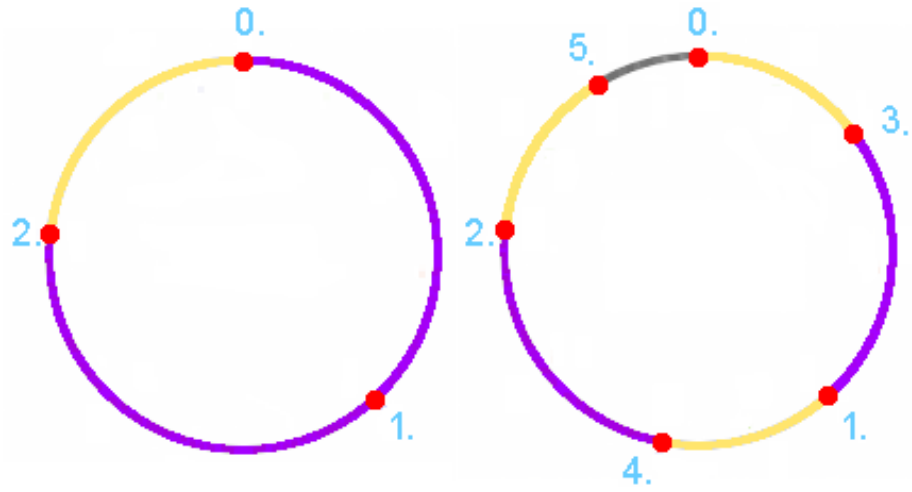
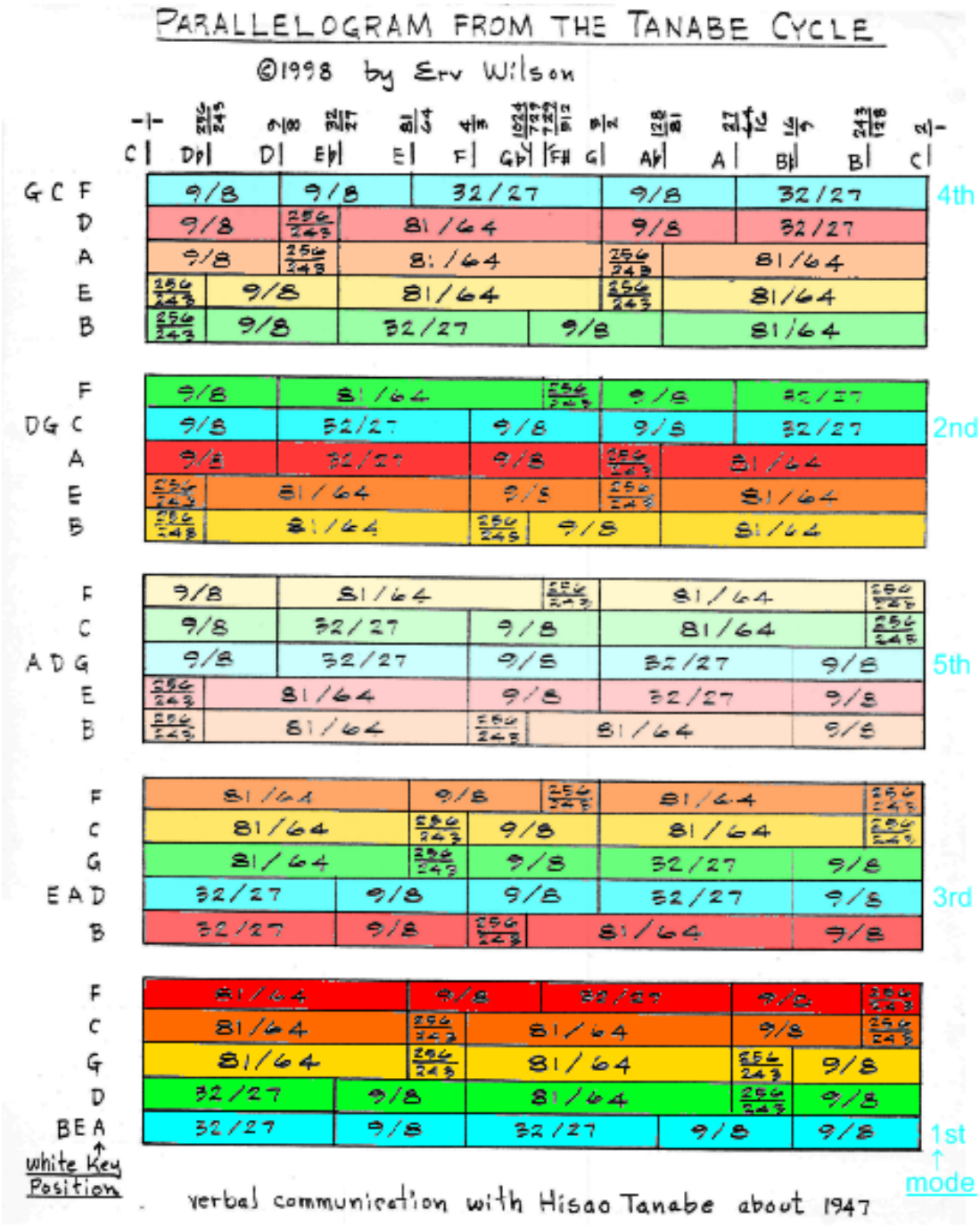


Web Figure 4.1. Steinhaus Conjecture shown as footsteps (red dots) around a circle: the distance between dots will be either two different lengths (as shown in purple and yellow on the left), or three (shown in purple, yellow and grey on the right).

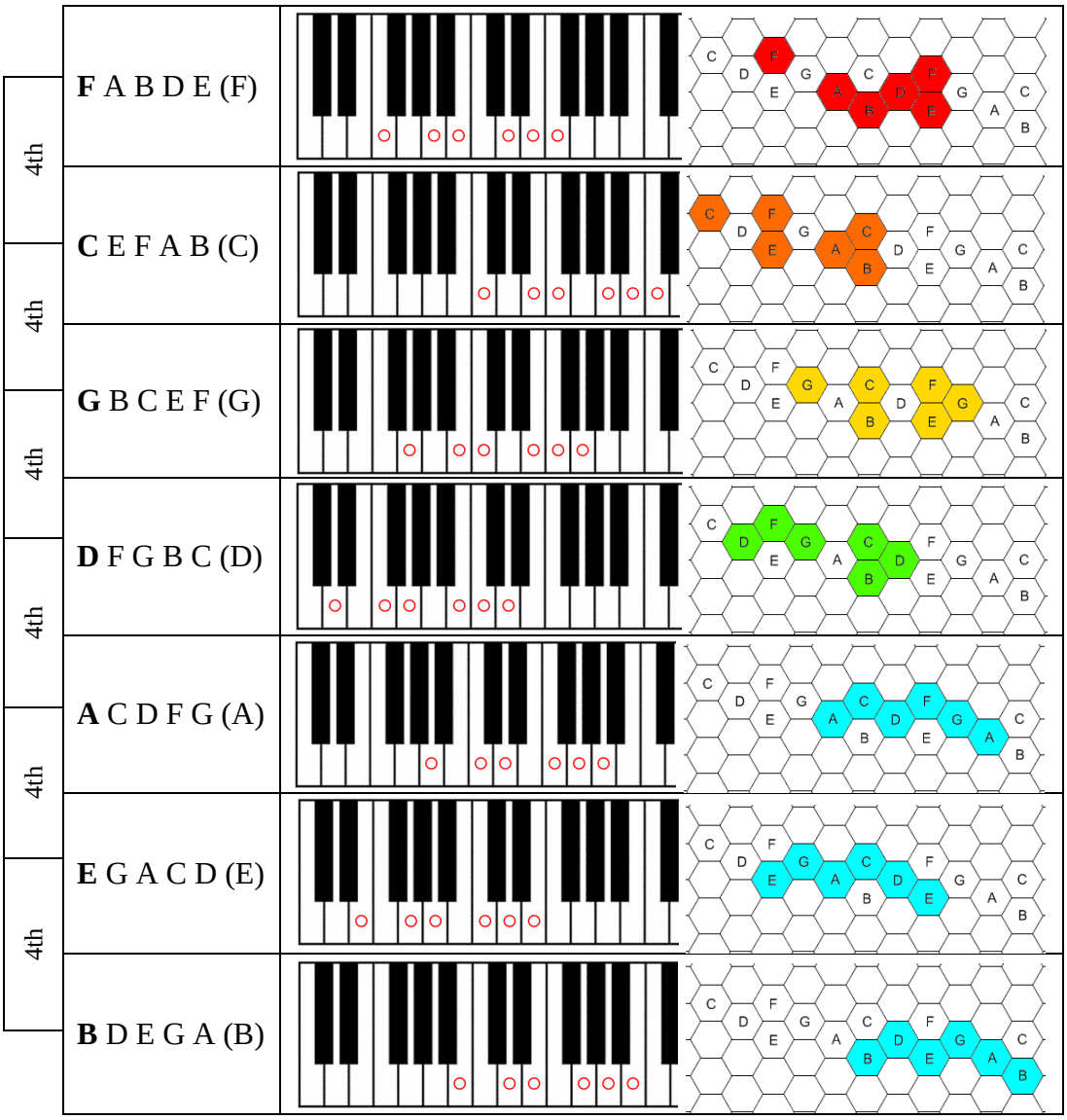
	Regular degrees		Auxiliary degrees		**Total**
Pentatonic ("Sub-infra-diatonic Scale")	2	+	3	=	**5**
Diatonic ("Infra-diatonic Scale")	5	+	2	=	**7**
Chromatic ("Diatonic Scale")	7	+	5	=	**12**
19-tone ("Supra-diatonic Scale")	12	+	7	=	**19**
Etc. (eventually leading to "Ultra-diatonic Scale")	…	+	…	=	**…**

Web Figure 4.2. Evolution of scales, adapted from Joseph Yasser's *A Theory of Evolving Tonality* (1932, p. 141).

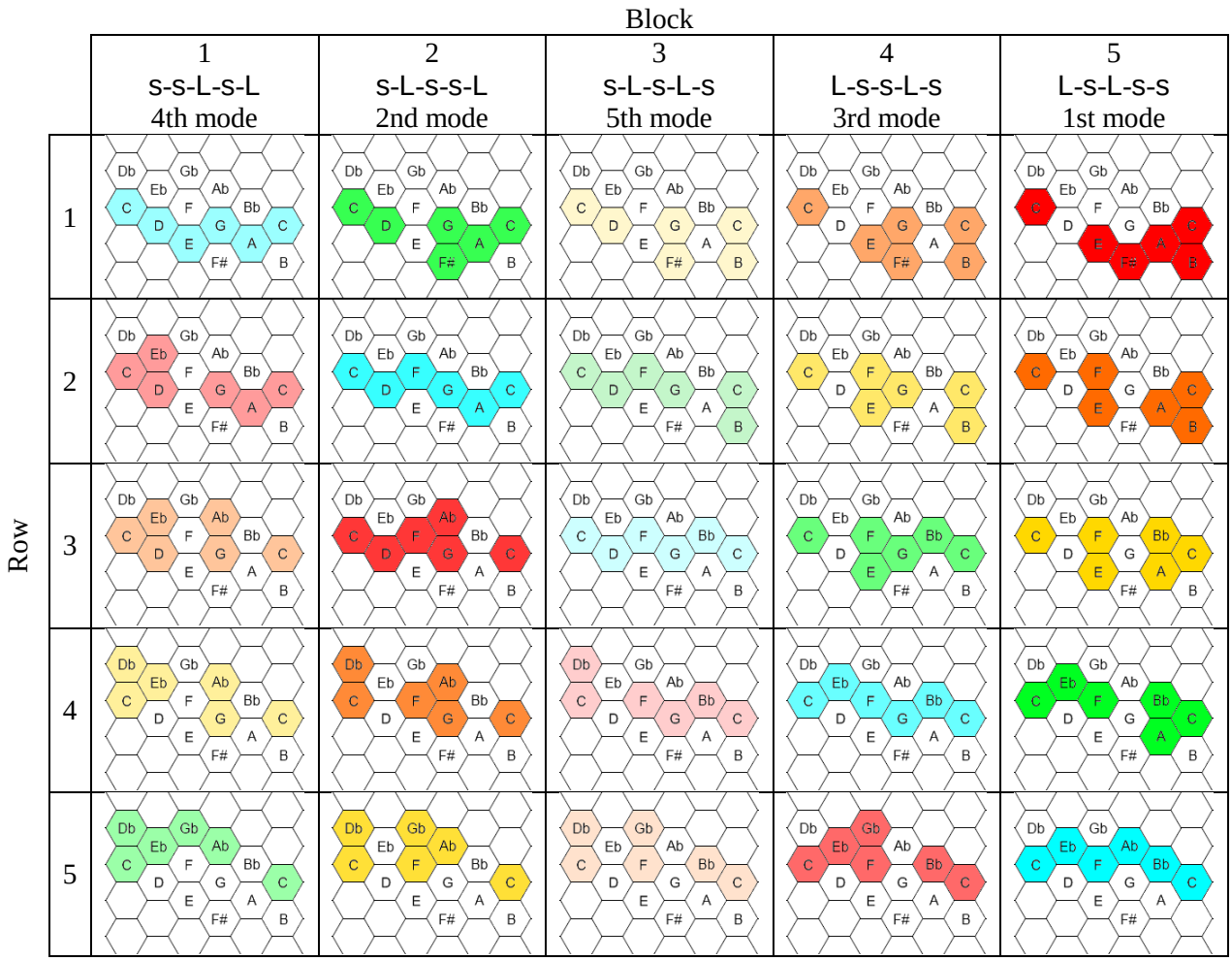


Web Figure 4.3. Parallelogram from the Tanabe Cycle (Wilson, 1998, p. 2), with coloured annotations to show modes.

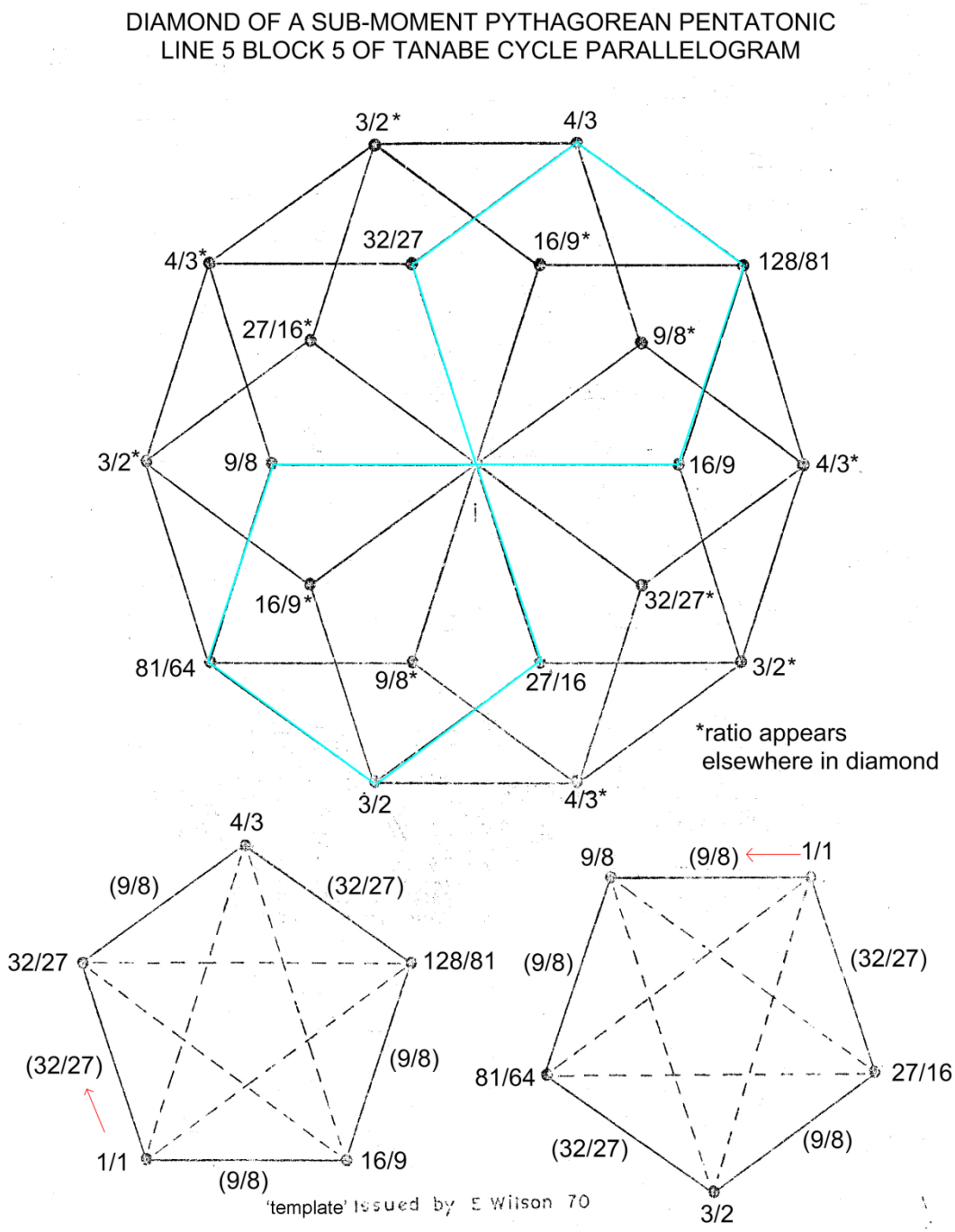
L-s-L-s-s



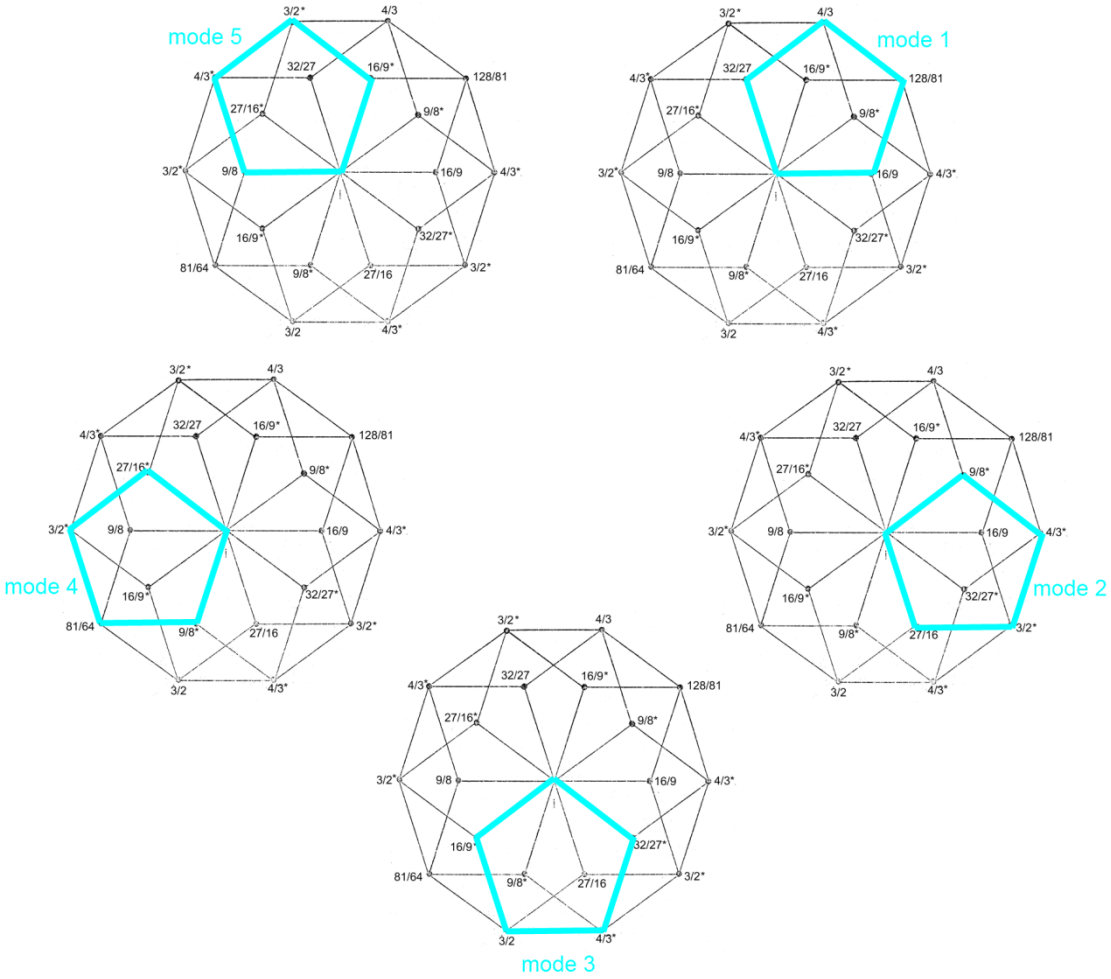
Web Figure 4.4. Keyboard layouts of the sub-moment pentatonic scales with interval structure L-s-L-s-s that appear in the bottom block of the Parallelogram from the Tanabe Cycle.



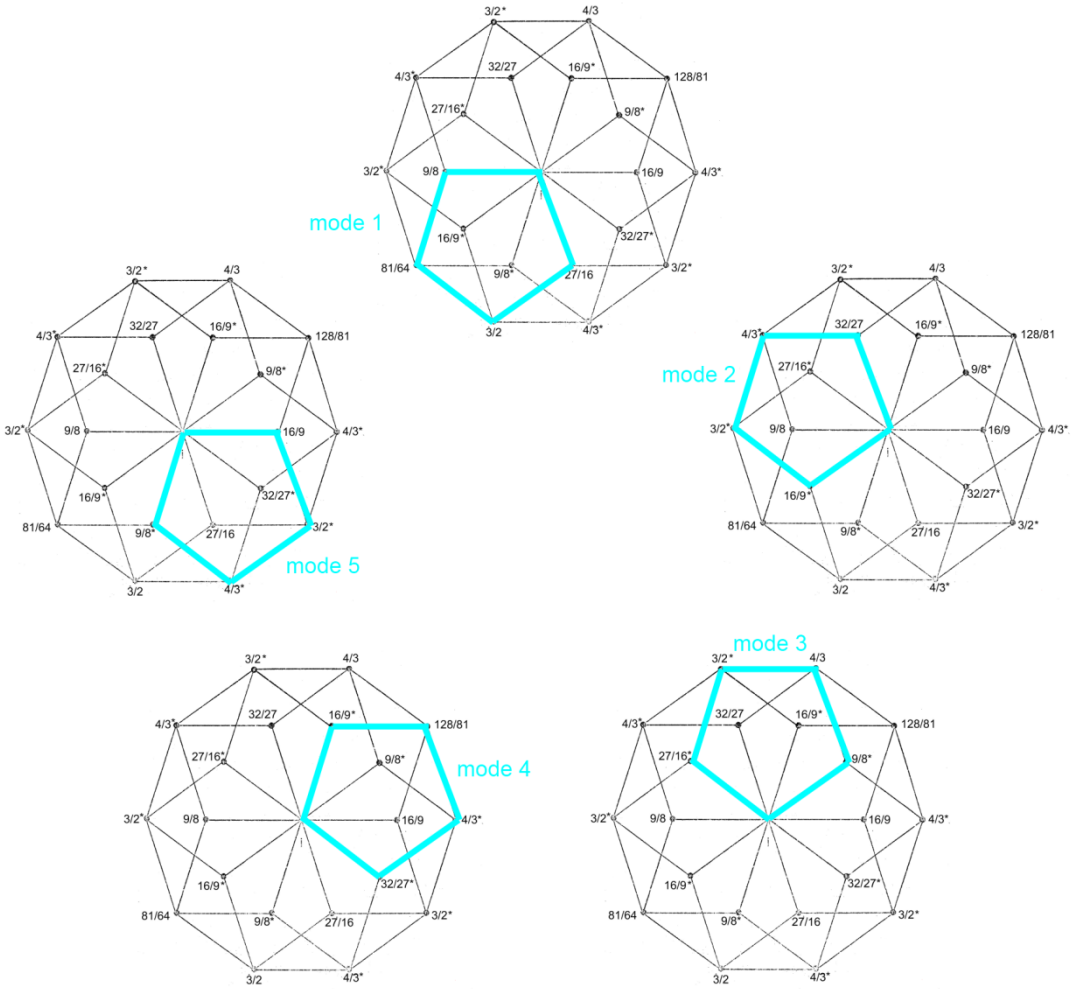
Web Figure 4.5. The 25 5)7 scales of the Parallelogram from the Tanabe Cycle mapped on a 2/5 keyboard.



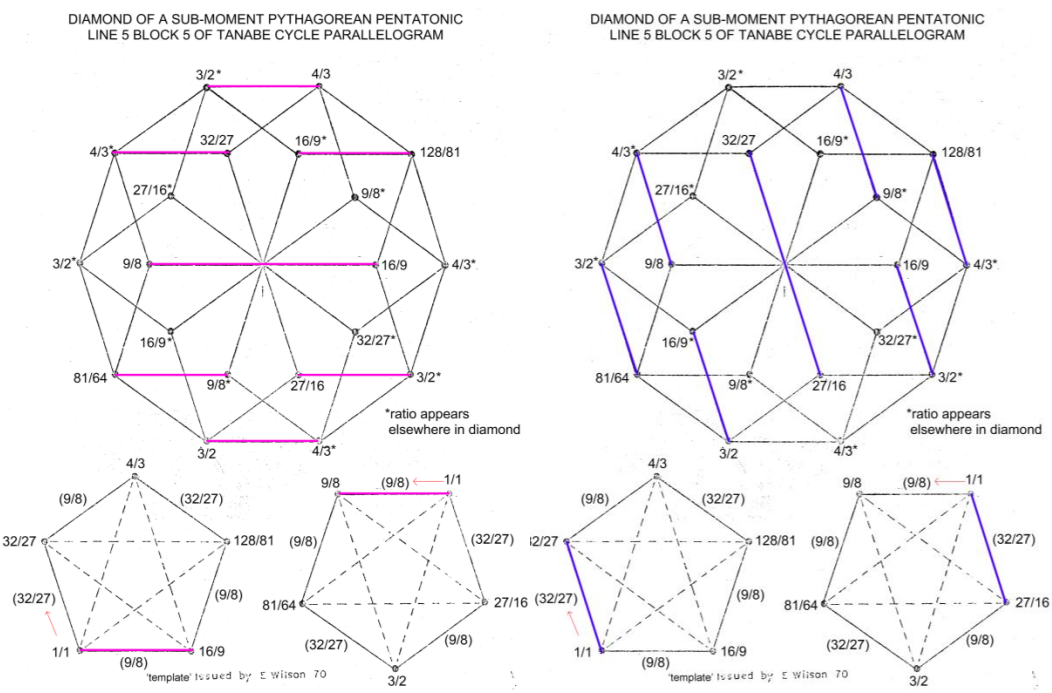
Web Figure 4.6. First Pentadic Diamond showing the blue pentatonic modes (starting with Block 5 Row 5) and blue reciprocal pentatonic modes (starting with Block 1 Row 1) of the Parallelogram from the Tanabe Cycle.



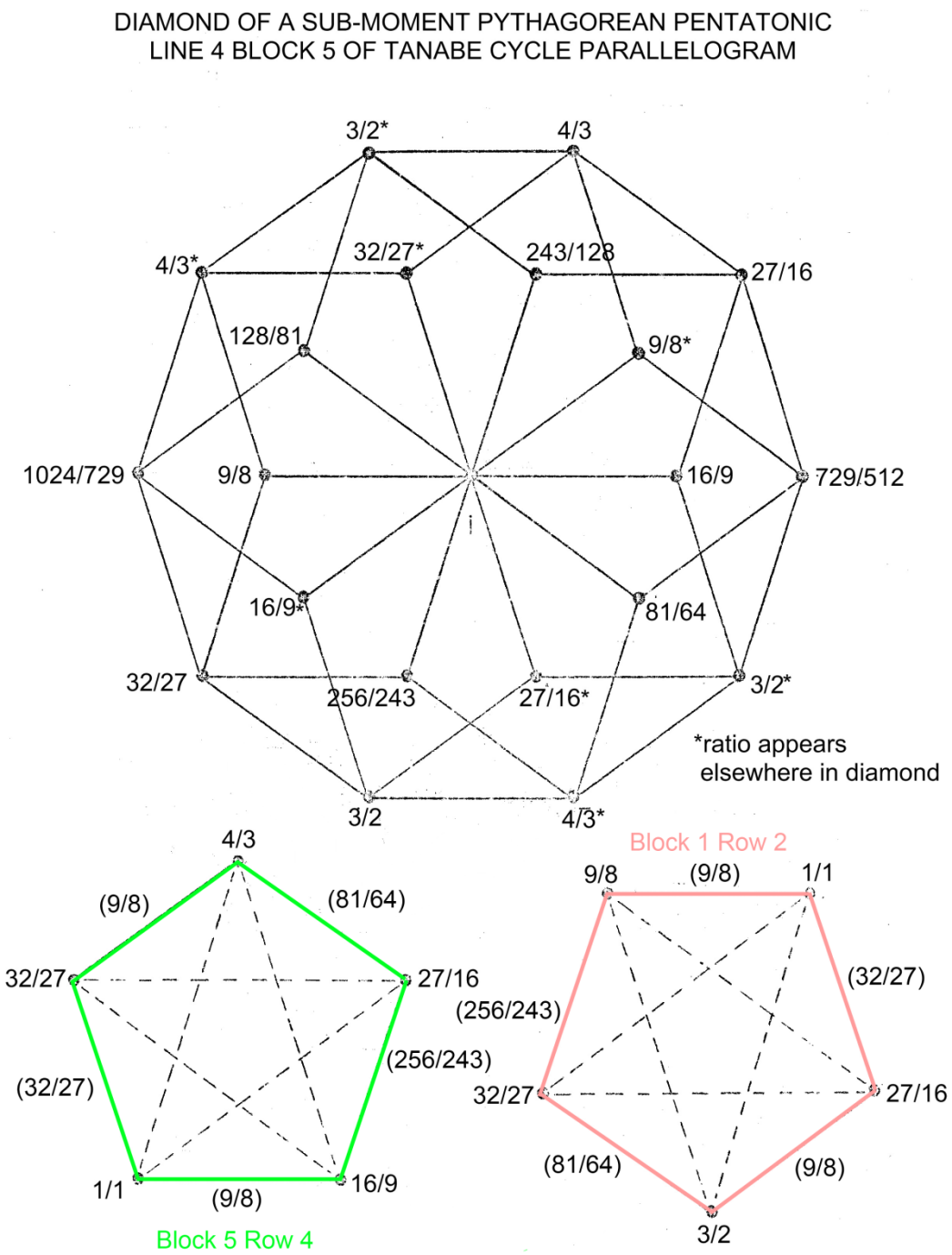
Web Figure 4.7. The blue pentatonic modes (starting with Block 5 Row 5) of the Parallelogram from the Tanabe Cycle on the first Pentadic Diamond.



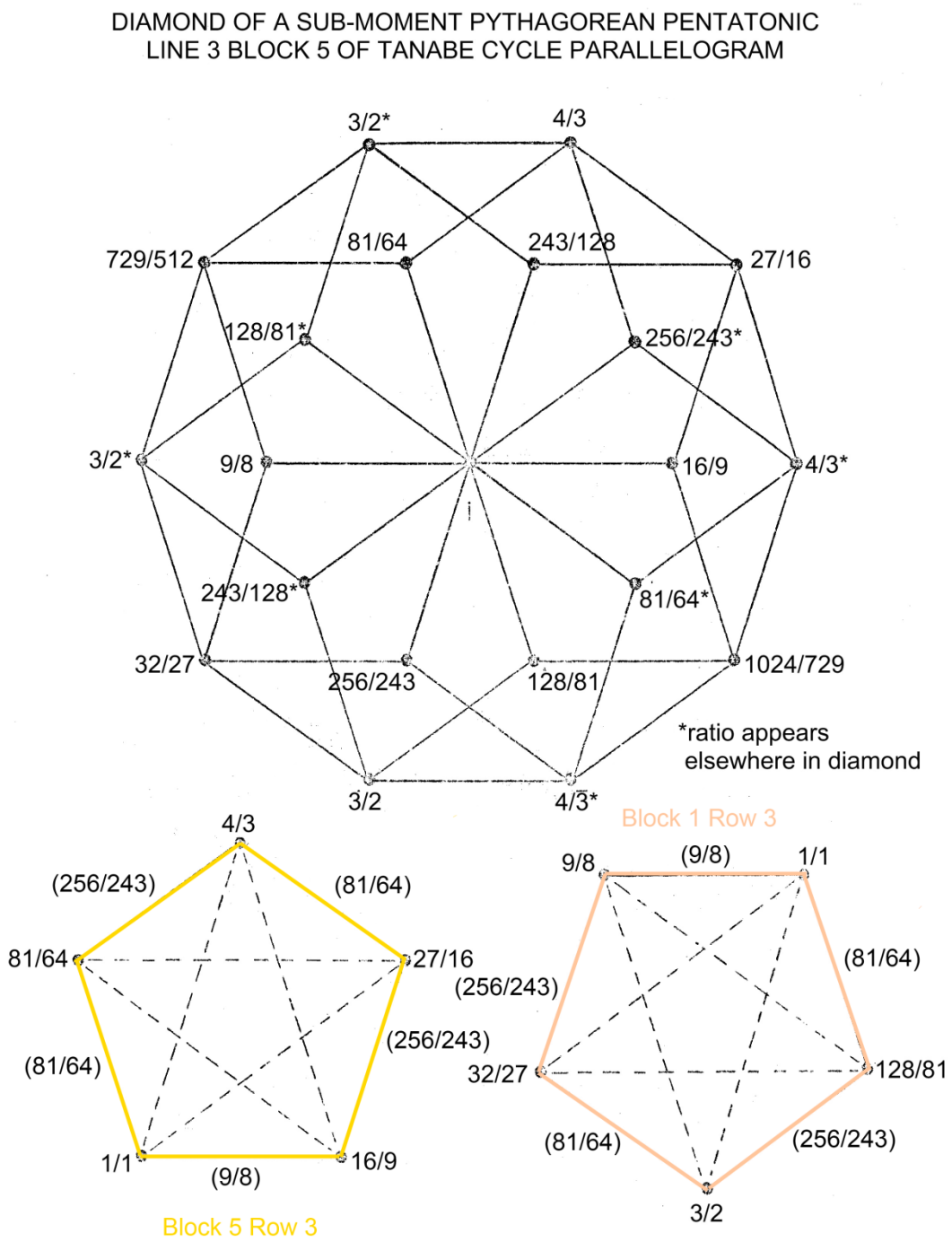
Web Figure 4.8. The blue inverse pentatonic modes (starting with Block 1 Row 1) of the Parallelogram from the Tanabe Cycle on the first Pentadic Diamond.



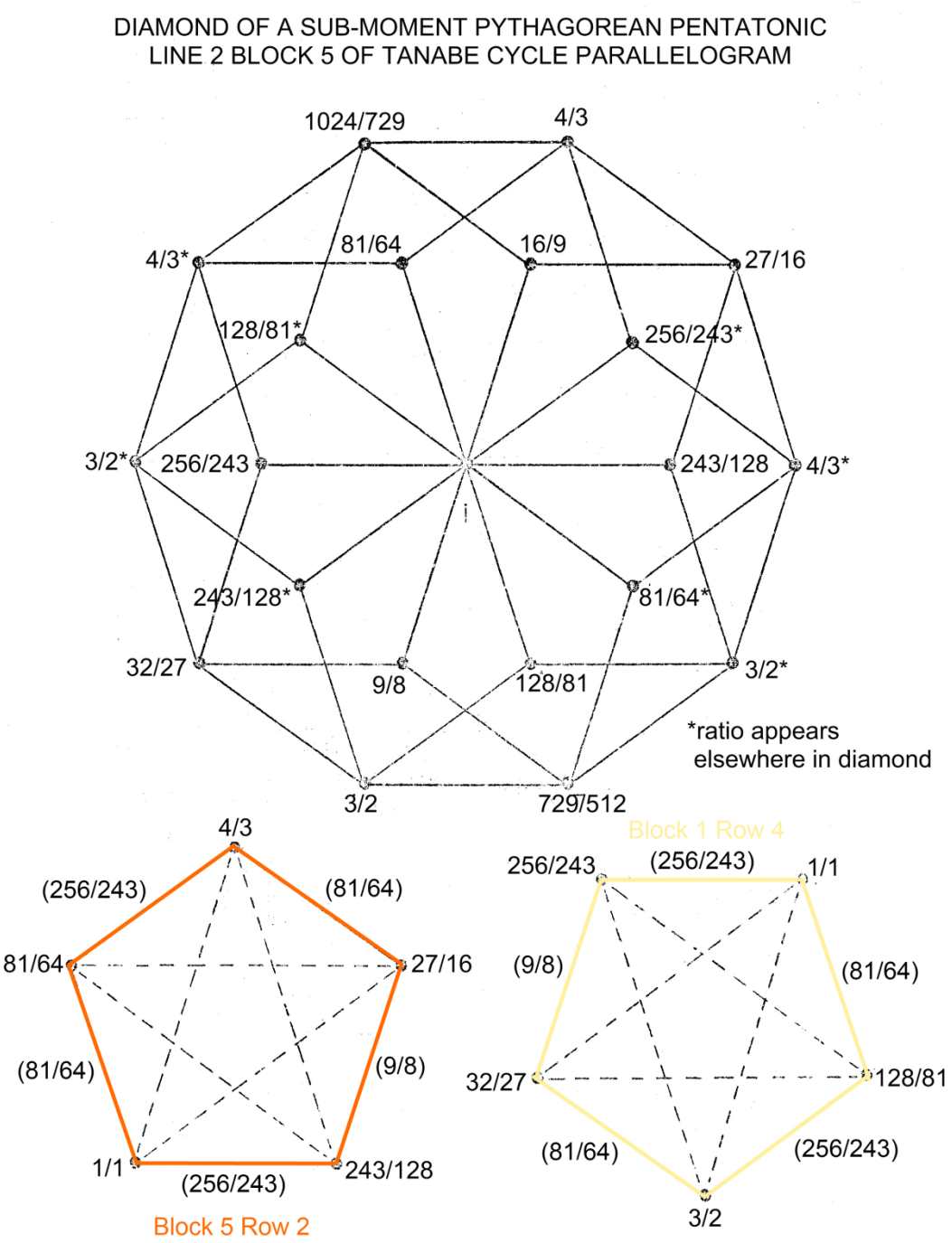
Web Figure 4.9. All horizontal lines in pink represent the interval 9/8 or its reciprocal 16/9, while all diagonal lines in dark blue represent the interval 32/27 or its reciprocal 27/16 on the first Pentadic Diamond showing blue the modes and inverse modes.



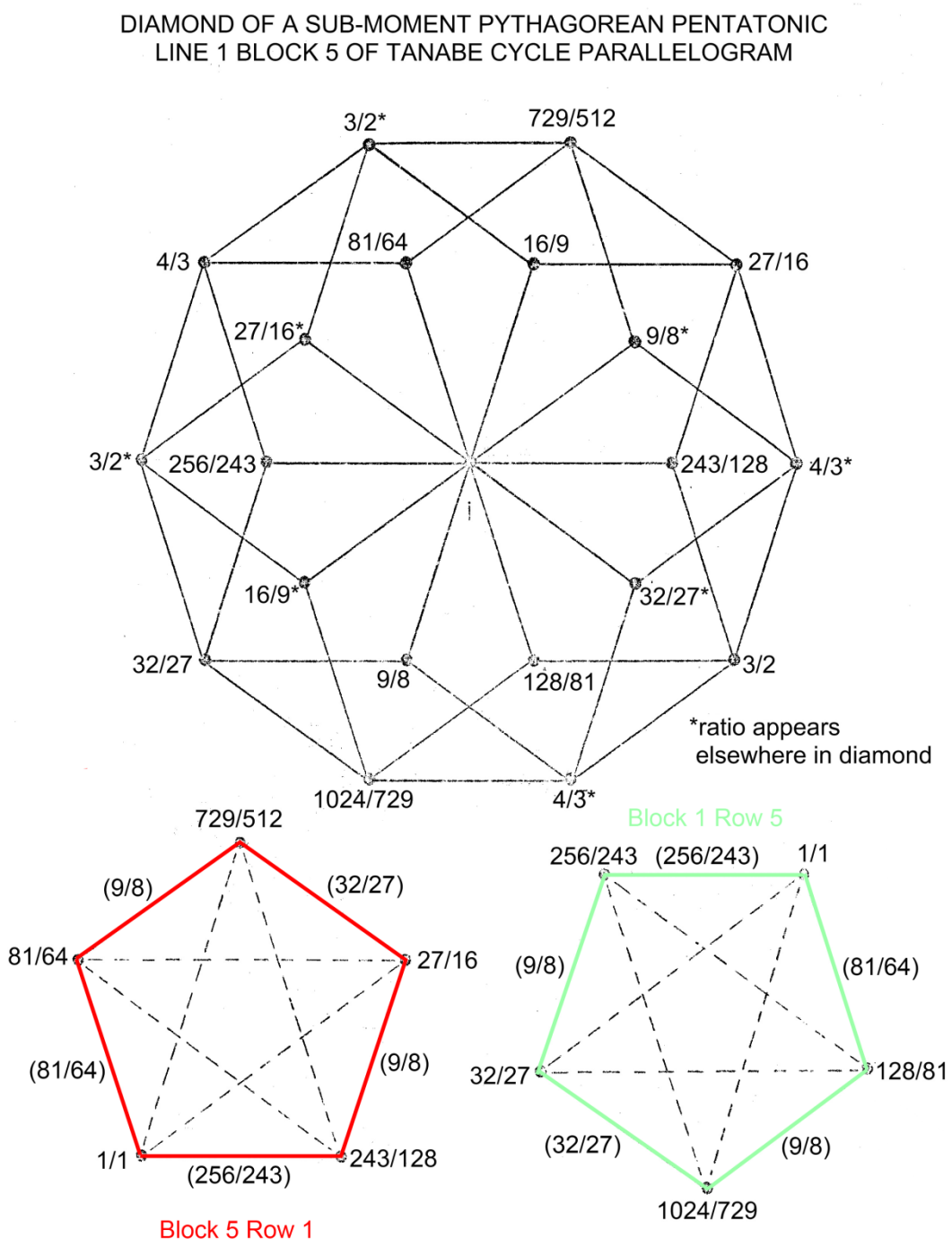
Web Figure 4.10. Second Pentadic Diamond showing the green pentatonic modes (starting with Block 5 Row 4) and red reciprocal pentatonic modes (starting with Block 1 Row 2) of the Parallelogram from the Tanabe Cycle.



Web Figure 4.11. Third Pentadic Diamond showing the yellow pentatonic modes (starting with Block 5 Row 3) and orange reciprocal pentatonic modes (starting with Block 1 Row 3) of the Parallelogram from the Tanabe Cycle.



Web Figure 4.12. Fourth Pentadic Diamond showing the orange pentatonic modes (starting with Block 5 Row 2) and yellow reciprocal pentatonic modes (starting with Block 1 Row 4) of the Parallelogram from the Tanabe Cycle.



Web Figure 4.13. Fifth Pentadic Diamond showing the red pentatonic modes (starting with Block 5 Row 1) and green reciprocal pentatonic modes (starting with Block 1 Row 5) of the Parallelogram from the Tanabe Cycle.

STRAIGHT LINE PATTERNS OF THE SCALE TREE

Audio demonstration of the Straight Line Patterns of the Scale Tree
http://anaphoria.com/StraightLinePatternsDemo.mp3

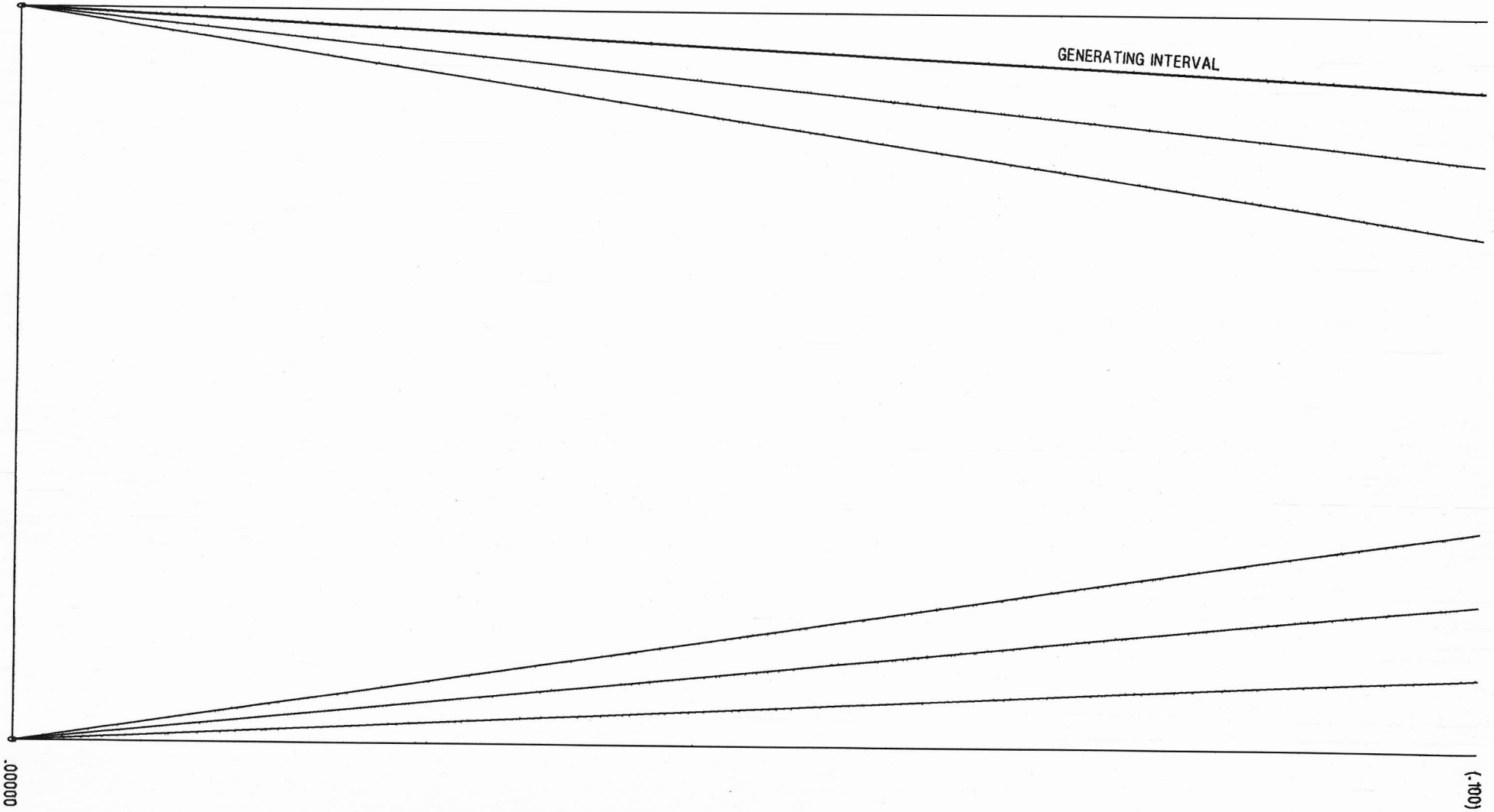
The leftmost and rightmost vertical lines in the diagram are represented as two pitches that are heard an octave apart in the audio demonstration of the Straight Line Patterns. This interval is sustained for the duration of the entire 5 minutes of the track, with each minute representing a page from Wilson's graph. Reading from the bottom of the first page upwards, the diagonal lines represent the generating interval and its superimpositions. These lines are heard as glissandi that gradually vary in pitch over time.

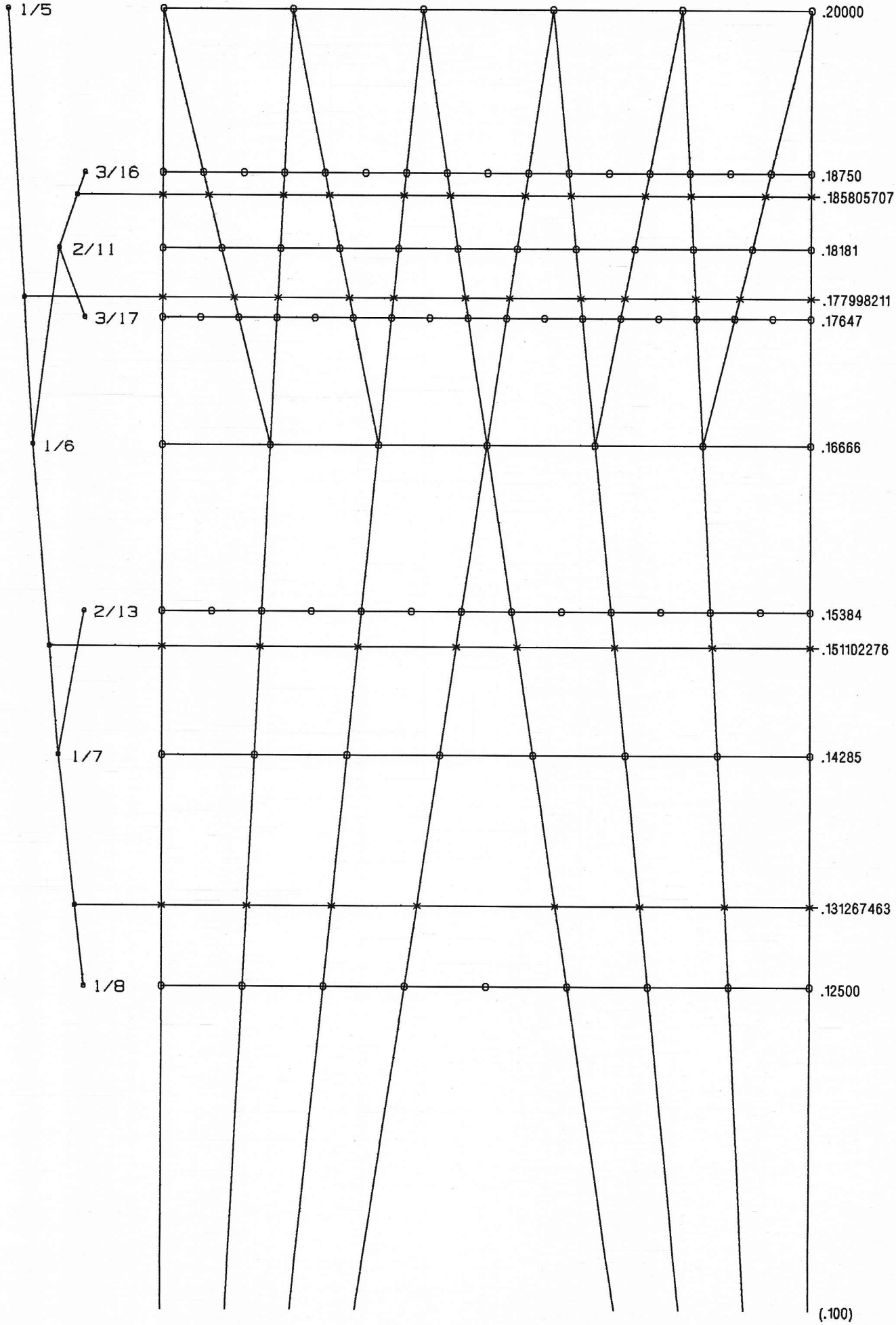
The graph continues on the next page from the bottom up. The horizontal lines that cut across the diagonals represent two types of MOS scales: those marked with circles are ET scales (the horizontal line is divided into segments of equal size), and those with crosses are Noble MOS. All these scales are heard as chords that punctuate the glissandi. For example, the first horizontal line at the bottom of the second page represents a 1/8 ET scale. This is heard as a chord at around 1:15 on the audio track. The next line above is a Noble MOS with generator 0.131267463 and this is heard as the second chord which has a different timbre to distinguish the Noble MOS from the ET chords.

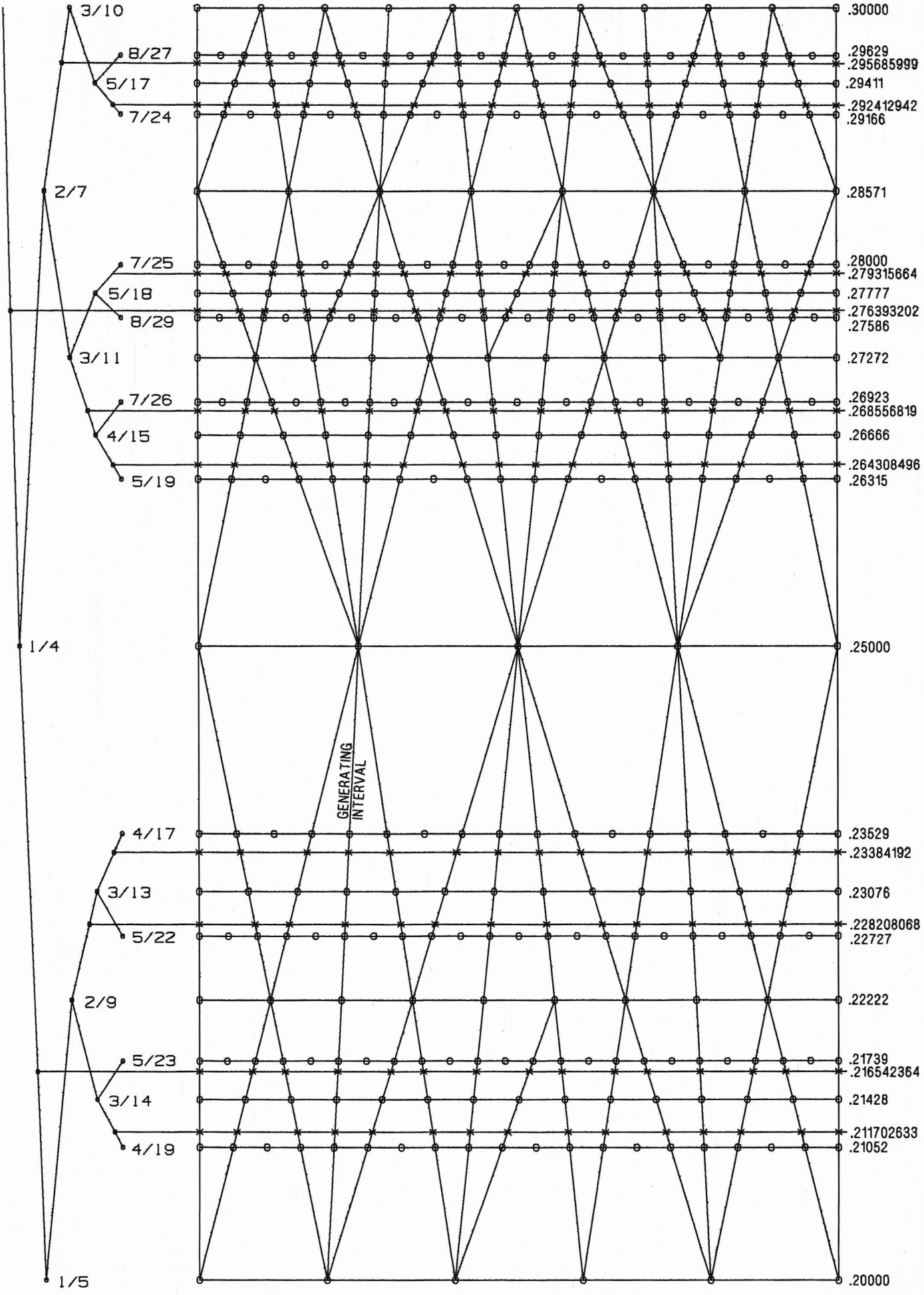
The audio demonstration was realised using Csound.

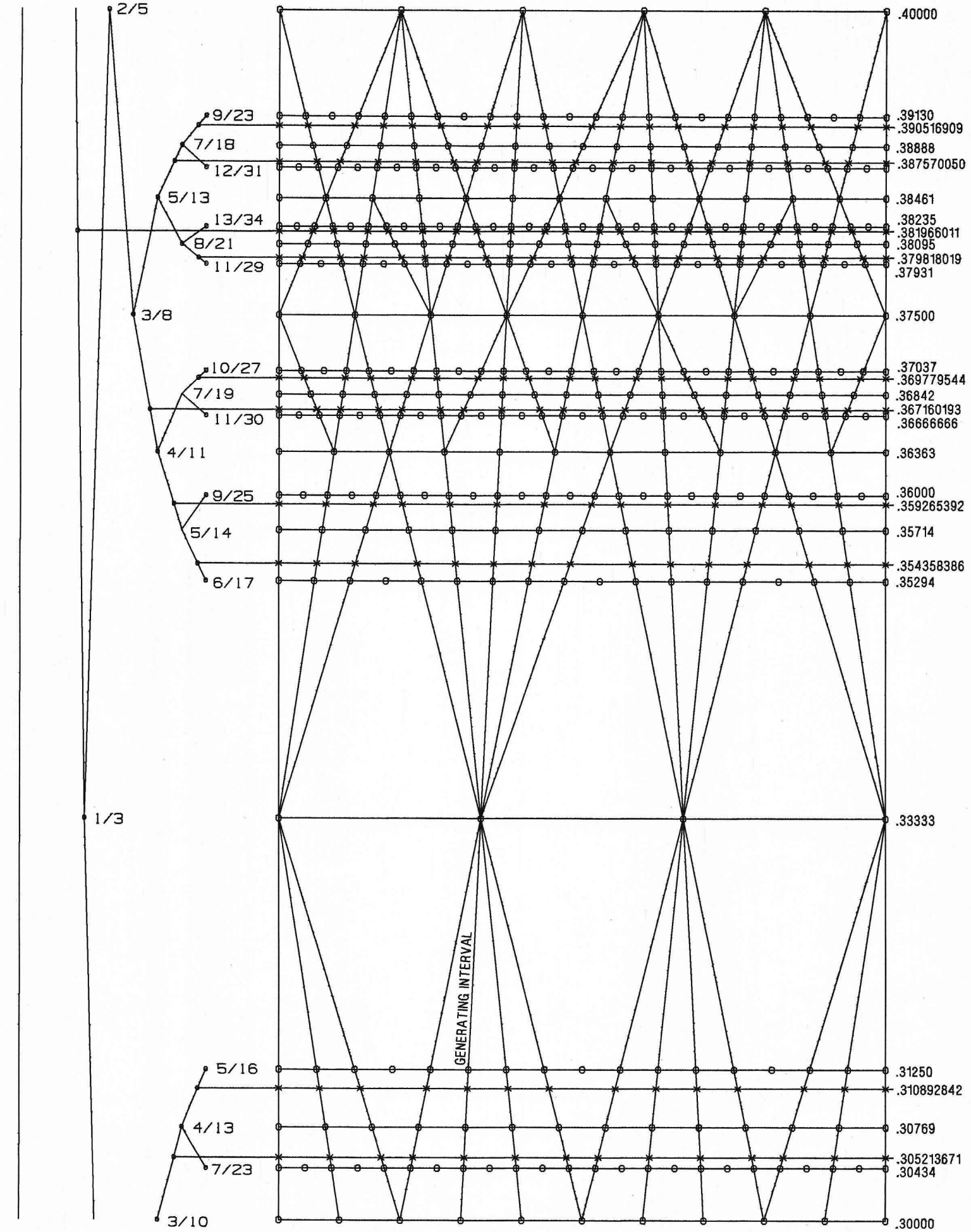
Instructions for how to calculate the Noble MOS scales, as well as a complete list of all Noble MOS that appear on the Straight Line Patterns of the Scale Tree, are included on the pages that follow the graph below.

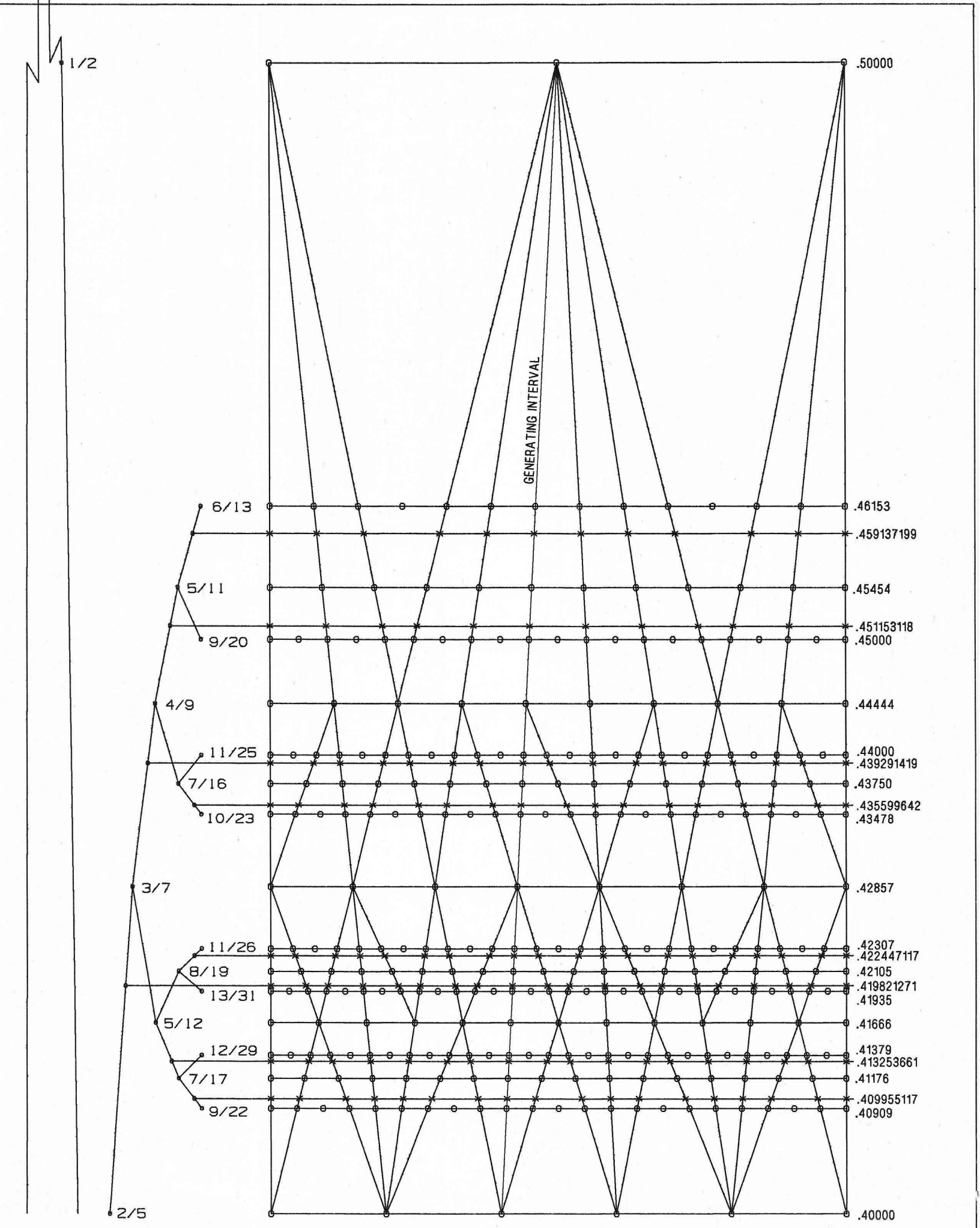
STRAIGHT LINE PATTERNS
Of the Scale Tree from 0/1 to 1/2




1/5
3/16
2/11
3/17
1/6
2/13
1/7
1/8
.20000
.18750
.185805707
.18181
.177998211
.17647
.16666
.15384
.151102276
.14285
.131267463
.12500
(.100)


3/10
8/27
5/17
7/24
2/7
7/25
5/18
8/29
3/11
7/26
4/15
5/19
1/4
4/17
3/13
5/22
2/9
5/23
3/14
4/19
1/5
GENERATING INTERVAL
.30000
.29629
.295685999
.29411
.292412942
.29166
.28571
.28000
.279315664
.27777
.276393202
.27586
.27272
.26923
.268556819
.26666
.264308496
.26315
.25000
.23529
.23384192
.23076
.228208068
.22727
.22222
.21739
.216542364
.21428
.211702633
.21052
.20000


2/5
9/23
7/18
12/31
5/13
13/34
8/21
11/29
3/8
10/27
7/19
11/30
4/11
9/25
5/14
6/17
1/3
5/16
4/13
7/23
3/10
GENERATING INTERVAL
.40000
.39130
.390516909
.38888
.387570050
.38461
.38235
.381966011
.38095
.379818019
.37931
.37500
.37037
.369779544
.36842
.367160193
.36666666
.36363
.36000
.359265392
.35714
.354358386
.35294
.33333
.31250
.310892842
.30769
.305213671
.30434
.30000


1/2
.50000
GENERATING INTERVAL
6/13
.46153
.459137199
5/11
.45454
.451153118
9/20
.45000
4/9
.44444
11/25
.44000
.439291419
7/16
.43750
.435599642
10/23
.43478
3/7
.42857
11/26
.42307
.422447117
8/19
.42105
.419821271
13/31
.41935
5/12
.41666
12/29
.41379
.413253661
7/17
.41176
.409955117
9/22
.40909
2/5
.40000

How to calculate frequencies for Noble MOS scales on the Straight Line Patterns of the Scale Tree using Scala

1. Find the convergence value indicated on the right side of the Straight Line Patterns next to the Noble MOS (non-ET MOS). These are marked with x's in place of dots, e.g. for Horogram 4 the convergence value is {(2phi + 1) / (11phi + 5)} = 0.185805707. This value is also indicated at the bottom of each page of the 32 Horograms (Wilson 1991).

2. Multiply this number by 1200 cents to obtain the size of the generating interval in cents, e.g. 0.185805707 x 1200 = 222.9668484 cents. Make a note of this value for later use.

3. Check on the Straight Line Patterns diagram the number of iterations of the generator in the positive (+1, +2, +3, etc.) and negative (-1, -2, -3, etc.) directions of the linear chain. If the scale has an odd number of notes, the linear chain will be symmetrical: it will have the same number of iterations up and down. If, however, the scale has an even number of notes, Wilson usually favours the chain in the positive (up direction) rather than down, e.g. Horogram 5 3/14 has +7, -6. [There seems to be an exception to this general preference for Horograms 29 and 30 (7/16 MOS): here, Wilson instead favours the negative over positive, i.e. +7 -8.] Also check what scale degree the generating interval lands on (see diagonal line labelled "GENERATING INTERVAL" in Straight Line Patterns diagram and count from the left the scale degree of the point where the line crosses the Noble MOS scale). For example, the scale for Horogram 4 on the Straight Line Patterns has 11 pitches: +5 and -5, with the generator on the 2nd scale degree, i.e. a 2/11 MOS.

4. In Scala, go File > New > Linear temperament, and enter the following information, e.g. for Horogram 4 Noble MOS with convergence value 0.185805707, scale with 11 notes, generators +5 and -5 ("number of fifths down"):

Scale size:	11 (number of notes in scale)
Formal octave (period):	2/1 (for octave)
Formal fifth (generator):	222.9668484 (cents value)
Number of fifths down:	5 (in linear chain; Scala calculates the required number of fifths up to obtain the correct number of notes in the scale)
Formal fifth degree:	2 (seems this does not need to be specified in Scala)

   Hit "OK". In the Scala main window, click on the "Show" button at the top to see the values of the new scale. To edit the scale, click on the "Edit" button.

5. While in "Edit Current Scale" window, check that the scale is correct (look at relative sizes of L and s interval patterns on the Straight Line Patterns diagram or Horogram. Include a "Description" of the scale at the top of the window. To save the scale as an Excel file (remember to name the file with .xls suffix), right-click on the "Pitch" list and select the "Write table to Excel file" option. When done, hit "OK". (Can also save scale from here by selecting "Save As").

6. To show the *linear factors* of the scale (e.g. to use in Csound), type “echo %listfactor(0)” (where 0=scale number in Scala) [command line written by Manuel Op de Coul upon Greg Schiemer’s request].

7. Back in the main Scala window, go to File > SaveAs and save the scale in Scala for later use.

8. Alternatively, if not using Scala, pitches for Noble MOS can be calculated using the following formula: new frequency = last note frequency x 2^(generator size in cents / 1200).

List of Noble MOS scales on the Straight Line Patterns of the Scale Tree

Golden Horograms 1-32

Showing linear factors (top), scale degrees (left) and interval sizes in cents.

Noble MOS 0.131267463 Horogram 1

1.00000000 1.09525551 1.19958462 1.31385165 1.52224187 1.66724379 1.82605793

0.	0.000
1.	157.521
2.	315.042
3.	472.563
4.	727.437
5.	884.958
6.	1042.479

Noble MOS 0.151102276 Horogram 2

1.00000000 1.11041755 1.23302714 1.36917497 1.46073368 1.62202432 1.80112427

0.	0.000
1.	181.323
2.	362.645
3.	543.968
4.	656.032
5.	837.355
6.	1018.677

Noble MOS 0.177998211 Horogram 3

1.00000000 1.07923493 1.13131306 1.22095257 1.27986924 1.38127959 1.44793279 1.56265963 1.63806527 1.76785726 1.85316464 2.00000000

0.	0.000
1.	132.011
2.	213.598
3.	345.609
4.	427.196
5.	559.206
6.	640.794
7.	772.804
8.	854.391
9.	986.402
10.	1067.989

Noble MOS 0.185805707 Horogram 4

1.00000000 1.05042377 1.13745203 1.19480665 1.29379713 1.35903525 1.47163218 1.54583741 1.67391100 1.75831590 1.90399347 2.00000000

0.	0.000
1.	85.166
2.	222.967
3.	308.133
4.	445.934
5.	531.099
6.	668.901
7.	754.066
8.	891.867
9.	977.033
10.	1114.834

Noble MOS 0.211702633 Horogram 5

1.00000000 1.04139195 1.11202519 1.15805408 1.20598821 1.28778531 1.34108926 1.39659957 1.49132504 1.55305390 1.65839101 1.72703505 1.79852041 1.92050648

0.	0.000
1.	70.216
2.	183.827
3.	254.043
4.	324.259
5.	437.871
6.	508.086
7.	578.302
8.	691.914
9.	762.129
10.	875.741
11.	945.957
12.	1016.173
13.	1129.784

Noble MOS 0.216542364 Horogram 6

1.00000000 1.05900677 1.09720305 1.16194547 1.23050812 1.27489012 1.35011727 1.42978334 1.48135280 1.56876265 1.62534481 1.72125117 1.82281666 1.88856205

0.	0.000
1.	99.254
2.	160.597
3.	259.851
4.	359.105
5.	420.447
6.	519.702
7.	618.956
8.	680.298
9.	779.553
10.	840.895
11.	940.149
12.	1039.403
13.	1100.746

Noble MOS 0.228208068 Horogram 7

1.00000000 1.06228268 1.10270000 1.17137911 1.24433574 1.29167974 1.37212901 1.45758889 1.54837143 1.60728325 1.70738917 1.81372994 1.88273803

0.	0.000
1.	104.601
2.	169.248
3.	273.850
4.	378.451
5.	443.098
6.	547.699
7.	652.301
8.	756.902
9.	821.549
10.	926.150
11.	1030.752
12.	1095.399

Noble MOS 0.23384192 Horogram 8

1.00000000 1.04581837 1.12444227 1.17596239 1.22984307 1.32230182 1.38288754 1.44624920 1.51251399 1.62622374 1.70073467 1.77865956 1.91237796

0.	0.000
1.	77.559
2.	203.052
3.	280.610
4.	358.169
5.	483.662
6.	561.221
7.	638.779
8.	716.338
9.	841.831
10.	919.390
11.	996.948
12.	1122.441

Noble MOS 0.264308496 Horogram 9

1.00000000 1.04046900 1.10944683 1.15434503 1.20106023 1.24966594 1.33251246 1.38643791 1.44254567 1.50092405 1.60042771 1.66519543 1.73258423 1.80270018 1.92221008

0.	0.000
1.	68.681
2.	179.809
3.	248.489
4.	317.170
5.	385.851
6.	496.979
7.	565.660
8.	634.340
9.	703.021
10.	814.149
11.	882.830
12.	951.511
13.	1020.191
14.	1131.319

Noble MOS 0.268556819 Horogram 10

1.00000000 1.05279699 1.08681190 1.14419230 1.20460221 1.26820159 1.30917602 1.37829658 1.45106650 1.52767845 1.57703634 1.66029912 1.74795793 1.84024485 1.89970147

0.	0.000
1.	89.073
2.	144.123
3.	233.195
4.	322.268
5.	411.341
6.	466.391
7.	555.464
8.	644.536
9.	733.609
10.	788.659
11.	877.732
12.	966.805
13.	1055.877
14.	1110.927

Noble MOS 0.276393202 Horogram 11

1.00000000 1.04626448 1.07592149 1.12569843 1.15760705 1.21116314 1.26719697 1.30311645 1.36340445 1.40205099 1.46691614 1.53478226 1.57828660 1.65130521 1.72770198 1.77667477 1.85887169 1.91156256

0.	0.000
1.	78.297
2.	126.687
3.	204.984
4.	253.375
5.	331.672
6.	409.969
7.	458.359
8.	536.656
9.	585.047
10.	663.344
11.	741.641
12.	790.031
13.	868.328
14.	946.625
15.	995.016
16.	1073.313
17.	1121.703

Noble MOS 0.279315664 Horogram 12

1.00000000 1.03153327 1.08467487 1.11887821 1.17651956 1.21361908 1.25188845 1.31638210 1.35789194 1.42784658 1.47287125 1.51931570 1.59758643 1.64796355 1.69992924 1.78750465 1.84387051 1.93886137

0	0.000
1	53.748
2	140.715
3	194.464
4	281.430
5	335.179
6	388.927
7	475.894
8	529.642
9	616.609
10	670.358
11	724.106
12	811.073
13	864.821
14	918.570
15	1005.536
16	1059.285
17	1146.252

Noble MOS 0.292412942 Horogram 13

1.00000000 1.03303604 1.08881676 1.12478695 1.18552193 1.22468688 1.26514569 1.33345960 1.37751183 1.45189316 1.49985796 1.58084560 1.63307048 1.68702067 1.77811451 1.83685637 1.93604087

0	0.000
1	56.269
2	147.313
3	203.582
4	294.627

5	350.896
6	407.164
7	498.209
8	554.478
9	645.522
10	701.791
11	792.836
12	849.104
13	905.373
14	996.418
15	1052.687
16	1143.731

Noble MOS 0.295685999 Horogram 14

1.00000000 1.04957262 1.08143129 1.13504068 1.16949363 1.22746850 1.28831733 1.32742284 1.39322667 1.43551659 1.50667891 1.55241256 1.62936972 1.71014184 1.76205139 1.84940091 1.90553751

0	0.000
1	83.762
2	135.530
3	219.293
4	271.061
5	354.823
6	438.586
7	490.354
8	574.116
9	625.884
10	709.646
11	761.414
12	845.177
13	928.939
14	980.707
15	1064.470
16	1116.238

Noble MOS 0.305213671 Horogram 15

1.00000000 1.06021656 1.12405917 1.16542380 1.23560163 1.31000531 1.38888933 1.43999955 1.52671137 1.61864468 1.71611391 1.77926577 1.88640705

0	0.000
1	101.231
2	202.462
3	265.026
4	366.256
5	467.487
6	568.718
7	631.282
8	732.513
9	833.744
10	934.974
11	997.538
12	1098.769

Noble MOS 0.310892842 Horogram 16

1.00000000 1.04776958 1.09782108 1.18391981 1.24047516 1.29973213 1.36181978 1.46862311 1.53877861 1.61228541 1.68930360 1.82179048 1.90881664

0	0.000
1	80.786
2	161.572
3	292.286
4	373.071
5	453.857
6	534.643
7	665.357
8	746.143
9	826.929
10	907.714
11	1038.428
12	1119.214

Noble MOS 0.354358386 Horogram 17

1.00000000 1.04469019 1.09137758 1.17137911 1.22372826 1.27841690 1.33554959 1.39523555 1.49751085 1.56443489 1.63434978 1.70738917 1.83254634 1.91444318

0	0.000
1	75.690
2	151.380
3	273.850
4	349.540
5	425.230
6	500.920
7	576.610
8	699.080
9	774.770
10	850.460
11	926.150
12	1048.620
13	1124.310

Noble MOS 0.359265392 Horogram 18

1.00000000 1.05540460 1.11387887 1.15162662 1.21543203 1.28277255 1.35384405 1.42885324 1.47727502 1.55912285 1.64550543 1.73667399 1.79552738 1.89500785

0	0.000
1	93.355
2	186.711
3	244.408
4	337.763
5	431.118
6	524.474
7	617.829
8	675.526
9	768.882
10	862.237
11	955.592
12	1013.289
13	1106.645

Noble MOS 0.367160193 Horogram 19

1.00000000 1.04443192 1.07287394 1.12054379 1.15105850 1.20220224 1.23494067 1.28981146 1.34712026 1.38380511 1.44529022 1.48464844 1.55061423 1.61951100 1.66361360 1.73753115 1.78484769 1.86415190 1.91491658

0	0.000

1	75.262
2	121.777
3	197.039
4	243.553
5	318.816
6	365.330
7	440.592
8	515.854
9	562.369
10	637.631
11	684.146
12	759.408
13	834.670
14	881.184
15	956.447
16	1002.961
17	1078.223
18	1124.738

Noble MOS 0.369779544 Horogram 20

1.00000000 1.02937143 1.07873361 1.11041756 1.16366619 1.19784473 1.25528583 1.29215536 1.33010782 1.39389141 1.43483200 1.50363751 1.54780150 1.59326263 1.66966549 1.71870594 1.80112426 1.85402586 1.94293327

0	0.000
1	50.116
2	131.206
3	181.323
4	262.413
5	312.529
6	393.619
7	443.735
8	493.852
9	574.942
10	625.058
11	706.148
12	756.265
13	806.381
14	887.471
15	937.587
16	1018.677
17	1068.794
18	1149.884

Noble MOS 0.379818019 Horogram 21

1.00000000 1.02707686 1.07244964 1.10148821 1.15014823 1.18129064 1.21327629 1.26687472 1.30117771 1.33640953 1.39544757 1.43323192 1.49654725 1.53706906 1.57868806 1.64842915 1.69306345 1.73890629 1.81572528 1.86488943 1.94727393

0	0.000
1	46.253
2	121.092
3	167.345
4	242.184
5	288.437
6	334.690
7	409.529

8	455.782
9	502.035
10	576.874
11	623.126
12	697.965
13	744.218
14	790.471
15	865.310
16	911.563
17	957.816
18	1032.655
19	1078.908
20	1153.747

Noble MOS 0.381966011 Horogram 22

1.00000000 1.03938352 1.06449557 1.10641915 1.13315082 1.17777828 1.22416334 1.25373977 1.30311645 1.35443776 1.38716169 1.44179299 1.47662747 1.53478226 1.59522738 1.63376891 1.69811248 1.76499012 1.80763321 1.87882417 1.92421754

0	0.000
1	66.874
2	108.204
3	175.078
4	216.408
5	283.282
6	350.155
7	391.486
8	458.359
9	525.233
10	566.563
11	633.437
12	674.767
13	741.641
14	808.514
15	849.845
16	916.718
17	983.592
18	1024.922
19	1091.796
20	1133.126

Noble MOS 0.387570050 Horogram 23

1.00000000 1.04402029 1.07218986 1.11938797 1.16866375 1.22010867 1.25302943 1.30818815 1.36577497 1.40262607 1.46437008 1.52883207 1.59613170 1.63919825 1.71135623 1.78669063 1.86534127 1.91567158

0	0.000
1	74.580
2	120.672
3	195.252
4	269.832
5	344.412
6	390.504
7	465.084
8	539.664
9	585.757
10	660.336

11	734.916
12	809.496
13	855.588
14	930.168
15	1004.748
16	1079.328
17	1125.420

Noble MOS 0.390516909 Horogram 24

1.00000000 1.03341194 1.08985430 1.12626844 1.16389925 1.20278738 1.26848060 1.31086299 1.35466147 1.42864967 1.47638362 1.52571246 1.57668947 1.66280428 1.71836179 1.77577559 1.83510769 1.93533665

0	0.000
1	56.899
2	148.962
3	205.861
4	262.759
5	319.658
6	411.722
7	468.620
8	525.519
9	617.583
10	674.481
11	731.380
12	788.278
13	880.342
14	937.241
15	994.139
16	1051.038
17	1143.101

Noble MOS 0.409955117 Horogram 25

1.00000000 1.03510390 1.09453204 1.13295438 1.17272549 1.21389273 1.28358562 1.32864448 1.37528508 1.45424395 1.50529358 1.55813525 1.64759205 1.70542895 1.76529615 1.82726492 1.93217319

0	0.000
1	59.731
2	156.377
3	216.108
4	275.838
5	335.569
6	432.215
7	491.946
8	551.677
9	648.323
10	708.054
11	767.785
12	864.431
13	924.162
14	983.892
15	1043.623
16	1140.269

Noble MOS 0.413253661 Horogram 26

1.00000000 1.04700498 1.07715389 1.12778548 1.18079702 1.23630036 1.27190010 1.33168573 1.39428160 1.43443046 1.50185584 1.57245054 1.61772985 1.69377121 1.77338690 1.85674491 1.91021058

0	0.000
1	79.522
2	128.669
3	208.191
4	287.713
5	367.235
6	416.382
7	495.904
8	575.426
9	624.574
10	704.096
11	783.618
12	832.765
13	912.287
14	991.809
15	1071.331
16	1120.478

Noble MOS 0.419821271 Horogram 27

1.00000000 1.04337018 1.07110978 1.11756400 1.16603295 1.19703374 1.24894930 1.28215454 1.33776182 1.39578078 1.43288977 1.49503445 1.55987436 1.60134602 1.67079668 1.71521739 1.78960667 1.86722223 1.91686522

0	0.000
1	73.501
2	118.928
3	192.429
4	265.930
5	311.357
6	384.858
7	430.284
8	503.786
9	577.287
10	622.713
11	696.214
12	769.716
13	815.142
14	888.643
15	934.070
16	1007.571
17	1081.072
18	1126.499

Noble MOS 0.422447117 Horogram 28

1.00000000 1.03016125 1.08090189 1.11350325 1.14708790 1.20358777 1.23988948 1.30096030 1.34019889 1.38062097 1.44862352 1.49231582 1.53732593 1.61304699 1.66169851 1.74354554 1.79613306 1.85030669 1.94144363

0	0.000
1	51.444
2	134.683
3	186.127
4	237.571

5	320.810
6	372.254
7	455.492
8	506.937
9	558.381
10	641.619
11	693.063
12	744.508
13	827.746
14	879.190
15	962.429
16	1013.873
17	1065.317
18	1148.556

Noble MOS 0.435599642 Horogram 29

1.00000000 1.03468921 1.09338441 1.13131306 1.19548948 1.23696007 1.30712956 1.35247286 1.42919509 1.47877274 1.53007020 1.61686707 1.67295492 1.76785726 1.82918283 1.93294757

0	0.000
1	59.037
2	154.561
3	213.598
4	309.122
5	368.159
6	463.683
7	522.720
8	618.243
9	677.280
10	736.317
11	831.841
12	890.878
13	986.402
14	1045.439
15	1140.963

Noble MOS 0.439291419 Horogram 30

1.00000000 1.05339019 1.08780289 1.14588089 1.18331513 1.24649255 1.28721361 1.35593819 1.40023469 1.47499349 1.55374367 1.60450217 1.69016685 1.74538210 1.83856839 1.89863169

0	0.000
1	90.048
2	145.701
3	235.749
4	291.401
5	381.449
6	437.102
7	527.150
8	582.802
9	672.850
10	762.898
11	818.551
12	908.599
13	964.251
14	1054.299
15	1109.952

Noble MOS 0.451153118 Horogram 31

1.00000000 1.07006154 1.14503169 1.19396918 1.27762049 1.36713254 1.46291595 1.56541009 1.67508512 1.74667655 1.86905139

0	0.000
1	117.233
2	234.465
3	306.919
4	424.151
5	541.384
6	658.616
7	775.849
8	893.081
9	965.535
10	1082.767

Noble MOS 0.459137199 Horogram 32

1.00000000 1.05828309 1.11996310 1.22746849 1.29900916 1.37471942 1.45484232 1.53963503 1.62936973 1.78577312 1.88985350

0	0.000
1	98.071
2	196.141
3	354.823
4	452.894
5	550.965
6	649.035
7	747.106
8	845.177
9	1003.859
10	1101.929