

844 N. Ave 65
Los Angeles, CA 90042
April 6, 1992

Copy: John Chalmers

Dear Harry,

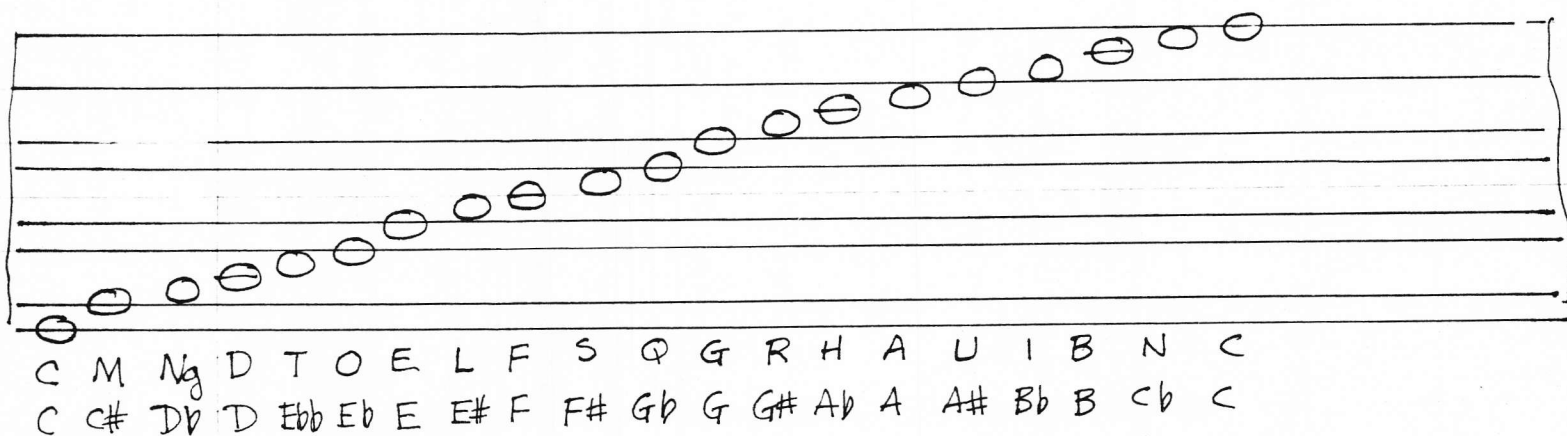
A couple of little items - first I took the liberty of sending your article in XH ~~XII~~ off to David Doty at 1/1 who states he has not seen, and asked me to send it.

ITEM 2

Some time ago I mentioned my tree notation for your 19, enclosed. I like this because it treats the bridge of minor thirds from the root to the Fifth as naturals, (as in a sense they should be) rather than as chain of curiously arranged sharps and flats. I.E.

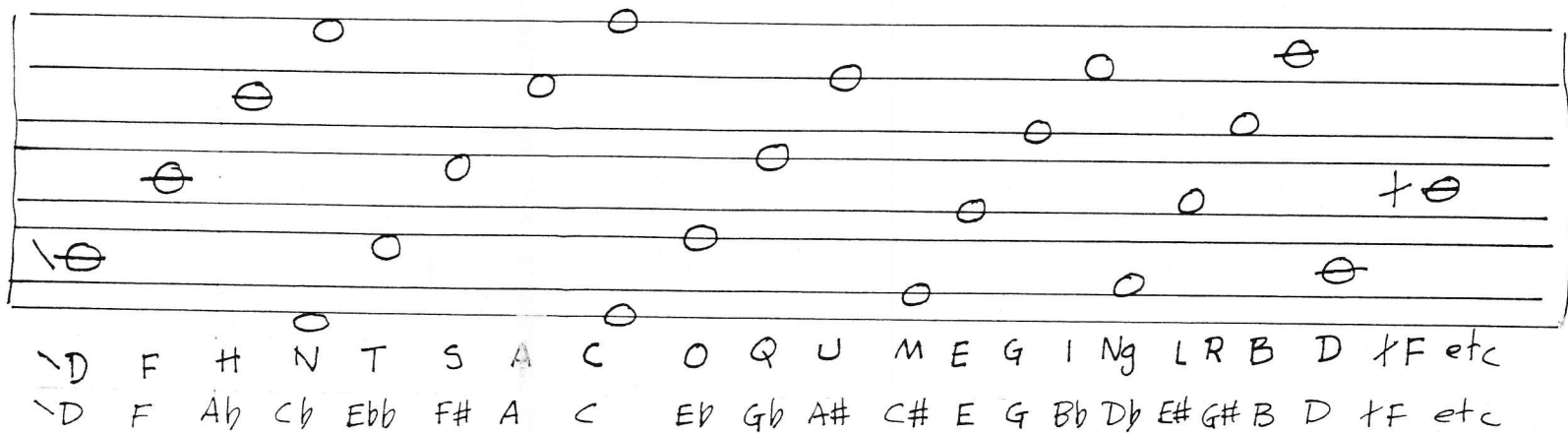
F H N T S A C O Q U M E G I N g L R B D
F A b C b E b b F# A C E b G b A# C# E G B b D b E# G# B D

The minor thirds Ebb-F#, Gb-A#, ~~D~~E# are spelled as doubly-augmented Seconds, enough to throw anybody. The script is taken with the organic 7^{scale} by a chain of ^{minor} thirds as the staff:



This allows using the supra-chromatic 19-tone scale as the basic artifact for composition and modulation without being bogged down (in this context) by archaic signatures. 2-interval patterns of 7, 11, 15, are easy to recognize and modulate, as well as the 19, 34 53 etc.

along the chain of minor thirds:



ITEM 3

I like this encl. variation of the Hanson Kbd. The octave reach is deliberately forfeited in order to git down into the micro-intervals of (here shown) 72 scale. ~~En~~ With the right hand the "virtual pitch continuum" can be performed with speed and potential ~~velocity~~ ^{virtuosity}. The left hand will take a little more practising, and by a conscientious performer, this "virtual-pitch-continuum" is powerful stuff. One has to hear it, 53 has close to the same quality.

Two of my instruments are presently on display at the Hollywood Bowl museum for a year; the 19-tone clavichord built by Scott Hackleman, and the Hebdomekontany (= a 70-tone per 8ve, 2 octaves, percussive tubulorg of 1" aluminum tubing) the sound of this thing is beyond belief. The tuning of this is attained by the 70 combinations of 4 out of 8 elements, where these elements are the harmonic entities 1, 3, 5, 7, 9, 11, 13, 15. ~~The~~ ^{the} elements of each combination ~~of 4~~ are multiplied (as $1 \times 3 \times 5 \times 7$ etc) to get 70 pitches. It is from this instrument that I learned how dramatically effective these small interval can be in sequence.

Yours,

Ern

Notes on the relationship of 19-tone and 34-tone Systems

P.1

By Eric Wilson, Feb 15 1996

19 and 34 divisions of the octave share in common a chain-of-minorThirds, ($5/19$ and $9/34$, respectively).
* Triads & Scales can be constructed from, and modulated along a chain of minor Thirds in very much the same way they are in a chain-of-Fifths.

7 out of 19
chain ident.

F F# A $\flat$ A C $\flat$ C D# F
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
0 +4 +1 +5 +2 +6 +3 0

7 out of 34
chain ident

F F# A $\flat$ A C $\flat$ C D# F
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34
0 +4 +1 +5 +2 +6 +3 0
minor thirds etc

Equivalent 7-tone scales are shown above in 19 and 34.
The first, in 19, has melodic steps of 1, 4, 1, 4, 1, 4, 4.
The second, in 34, has melodic steps of 2, 7, 2, 7, 2, 7, 7.
These 2-interval patterns are sometimes called moments of symmetry (Mos). The 7 modes of each are listed for example below;

mode identity

19

34

0	1	4	1	4	1	4	4	2	7	2	7	2	7	7
+1	1	4	1	4	4	1	4	2	7	2	7	7	2	7
+2	1	4	4	1	4	1	4	2	7	7	2	7	2	7
+3	4	1	4	1	4	1	4	7	2	7	2	7	2	7
+4	4	1	4	1	4	4	1	7	2	7	2	7	7	2
+5	4	1	4	4	1	4	1	7	2	7	7	2	7	2
+6	4	4	1	4	1	4	1	7	7	2	7	2	7	2

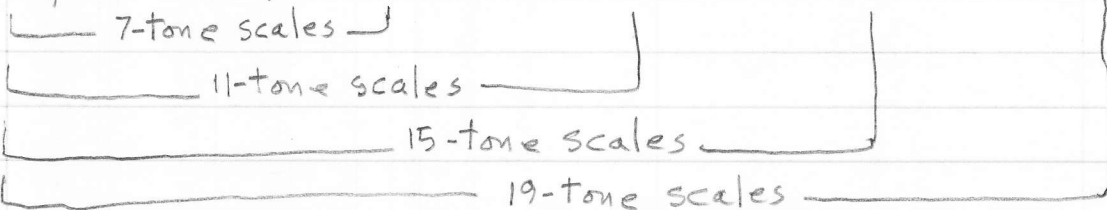
* As can be seen, a mode can be changed to either of its adjacent neighbors by altering a single note, respectively. This exercise should acquaint you with how closely related 19 and 34 are. 53 is next in series.

By continuing the chain-of-minor thirds, scale-like 2-interval-patterns (MOS) occur also at 11-tones, 15-tones, and 19-tones consecutive along the chain. Shown below;

F A $\flat$ C $\flat$ D $\sharp$ F $\sharp$ A C E $\flat$ G $\flat$ A $\sharp$ C $\sharp$ E G B $\flat$ D $\flat$ E $\sharp$ G $\sharp$ B D (ref L.A. Hanson)

19
Chain Identity $\frac{19}{19}$, 5, 10, 15, 1, 6, 11, 16, 2, 7, 12, 17, 3, 8, 13, 18, 4, 9, 14
0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10 +11 +12 +13 +14 +15 +16 +17 +18

34
 $\frac{19}{34}$, 9, 18, 27, 2, 11, 20, 29, 4, 13, 22, 31, 6, 15, 24, 33, 8, 17, 26



ref key - F F $\sharp$ G $\flat$ A $\flat$ A A $\sharp$ C $\flat$ C C $\sharp$ D $\sharp$ E $\flat$ F

11 out of 19 $\frac{19}{19}$ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

0 +4 +8 +1 +5 +9 +2 +6 +10 +3 +7 0

F F $\sharp$ G $\flat$ A $\flat$ A A $\sharp$ C $\flat$ C C $\sharp$ D $\sharp$ E $\flat$ F

11 out of 34 $\frac{19}{34}$ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

0 +4 +8 +1 +5 +9 +2 +6 +10 +3 +7 0

F F $\sharp$ G $\flat$ G A $\flat$ A A $\sharp$ B $\flat$ C $\flat$ C C $\sharp$ D $\flat$ D $\sharp$ E $\flat$ E F

15 out of 19 $\frac{19}{19}$ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

0 +4 +8 +12 +1 +5 +9 +13 +2 +6 +10 +14 +3 +7 +11 0

F F $\sharp$ G $\flat$ C A $\flat$ A A $\sharp$ B $\flat$ C $\flat$ C C $\sharp$ D $\flat$ D $\sharp$ E $\flat$ E F

15 out of 34 $\frac{19}{34}$ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

0 +4 +8 +12 +1 +5 +9 +13 +2 +6 +10 +14 +3 +7 +11 0

F F $\sharp$ G $\flat$ G G $\sharp$ A $\flat$ A A $\sharp$ B $\flat$ B C $\flat$ C C $\sharp$ D $\flat$ D D $\sharp$ E $\flat$ E E $\sharp$ F

19 out of 19 $\frac{19}{19}$ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

0 +4 +8 +12 +16 +1 +5 +9 +13 +17 +2 +6 +10 +14 +18 +3 +7 +11 +15 0

F F $\sharp$ G $\flat$ G G $\sharp$ A $\flat$ A A $\sharp$ B $\flat$ B C $\flat$ C C $\sharp$ D $\flat$ D D $\sharp$ E $\flat$ E E $\sharp$ F

19 out of 34 $\frac{19}{34}$ 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

0 +4 +8 +12 +16 +1 +5 +9 +13 +17 +2 +6 +10 +14 +18 +3 +7 +11 +15 0

* Triads on the chain-of-minor thirds are; Unison=0, Major 3rd=+5, 5th=+6. These are an unexpectedly rich resource in these otherwise unorthodox scales!

Hanson 19 in 53 Equal

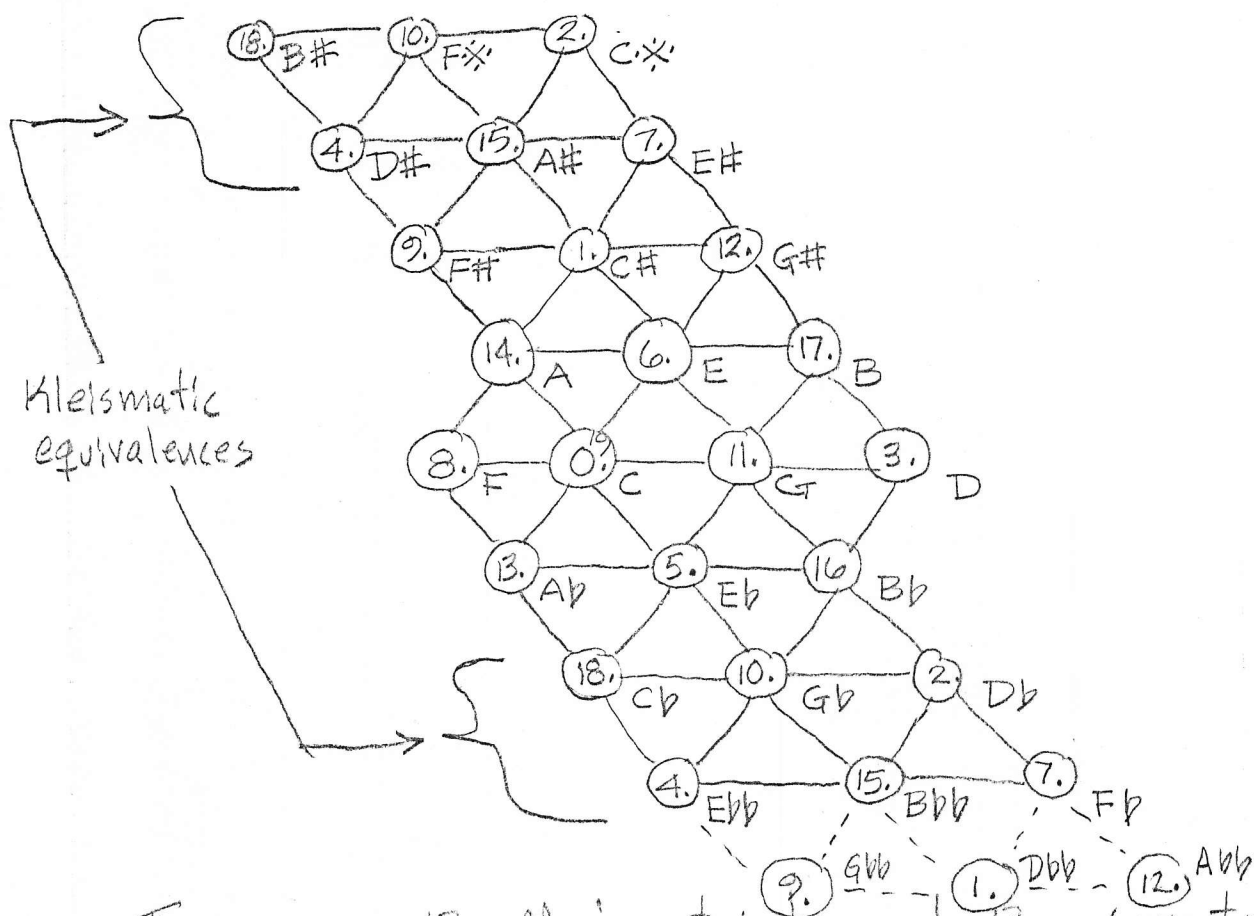
Proportional (1.20160781285)

F 702.585124692

+6	31.	528.41	(C#)	2 6 7 9	(+6)	528.71	C	2 6 7 9	
+10	34.	549.55	(D)	1 2 6 8 9	(+10)	551.12	C# (Dbb)	1 2 3 6 8 9	
+14	37.	571.53	D	1 6 7 8 9	+14	574.46	Db	1 4 6 7 8 9	
+18	40. ?	594.41	D#	2 3 4 5 10	+18	598.80	D	1 4 6 10	
+3	42.	610.16	(D#)	3 7 10	(+3)	609.48	D# (Ebb)	1 2 7 10	
+7	45.	634.58	(E)	1 3 4 5 6 7 10	(+7)	635.30	Eb	1 2 3 4 5 6 7 10	
+11	48.	659.97	E	1 2 5 6 8 10	+11	662.22	E	4 5 6 8 10	
+15	51.	686.38	F	1 2 3 6 7 8 10	+15	690.271	Fb	1 2 3 4 6 7 8 10	
F	0	0/53.	704.57	(F)	1 4 9 10	(0)	702.59	F	2 3 9 10
+4	3.	732.77	(F#)	2 4 5 6 9 10	(+4)	732.35	F# (Gbb)	1 4 5 6 9 10	
+8	6.	762.09	(G)	1 4 6 7 9 10	(+8)	763.38	Gb	1 2 4 6 7 9 10	
+12	9.	792.58	G	2 3 5 8 9 10	+12	795.72	G	1 2 4 5 8 9 10	
+16	12.	824.30	G#	2 7 8 9 10	+16	829.44	G# (Abb)	4 7 8 9 10	
+1	14.	846.14	(G#)	2 3 4 5 7 8 9 10	(+1)	844.23	Ab	1 2 4 5 7 8 9 10	
A	+5	17.	440	(A)	1 3 4	(+5)	440	A	1 3 4
+9	20.	457.61	(B)	1 2 4 5 7	(+9)	458.64	A# (Bbb)	6 7	
+13	23.	475.92	B	1 2 3 6 8	+13	478.07	Bb	1 2 3 4 6 8	
+17	26.	494.96	C	1 2 3 4 6 7 8	+17	498.33	B	1 2 4 5 6 7 8	
+2	28.	508.08	(C)	2 3 4 5 9	(+2)	507.22	cb	1 2 4 5 9	
C (+6)	31.	528.41		2 6 7 9					

Normal Notation of All Triads in 19-Tone (MOS), with 5-step Generator

by Eric Wilson

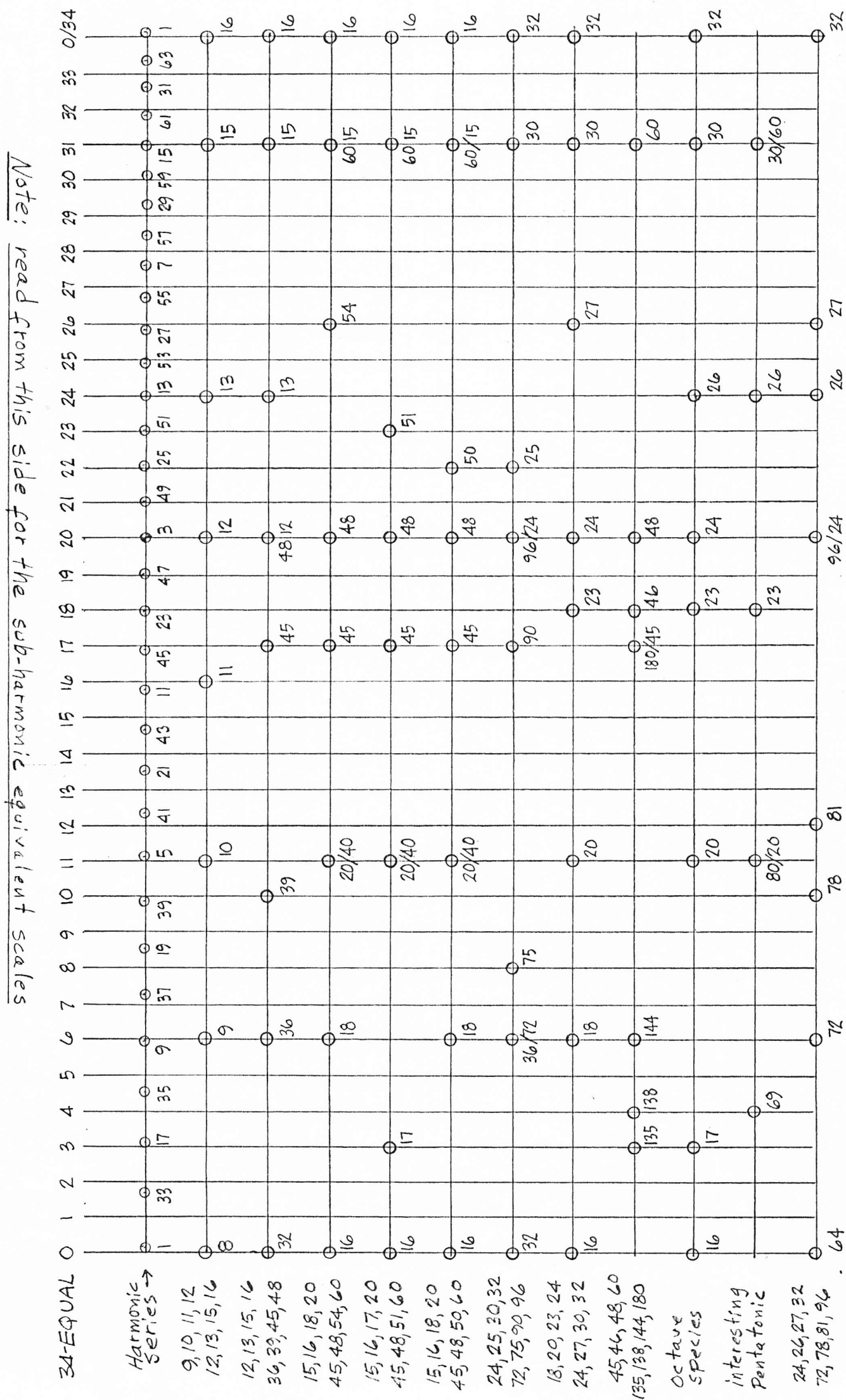


There are 13 Major triads and 13 minor triads in the 19-tone scale (MOS) with a 5-step generator. These can be spelled in normal notation as shown.

Resources of the 34-Tone Scale

work in progress, all rights reserved
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Notes on Harmonics and Tetrachords

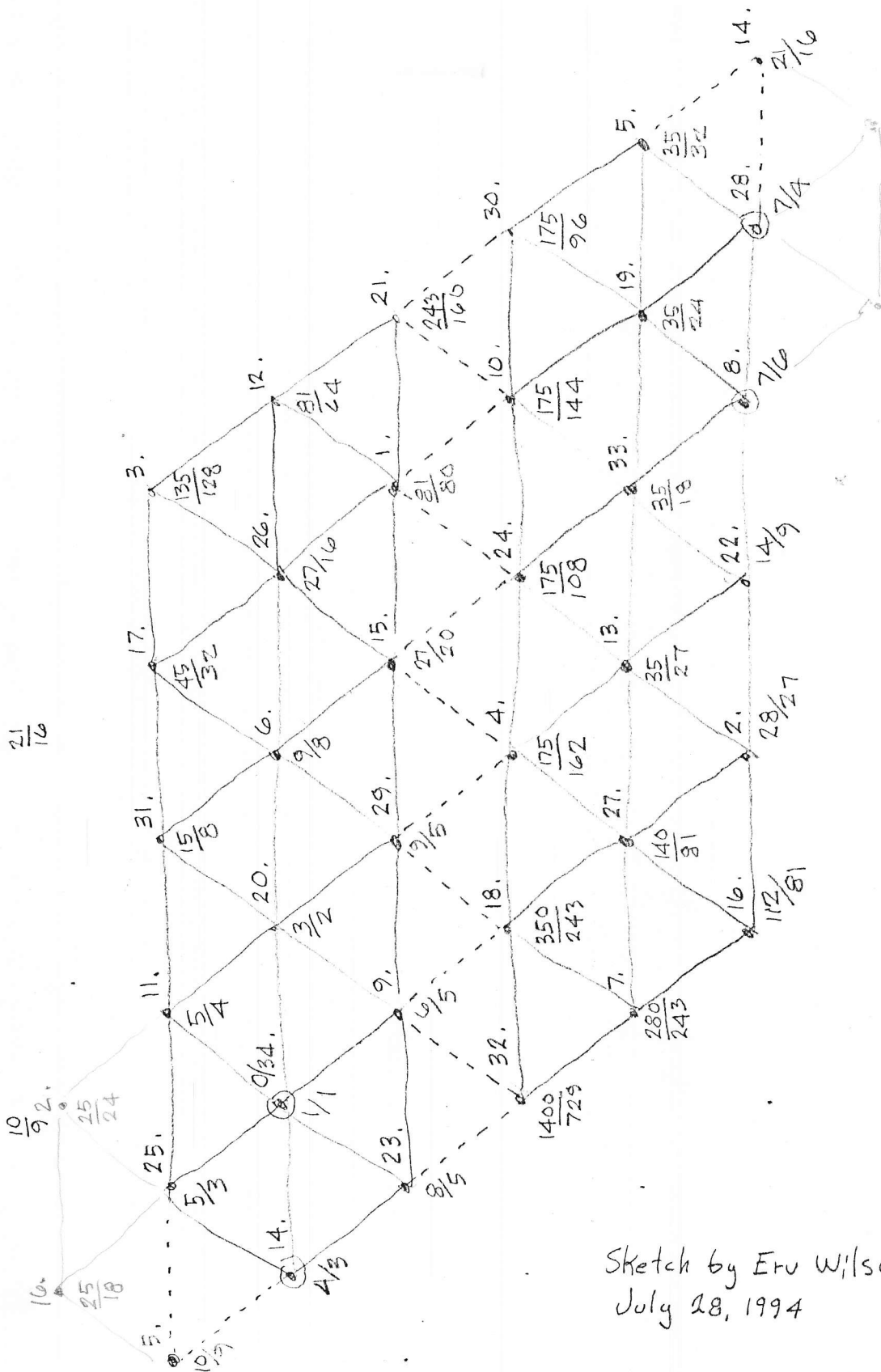


A 34-Tone Scale

Using the $\frac{4,375}{4,374}$ Equivalence $(\frac{547}{37.2})$

©1994 by Larry Hanson (July 26, 1994)

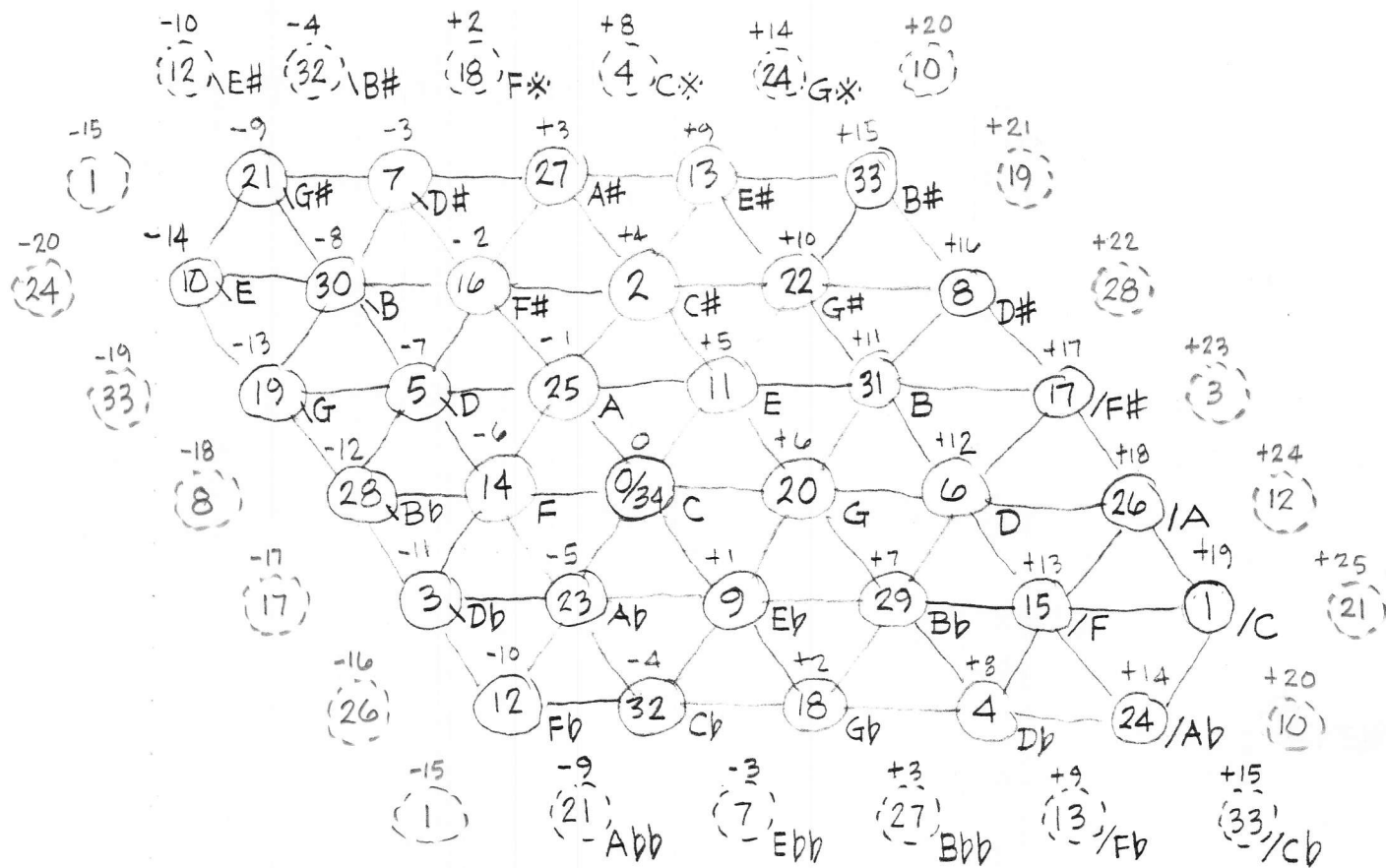
0. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34.
 1. $\frac{81}{80}$ 2. $\frac{28}{27}$ 3. $\frac{135}{128}$ 4. $\frac{175}{162}$ 5. $\frac{35}{32}$ 6. $\frac{9}{8}$ 7. $\frac{280}{243}$ 8. $\frac{7}{6}$ 9. $\frac{5}{4}$ 10. $\frac{175}{144}$ 11. $\frac{5}{3}$ 12. $\frac{81}{64}$ 13. $\frac{35}{27}$ 14. $\frac{27}{20}$ 15. $\frac{112}{81}$ 16. $\frac{45}{32}$ 17. $\frac{12}{5}$ 18. $\frac{175}{108}$ 19. $\frac{35}{24}$ 20. $\frac{140}{81}$ 21. $\frac{27}{16}$ 22. $\frac{5}{3}$ 23. $\frac{175}{96}$ 24. $\frac{35}{18}$ 25. $\frac{1400}{729}$ 26. $\frac{140}{81}$ 27. $\frac{28}{27}$ 28. $\frac{7}{4}$ 29. $\frac{35}{16}$ 30. $\frac{175}{144}$ 31. $\frac{243}{160}$ 32. $\frac{81}{64}$ 33. $\frac{135}{128}$ 34. $\frac{2}{1}$



Sketch by Erv Wilson
 July 28, 1994

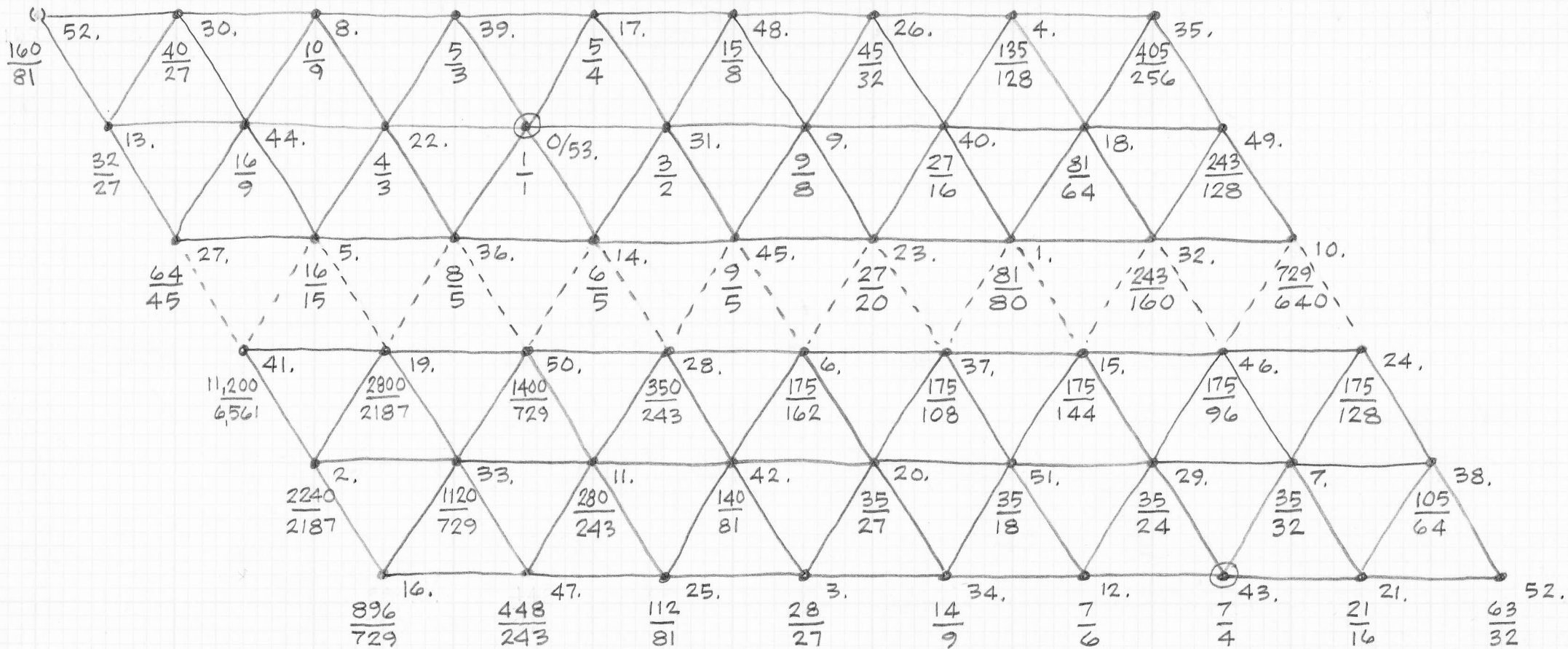
Triad Lattice for 34 Chain

Issued 1994 by En Wilson



1
24
33

- 53/0. 2/1
 52. 160/81 or 63/32
 51. 35/18
 50. 1400/729
 49. 243/128
 48. 15/8
 47. 448/243
 46. 175/96
 45. 9/5
 44. 16/9
 43. 7/4
 42. 140/81
 41. 11,200/6,561
 40. 27/16
 39. 5/3
 38. 105/64
 37. 175/108
 36. 8/5
 35. 406/256
 34. 14/9
 33. 1120/729
 32. 243/160
 31. 3/2
 30. 40/27
 29. 35/24
 28. 350/243
 27. 64/45
 26. 45/32
 25. 112/81
 24. 175/128
 23. 27/20
 22. 4/3
 21. 21/16
 20. 35/27
 19. 2800/2187
 18. 81/64
 17. 5/4
 16. 896/729
 15. 175/144
 14. 6/5
 13. 32/27
 12. 7/6
 11. 280/243
 10. 729/640
 9. 9/8
 8. 10/9
 7. 35/32
 6. 175/162
 5. 16/15
 4. 135/128
 3. 28/27
 2. 2240/2187
 1. 81/80
 53/0. 1/1

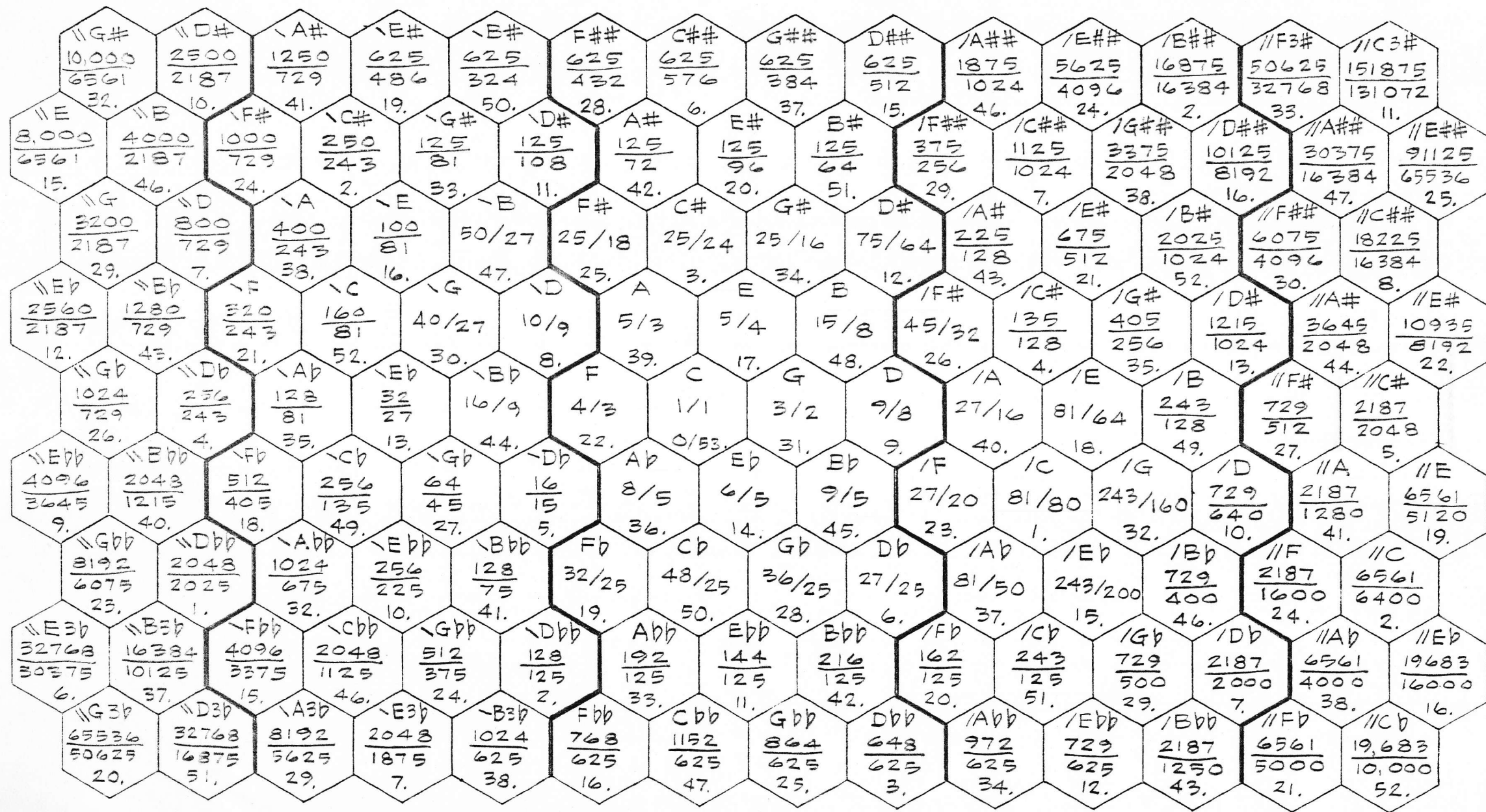


4,375
 4,374

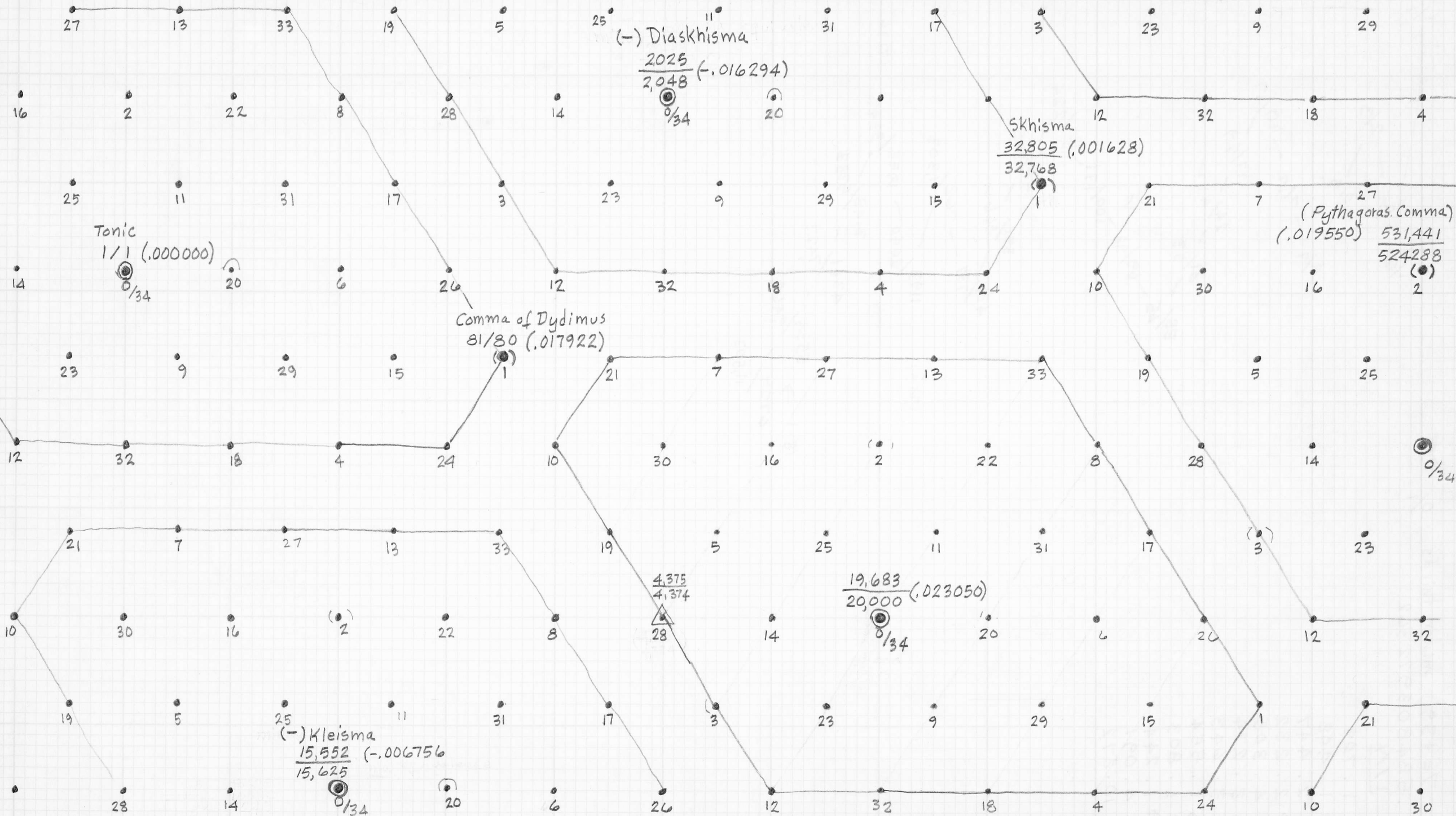
+22 = 7, .263970678275
 -21 = 11, .263836589590
 7 = +39, .584803972362

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------|--------------|-----------------|-----------------|--------------|----------------|---------------|--------------|-----------------|-----------------|---------------|---------------|-----------------|-----------------|-----------------|-----------------|---------------|-----------------|---------------|---------------|-----------------|---------------|---------------|---------------|-----------------|---------------|----------------|---------------|-----------------|----------------|--------------|----|---------------|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 3 | | | | | |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 |
| $\frac{1}{1}$ | | $\frac{25}{24}$ | $\frac{16}{15}$ | | $\frac{10}{9}$ | $\frac{9}{8}$ | | $\frac{6}{5}$ | $\frac{16}{13}$ | $\frac{5}{4}$ | | $\frac{4}{3}$ | $\frac{27}{20}$ | $\frac{18}{13}$ | $\frac{45}{32}$ | | $\frac{40}{27}$ | $\frac{3}{2}$ | | $\frac{25}{16}$ | $\frac{8}{5}$ | | $\frac{5}{3}$ | $\frac{27}{16}$ | | $\frac{16}{9}$ | $\frac{9}{5}$ | $\frac{24}{13}$ | $\frac{15}{8}$ | | | $\frac{1}{1}$ | | | |
| | | | | | | | | $\frac{40}{39}$ | $\frac{65}{64}$ | | | $\frac{40}{39}$ | $\frac{65}{64}$ | | | | | | | | | | | | | | | | | | | | | | |





Some Notes on L.A. Hanson's 34-Grid by E. Wilson 02-22-96



34-notation

© 1993 Erv Wilson

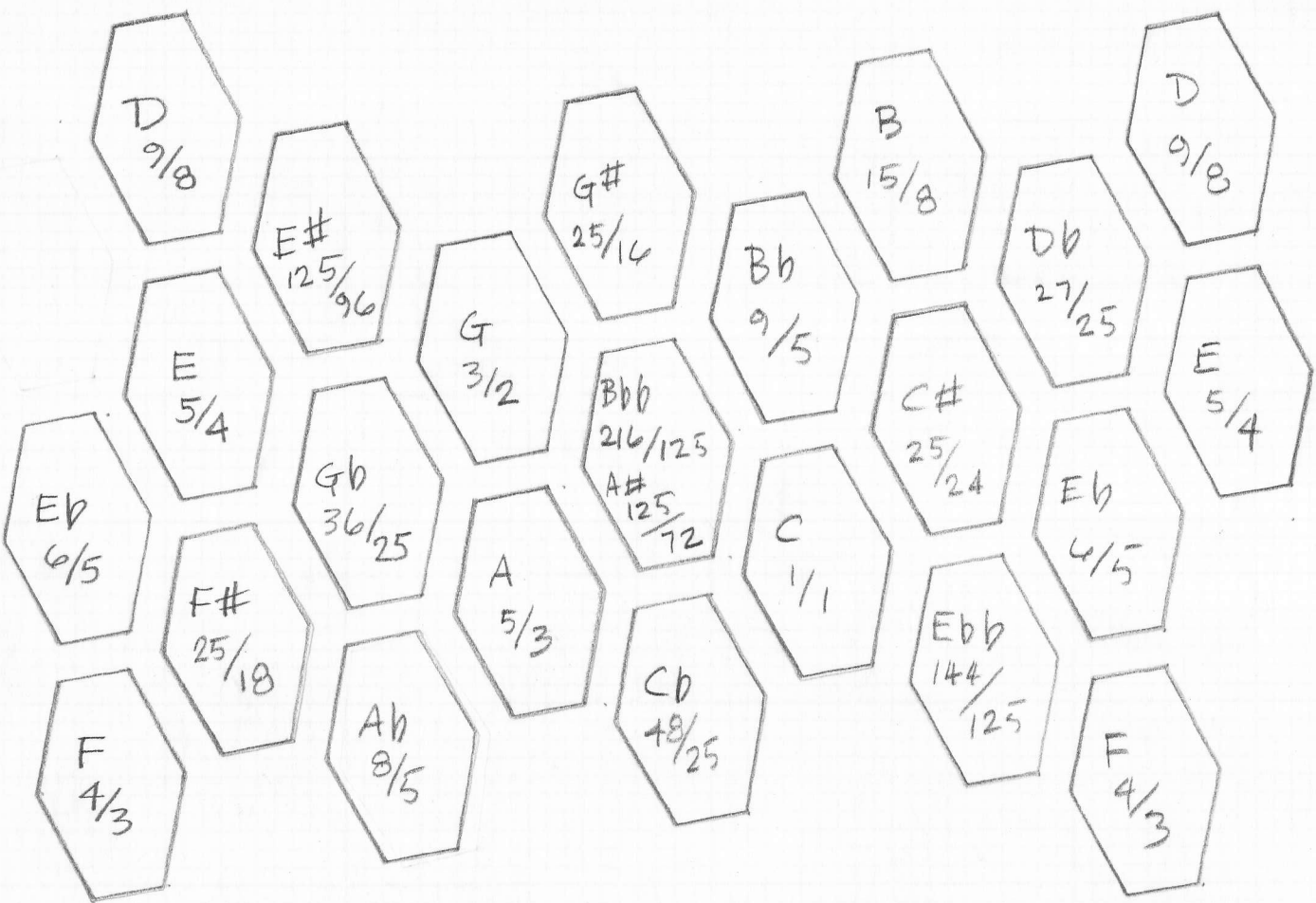
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|------------|------------|---|------------|------------|------------|---|------------|------------|------------|------------|-----------|------------|----|-----------|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 |
| C | D $\flat$ | C $\sharp$ | D | D $\sharp$ | E $\flat$ | D $\sharp$ | E | F | G $\flat$ | F $\sharp$ | G | A $\flat$ | G $\sharp$ | A | B $\flat$ | A $\sharp$ | B | C | | | | | | | | | | | | | | | | |
| C | C $\sharp$ | C $\sharp$ | D | D $\sharp$ | C $\sharp$ | E | F | F $\sharp$ | F $\sharp$ | G | G $\sharp$ | A | A $\sharp$ | A | B $\flat$ | A $\sharp$ | B | C | | | | | | | | | | | | | | | | |
| C | D $\flat$ | C $\sharp$ | D | D $\sharp$ | E $\flat$ | E | F | F $\sharp$ | G $\flat$ | G $\sharp$ | A | A $\flat$ | A $\sharp$ | B | B $\flat$ | B $\sharp$ | C | | | | | | | | | | | | | | | | | |

| Unison | $\frac{1}{6}$ | $\frac{1}{3}$ | $\frac{1}{2}$ | $\frac{2}{3}$ | $\frac{5}{6}$ | Whole Tone |
|--------|---------------|---------------|---------------|---------------|---------------|------------|
| C | C $\sharp$ | C $\sharp$ | C $\sharp$ | C $\sharp$ | C $\sharp$ | D |
| C | D $\flat$ | D $\flat$ | D $\flat$ | D $\flat$ | D $\flat$ | D |
| C | C $\uparrow$ | C $\sharp$ | C $\sharp$ | C $\sharp$ | C $\sharp$ | D |
| C | D $\flat$ | D $\flat$ | D $\flat$ | D $\flat$ | D $\flat$ | D |

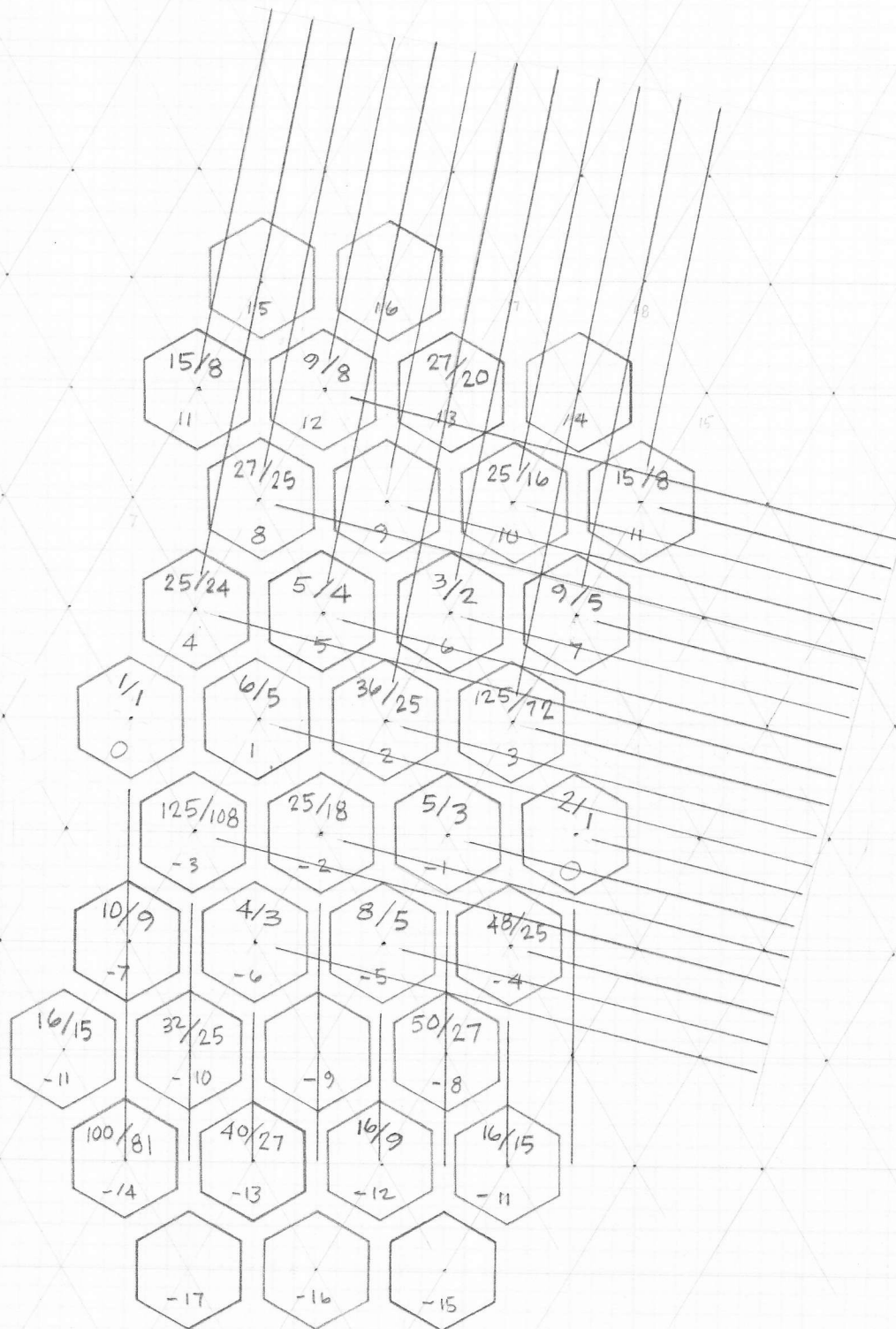
| | | | | | |
|----------------|----------------|----------------|----------------|----------------|----------------|
| whole tone | | | | | |
| Third tone | | Third tone | | Third tone | |
| $\frac{1}{6}T$ | $\frac{1}{6}T$ | $\frac{1}{6}T$ | $\frac{1}{6}T$ | $\frac{1}{6}T$ | $\frac{1}{6}T$ |

| | | | |
|---|------------|---|----------------------------|
| # | Third high | # | $\frac{2}{3}$ high (sharp) |
| ↓ | Third low | b | $\frac{2}{3}$ low (flat) |
| ↑ | sixth high | | |
| ↓ | sixth low | | |

19-Tone Basic Set for Hanson Kbd Geometry
Digital design by Erv Wilson Feb 27, 1978

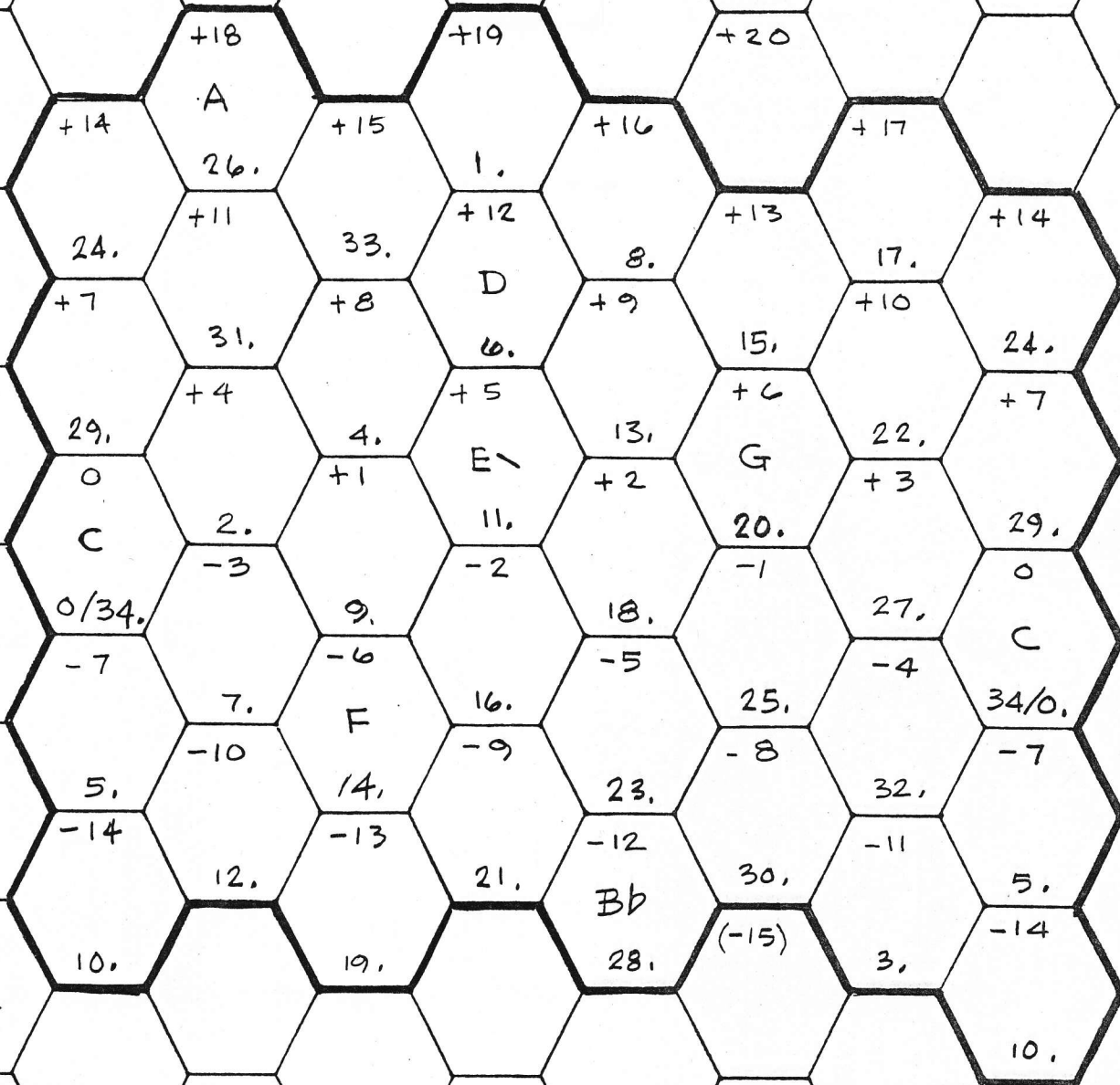


11-fold axis



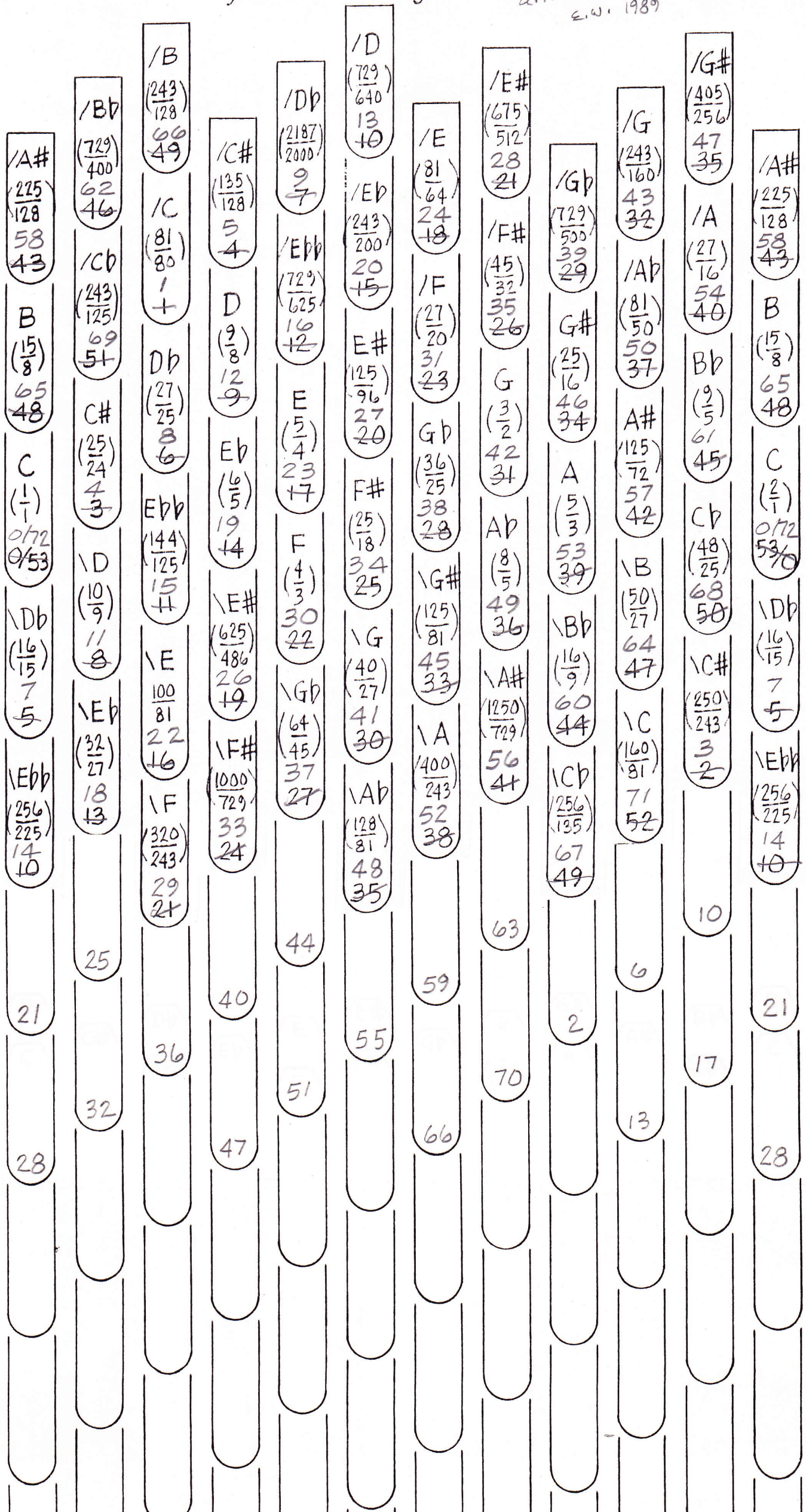
2/7 KBD, 9/34 Scale

©1988 by Eric Wilson



7-rank variation of Hanson Keyboard Geometry
used by permission

Figure # 8
Keyboard Design "A" annotated for 72
E.W. 1989



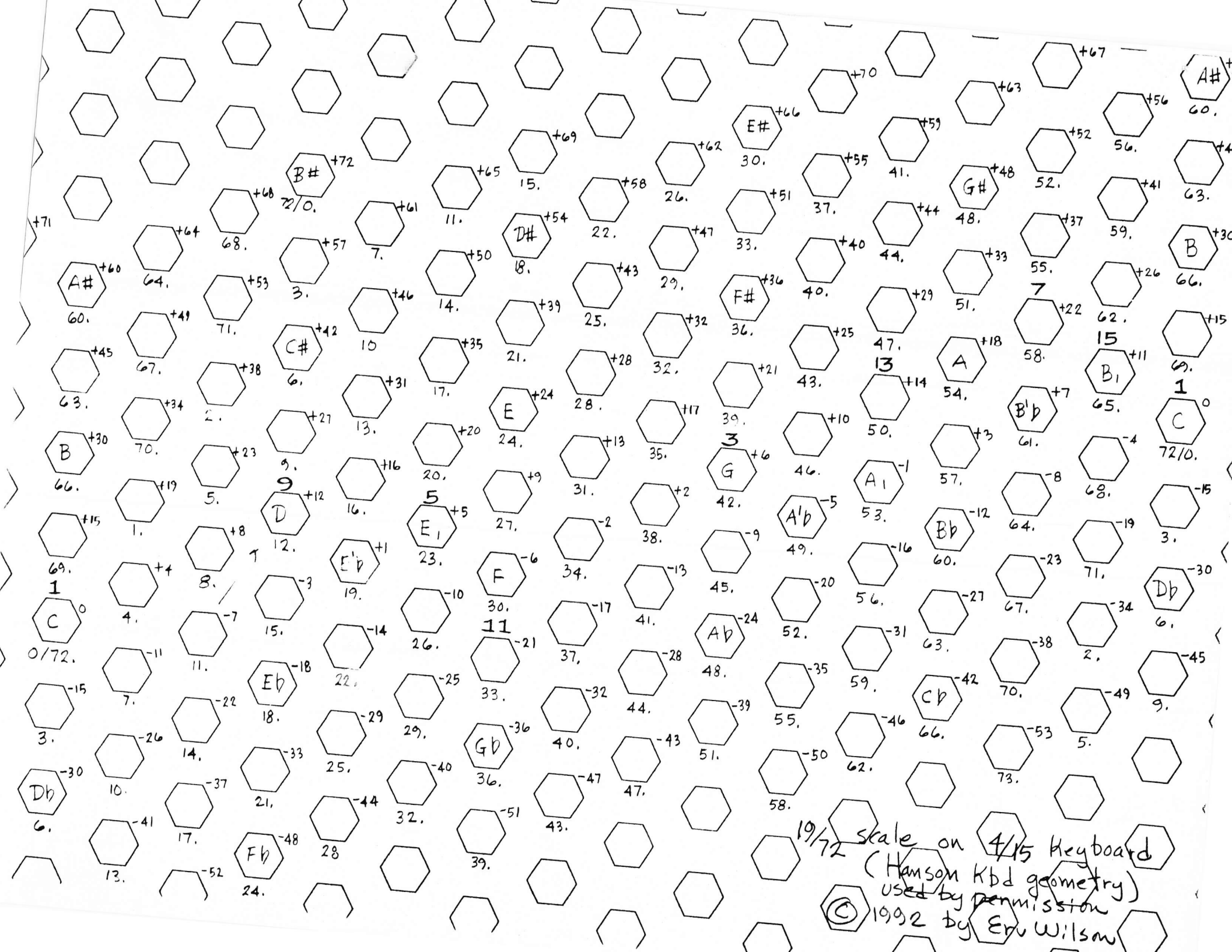
Handwritten text on the cards includes:

- Row 1: +B, +D, +L, +R, +B
- Row 2: +Ng, +M, +E, +G, +I
- Row 3: +C, +O, +Q, +U
- Row 4: +N, +T, +S, +A, +N
- Row 5: I, D, F, H, B
- Row 6: Ng, Duit, Luis, R, Ruís, I, Beth
- Row 7: M, Muín, E, Eadha, G, Gort, U, Idho
- Row 8: C, coll, 3, O, John, S, Saile, A, ailm., C, coll
- Row 9: O, D, T, Tinne, F, Feann, H, Uath, B, Níon
- Row 10: -Ng, 8, -L, -R, -I, -M
- Row 11: -M, 5, -O, -Q, -U, -C
- Row 12: 2, -T, 13, -S, -A, -N
- Row 13: 21, -F, -H

At the bottom of the image, there is a row of letters: D, T, E, F, G, A, B, C.

C M N G D T O E L F S Q G R H A U I B N C

F H N T S A C O Q U M E G I N g L R B D



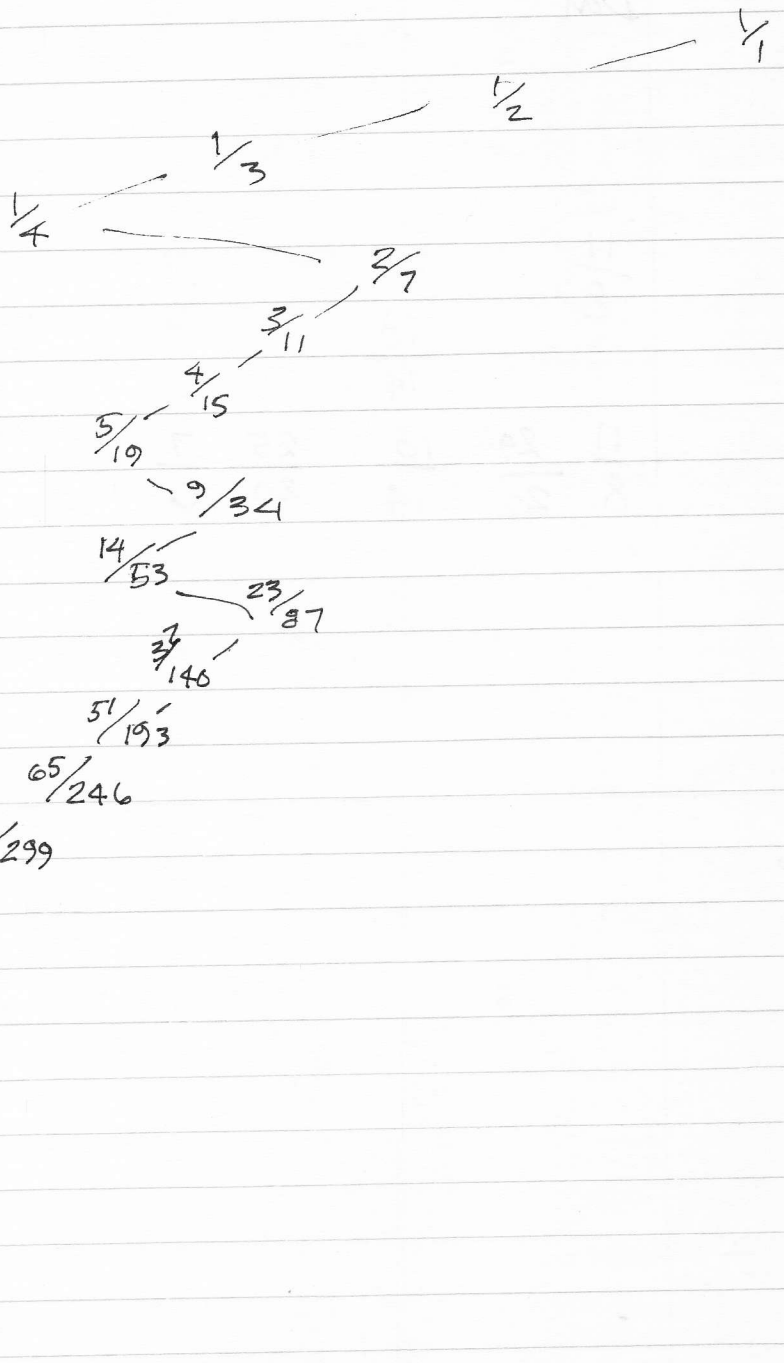
19/72 scale on 4/15 keyboard
(Hanson kbd geometry)
used by permission
© 1992 by Eric Wilson

$\sqrt[6]{3}, 264 \dots$

$1/14$ Pattern

$0/1$

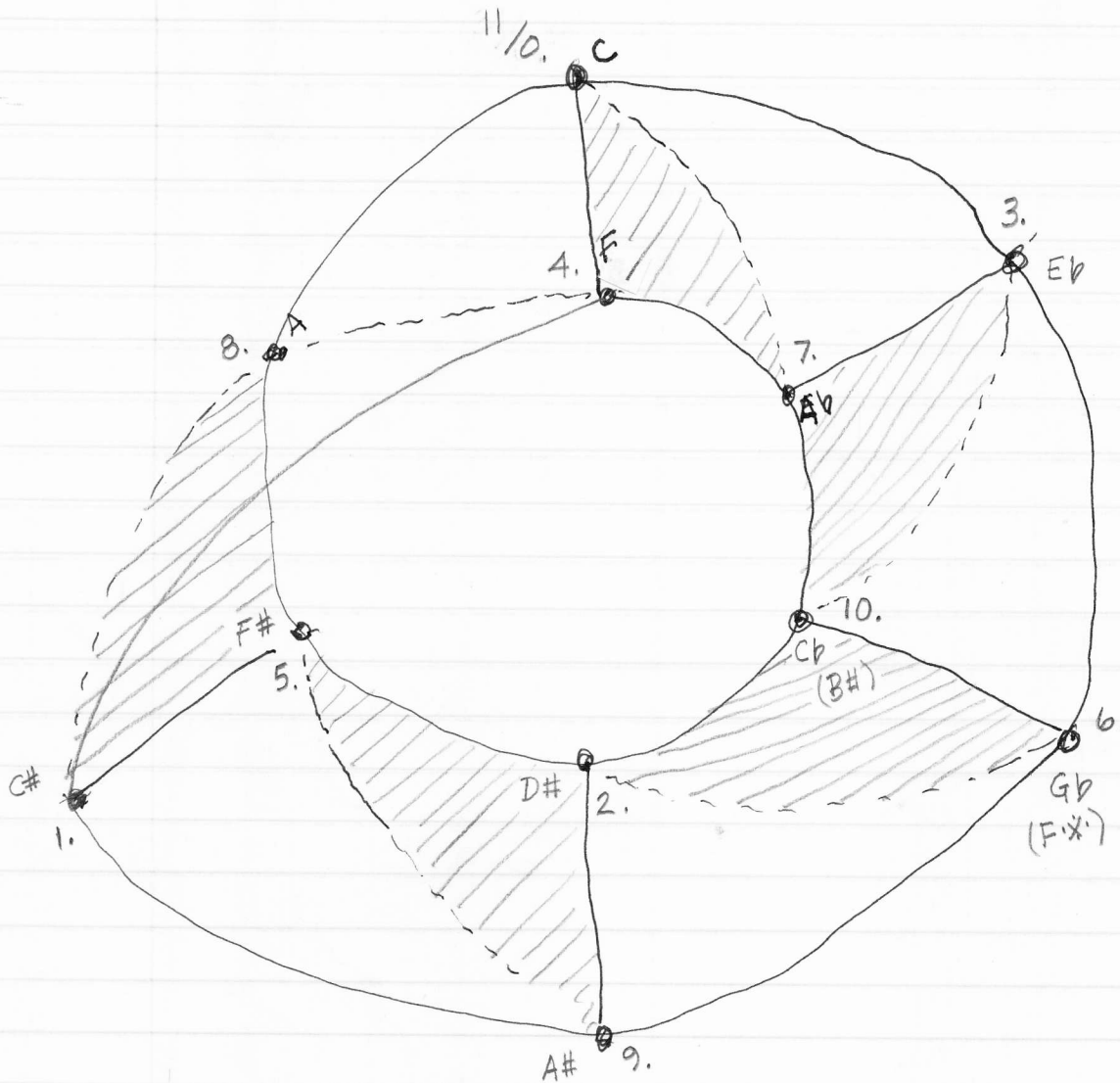
| | |
|----|------|
| 3 | .785 |
| 1 | .272 |
| 3 | .663 |
| 1 | .506 |
| 1 | .973 |
| 1 | .027 |
| 36 | .937 |



Eleven-tone Loop

©1997, ©1994 by Eru Wilson

(Inferred from the Hanson sequence)



Shaded areas are minor triads.
unShaded areas are Major triads.
(except the triad F, A, C# is augmented)

This is like a moebius loop,

| | | | |
|----|----|-----|-------|
| 0 | C | 0 | 11/0. |
| -4 | B# | 10. | 18. |
| | Cb | | 32. |
| | | | 34/0. |

| | | | | |
|----|----|----|-----|-----|
| +3 | A# | 9. | 15. | 27. |
| -1 | A | 8. | 14. | 25. |
| -5 | Ab | 7. | 13. | 23. |

| | | | | |
|----|----|----|-----|-----|
| +2 | F# | 6. | 10. | 18. |
| -2 | F# | 5. | 9. | 16. |
| -6 | F | 4. | 8. | 14. |

| | | | | |
|----|----|----|----|----|
| +1 | Eb | 3. | 5. | 9. |
| -3 | D# | 2. | 4. | 7. |

| | | | |
|---------------|----|----|-------|
| chain of -3ds | | | |
| 0 | +4 | C# | 0 |
| | | C | 0/11. |
| | | | 0/19. |
| | | | 0/34. |

34 MOS - Erv's sketch Tones intervals

8/2/94

| | | | | |
|-------------|---------|---------|-------|--------------------|
| 1 / 1 | 21.51 | 21.51 | 49.17 | |
| 81 / 80 | 62.57 | 41.06 | 41.06 | 8.107278862071810 |
| 648 / 625 | 92.18 | 29.61 ✓ | 29.61 | 11.445289946708900 |
| 135 / 128 | 133.24 | 41.06 | 21.51 | 8.107278862071820 |
| 27 / 25 | 154.74 | 21.51 | | |
| 2187 / 2000 | 203.91 | 49.17 Z | | 3.378 |
| 9 / 8 | 244.97 | 41.06 | | |
| 144 / 125 | 266.48 | 21.51 | | |
| 729 / 625 | 315.64 | 49.17 Z | | |
| 6 / 5 | 337.15 | 21.51 | | |
| 243 / 200 | 386.31 | 49.17 Z | | |
| 5 / 4 | 407.82 | 21.51 | | |
| 81 / 64 | 448.88 | 41.06 | | |
| 162 / 125 | 498.04 | 49.17 Z | | |
| 4 / 3 | 519.55 | 21.51 | | |
| 27 / 20 | 560.61 | 41.06 | | |
| 864 / 625 | 590.22 | 29.61 ✓ | | |
| 45 / 32 | 631.28 | 41.06 | | |
| 36 / 25 | 652.79 | 21.51 | | |
| 729 / 500 | 701.96 | 49.17 Z | | |
| 3 / 2 | 723.46 | 21.51 | | |
| 243 / 160 | 764.52 | 41.06 | | |
| 972 / 625 | 813.69 | 49.17 Z | | |
| 8 / 5 | 835.19 | 21.51 | | |
| 81 / 50 | 884.36 | 49.17 Z | | |
| 5 / 3 | 905.87 | 21.51 | | |
| 27 / 16 | 946.92 | 41.06 | | |
| 216 / 125 | 968.43 | 21.51 | | |
| 2187 / 1250 | 1017.60 | 49.17 Z | | |
| 9 / 5 | 1039.10 | 21.51 | | |
| 729 / 400 | 1088.27 | 49.17 Z | | |
| 15 / 8 | 1129.33 | 41.06 | | |
| 48 / 25 | 1150.83 | 21.51 | | |
| 243 / 125 | 1200 | 49.17 Z | | |
| 2 / 1 | | | | |

81/80 21.51 49.16
25/24 70.67 21.51
135/128 92.18

27/20
25/18
45/32