by numbering the flatmost as 1 and the following as ascending numbers moving through fifths. Each of the missing notes may be defined as between 2 and x.

5. The megamode may now be defined by the number of steps and the position of the missing notes (m1, m2, etc.). Eg. x=12 m1=2; m2=5; m3=9; and m4=11. Therefore there are four notes missing in the sequence. The extent is (x)=12. So there are thirteen notes of which four (m1 to m4) are missing leaving 13-4 = 9 notes. In this case numbers 1, 3, 4, 6, 7, 8, 9, 10, and 12. 6.

The mode is determined by which of the notes is chosen as the start of a sequence of ascending frequencies. This starting note may be identified by stating its position on the chain of fifths. For example, if the notes were six consecutive steps (Eg. **F C G D A E B**); these pitches could be arranged in seven modes of different ascending pitch orders:

	I	bII	II	bIII	III	IV	#IV	bV	V	bVI	VI	bVII	VII	Name
1	F	-	G	-	A	-	B	-	C	-	D	-	E	Lydian
2	C	-	D	-	E	F	-	-	G	-	A	-	B	Ionian
3	G	-	A	-	B	C	-	-	D	-	E	-	F	Mixolydian
4	D	-	E	F	-	G	-	-	A	-	B	C	-	Dorian
5	A	-	B	C	-	D	-	-	E	F	-	G	-	Aeolian
6	E	F	-	G	-	A	-	-	B	C	-	D	-	Phrygian
7	B	C	-	D	-	E	-	F	-	G	-	A	-	Locrian
	I	bII	II	bIII	III	IV	#IV	bV	V	bVI	VI	bVII	VII	Name

L = Large interval

s = small interval

(F) 1 (first note in chain) (Lydian) I-**L**-II-**L**-III-**L**-#IV-**s**-V-**L**-VI-**L**-VII-**s**

(C) 2 (2nd in chain) (Major or Ionian) I-**L**-II-**L**-III-**s**-IV-**L**-V-**L**-VI-**L**-VII-**s**

(G) 3 (Mixolydian) I-**L**-II-**L**-III-**s**-IV-**L**-V-**L**-VI-**s**-bVII-**L**

(D) 4 (Dorian) I-**L**-II-**s**-bIII-**L**-IV-**L**-V-**L**-VI-**s**-bVII-**L**

(A) 5 (Aeolian) I-**L**-II-**s**-bIII-**L**-IV-**L**-V-**s**-bVI-**L**-bVII-**L**

(E) 6 (Phrygian) I-**s**-bII-**L**-bIII-**L**-IV-**L**-V-**s**-bVI-**L**-bVII-**L**

(B) 7 (Locrian) I-**s**-bII-**L**-bIII-**L**-IV-**s**-bV-**L**-bVI-**L**- bVII-**L**

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7. The key of the scale and scale is determined by the tonal center, which may defined as C,D,E,F,G,A, or B with the appropriate sharps or flats. The scale may then be listed in ascending frequency order by note name.

8. A scale or mode may therefore be defined as: Number of steps in chain (x)/position(s) of missing notes (counted from fourths towards fifths)/Position of tonic (counted from fourths towards fifths). Eg. The scale and mode described as 5/25/3 could give the notes F-G-D-E from the chain F-C-G-D-A-E. Using the third note of the chain (G) as the starting note giving a scale of G-D-E-F or the mode of I-V-VI-bVII.

To view table of more than sixty scales and their codes

Visitors' comments and corrections Feb '98

Table of chords derived from scalecoding

Recipe to build a physical model

To go back to LucyTuning homepage

Some of the scales and intervals available using LucyTuning

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	Scale Names / Mode Code / Intervals	1	2	3	4	5	6	7
1	Ionian / *Bilaval* **6/0/2** (White notes on piano ascending from C up to B)	C L	D L	E s	F L	G L	A L	B s
2	Dorian (Western Name) **6/0/4** *Kafi (Indian Name)* **(Naturals D- C)**	C L	D s	Eb L	F L	G L	A s	Bb L
3	Phrygian / *Bhairavi* **6/0/6(Naturals E- D)**	C s	Db L	Eb L	F L	G s	Ab L	Bb L
4	Lydian / *Kalyan* **6/0/1 (Naturals F- E)**	C L	D L	E L	F# s	G L	A L	B s
5	Mixolydian / *Khamaj* **6/0/3 (Naturals G- F)**	C L	D L	E s	F L	G L	A s	Bb L
6	Aeolian / *Asavari* **6/0/5 (Naturals A- G)**	C L	D s	Eb L	F L	G s	Ab L	Bb L
7	Locrian **6/0/7 (Naturals B- A)**	C s	Db L	Eb L	F s	Gb L	Ab L	Bb L
8	Melodic Minor **8/2/4**	C L	D s	Eb L	F L	G L	A L	B s
8d	*(descends as Aeolian)*					s	AbL	Bb L
9	Neapolitan **10/2/4/8/10/6**	C s	Db L	Eb L	F L	G L	A L	B s
10	Neapolitan Minor **10/4/8/9/10/6**	C s	Db L	Eb L	F L	G s	Ab (2L- s)	B s
11	Harmonic Minor **9/3/8/9/5**	C L	D s	Eb L	F L	G s	Ab (2L- s)	B s
12	Hungarian Minor **10/3/4/8/9/5**	C L	D s	Eb (2L- s)	F# s	G s	Ab (2L- s)	B s
13	Romanian **9/3/8/9/4**	C L	D s	Eb (2L- s)	F# s	G L	A s	Bb L
14	Hungarian Folk or Byzantine **10/3/4/8/9/6**	C s	Db (2L- s)	E s	F L	G s	Ab (2L- s)	B s
	Indian Name scales							
15	Bhairav **9/2/3/8/6**	C s	Db (2L- s)	E s	F L	G L	A s	Bb L
16	Marva / Marvi **11/2/3/4/5/8/6**	C s	Db (2L- s)	E L	F# s	G L	A L	B s
17	Purvi bVI **11/3/4/5/8/9/6**	C s	Db (2L- s)	E L	F# s	G s	Ab (2L- s)	B s
18	Purvi bVII **11/2/3/5/8/11/6**	C s	Db (2L- s)	E L	F# s	G L	A s	Bb L
19	Todi bVI **11/4/5/8/9/10/6**	C s	Db L	Eb (2L- s)	F# s	G s	Ab (2L- s)	B s
20	Todi bVII **11/2/5/8/10/11/6**	C s	Db L	Eb (2L- s)	F# s	G L	A s	Bb L
21	Persian **11/4/5/8/9/10/7**	C s	Db (2L- s)	E s	F s	Gb L	Ab (2L- s)	B s
22	Spanish Folk & Jewish Major **9/3/8/9/6**	C s	Db (2L- s)	E s	F L	G s	Ab L	Bb L
23	Enigmatic / Verdi **15/2/3/4/5/7/8/9/11/13/15/6**	C s	Db (2L- s)	E L	F# L	G# L	A# s	B s
24	Stravinski example **10/2/4/8/10/5**	C L	D L	E L	F# s	G s	Ab L	Bb L
25	Whole Tone alternate **12/2/4/6/8/10/12/1**	C L	D L	E L	F# L	G# L	A# L	B# (2s- L)
26	Hindi bVI & bVII **8/2/8/5**	C L	D L	E s	F L	G s	Ab L	Bb L
27	Hindi #IV & #V **8/2/8/1**	C L	D L	E L	F# L	G# s	A L	B s
28	Hindi #IV & bVII or Dominant 7th Lydian **8/2/8/3**	C L	D L	E L	F# s	G L	A s	Bb L
29	Hindi 3 flats & bV **8/2/8/7**	C L	D s	Eb L	F s	Gb L	Ab L	Bb L
30	Hindi 5 flats & bIV **8/2/8/9**	C s	Db L	Eb s	Fb L	Gb L	Ab L	Bb L
31	Hindi bII, bIII & bVII **8/2/8/6**	C s	Db L	Eb L	F L	G L	A s	Bb L
32	Damien Emanuel **10/4/8/9/10/5**	C L	D s	Eb (2L- s)	F# s	G s	Ab L	Bb L
33	Pseudo Turkish **9/3/8/9/7**	C s	Db L	Eb L	F s	Gb (2L- s)	A s	Bb L

Mode Code and Classification

x/m1 m2/T. *x* = The expanse. i.e. The number of steps along the chain of fourths and fifths from the flatmost fourth note name to the sharpmost fifth for each scale. *m1 m2* etc. = position of missing notes. *T* = Tonic.
Eg. 9/3/8/9/7 Pseudo Turkish (last listing above)

Chain is 9 steps (from Gb to A) – Notes 3 (Ab), 8 (G), and 9 (D) are

JAPANESE

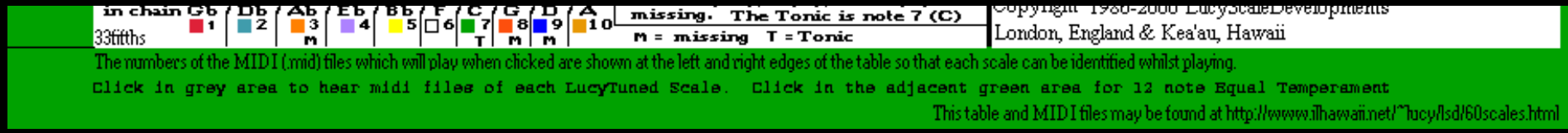
SOME OF THE PENTATONIC POSSIBILITIES

	1	2	3	4	5	
Blues Scales						
Blues bV **6/2/3/7**	C (L+s)	Eb L	F s	Gb (2L)	Bb L	34
Blues #IV **9/2/5/6/7/8/4**	C (L+s)	Eb L	F (L- s)	F# (2L+s)	B s	35
Minor Blues **4/0/4**	C (L+s)	Eb L	F L	G (L+s)	Bb L	36
Country and Old Chinese **4/0/1**	C L	D L	E (L+s)	G L	A (L+s)	37
Scriabin **9/2/3/4/5/8/6**	C s	Db (2L- s)	E (L+s)	G L	A (L+s)	38
Oriental **5/4/8**	C L	D (L+s)	F (2L)	A (L+s)	Bb L	39
Ancient Egyptian & Indian **6/5/6/8**	C (2L)	E s	F L	G (L+s)	Bb L	40
Example of Slendro **11/4thru10/12**	C (2s)	Ebb (2L- s)	F (2s)	Abb L	Bbb (2L- s)	41
Japanese Scales						
Ritusen **4/0/2**	C L	D (L+s)	F L	G L	A (L+s)	42
Hirajoshi **6/3/5/4**	C L	D s	Eb (2L)	G s	Ab (2L)	43
Kumoi **6/2/3/4**	C L	D s	Eb (2L)	G L	A (L+s)	44
Iwato **6/3/4/7**	C s	Db (2L)	F s	Gb (2L)	Bb L	45
Soft Ascend **6/2/3/5**	C s	Db (2L)	F L	G (L+s)	Bb L	46a
Soft Descend **6/3/4/5**	C s	Db (2L)	F L	G s	Ab (2L)	46d
Hard Ascend **4/0/4**	C (L+s)	Eb L	F L	G (L+s)	Bb L	47a
Hard Descend **4/0/2**	C L	D (L+s)	F L	G L	A (L+s)	47d
Example of Pelog **2/2/3/4/6/7/8/11/12** **1/3/16 thru21/9**	C (2L-2s)	C‡ (4s - L)	Fb (2L-2s)	F‡ s	G s	Ab (2L- s)	B s	48

Some other 6&8 note scales

1	2	3	4	5	6	7	8	Mode Code & Classification	
C (L+s)	Eb L	F s	Gb (L- s)	G (L+s)	Bb L			**7/2/3/7**	49
C (L+s)	Eb L	F (L- s)	F# s	G (L+s)	Bb L			**9/6/7/8/4**	50
C L	D L	E L	F# L	G# L	A# (2s)			**10/2/4/6/8/10/1**	51
C L	D L	E (2s)	Gb L	Ab L	Bb L			**10/2/4/6/8/10/7**	52
C L	D L	E L	F# (L+s)	A s	Bb L			**8/2/4/8/3**	53
C s	Db (2L- s)	E L	F# (L+s)	A s	Bb L			**11/2/3/5/7/8/11/6**	54
C L	D s	Eb L	F (L- s)	F# s	G s	Ab L	Bb L	**10/8/9/10/5**	55
C s	Db L	Eb L	F (L- s)	F# L	G# s	A L	B s	**13/2/4/7/8/10/13/6**	56
C s	Db L	Eb (L- s)	E s	F s	Gb L	Ab L	Bb L	**10/8/9/10/7**	57
C L	D s	Eb L	F L	G s	Ab L	Bb (L- s)	B s	**9/8/9/5**	58
C (L- s)	C# s	D L	E L	F# s	G L	A L	B s	**7/0/1**	59
C L	D L	E s	F (L- s)	F# s	G L	A L	B s	**7/0/2**	60
C L	D L	E s	F L	G L	A s	Bb (L- s)	B s	**7/0/3**	61
C L	D s	Eb (L- s)	E s	F L	G L	A s	Bb L	**7/0/4**	62

Interval to note above is listed under each note name
L = Large interval (II) = 2(1/(2*Pi)) = 1.116633
= 190.9858 ¢
s = small interval (bII) = 122.5354 ¢
(2s- L) = bbII (L- s) = #I
(2s) = bbIII (2L- s) = #II (L+s) = bIII (2L) = III



This diagram is also in the LucyTuned Lullabies (from around the world) booklet.

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The following EMail comment was received a few days ago: my replies are included - CEHL

>Date: Wed, 25 Feb 1998 20:56:19 -0500
>From: anonymousAddress
>To: "Charles E. H. Lucy"
>Subject: Pitch, Pi, And Other Musical Paradoxes
>Dear Mr. Lucy,
>Your fascinating work is sure to benefit musicians and listeners.
>I hope to be able to make practical use of it soon.
>I found your 60-scale chart enlightening. There are several small concerns I'd like to address:
>The melodic major scale (descending) is correctly described as Aeolian.
>However, the Locrian scale is shown.
>The Slendro scale shown includes note 3 in the chain, contrary to the legend.
>The Pelog scale shown is 22 steps long, not 21, and includes note 5 in the chain, contrary to the legend.

Thank you for the corrections. You are totally correct, and I have amended 60scales.gif to the appropriate values.
To view table of more than sixty scales and their codes (60scales.html)
CEHL 27th Feb '98.

>Also, on the "Scalemaking" page, you speak of the "Greek names" of modes.
>According to an article on Greece in the New Grove Dictionary of Music and
>Musicians, ancient Greek names for species of the octave included the following (on white keys):
>B-B: Mixolydian
>E-E: Dorian
>A-A: Hypodorian
>D-D: Phrygian
>G-G: Hypophrygian
>C-C: Lydian
>F-F: Hypolydian
>Apparently, the Greeks counted intervals from top to bottom. When medieval
>ecclesiastical scholars tried to interpret the ancient texts, they counted
>from bottom to top, jumbling the information. The names on the table are the
>ecclesiastical names.

Interesting! I had used other reference books. I realise that I had developed a particular prejudice against Dr. Stanley Sadie, the editor of ***Groves****.*
About ten years ago, I phoned him to check some detail, and he was extremely haughty to me. I shall check this out as soon as I get the opportunity. Maybe I should include both sets of names.
Assuming that you are once again perfectly correct; it is small wonder there has been such confusion amongst musicians on how to name scales and modes. Perhaps the idea of scalecoding will help to clarify the situation.
CEHL 27th Feb '98

>On the chart on that same page, the Locrian scale is shown as having one and
>one-half steps between C and D, instead of the actual one step.

Thank you. Again you are correct. This was a typo on my HTML table construction. I have moved the column left by one step and aligned it correctly.

I appreciate your comments.
CEHL 27th Feb '98

>--Charlie Anon

Charlie Anon's website (http://www.rev.net/~aloe/couchpotato) - (Lotsa useful links)

Date: Fri, 13 Mar 1998 09:55:15 -0800 (PST)
From: John Chalmers (non12@deltanet.com)
To: Alternative Tuning List tuning@eartha.mills.edu
Subject: Modes
Message-ID:
Pine.SCO.3.96.980313095459.8340A-100000@delta1.deltanet.com
Charles: The ancient Greek names for the heptatonic modes are correct in your post. To avoid accidentals, the key of C major is used and the various modes occur as octave species in the order Mixolydian (B-b), Lydian (C-c), Phrygian (D-d), Dorian (E-e), Hypolydian (F-f), Hypophrygian (G-g), and Hypodorian (a-a'). Hypolydian (F-f), Hypophrygian (G-g), and Hypodorian (a-a'). The extinct Ionian mode was a G mode and the Aeolian and Locrian were A modes, but it is not known how these differed from the HP and HD modes. The Mixolydian was also called Hyperdorian and the lower A mode (on the note Proslambanomenos) was called Hypermixolydian and Hyperphrygian. (In Argos, it was outlawed because it had no ethos of its own, but was merely a lower octave repetition of the Hypodorian.) Greek music was based on a 15-tone two-octave gamut running in our notation from A-a-a', to which an accidental b-flat was added to illustrate modulation at the fourth. This system could be taken at various pitch levels (see below). The absolute pitch is not known and may have been irrelevant in any case.

In musical practice, these modes were transposed so that the modal patterns of all 7 species moved into the middle range of the two octave system. Thus a system of pitch keys developed at roughly semitonal intervals. These keys took the names of the modes and new names (Hyperionian, etc.) were coined to complete a set of 15 keys or TONOI. The center of the system was also changed from Dorian (E) to Hypolydian (F) and two series of names were applied (high and low Dorian, etc.).
In the Middle Ages, confusion arose between the keys and the modes and the order of the modal names was reversed. Schlesinger attributes this error to Boethius. Later, other ecclesiastical names were invented as musical practice changed. The plagal/authentic distinction developed at that time.
To avoid confusion, one should always specify whether Greek or

ecclesiastical nomenclature is being used unless the context is clear.
--John

Date: Sun, 15 Mar 1998 07:50:44 -0500
From: monz@juno.com (Joseph L Monzo)
To: tuning@eartha.mills.edu
Subject: Re: TUNING digest 1353, Topic No. 1: modes
Message-ID: 19980315.091024.3982.1.monz@juno.com

John Chalmers' answer to the confusion between ancient Greek and medieval ecclesiastical modes is correct, however, so is the original statement that the medieval theorists determined the modal structure from the opposite direction. In determining the particular modal scale, the Greeks started "counting notes" at the highest note and went downward, while medieval musicians started at the lowest pitch and ascended. Spacing the intervals in the same order as the Greeks, but in the opposite direction, gave the ecclesiastical correspondences Chalmers described.

Joseph L. Monzo
monz@juno.com

Date: Sun, 15 Mar 1998 15:22:24 -0800 (PST)
From: John Chalmers (non12@deltanet.com)
To: Charles Lucy lucy@ilhawaii.net
Subject: Re: Ambiguous Mode and scale names (aliases?)

Charles: I just posted this to the List, but you may want a separate copy. The relationship between the Greek and Ecclesiastical modal nomenclatures is a confusing topic and I think somewhat more complex than the result of simple intervallic inversion, though this is a good way to remember the orders.

In the natural key (C major, no accidentals), the order of the Greek modes (ascending) is Mixolydian (B), Lydian (c), Phrygian (d), Dorian (e), Hypolydian (f), Hypophrygian (g) and Hypodorian (a). The corresponding interval patterns (ascending) are (in generalized diatonic tuning):

M S T T S T T T
L T T S T T T S
P T S T T T S T
D S T T T S T T
HL T T T S T T S
HP T T S T T S T
HD T S T T S T T

Retrograding these interval patterns or doing the equivalent operation of inverting the scales around the octave yields the following pairs:

M HL
L D
P P

D L
HL M
HP HD
HD HP
It is true that the order of the M L P D HL modes is reversed to HL D P L M, but the HP and HD modes do not fit the pattern unless the HD mode is taken an octave lower to low A (on proslambanomenos). Then the inversion pattern fits exactly. However, I do not think this is the way the system developed historically, though I admit that the effect is the same.
Although the modes may be thought of as sections of the diatonic scale starting on different notes, the Greeks actually transposed all their modes to the same register. Thus there developed a set of pitch keys named after the modes which they transposed into the central two octave range. The Dorian key and mode were the center point. The Phrygian key was a tone higher so that the sequence D-d now fell on the notes that formerly represented the E mode. The Hypolydian was a tone higher still (two tones in all) and the Mixolydian a semitone above this. Similarly, the Hypolydian key was a semitone below the Dorian (to bring the sequence f-f' into the center range), the Hypophrygian a tone and 1/2, and the Hypodorian a tone below this.

These pitch keys ran in the ascending order HD HP HL D P L M which corresponds to the Ecclesiastical modes Aeolian or Hypodorian (A), Hypophrygian (B), Ionian or Hypolydian (c), Dorian (d), Phrygian (e) Lydian (f), and Mixolydian (g). In other words, the ecclesiastical modes are in the order of the pitch keys, the Greek in the order of their starting notes.
This is a simplified account as there was another series of late Greek pitch keys interleaved between these (so that keys stood at semitonal intervals) and the entire system was transposed so that the f mode (Hypolydian still) was the center rather than the e mode (Dorian). The topic is further complicated by there being more than one set of ecclesiastical names depending upon the writer and the period.
--John

Thank you John C. , Joseph L. Monzo and Charlie Anon, who posed the original query. So to summarise (and for all practical modern purposes), we have the following result:

Scale of White Notes	**Ecclesiastic Names**	**Ancient Greek Names**	**Indian Names**	**ScaleCoding**
C-C	Ionian	Lydian	Bilaval	6/0/2
D-D	Dorian	Phrygian	Kafi	6/0/4
E-E	Phrygian	Dorian	Bhairavi	6/0/6

F-F	Lydian	Hypolydian	Kalyan	6/0/1
G-G	Mixolydian	Hypophrygian	Khamaj	6/0/3
A-A	Aeolian	Hypodorian	Asavari	6/0/5
B-B	Locrian	Mixolydian	???	6/0/7
or in order of fifths:				
F-F	Lydian	Hypolydian	Kalyan	6/0/1
C-C	Ionian	Lydian	Bilaval	6/0/2
G-G	Mixolydian	Hypophrygian	Khamaj	6/0/3
D-D	Dorian	Phrygian	Kafi	6/0/4
A-A	Aeolian	Hypodorian	Asavari	6/0/5
E-E	Phrygian	Dorian	Bhairavi	6/0/6
B-B	Locrian	Mixolydian	???	6/0/7

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Table of more than sixty scales and their codes (60scales.html)
Instructions for Lucy Scalecoding

LucyTuning homepage

LucyScaleDevelopments present: LucyTuned chords and scalecoding

When two or more pitches are played simultaneously they are referred to as a chord. In Western harmony there are two fundamental types of chords, known as **triads** (*three notes*): **Major** (sometimes referred to as *happy*); and **minor** (*sad).*

Major chords use the **natural third** in the pattern I (2L) **III** (L+s) V (2L+s) VIII. Eg. C-**E**-G-C**:** and **minor** chords use the **flatten third** instead I (L+s) **bIII** (2L) V (2L+s) VIII.Eg. C-**Eb**-G-C

Additional notes are usually identified by their position in the scale, as detailled in the table below: In classical stave notation the note names are clear, yet popular music uses symbols to specify chords. (*There are some strange and partly illogical rules):

*the **second** (**II**) **as the ninth** (**IX**), which is more commonly the position used.

*Usually the **fourth** (**IV**) is described as **suspended** (**sus**) eg. **Csus4** i.e. **C-E-F I-III-IV.**

*The seventh note **(7)** is usually assumed to be the flattened (diminished or dominant) seventh **(bVII)**; if the natural seventh **(VII)** is used, it is described as the **major seventh (Maj7)**

*If **both** a sixth (**VI**) **and** a seventh (**VII**) are used, the chord is usually referred to as a **thirteenth** (**13),** if the seventh is flattened (**bVII**): **or** as a major thirteenth (**Maj13),** if the the seventh is a natural (**VII**).

The terms *augmented, +, sharp, or raised* are used to show that a note is sharpened, (by L-s) eg. from C to C#: *diminished, -, or flattened* show that a note is flattened (by L-s) eg. from B to Bb

The two terms used to describe further Major and minor chords respectively are: **Augmented** and **Diminished**.

Augmented refers to the pattern **I-III-#V**, (in 12tET this would be **three** intervals each of **four** semitones - splitting the octave into *three* equal parts). In LucyTuning and other meantones this becomes steps of thirds Eg. C-(**2L**)-E-(**2L**)-G#-(**2L**)-B#. (*total = 6L*). [If the the flattened seventh (**bVII**) is use it is described as **Aug7**. (**I-III-#V-bVII**)]

Diminished refers to the pattern of **I-bIII-bV-bbVI**, (**four** intervals each of **three** semitones in 12tET - splitting the octave into *four* equal parts). In LucyTuning and other meantones this becomes steps of flattened thirds Eg. C-(**L+s**)-Eb-(**L+s**)-Gb-(**L+s**)-Bbb-(**L+s**)-Dbb.(*total = 4L+4s*). In LucyTuning, of course, this does not exactly split the octave, as in 12tET.

***Modal** chords* is a loose term some musicians use to describe chords which fall **outside** the usual **major/minor** designation. Eg: C-(**2L+s**)-F-(**2L+s**)-Bb-(**2L+s**)-Eb - (a *chain of fourths*).

The (long and slow to load) table below lists how LucyScaleCoding may be used to analyse and synthesise chords (Patience Please!). The table is arranged in ascending scalecoding order:

ScaleCoding *a*	Chord Symbol from C *b*	Notenames In C *c*	Positions (Roman#) *d*	Chord Name *e*	Chain of Fifths *f*	Other names from C *g*	Same Notes Chords Major *h*	Same Notes Chords Minor *i*
1/0/1	C (No III)	CG	I V	C no third	CG			
1/0/2	Csus (No III No V)	CF	I IV	Csus (no third no fifth)	FC		F (No III)	
2/0/1	C9 (No III No VII)	CGD	I II V	C9 (no third no seventh)	CGD		Gsus4 (No III)	
2/0/2	Csus4 (No IIIrd)	CFG	I IV V	C suspended fourth no Third	FCG			
2/0/3	C7sus4 (No III No V)	CFBb	I IV bVII		BbFC		Bb9 (No III)	
2/2/1	C9 (No III No V No VII)	CD	I II	C Ninth no Third Fifth or Seventh)	C*D			
2/2/3	C7 (No III No V)	CBb	I bVII	C7 (no Third no Fifth)	Bb*C			
3/0/1	C69 (No III)	CGAD	I II V VI	C Six nine (no Third)	CGDA			

3/0/2	C9sus4 (No IIIrd)	CFGD	I IV V IX	C9sus4 no Third	FCGD			
3/0/3	C7sus4 (No III)	CFGBb	I IV V VII	C7sus4 no third	BbFCG			Gm7sus4 (No V)
3/0/4	Cm7sus4 (No IIIrd)	CEbFBb	I bIII IV bVII	C minor seventh sus 4 no third	EbBbFC		Eb9 (No VII)	
3/2/1	C69 (No III No V)	CAD	I VI XI	C69 no Third no Fifth	C*DA		D7 (No III)	
3/2/3	C7 (No III)	CGBb	I V bVII	C7 no third	Bb*CG			Gmsus4 (No V)
3/2/4	Cmsus4 (No Vth)	CEbF	I bIII V	C minor sus 4 no fifth	Eb*FC		F7 (No III)	
3/23/1	C9 (No III No V No VII)	CD	I IX	C9 no third no fifth no seventh	C**D			
3/23/4	Cm (No V)	CEb	I bIII	C minor no fifth	Eb**C			
3/3/1	C6 (No III)	CGA	I V VI	C sixth no Third	CG*A			Am7 (No Vth)
3/3/2	C9sus4 (No III No V)	CFD	I IV IX	C ninth sus 4 no third no fifth	FC*D			Dm7 (No Vth)
3/3/4	Cm7 (No Vth)	CEbBb	I bIII bVII	C minor 7 no fifth	EbBb*C		Eb6 (No III)	
4/0/1	C69	CEGAD	I III V VI XI	C sixth ninth	CGDAE			Am7sus4
4/0/2	C69sus4 (No III)	CFGAD	I iV V VI IX	C sixth ninth sus4 no third	FCGDA		F69	
4/0/3	C9sus4 (No III)	CFGBbD	I IV V bVII IX	C ninth sus 4 no third	BbFCGD		Bb69	Gm7sus4
4/0/4	Cm11	CEbGBbF	I bIII V bVII XI	C minor eleventh	EbBbFCG	Cm7sus4	Eb69	
4/0/5	Cm7b6sus4 (No V)	CEbFAbBb	I bIII IV bVI bVII	C minor seventh flat sixth sus4 no fifth	AbEbBbFC			Fm7sus4
4/2/1	C69 (No VII No Vth)	CEAD	I III VI IX	C sixth ninth (no seventh no fifth)	C*DAE			Amsus4
4/2/3	C9 (No III)	CGBbD	I V bVII IX	C ninth (no third)	Bb*CGD			Gmsus4
4/2/4	Cmsus4	CEbFG	I bIII IV V	C minor suspended fourth	Eb*FCG		F9 (No III)	

4/2/5	C7b6sus4 (No III No V)	CFAbBb	I IV bVI bVII	C seventh flat sixth sus4 no third no fifth	Ab*BbFC		Fmsus4	
4/23/1	C6 (No Vth)	CEA	I III VI	C6 (No V)	C**AE		Am	
4/23/4	Cm	CEbG	I bIII V	C minor	Eb**CG			
4/23/5	C(b6)sus4 (No III No V)	CFAb	I bVI bVII	C flattened sixth sus4 no third no fifth	Ab**FC		F minor	
4/234/1	C (No V)	CE	I III	C (No fifth)	C***E			
4/234/5	C (b6) (No III No V)	CAb	I bVI	C flattened sixth no third no fifth	Ab***C			
4/24/1	C9 (No Vth No VIIth)	CED	I III IX	C9 (No V) (No VII)	C*D*E			
4/24/3	C9 (No III No VII)	CBbD	I bVII IX	C ninth no third no seventh	Bb*C*D			
4/24/5	C (b6b7) (No III No V)	CAbBb	I bVI bVII	C flattened sixth & seventh no third no fifth	Ab*Bb*C			
4/3/1	C6	CEGA	I III V VI	C sixth	CG*AE			Am7
4/3/2	C69sus4 (No III No Vth)	CFAD	I IV VI IX	C sixth ninth sus4 no third no fifth	FC*DA		F6	Dm7
4/3/4	Cm7	CEbGBb	I bIII V bVII	C minor dominant seventh	EbBb*CG		Eb6	
4/3/5	Cmb6sus4 (No Vth)	CEbFAb	I bIII IV bVI	C minor flat sixth sus four no fifth	AbEb*FC		Ab6	Fm7
4/34/1	C	CEG	I III V	C Major	CG**E	C Major		
4/34/2	C6sus4 (No III No Vth)	CFA	I IV VI	C sixth sus4 no third no fifth	FC**A		F Major	
4/34/5	Cmb6 (No Vth)	CEbAb	I bIII bVI	C minor sixth no fifth	AbEb**C		Ab Major	
4/4/1	C9 (No VIIth)	CEGD	I III V IX	C Ninth (No VII)	CGD*E			
4/4/2	C6sus4 (No III)	CFGA	I IV V VI	C sixth sus4 no third	FCG*A		F9 (No VII)	

4/4/3	C9sus4 (No III No V)	CFBbD	I IV bVII IX	C ninth sus4 No third no fifth	BbFC*D		Bb9 (No VII)	
4/4/5	Cm7b6 (No V)	CEbAbBb	I bIII bVI bVII	C minor seventh flat sixth no fifth	AbEbBb*C		Ab9 (No VII)	
5/0/1	CMaj769	CEGABD	I II III V VI VII	C Major seventh sixth ninth	CGDAEB		G69sus4	Am9sus4 Emb67sus4
5/0/2	C69sus4 (No VII)	CEFGAD	I II VI V VI IX	C sixth Ninth sus4 no seventh	FCGDAE	C19	FMaj769	Dm9sus4 Am7b6sus4
5/0/3	C69sus4 (No V)	CFGABbD	I IV V VI bVII IX	C sixth ninth sus fourth no fifth	BbFCGDA	C15sus4 (NoV)		
5/0/4	Cm9sus4	CDEbFGBb	I bIII F V bVII	C minor ninth suspended fourth	EbBbFCGD			
5/0/5	Cm7b6sus4	CEbFGAbBb	I bIII IV V bVI bVII	C minor seventh flattened sixth sus fourth	AbEbBbFCG	Cmb13sus4		
5/0/6	Cm7b6b9sus4	CDbEbFAbBb	I bII bIII IV bVI bVII	C minor 7 flat 6 flat 9 sus4	DbAbEbBbFC			
5/2/1	CMaj96 (No V)	CDEAB	I II III VI VII	C Major Ninth sixth no fifth	C*DAEB	CMaj15 (No Vth)		Am9sus4 (No 7)
5/2/3	C96 (No III)	CDGABb	I II V VI bVII	C Ninth Sixth no third	Bb*CGDA	C15 (No III)		Gm9sus4 (No VII)
5/2/4	Cm9sus4 (No VII)	CDEbFG	I II bIII IV V	C minor ninth sus fourth no seventh	Eb*FCGD			
5/2/5	C (b6) sus4 (No III)	CFGAbBb	I IV V bVI bVII	C flattened sixth sus fourth no third	Ab*BbFCG			Fm9sus4 No VII
5/2/6	Cmb9sus4 (No V)	CDbEbFBb	I bII bIII IV bVII	C minor ninth sus fourth no fifth	Db*EbBbFC			
5/23/4	Cm9 (No VIIth)	CEbGD	I bIII V IX	C minor ninth (No seventh)	Eb**CGD			
5/23/5	C (b6)sus4 (No III No VII)	CFGAb	I IV V bVI		Ab**FCG			Fm9 (No VII)

5/23/6	Cmb9sus4 (No V)	CFBbDb	I bII IV bVII		Db**BbFC			
5/234/1	CMaj7 (No V)	CEB	I III VII		C***EB		E(b6) (No III)	
5/234/5	C(b6) (No III)	CGAb	I V bVI		Ab***CG		AbMaj7 (No V)	
5/234/6	Csus4b((No III No V No VII)	CFDb	I IV bII		Db***FC			
5/2345/1	CMaj7 (No III No V)	CB	I VII		C****B			
5/2345/6	C(b9) (No III No V No VII)	CDb	I bIX		Db****C		DbMaj7 (No III No V)	
5/24/1	CMaj9 (No V)	CEBD	I III VII IX		C*D*EB			
5/24/3	C139 (No III NoV)	CABbD	I VI bVII IX		Bb*C*DA			
5/24/5	Cb13 (No III)	CGAbBb	I V bVI bVII		Ab*Bb*CG			
5/24/6	Cmb9sus4 (No V No VII)	CEbFDb	I bIII IV bIX		Db*Eb*FC			
5/245/1	C Maj9 (No III No V)	CBD	I VII IX		C*D**B			Bmb9 (No V No VII)
5/245/3	C13 (No III No V)	CABb	I VI VII		Bb*C**A			
5/245/6	Cmb9 (No V No VII)	CEbDb	I bIII bIX		Db*Eb**C			
5/25/1	CMaj69 (No III No V)	CABD	I VI VII IX		C*DA*B			
5/25/3	C13 (No III)	CGABb	I V VI bVII		Bb*CG*A			
5/25/4	Cm9sus4 (No V No VII)	CEbFD	I bIII IV IX		Eb*FC*D			
5/25/6	Cmbb9 (No V)	CDbEbBb	I bII bIII bVII		Db*EbBb*C			
5/3/1	CMaj13	CEGAB	I III V VI VII		CG*AEB	CMaj76 C6Maj7		Am9
5/3/2	C69sus4 (No V)	CEFAD	I III IV VI IX		FC*DAE			Dm9
5/3/4	Cm9	CEbGBbD	I bIII V bVII IX	C minor Ninth	EbBb*CGD		Eb6Maj7 (No V)	
5/3/5	Cmb6sus4	CEbFGAb	I bIII IV V bVI		AbEb*FCG			Fm9
5/3/6	C(b9)b6sus4 (No III No V)	CFAbBbDb	I IV bVI bVII bIX		DbAb*BbFC			Fmb6sus4
5/34/1	CMaj7	CEGB	I III V VII	C Major Seventh	CG**EB			Emb6
5/34/2	C6sus4 (No V)	CEFA	I III IV VI		FC**AE		Fmaj7	Amb6
5/34/5	Cmb6	CEbGAb	I bIII V bVI	C minor flattened sixth (minor Neopolitan)	AbEb**CG		AbMaj7	

5/34/6	C(b6)b9sus4 (No III No V)	CFAbDb	I IV bVI bIX		DbAb**FC		DbMaj7	Fmb6
5/345/1	CMaj7 (No III)	CGB	I V VII		CG***B		Gsus4 (No V)	Emb6 (No I)
5/345/2	Csus4 (No V)	CEF	I III IV		FC***E		FMaj7 (No III)	
5/345/6	C(b6b9) (No III No V)	CAbDb	I bVI bIX		DbAb***C		DbMaj7 (No III)	
5/35/1	CMaj13 (No III)	CGAB	I V VI VII		CG*A*B			Am9 (No V)
5/35/2	C9sus4 (No V No VII)	CEFD	I III IV IX		FC*D*E			Dm9 (No VII)
5/35/4	Cm9 (No V)	CEbBbD	I bIII bVII bIX		EbBb*C*D		EbMaj13 (No III)	
5/35/6	C(b6b9) (No III No V No VII)	CAbBbDb	I bVI bVII bIX		DbAb*Bb*C			
5/4/1	CMaj9	CEGBD	I III V VII IX		CGD*EB			Emb13
5/4/2	C6sus4	CEFGA	I III IV V VI		FCG*EA		FMaj9	
5/4/3	C139sus4 (No III No V)	CFABbD	I IV VI bVII IX		BbFC*DA		Bb69 F6sus4	Dm7b6
5/4/5	Cm7b6	CEbGAbBb	I bIII V bVI bVII		AbEbBb*CG	Cmb13	Eb6sus4	
5/4/6	Cmb9sus4 (No V No VII)	CEbFAbDb	I bIII IV bVI bIX		DbAbEb*FC			Fmb13
5/45/1	Cmaj9 (No III)	CGBD	I V VII IX		CGD**B		Gsus4	
5/45/2	Csus4	CEFG	I III IV V	C suspended Fourth	FCG**E			
5/45/3	C13sus4 (No III No V)	CFABb	I IV VI bVII		BbFC**A		Fsus4	
5/45/6	Cmb6b9 (No V No VII)	CEbAbDb	I bIII bVI bVII		DbAbEb**C			
5/5/1	CMaj69 (No III)	CGABD	I V VI VII IX		CGDA*B		G9sus4 (No VII)	
5/5/2	C9sus4 (No VII)	CEFGD	I III IV V IX		FCGD*E			
5/5/3	C13sus4 (No III)	CFGABb	I IV V VI bVII		BbFCG*A		F9sus4 (No VII)	
5/5/4	Cm9sus4 (No V)	CEbFBbD	I bIII IV bVII IX		EbBbFC*D		EbMaj9	
5/5/6	Cmb6b9 (No V)	CEbAbBbDb	I bIII bVI bVII bIX		DbAbEbBb*C	Cmb13b9 (No V)	Ab9sus4	
6/0/1	CMaj69sus#4	CEF#GABD	I III #IV V VI VII IX		CGDAEBF#			
6/0/2	CMaj69sus4	CEFGABD	I II IV V VI VII IX		FCGDAEB	All the whites		
6/0/3	C69sus4	CEFGABbCD	I III IV V VI bVII IX		BbFCGDAE			

6/0/4	Cm69sus4	CEbFGABbD	I bIII IV VI VI bVII IX	EbBbFCGDA			
6/0/5	Cm9b6sus4	CEbFGAbBbD	I bIII IV V bVI bVII IX	AbEbBbFCGD			
6/0/6	Cm7b6b9	CEbFGAbBbDb	I bIII IV V bVI bVII bIX	DbAbEbBbFCG			
6/0/7	Cm7b5b6b9sus4 (No V)	CEbFGbAbBbDb	I bIII IV bV bVI bVII bIX	GbDbAbEbBbFC			
6/2/1	CMaj69sus#4 (No V)	CEF#ABD	I III #IV VI VII IX	C*DAEBF#			
6/2/3	C13add9	CEGABbD	I III V VI bVII IX	Bb*CGDAE			Gm69sus4 (No VII)
6/2/4	Cm69sus4 (No VII)	CEbFGAD	I bIII IV V VI IX	Eb*FCGDA		F13add9	Dm7b9sus4
6/2/5	C9b6sus4 (No III)	CFGAbBbD	I IV V bVI bVII IX	Ab*BbFCGD			
6/2/6	Cm7b9sus4	CEbFGBbDb	I bIII VI V bVII bIX	Db*EbBbFCG		Eb7add6add9	
6/2/7	Cm7addb6b5sus4	CEbFGbAbBb	I bIII IV bV bVI bVII	Gb*AbEbBbFC			Ebm69sus4 (No VII)
6/23/1	CMaj76sus#4 (No V)	CEF#AB	I III #IV VI VII	C**AEBF#			Am69 (No VII)
6/23/4	Cm69 (No VII)	CEbGAD	I bIII V VI IX	Eb**CGDA	Cm69 No VII		
6/23/5	C9b6(sus4) No III	CFGAbD	I IV V bVI IX	Ab**FCGD			Fm69 (No VII)
6/23/6	Cb6b9sus4 (No III) (VII)	CFGAbDb	I IV V bVI bIX	DbAb**FCG			Fm9b6 (No VII)
6/23/7	C(b5b6b9)sus4 (No III) (No V) (No VII)	CFGbBbDb	I IV bV bVII bIX	GbDb**BbFC			
6/234/1	CMaj7sus#4 (No V)	CEF#B	I III #IV VII	C***EBF#			
6/234/5	C9b6 (No III)	CGAbD	I V bVI IX	Ab***CGD			
6/234/6	Cb9sus4 (No III No VII)	CFGDb	I IV V bIX	Db***FCG			
6/234/7	C7b5sus4 (No III No V)	CFGbBb	I IV bV bVII	Gb***BbFC			
6/2345/1	CMaj7(sus#4) (No III No V)	CF#B	I #IV VII	C****BF#			
6/2345/6	Cb9 (No III No VII)	CGDb	I V bIX	Db****CG			
6/2345/7	Csus4b5 (No III No V)	CFGb	I IV bV	Gb****FC		Fb9 (No III No VII)	

6/23456/1	Csus#4 (No III No V)	CF#	I#IV	C*****F#		
6/23456/7	CbV (No III No V)	CGb	I bV	Gb*****C		
6/235/1	CMaj13sus#4 (No III No V)	CF#AB	I #IV VI VII	C**A*BF#	B7b9 (No III)	
6/235/4	Cm69 (No V No VII)	CEbAD	I bIII VI VII	Eb**C*DA	D7b9 (No III)	
6/235/6	C7b9 (No III)	CGBbDb	I V bVII bIX	Db**Bb*CG		Gmb5sus4 (No V)
6/235/7	Cmb5sus4 (No V)	CEbFGb	I bIII IV bV	Gb**Eb*FC	F7b9 (No III)	
6/236/1	C6sus#4 (No V)	CEF#A	I III #IV VI	C**AE*F#		Am#6
6/236/4	Cm6	CEbGA	I bIII V VI	Eb**CG*A		
6/236/5	C(b6)sus4 (No V)	CEFAb	I III IV bVI	Ab**FC*E		FmMaj7
6/236/7	Cdim7 (No bbVII) Cm7b5 (No V)	CEbGbBb	I bIII bV bVII	Gb**EbBb*C	Gb6(sus#4) (No V)	Ebm6
6/24/1	CMaj9sus#4 (No V)	CEF#BD	I III #IV VII IX	C*D*EBF#	E913 (No III)	Bmb9sus4
6/24/3	C139 (No V)	CEABbD	I III VI bVII IX	Bb*C*DAE		Amb9sus4 (No VII)
6/24/5	C(b13b9) (No III)	CGAbBbD	I V bVI bVII IX	Ab*Bb*CGD		GmMaj7(sus4)
6/24/6	Cmb9sus4 (No VII)	CEbFGDb	I bIII IV V bIX	Db*Eb*FCG	F9b13 (No III)	
6/24/7	C13sus4 (No III)	CFGbAbBb	I IV bV bVI bVII	Gb*Ab*BbFC		Fmb9sus4 (No VII)
6/245/1	CMaj9(sus#4) (No III No V)	CF#BD	I #IV VII IX	C*D**BF#		Bmb9
6/245/3	C13 (No V)	CEABb	I III VI bVII	Bb*C**AE		Amb9 (No VII)
6/245/6	Cmb9 (No VII)	CEbGDb	I bIII V bIX	Db*Eb**CG		
6/245/7	Csus4b5b6 (No III No V)	CFGbAb	I IV bV bVI	Gb*Ab**FC		Fmb9 (No VII)
6/2456/1	Csus#49 (No III No V No VII)	CF#D	I #IV IX	C*D***F#	D7 (No V)	
6/2456/3	C7 (No V)	CEBb	I III bVII	Bb*C***E		
6/2456/7	C(b5b6) (No III No V)	CGbAb	I bV bVI	Gb*Ab***C	Ab7 (No V)	
6/25/1	CMaj69sus#4 (No III No V)	CF#ABD	I #IV VI VII IX	C*DA*BF#	D13	Bm7b9

6/25/3	C13	CEGBbA	I III V VI bVII	C thirteenth	Bb*CG*AE			Am7> **Transfer interrupted!** D>Cm69sus4 (No V No VII)	CEbFAD	I bIII IV VI IX	C minor fifteenth sus four	Eb*FC*DA	F13	Dmb9
6/25/6	Cm7b9	CEbGBbDb	I bIII V bVII bIX		Db*EbBb*CG		Eb13							
6/25/7	Cmb5b6sus4 (No V)	CEbFGbAb	I bIII IV bV bVI		Gb*AbEb*FC		Ab13							
6/256/1	CMaj9 (No III)	CGBD	I V VII IX		C*GD**B		Gsus4							
6/256/3	C7	CEGBb	I III V bVII	C Dominant Seventh	Bb*CG**E			Gm6sus4 (No V)						
6/256/4	Cm6sus4 (No V)	CEbFA	I bIII IV VI		Eb*FC**A		F7							
6/256/7	CDiminishedb6 (No bbVII)	CEbGbAb	I bIII bV bVI		Gb*AbEb**C	Cmb6b5 (No V)								
6/26/1	C69sus#4 (No V)	CEF#AD	I III #IV VI IX		C*DAE*F#		D9	Am6sus4						
6/26/3	C9	CEGBbD	I III V bVII IX	C9	Bb*CGD*E			Gm6sus4						
6/26/4	Cm9sus4 (No VII)	CEbFGD	I bIII IV V IX		Eb*FCG*D		F139 (No III)							
6/26/5	C9b6sus4 (No III No V)	CFAbBbD	I IV bVI bVII IX		Ab*BbFC*D		Bb9	Fm6sus4						
6/26/7	Cmb13b9 (No V)	CEbAbBbDb	I bIII bVI bVII bIX		Db*EbAbBb*C		Ab9sus4 (No VII)							
6/3/1	CMaj6sus#4	CEF#GAB	I III #IV V VI VII		CG*AEBF#			Am139 Em9b6sus4						
6/3/2	CMaj69sus4 (No V)	CEFABD	I III IV VI VII IX		FC*DAEB		FMaj6sus#4	Dm69						
6/3/4	Cm96	CEbGABbD	I bIII V VI bVII IX		EbBb*CGDA		Ebmaj9sus#4	Gm9b6sus4 (No VII)						
6/3/5	Cm9b6sus4 (No VII)	CEbFGAbD	I bIII IV V bVI IX		AbEb*FCGD			Fm69						
6/3/6	C(b9b6)sus4 (No III)	CFGAbBbDb	I IV V bVI bVII bIX		DbAb*BbFCG									
6/3/7	Cm(b9b5)sus4 (No V) Cdim7b9sus4 (No bbVII)	CEbFGbBbDb	I bIII IV bV bVII bIX		GbDb*EbBbFC			Ebm69						
6/34/1	CMaj7(sus#4)	CEF#GB	I III #IV V VII		CG**EBF#			Em9b6 (No VII)						
6/34/2	CMaj13sus#4 (No V)	CEFAB	I III IV VI VII		FC**AEB		FMaj7sus#4	Am9b6 (No VII)						

6/34/5	Cm9b6 (No VII)	CEbGAbD	I bIII V bVI IX		AbEb**CGD	AbMaj7sus#4	
6/34/6	C(b6b9)sus4 (No III)	CFGAbDb	I IV V bVI bIX		DbAb**FCG	DbMaj7sus#4	Fmb69 (No VII)
6/34/7	C(b5b9)sus4 (No III No V)	CFGbBbDb	I IV bV bVII bIX		GbDb**BbFC	GbMaj7sus#4	
6/345/1	CMaj7sus#4 (No III)	CF#GB	I #IV V VII		CG***BF#		
6/345/2	CMaj7sus4 (No V)	CEFB	I III IV VII		FC***EB	Eb9b6 (No III)	
6/345/6	C(b6b9) (No III No VII)	CDbGAb	I V bVI bIX		DbAb***CG	DbMaj7sus#5 (No III)	
6/345/7	Csus4b5b9 (No III No V No VII)	CFGbDb	I IV bV bIX		GbDb***FC		
6/346/1	Csus#4	CEF#G	I III #IV V		CG**E*F#		Em9b6 (No V No VII)
6/346/2	CMaj76sus4 (No III No V)	CFAB	I IV VI VII		FC**A*B	Fsus#4	
6/346/5	Cm9b6 (No V)	CEbAbD	I bIII bVI IX		AbEb**C*D	Absus#4	
6/346/7	C7b5b9 (No III No V)	CGbBbDb	I bV bVII bIX		GbDb**Bb*C	Gbsus#4	
6/35/1	CMaj6sus#4 (No III)	CF#GAB	I #IV V VI VII		CG*A*BF#	GMaj9sus4 (No V)	
6/35/2	C69sus4 (No V No VII)	CDEFA	I II III IV VI		FC*D*AE	FMaj6	Dm9
6/35/4	Cm139 (No V0	CEbABbD	I bIII VI bVII IX		EbBb*C*DA		
6/35/6	Cb139 (No III)	CGAbBbDb	I V bVI bVII bIX		DbAb*Bb*CG		
6/35/7	Cmb5b9sus4 (No V)	CEbFGbDb	I bIII IV bV bIX		GbDb*Eb*FC		
6/36/1	C6sus#4	CEF#GA	I III IV V VI		CG*AE*F#		Am13
6/36/2	CMaj69sus4 (No III No V)	CFABD	I IV VI VII IX		FC*DA*B	F6b5	Dm13
6/36/4	Cm13	CEbGBbA	I bIII V bVII XIII	C minor thirteenth	EbBb*CG*A	Eb6#4	
6/36/5	Cmb69sus4 (No V)	CEbFAbD	I bIII IV bVI IX		AbEb*FC*D	Ab6sus#4	Fm13
6/36/7	Cm7b5b9 (No V)	CEbGbBbDb	I bIII bV bVII bIX		GbDb*EbBb*C	Gb6sus#4	Ebm13
6/4/1	C69sus#4 (No V) (No VII)	CEF#GAD	I III #IV V VI IX		CGDAE*F#	D9sus4	Am13sus4
6/4/2	CMaj6sus4	CEFGAB	I III IV V VI VII		FCG*AEB	FMaj9sus#4	Am9b6
6/4/3	C69sus4 (No V)	CEFABbD	I III IV VI bVII IX		BbFC*DAE	BbMaj9sus#4	Amb6b9sus4 (No VII) Dmb13b9

6/4/5	Cm9b13	CEbGAbBbD	I bIII V bVI bVII bXI		AbEbBb*CGD	Abmaj79sus#4	Gmb6b9sus4
6/4/6	Cmb6b9sus4 (No VII)	CEbFGAbDb	I bIII IV V bVI bIX		DbAbEb*FCG	AbMaj13sus4	Fm9b6
6/4/7	C(b5b6b9) (No III No V)	CFGbAbBbDb	I IV bV bVI bVII bIX		GbDbAb*BbFC	GbMaj7b9sus#4	Fmb6b9sus4 (No VII)
6/45/1	CMaj9sus#4 (No III)	CF#GBD	I #IV V VII IX		CGD**BF#	Gmaj7sus4	Bmb9b6 (No VII)
6/45/2	CMaj7sus4	CEFGB	I III IV V VII	C Major seven sus four	FCG**EB		Emb6b9 (No VII)
6/45/3	C13sus4 (No V)	CEFABb	I III IV VI bVII	C thirteen sus four no fifth	BbFC**AE	FMaj7sus4	Amb6b9 (No VII)
6/45/6	Cmb6b9 (No VII)	CDbEbGAb	I bII bIII V bVI		DbAbEb**CG	AbMaj7 sus4	
6/45/7	C-b5b6b9sus4	CDbFGbAb	I bII IV bV bVI		GbDbAb**FC		
6/456/1	C9sus#4 (No III) (No VII)	CDF#G	I II #IV V		CGD***F#	D7sus4 (No V)	
6/456/2	CMaj7sus4 (No III)	CFGB	I IV V VII		FCG***B	G7sus4 (No V)	
6/456/3	C7sus4 (No V)	CEFBb	I III IV bVII		BbFC***E	FMaj7sus4 (No III)	
6/456/7	C-b5b6b9 (No III) (No V) (No VII)	CDbGbAb	I bII bV bVI		GbDbAb***C		
6/46/1	C9sus#4 (No VII)	CDEF#G	I II III #IV V		CGD*E*F#		
6/46/2	CMaj6sus4	CFGAB	I IV V VI VII		FCG*A*B	F9sus#4 (No VII)	Am9b6 (No V)
6/46/3	C9sus4 (No V)	CDEFBb	I II III IV VII		BbFC*D*E	Bb9sus#4 (No VII)	
6/46/5	Cm9b6 (No V)	CDEbAbBb	I II bIII bVI bVII		AbEbBb*C*D	Ab9susb4 (No VII)	
6/46/7	Cb9b6b5 (No III) (No V)	CDbGbAbBb	I bII bV bVI bVII		GbDbAb*Bb*C		
6/5/1	CMaj69sus#4 (No III)	CDF#GAB	I II #IV V VI VII		CGDA*BF#	D13sus4	Bm7b6b9
6/5/2	CMaj9sus4	CDEFGB	I II III IV V VII		FCGD*EB		
6/5/3	C13sus4	CEFGABb	I III IV V VI bVII		BbFCG*AE		
6/5/4	Cm69sus4	CDEbFABb	I II bIII IV VI bVII		EbBbFC*DA		
6/5/6	Cmb6b9	CDbEbGAbBb	I bIII V bVI bVII bIX		DbAbEbBb*CG		

6/5/7	Cmb6b9sus4 (No V)	CDbEbFAbBb	I bII bIII IV bVI bVII		GbDbAbEb*FC		
6/56/1	C69sus#4 (No III) (No VII)	CDF#GA	I II #IV V VI		CGDA**F#	D7sus4	
6/56/2	CMaj9sus4 (No III)	CDFGB	I II IV V VII		FCGD**B	G7sus4	Dm13sus4 (No V)
6/56/3	C7sus4	CEFGBb	I III IV V bVII		BbFCG**E		
6/56/4	Cm13sus4 (No V)	CEbFABb	I bIII IV VI bVII		EbBbFC**A	F7sus4	
6/56/7	Cmb9b6b5 (No V) (No VII)	CDbEbGbAb	I bII bIII bV bVI		GbDbAbEb**C	Ab7sus4	Ebm13 (No V)
6/6/1	C69sus#4 (No VII)	CDEF#GA	I II III #IV V VI		CGDAE*F#	D9sus4	
6/6/2	CMaj69sus4 (No III)	CDFGAB	I II IV V VI VII		FCGDA*B	F69sus#4 (No VII)	Dm13sus4
6/6/3	C9sus4	CDEFGBb	I II III IV V bVII		BbFCGD*E	Bb69sus#4 (No VII)	Gm13sus4
6/6/4	Cm13sus4	CEbFGABb	I bIII IV V VI bVII		EbBbFCG*A		
6/6/5	Cm913sus4 (No V)	CDEbFAbBb	I II bIII IV bVI bVII		AbEbBbFC*D	Ab69sus#4 (No VII) Bb9sus4	
6/6/7	Cmb5b6b9 (No V)	CDbEbGbAbBb	I bII bIII bV bVI bVII		GbDbAbEbBb*C	Gb13sus#4	
7/2356/7	Cmb5	CEbGbG	I bIII bV V	C minor flattened fifth	Gb**Eb**CG		
8/2345678/1	CAug	CEG#	I III #V	Augmented	C***E***G#		
8/2347/8	Cmb8	CEbGCb	I bIII V bVIII	C minor flattened Octave	Cb***EbBb*CG	Eb6b6	
8/23478/6	C(b6) (No VII)	CEGAb	I III V bVI	C Flattened Sixth (Neopolitan sixth)	Ab***CG**E		
8/23678/4	CmMaj7	CEbGB	I bIII V VII	C minor major seventh	Eb**CG***B		
8/2478/5	C(b13)	CEGBbAb	I III V bVII bXIII	C flattened thirteenth	Ab*Bb*CG**E		
9/235689/10	Cdim	CEbGbBbb	I bIII bV bbVII	Diminished	Bbb**Gb**Eb**C		
9/23569/10	Cdim7	CEbGbBbbBb	I bIII bV bbVII bVII	C diminished seventh	Bbb**Gb**EbBb*C		
9/23589/6	C(b9)	CEGBbDb	I III V bVII bIX	C Flattened Ninth	Db**Bb*CG**E		

9/39/4	Cm693sus#4	CEbEF#GABbD	I bIII III #IV V VI bVII IX	C six nine flat three sus sharp four	EbBb*CGDAE*F#	
10/23456910/7	C (b5)	CEGbG	I III bV V	C Major Flattened Fifth	Gb*****CG**E	
10/2346910/7	C(b12)	CEGGb	I III V bVII bXII	C flattened twelfth	Gb***Bb*CG**E	
11/2345671011/8	C(b8)	CEGCb	I III V bVIII	C Major Flattened Octave	Cb******CG**E	
11/2367891011/4	Cm#12	CEbGG#	I bIII V #XII	C minor sharp twelve	Eb**CG******G#	Cmsus#4
12/2345681112/9	C(b11)	CEGBbFb	I III V bVII bXI	C flattened eleventh	Fb*****Bb*CG**E	
12/25689101112/3	C(#13)	CEGBbA#	I III V bVII #XIII	C sharp thirteenth	Bb*CG**E*****A#	

To view table of more than sixty scales and their codes

Midi - Hear and compare LucyTuned and 12tET chords using pitchbend

Information on scalecoding

Recipe to build a physical model

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LucyScaleDevelopments presents extracts from:

"Pitch, Pi, and Other Musical Paradoxes (a practical guide to natural microtonality)"

Recipe for a 3D Physical Model display of LucyTuning

Ingredients:

Length of flexible wire (8 to 10 metres) (25 to 30 feet) or 5-8 wire coat hangers.

50 (Elastic) rubber bands.

31 wooden clothes pegs (clothes pins) or 31 tags or sticky labels for pegs.

5 one metre (3 foot) lengths of different colored string or wool..

One cylindrical can.

(For optional coloured note positions) Palette of paints and brushes. Pitch to colour

Tools required:

One protractor.

Directions:

To prepare coat hangers:

Unbend coat hangers. Join ends of straightened wires end to end with tape or weld to provide a 8 to 10 metres continuous length of wire.

Construction from wire: Bend wire around a conveniently sized cylindrical tin (can) to form spiral spring shape of 8-12 inch (200-400mm) diameter.

Position, place or tie 31 elastic bands for markers at intervals of 208.65 degrees around the spiral spring using protractor.

Label thirty-one clothes pegs (pins). One for each note name: Fbb Cbb Gbb Dbb Abb Ebb Bbb Fb Cb Gb Db Ab Eb Bb F C G D A E B F# C# G# D# A# E# B# F## C## G##.

Attach labeled clothes pegs: Suspend the wire spiral with its elastic band markers by a loop bent from the wire after your last mark. Eg. From a lamp or ceiling. Attach the clothes pegs in the above sequence (at the marks, beginning at the end you started your angle measurements from. (the bottom of the spiral), and ascending by one fifth (208.65 degrees) each step.

There are many possible modifications for this basic design, eg. paint markings, color code pegs. blue tack, or chewing gum instead of elastic bands, although the angle and spiral shape should be precise.

Display various scales

1. *Greek Modes and Indian equivalents using only naturals,* attach a length of string to join the pegs: C-D-E-F-G-A-B and back to C.

You will notice that the Large intervals move upwards and one radian around the spiral. The small intervals move downwards and 68.45 degrees around the spiral.

Starting at each of the points and listing them in ascending order will give you the seven Greek modes (Indian names in brackets):

starting from C=Ionian (Indian Bilaval Scale); D=Dorian (Kafi); E=Phrygian (Bhairavi); F=Lydian (Kalyan); G=Mixolydian (Khamaj); A=Aeolian (Asavari; and B=Locrian Mode.

2. *Sharps and flats* Attach second and third strings of different colours in the following sequences:

1) G#-A#_B#-C#-D#-E#-F##-G#

2) Ab-Bb-C-D-Eb-F-G-Ab

You will see that you have generated the same shapes, but higher and lower on the spiral and with a small phase shift between them of (2s-L)=54.084" or 16.2252 degrees

(1) Up into the sharp tonalities [G# Major scale (Ionian) i.e. 8 sharps]

(2) Down into the flat tonalities [Ab Major (Ionian) Scale i.e. 4 flats]

3. *Hindi Scale* Tie strings to connect the following sequence: C-D-E-F-G-Ab-Bb-C

This produces the shape of one of the fundamental Hindi scales. You will notice that it follows the sequence of the Ionian mode up to G but diverges after that as though it was a flat Western scale having three flats. You could consider it as an Ab Major with the Eb sharpened to E in Western terms or as the root of five further modes following the pattern of four adjacent Large intervals and a single Large separated by two separate small intervals. (LLsLsLL).

4. *The Mysterious Middle Eastern Interval.* East of a line North/South from about where the Iron Curtain used to stand, there is a cultural area which uses an interval absent from Western music. This interval is called the sharp second and is the difference between two Large and one small interval ***(2L-s)***. Examples of this interval are found in many Indian, Hungarian, and Romanian scales. You can represent it on your model by joining Ab and B; Db and E; Eb and F#, or any other way which gives the same angles or phase.

I trust these instructions have given you a taste for the geometry of musical harmonics. This is just a beginning. You can build your own new musical scales by connecting the pegs in any way which makes sense to you, and produce new modes, scales, and harmonies. Have fun with it.

LucyScaleDevelopments, PO Box 446, Kea'au, Hawaii, 96749 USA

lucy@hour.com Nov, 1997.

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