Letter to Walter O'Connell

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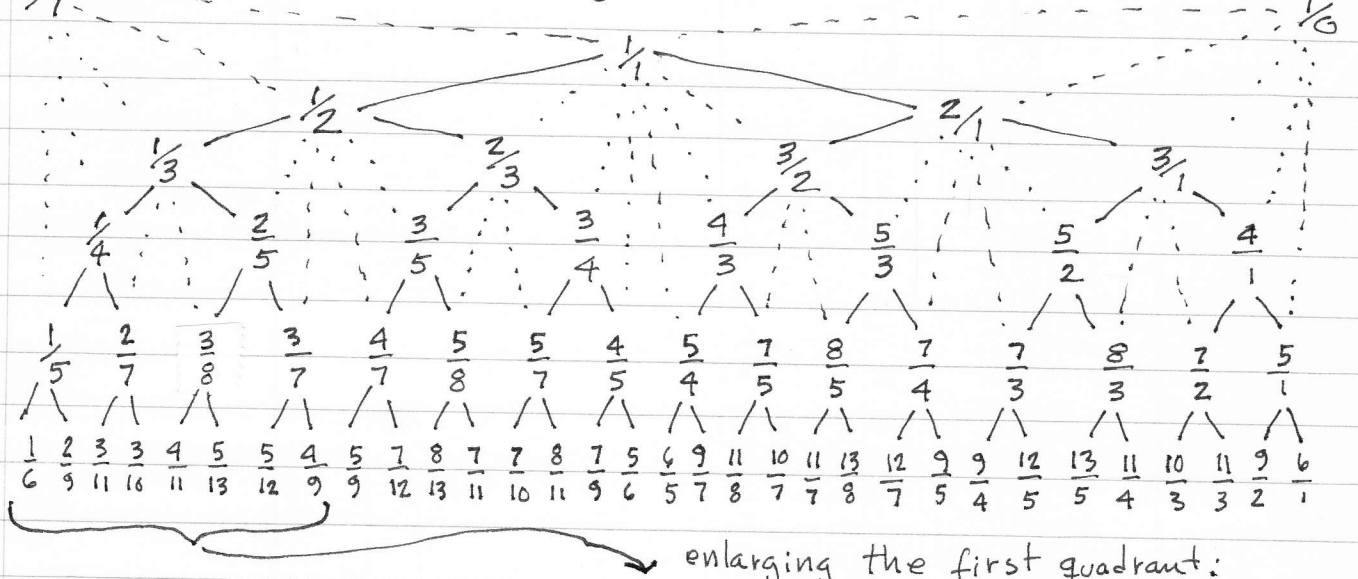
Dear Walter,

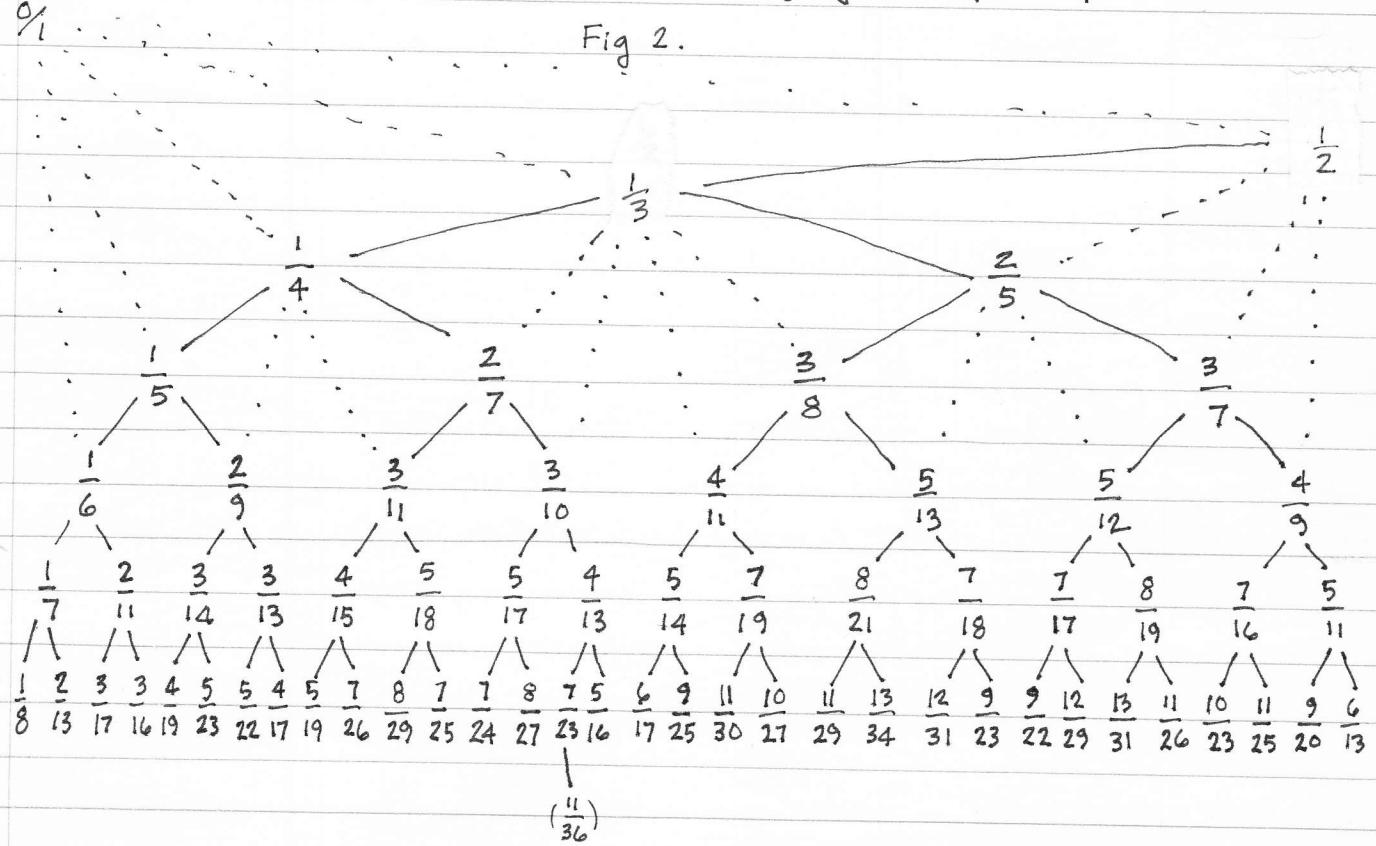
As a backdrop to what I will be saying I will first describe a numerical artifact I call the "Scale Tree". This was prompted by my pondering the Yasserian Sequence 5, 7, 12, 19 . . . . It is constructed by adding the numerators and denominators respectively as shown:

Fig 1.



enlarging the first quadrant:

Fig 2.



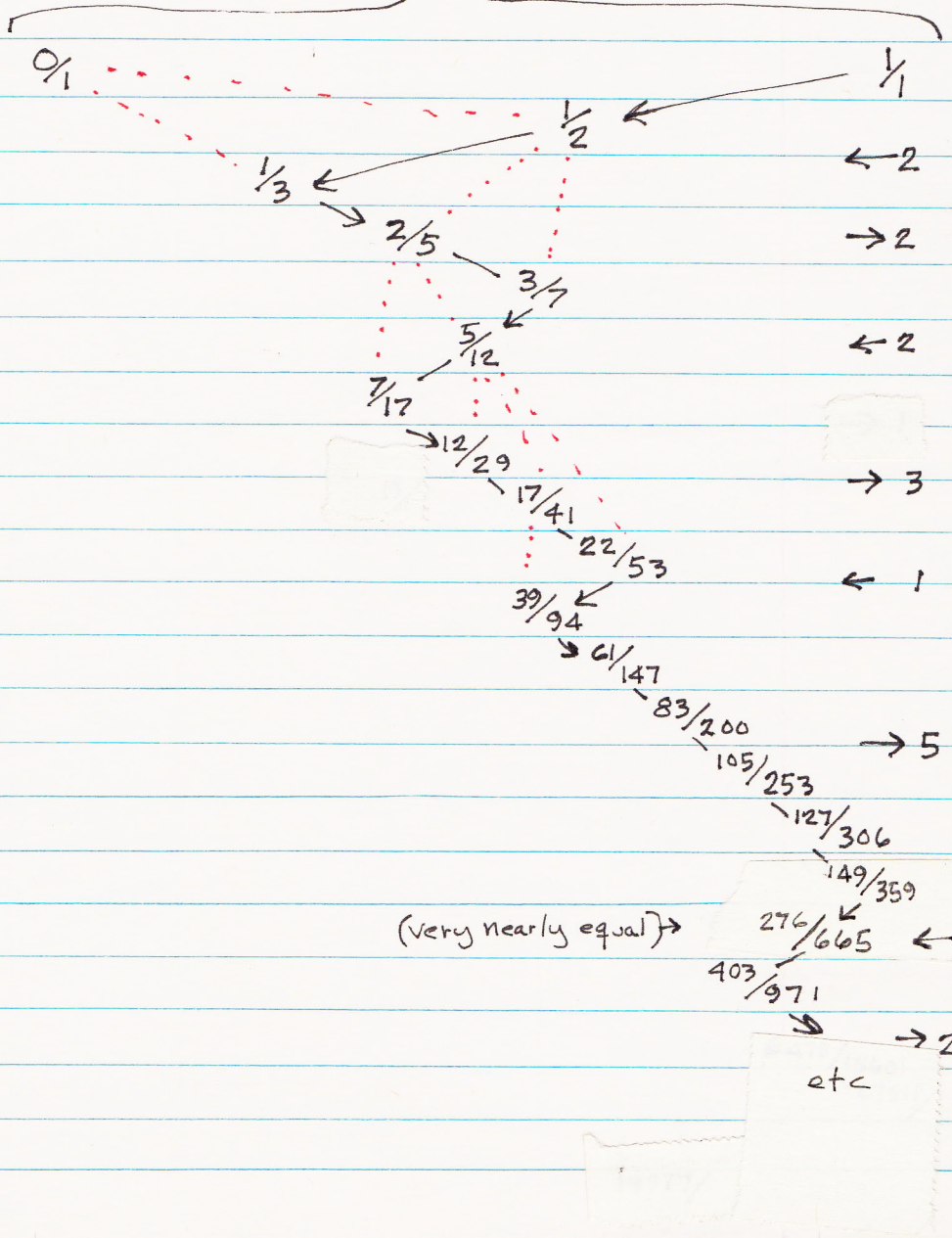
I've been long interested in the 2-interval patterns formed when a given interval (generator) is projected around the cycle of the Octave. The pythagorean 5- and 7-tone scales are time-honored examples (dating back to the Sumerians) formed by projecting the interval of the ratio 4/3, in a chain, about the cycle of the Octave. The sequence of 2-interval patterns based on the 4/3 (1.333...) can be found as shown:

4/3 = 1.333..

Log_2 = .415037499

	1/x	Pattern
←	2	.409
→	2	.442
←	2	.260
→	3	.845
←	1	.182
→	5	.489
←	2	.042
→	23	.415
←	2	.406

Zig-Zag
Sequence of 2-interval Patterns



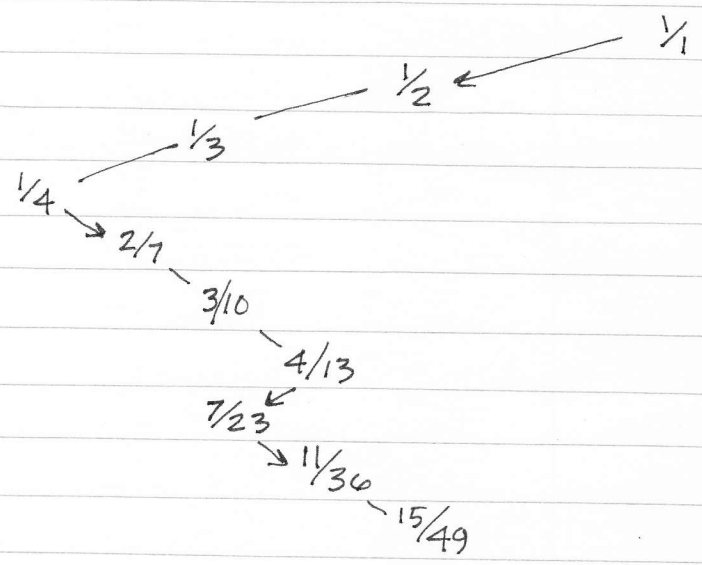
Φ (1.618..), or for convenience $2/\Phi$ (1.236) can be treated in a similar way, producing a sequence of scale-like 2-interval patterns:

$2/\Phi = 1.236067978$

Log_2, .305758086

	1/N	Pattern
←	3	.270
→	3	.696
←	1	.436
→	2	.289
←	3	.448
	2	.228
	4	.373
	2	.676
	1	.478
	2	.088
	11	.327

Sequence of 2-interval Patterns



2-Interval Patterns of Phi (1.618033989)

ϕ (1.618 ...)

$\log_2$ = .694241914

(2-interval Scales)

1/N Pattern		
←	1	.440 ...
→	2	.270 ...
←	3	.696 ...
→	1	.436 ...
←	2	.289 ...
→	3	.448 ...
←	2	.228 ...
→	4	.373 ...
←	2	.676 ...
→	1	.478 ...
←	2	.088 ...
	11 (?)	.357 ← (unuseable)

Subtract the number left of decimal point and record as shown. "1/N" the number to the right of decimal point. (The numbers to the right of the decimal point quickly become unuseable.)

Zig-Zag Pattern

0/1 . . . . . 1/1 ← 1

1/2 → 2

2/3 ← 3

3/4

5/7

7/10 → 1

9/13

16/23 ← 2

25/36

34/49 → 3

59/85

84/121

109/157 ← 2

193/278

277/399 → 4

470/677

663/955

856/1233

1049/1511 ← 2

1905/2744

2761/3977 → 1

4666/6721

7427/10698 ← 2

Very nearly equal →

10188/14675 → 11 (?)

Larry Hanson showed me how to do this calculation.