BARBS AND BROADSIDES

A RECORD OF HARRY PARTCH

Compiled by Danlee Mitchell

for the

FESTIVAL OF NEW INSTRUMENTAL RESOURCES

Center for Music Experiment

University of California at San Diego

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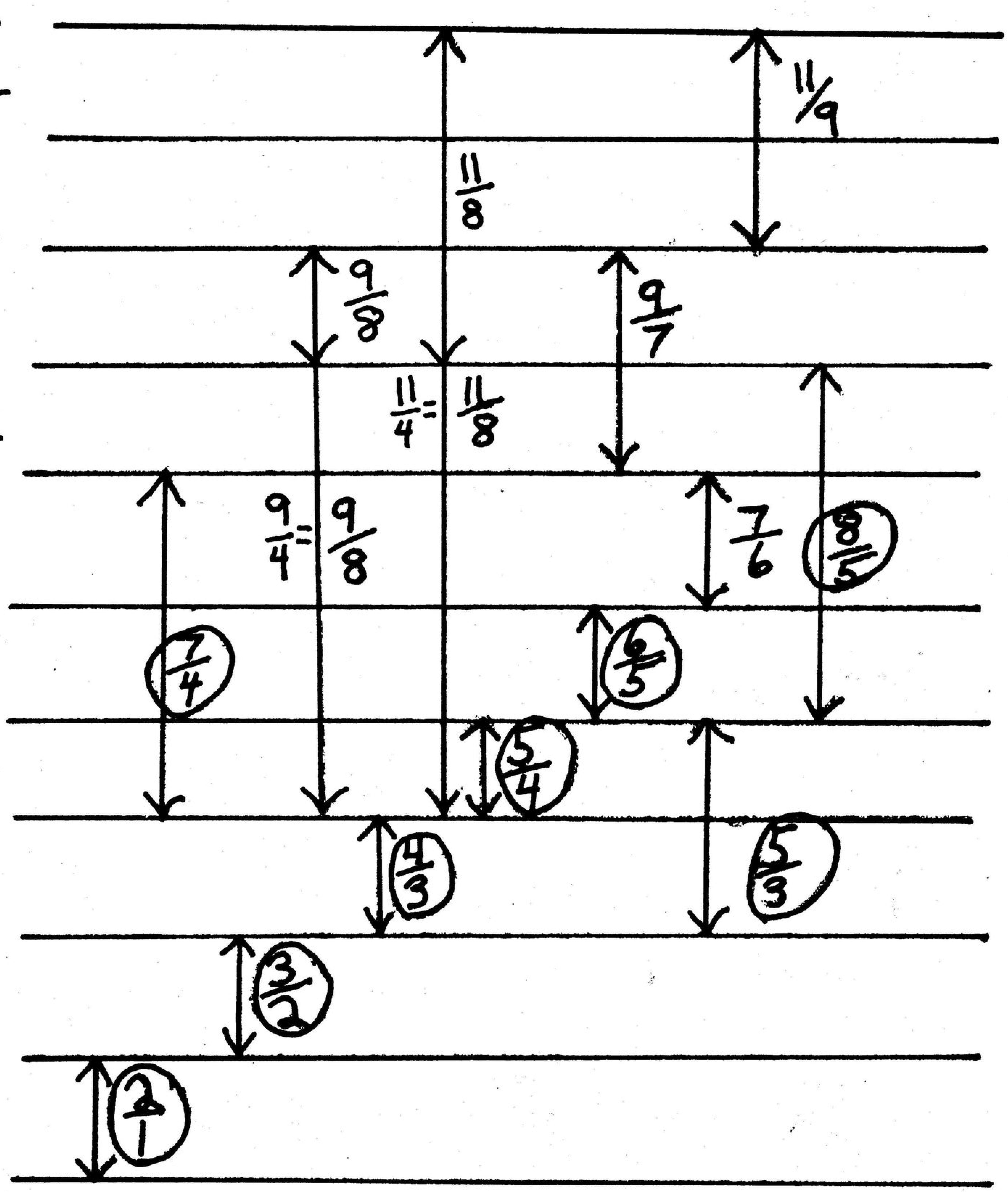
Partials

Partials as ratios to Fundamental $\frac{1}{1}$

Partials expressed as ratios within each octave

G	16	$\frac{16}{1}$	$\frac{1}{1}$
F#	15	$\frac{15}{1}$	$\frac{15}{8}$
F	14	$\frac{14}{1}$	$\frac{7}{4}$
E♭	13	$\frac{13}{1}$	$\frac{13}{8}$
D	12	$\frac{12}{1}$	$\frac{3}{2}$
C#	11	$\frac{11}{1}$	$\frac{11}{8}$
B	10	$\frac{10}{1}$	$\frac{5}{4}$
A	9	$\frac{9}{1}$	$\frac{9}{8}$
G	8	$\frac{8}{1}$	$\frac{1}{1}$
F	7	$\frac{7}{1}$	$\frac{7}{4}$
D	6	$\frac{6}{1}$	$\frac{3}{2}$
B	5	$\frac{5}{1}$	$\frac{5}{4}$
G	4	$\frac{4}{1}$	$\frac{1}{1}$
D	3	$\frac{3}{1}$	$\frac{3}{2}$
G	2	$\frac{2}{1}$	$\frac{1}{1}$
G	1	$\frac{1}{1}$	$\frac{1}{1}$

Just intervals found in the lower part of the overtone series



THINKING IN RATIOS

A RATIO IS A SYMBOL THAT REPRESENTS NOT ONLY A SINGLE TONE, BUT ALSO A DISTANCE OR INTERVAL BETWEEN TWO DIFFERENT TONES. THINKING IN RATIOS, OR CYCLES PER SECOND(A DIFFERENT MODE OF REFERENCE), IS MUCH MORE PRECISE THAN THINKING IN LETTER NAMES, WHEN A CLOSE STUDY OF MUSICAL MATERIALS IS BEING ORGANIZED AND DOCUMENTED.

1. To find an interval relationship above a given ratio:

MULTIPLY THE DISTANCE AND THE GIVEN RATIO

Let's say we want to find the distance of a 6/5 above the tone 3/2.
Do this: 6/5 X 3/2 = 18/10 = 9/5

(Ratios are always reduced down)

2. To find an interval relationship below a given ratio:

INVERT THE DISTANCE, THEN MULTIPLY THAT AND THE GIVEN RATIO

Suppose you want to find the distance of a 6/5 below the tone 3/2.
Do this: 5/6 X 3/2 = 15/12 = 5/4

(Ratios are always reduced down)

3. To find the interval relationship between two given ratios:

INVERT THE SMALLER OR NARROWER RATIO, THEN MULTIPLY BOTH

Suppose you want to know the distance between 4/3 and 3/2. To find the smaller ratio, divide the top number by the bottom number of each ratio to get a decimal fraction. The smaller decimal fraction is the smaller ratio.

Do this: $3\overline{)4}$ = 1.3 $2\overline{)3}$ = 1.5 (Therefore 4/3 is the smaller ratio)

Then do this: 3/4 X 3/2 = 9/8

4. To find the sum of two ratios, either as tones or distances, up or down:

MULTIPLY THE TWO RATIOS

The process here is the same as #1, but the concept is slightly different. Suppose you want to find out the interval of two, successive 3/2's.
Do this: 3/2 X 3/2 = 9/4 = 9/8

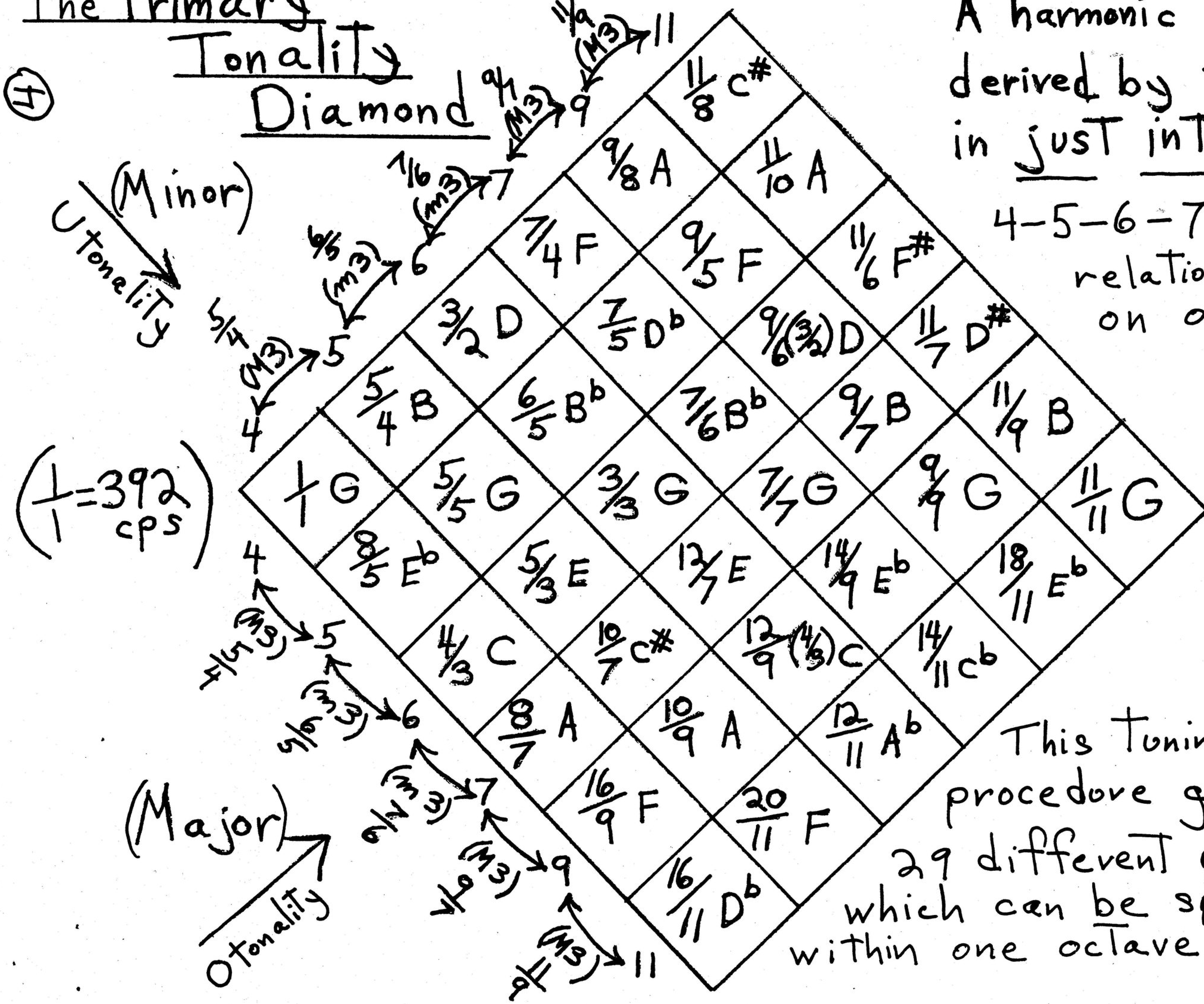
(The ratio 9/4 is brought into the range expressed within one octave by doubling the 4. The 9 cannot be halved)

The Primary Tonality Diamond

4

A harmonic grid derived by tuning in just intonation.

4–5–6–7–9–11 relationships on one tone



This tuning procedure gives 29 different pitches, which can be spaced within one octave.

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drian scientist of the second century, the ratios within the 11 limit are either given or implied, as a body. "Implied," in the sense intended here, does not signify any sort of temperament; it signifies a realization of all intervals between degrees (see page 171). These scales were either Ptolemy's own, or versions by Archytas, Eratosthenes, or Didymus, explaining the diatonic, chromatic, and enharmonic genera in terms of monochord ratios. Although prime numbers larger than 11 appear, they do not appear nor are implied as a body; that is, not all possible ratios within a limit higher than 11 are given or implied.

In Ptolemy's scales there is enough evidence to warrant the conclusion that his procedure was generally governed by the principle of appropriating the smallest-number ratios permissible to the purpose of the scale in question. In this light it is quite natural that he should have used all the ratios of the 11 limit as a body.

Orientation of Ratios in the 11 Limit

The ratios of the 11 limit, totaling twenty-nine, are given below, with the intervals between degrees and the number of cents in each degree and each interval between degrees:

Cents	0	150.6	165.0	182.4	203.9	231.2
Degrees	1/1	12/11	11/10	10/9	9/8	8/7
Cents	12/11 150.6	121/120 14.4	100/99 17.4	81/80 21.5	64/63 27.3	49/48 35.7
Cents	266.9	315.6	347.4	386.3	417.5	435.1
Degrees	7/6	6/5	11/9	5/4	14/11	9/7
Cents	36/35 48.7	55/54 31.8	45/44 38.9	56/55 31.2	99/98 17.6	28/27 63.0
Cents	498.0	551.3	582.5	617.5	648.7	702.0
Degrees	4/3	11/8	7/5	10/7	16/11	3/2
Cents	33/32 53.2	56/55 31.2	50/49 35.0	56/55 31.2	33/32 53.2	28/27 63.0
Cents	764.9	782.5	813.7	852.6	884.4	933.1
Degrees	14/9	11/7	8/5	18/11	5/3	12/7
Cents	99/98 17.6	56/55 31.2	45/44 38.9	55/54 31.8	36/35 48.7	49/48 35.7
Cents	968.8	996.1	1017.6	1035.0	1049.4	1200
Degrees	7/4	16/9	9/5	20/11	11/6	2/1
Cents	64/63 27.3	81/80 21.5	100/99 17.4	121/120 14.4	12/11 150.6	

center

The circles show gaps in the scale of the 29 "primary" ratios, derived by 11 limit, tonality diamond tuning. The next page shows how these gaps are filled.

D.M.

6

The circled ratios are new "secondary" ratios, derived by tuning 4-5-6-7-9-11 harmonic relationships on 3/2 + 6/5, and subharmonic relationships on 4/3 + 5/3. D.M.

9; six, 16/15–O, 15/8–U, 32/27–O, 27/16–U, 9/5–O, and 10/9–U, have the 9 Identities, but 7 is missing in all. The remaining four of the secondary tonalities, 7/5–O, 10/7–U, 27/20–O, and 40/27–U, are represented only by triads; that is, they are complete only through the 5 Identities.

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THE SIXTEEN SECONDARY TONALITIES

Otonalities (Upward)

4/1 Unity	5 5 Odentity	6 3 Odentity	7 7 Odentity	9 9 Odentity	11 11 Odentity
3/2	15/8	9/8	21/16	27/16	33/32
6/5	3/2	9/5	21/20	27/20	——
9/5	9/8	27/20	——	81/80	——
16/15	4/3	8/5	——	6/5	——
32/21	40/21	8/7	4/3	12/7	——
32/27	40/27	16/9	——	4/3	——
7/5	7/4	21/20	——	——	——
27/20	27/16	81/80	——	——	——

Utonalities (Downward)

4/1 Unity	5 5 Udentity	6 3 Udentity	7 7 Udentity	9 9 Udentity	11 11 Udentity
4/3	16/15	16/9	32/21	32/27	64/33
5/3	4/3	10/9	40/21	40/27	——
10/9	16/9	40/27	——	160/81	——
15/8	3/2	5/4	——	5/3	——
21/16	21/20	7/4	3/2	7/6	——
27/16	27/20	9/8	——	3/2	——
10/7	8/7	40/21	——	——	——
40/27	32/27	160/81	——	——	——

The Question of Extraneous Phenomena

To catalog the effects of minor tonal phenomena upon Monophony's listed resources would expand this volume to encyclopedic size. An outline of the project—and I use the word advisedly—would mean an examination of the effects upon each of the 340 Monophonic intervals, and upon every triad, every quadrad, every hexad, and upon every "inversion" of every triad, quadrad, and hexad, of the following factors: (1) the harmonic content, or quality, of each musical tone in an interval or chord, and its potential for dissonance, in every musical register; (2) combinational tones, difference and summation,[1] of the first order and of the second order, for

[1] Perrett calls this Helmholtz's "hypothetical summation tone." *Questions of Musical Theory*, 85.

The rationale for using 3/2, 6/5, 4/3, and 5/3 To derive the "secondary" Tonalities can be found on pages 114, 115 and 186 in Partch's book, Genesis of a Music. D.M.

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Below the solid lines other harmonic + subharmonic relationships pop up, willy-nilly, from all the pitches derived so far.
D.M.

Circled ratios are the new "secondary" ratios, derived To fill-in the gaps of the "primary" pitch scale. DPM. 7

The Forty-Three-Tone Scale

Diagram 8 graphs the sequence of steps of the Monophonic fabric against a scale tempered to exactly twelve equal steps; the ratios that correspond most closely to the common chromatic scale (excepting "C#") are shown in a larger size. Below is given the sequence of fabric degrees, showing the number of cents in each degree and in each interval between degrees, as usual:

Cents	0		21.5		53.2		84.5		111.7		150.6		
Degrees	1/1		81/80		33/32		21/20		16/15		12/11		
Cents		81/80 21.5		55/54 31.8		56/55 31.2		64/63 27.3		45/44 38.9		121/120 14.4	
Cents	165.0		182.4		203.9		231.2		266.9		294.1		
Degrees	11/10		10/9		9/8		8/7		7/6		32/27		
Cents		100/99 17.4		81/80 21.5		64/63 27.3		49/48 35.7		64/63 27.3		81/80 21.5	
Cents	315.6		347.4		386.3		417.5		435.1		470.8		
Degrees	6/5		11/9		5/4		14/11		9/7		21/16		
Cents		55/54 31.8		45/44 38.9		56/55 31.2		99/98 17.6		49/48 35.7		64/63 27.3	
Cents	498.0		519.5		551.3		582.5		617.5		648.7		
Degrees	4/3		27/20		11/8		7/5 center		10/7		16/11		
Cents		81/80 21.5		55/54 31.8		56/55 31.2		50/49 35.0		56/55 31.2		55/54 31.8	
Cents	680.5		702.0		729.2		764.9		782.5		813.7		
Degrees	40/27		3/2		32/21		14/9		11/7		8/5		
Cents		81/80 21.5		64/63 27.3		49/48 35.7		99/98 17.6		56/55 31.2		45/44 38.9	
Cents	852.6		884.4		905.9		933.1		968.8		996.1		
Degrees	18/11		5/3		27/16		12/7		7/4		16/9		
Cents		55/54 31.8		81/80 21.5		64/63 27.3		49/48 35.7		64/63 27.3		81/80 21.5	
Cents	1017.6		1035.0		1049.4		1088.3		1115.5				
Degrees	9/5		20/11		11/6		15/8		40/21				
Cents		100/99 17.4		121/120 14.4		45/44 38.9		64/63 27.3		56/55 31.2			
Cents	1146.8		1178.5		1200								
Degrees	64/33		160/81		2/1								
Cents		55/54 31.8		81/80 21.5									

Proceeding up or downwards from 1/1 the scale is symmetrical intervalically.