

akkoc@~~masms~~.net

Dr. Can Akkoc (334) 441-2100

7, Mar, 2001

Alabama School of Mathematics and Science
Mobile, AL 36604
1255 Dauphin Street

Dear Dr. Akkoc,

At hand is your impressive paper, Non-Deterministic Sound Structures Observed in Traditional Turkish Music. you might want to see the enclosed papers;

Organization in Auditory Perception, (Interim Report)

by Paul C. Boomsliter and Warren Creel, 1962 67 pages

Extended Reference: An Unrecognized Dynamic in Melody

circa 1963, Journal of Music Theory, Yale, Boomsliter/Creel, 23 pages

They have further papers on the subject beginning 1961. Sadly, their work on the subject was unceremoniously de-funded just as the got rolling, about 1966. They had made their point tho, and I have been greatly influenced by thier procedures and findings ever since.

I have attempted to infer what the rationals of the 24-tone system in your Clock~7 would be. I have shown what I think the ratios might be, in the theoretical overlay in dotted lines. (I regret I do not have [7] Ezgi, Suphi: Ameli ve Nazari Türk Musikisi). A copy of the inferred 24-Note Turkish Tonal System is enclosed. I should appreciate a source on the above mentioned [7] Treatise on Turkish music, if you have a chance. Stamped envelope enclosed. Also I should like to stay informed on further developments in your music project. Its ramifications in other musics is far-reaching & indeed, Good luck! Sincerely

Ervin M. Wilson

ERVIN M. WILSON

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copy to Sonja Wayne, microtonezone@aol.com

A 24-Note Turkish Tonal System, (as inferred*)

Erv Wilson, Mar 5 2001

<u>Modulus</u>	<u>Name</u>	<u>chain Position Ratio</u>	<u>Difference</u>
0/53	•DUGAH	• 0 2/1 -----	
52	•Dik Zengule	• -12 160/81 -----	81/80
51			
50			
49	•Sehnaz	• +5 243/128 -----	20,480/19,683
48	•Nim Sehnaz	• -7 15/8 -----	81/80
47			
46			
45			135/128
44	•GERDANIYE	• -2 16/9 -----	81/80
43	•DikMahur	• -14 1280/729 -----	
42			
41			20,480/19,683
40	•Mahur	• +3 27/16 -----	81/80
39	•Evic	• -9 5/3 -----	
38			20,480/19,683
37			
36	•DikAcem	• +3 6,561/4,096 -----	81/80
35	•ACEM	• -4 405/256 -----	
34			
33			135/128
32			
31	•HUSEYNI	• +1 3/2 -----	81/80
30	•Dik Hisar	• -11 40/27 -----	
29			
28			20,480/19,683
27	•Hisar	• +6 729/512 -----	81/80
26	•Nim Hisar	• -6 45/32 -----	
25			
24			135/128
23			
22	•NEVA	• -1 4/3 -----	81/80
21	•Dik Hicaz	• -13 320/243 ---	
20			
19			20,480/19,683
18	•Hicaz	• +4 81/64 -----	81/80
17	•Nim Hicaz	• -8 5/4 -----	
16			
15			20,480/19,683
14	•-----	• +9 19,683/16,384 -----	81/80
13	•CARGAH	• -3 1215/1024 -----	
12			
11			135/128
10			
9	•BUSELIK	• +2 9/8 -----	
8	•Segah	• -10 10/9 -----	81/80
7			
6			
5	•Dik kurdi	• +7 2187/2048 -----	
4	•Kurdi	• -5 135/128 -----	81/80
3			
2			135/128
1			
53/0	•DUGAH (440)	• 0 1/1 -----	
(52	•Dik Zengule)	• - -----	

Ref: "Non-Deterministic Sound Structures Observed in Traditional Turkish Music"
by Can AKKÖŞ, 1999, Clock~7, *

January 16, 2003

Mr. Ervin Wilson
844 N. Ave. 65
Los Angeles, CA 90042-1541

Dear Mr. Wilson,

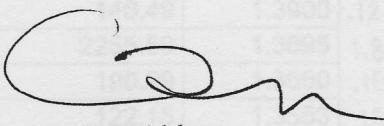
Thank you for the most interesting articles on music perception in the human auditory system, as well as your mathematical/geometrical work on tuning systems. I would not even venture to speculate as to what might happen if the said procedures were applied to Turkish music.

In this connection I was wondering whether you received my letter dated August 03, 2002 and the accompanying material, which included a copy of my paper, soon to be published in the Journal of New Music Research in the Netherlands. As I indicated in that letter, "I am anticipating using your results when my research gets to a point where I start constructing deterministic scales made up of 'anchor' notes (medoids) to form the 'skeleton' of non-deterministic scales for traditional Turkish music."

On another front, I am trying to make sense out of the set of intervals used in Turkish music by master musicians. As a preliminary "experiment" I compiled a histogram of all intervals used by a well-known ney player in a taksim (improvisation) in the Mahur maqam. I have enclosed a copy for you to look at, and possibly (hopefully) direct me along a path that might lead to a meaningful characterization/classification of these intervals within the framework of other musics on the planet. I hope I am not imposing an undue burden on you. If you find this idea irrelevant and/or not worthy of pursuit, please ignore it altogether.

I wish you a happy 2003, and hope that I might meet you in person at a not so distant future.

Kindest regards,


Can Akkoc
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Enclosure: Histogram of intervals in the Mahur maqam.

Mahur 1~Distribution of Weighted Intervals (cents vs weight)

Interval (cents)	Weight (%)	Log 2	ratio	Log 2
1	46.77	11.7482	,038975	.37/36 = .039528
2	43.72	11.5716	,036433	.40/39 = .036527
3	31.71	7.6407	,026425	.55/54 = .026472
4	1200.00	7.0744	1.000000	2/1 = 1.000000
5	94.48	7.0726	,078733	.19/18 = .078003
6	49.66	6.9099	,041383	.36/35 = .040642
7	40.83	6.8735	,034025	.41/40 = .035624
8	52.17	6.2665	,043475	.33/32 = .044394
9	38.65	5.6799	,032208	.45/44 = .032421
10	334.84	4.7672	,279033	.17/14 = .280108
11	1229.44	4.6330	,1024533	.59/29 = 1.024662
12	21.10	4.5255	,017583	.81/80 = .017922
13	55.87	3.9526	,046558	.32/31 = .045803
14	80.39	3.8642	,066992	.22/21 = .067114
15	175.72	3.8322	,146433	.21/19 = .144390
16	263.17	3.8047	,219308	.7/6 = .222392
17	28.43	3.5844	,023691	.64/63 = .022720
18	37.33	3.5159	,031110	.48/47 = .030373
19	73.61	2.8511	,061341	1.043435 = 1.043478
20	1179.89	2.4440	,983242	1.976902 = 1.975309
21	166.36	2.3098	,138633	1.100862 = 1.100000
22	25.79	2.2521	,021492	1.015008 = 1.014085
23	1191.71	2.0325	,993092	1.990446 = 1.990431
24	312.20	2.0263	,260167	1.197617 = 1.200000
25	449.52	1.9259	,374460	1.296480 = 1.296296
26	1244.40	1.9126	,037000	2.051956 = 2.051282
27	519.17	1.7766	,432642	1.349703 = 1.350000
28	352.32	1.7037	,293600	1.225695 = 1.227273
29	58.36	1.6442	,048633	1.034285 = 1.034483
30	250.15	1.6157	,208458	1.155453 = 1.155556
31	2444.13	1.5784	,2.036775	4.103273 = 4.102564
32	100.00	1.5606	,083333	1.059463 = 1.058824
33	216.26	1.5464	,180217	1.133054 = 1.133333
34	62.04	1.5091	,051700	1.036486 = 1.037037
35	184.55	1.5029	,153792	1.112489 = 1.111111
36	360.53	1.4949	,300442	1.231521 = 1.230769
37	178.57	1.4486	,148808	1.108653 = 1.107143
38	1900.00	1.3980	,1.58333	2.996614 = 3.000000
39	146.49	1.3900	,122075	1.088299 = 1.086420
40	2255.59	1.3695	,1.879658	3.679879 = 3.666667
41	190.29	1.3660	,158575	1.116184 = 1.117647
42	122.15	1.3553	,101792	1.073105 = 1.074074
43	105.41	1.3331	,087842	1.062779 = 1.062500
44	200.00	1.2398	,166667	1.122462 = 1.125000
45	108.99	1.1571	,090825	1.064979 = 1.066667
46	1117.31	1.1518	,931092	1.906718 = 1.904762
47	161.79	1.1385	,134825	1.097960 = 1.096774
48	212.27	1.1109	,176892	1.130446 = 1.130435
49	718.79	1.0878	,598992	1.514658 = 1.500000
50	266.27	1.0692	,221892	1.166262 = 1.166667
51	82.40	1.0647	,068667	1.048747 = 1.050000
			+	21/20 = 1.050000
			=	22/21 = 1.047619
			=	43/41 = 1.048780

Trough

try 53/35

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

(1/12)

270 Sort by magnitude
abyss French

8/7 Troug Funnel

Mahur 1~Distribution of Weighted Intervals (cents vs weight)

(anti-log₂)

Interval (cents)	Weight (%)	Log 2	Decimal	Ratio	Decimal	Log 2	Cents
52	327.97	1.0416	.273308	1.208576	29/24	= 1.208333	.273018 327.62
53	505.08	1.0096	.420900	1.338762	4/3	1.333333	.415037 498.04
54	725.14	0.9945	.604283	1.520223	32/21	1.523810	.607683 729.22
55	140.84	0.9821	.117367	1.084753	13/12	1.083333	.115477 138.57
56	64.04	0.9669	.053367	1.037684	28/27	1.037037	.052467 62.96
57	300.00	0.9296	.250000	1.189207	19/16	1.187500	.247928 297.51
58	154.59	0.8888	.128825	1.093403	35/32	1.093750	.129283 155.14
59	170.57	0.8470	.142142	1.103542	32/29	1.103448	.142019 170.42
60	1700.00	0.8194	.1416667	2.669680	8/3	2.666667	1.415037 1698.04
61	245.85	0.8008	.204875	1.152586	15/13	1.153846	.206451 247.74
62	546.15	0.7919	.455125	1.370902	37/27	1.370370	.454566 454.48
63	97.48	0.7723	.081233	1.057922	18/17	1.058824	.082462 98.95
64	91.22	0.7252	.076017	1.054104	256/243	1.053498	.075187 90.22
65	226.27	0.7172	.188558	1.139624	8/7	1.142857	.192645 231.17
66	943.21	0.7128	.786008	1.724297	50/29	1.724138	.785875 943.05
67	954.79	0.6897	.795658	1.735869	26/15	1.733333	.793549 952.26
68	431.54	0.6621	.359617	1.283085	9/7	1.285714	.362570 435.08
69	136.85	0.6568	.114042	1.082256	13/12	1.083333	.115477 138.57
70	985.39	0.6479	.821158	1.766824	23/13	1.769231	.823122 987.75
71	34.64	0.6479	.028867	1.020210	51/50	1.020000	.028569 34.28
72	220.76	0.6292	.183967	1.136003	256/225	1.137778	.186219 223.46
73	288.52	0.6257	.240433	1.181347	13/11	1.181818	.241008 289.21
74	500.00	0.6150	.416667	1.334840	4/3	1.333333	.415037 498.05
75	112.15	0.6115	.093458	1.066925	16/15	1.066667	.093109 111.73
76	230.66	0.6061	.192217	1.142518	8/7	1.142857	.192645 231.17
77	218.50	0.6052	.182083	1.134521	17/15	1.133333	.180572 216.70
78	339.10	0.5786	.282583	1.216371	45/37	1.216216	.282400 338.88
79	899.06	0.5652	.749217	1.680880	37/22	1.681818	.750022 900.03
80	261.36	0.5555	.217800	1.162959	7/6	1.166667	.222392 266.87
81	323.61	0.5359	.269675	1.205536	35/29	1.206897	.271302 325.56
82	126.70	0.5208	.105583	1.075929	14/13	1.076923	.106915 128.30
83	88.92	0.5137	.074100	1.052704	19/20	1.052632	.074001 88.80
84	316.73	0.5092	.263942	1.200755	6/5	1.200000	.263034 315.64
85	98.77	0.4906	.082308	1.058711	18/17	1.058824	.082462 98.95
86	197.82	0.4639	.164850	1.121050	28/25	1.120000	.163499 196.20
87	381.21	0.4346	.317675	1.246320	5/4	1.250000	.321928 386.31
88	1211.48	0.4168	1.009567	2.013306	121/10	2.016667	1.011973 1214.37
89	282.14	0.4070	.235117	1.177002	20/17	1.176471	.234465 281.36
90	110.17	0.4026	.091808	1.065705	16/15	1.066667	.093109 111.73
91	309.22	0.3893	.257683	1.195557	6/5	1.200000	.263034 315.64
92	435.87	0.3848	.363225	1.286298	9/7	1.285714	.362570 435.08
93	149.22	0.3839	.124350	1.090017	12/11	1.090909	.125531 150.64
94	305.08	0.3750	.254233	1.192702	31/26	1.192308	.253757 304.51
95	378.04	0.3750	.315033	1.244040	56/45	1.244444	.315502 378.60
96	256.10	0.3555	.213417	1.159431	22/19	1.157895	.211504 253.80
97	1216.93	0.3288	1.014108	2.019654	200/99	2.020202	1.014500 1217.40
98	400.00	0.3004	.333333	1.259921	34/27	1.259259	.332575 399.09
99	1183.07	0.2871	.985892	1.980537	99/50	1.980000	.985500 1182.60
100	223.70	0.2835	.186417	1.137934	256/225	1.137778	.186219 223.46
101	411.48	0.2728	.342900	1.268303	52/41	1.268293	.342888 411.46
102	1143.30	0.2728	.952750	1.935559	60/31	1.935484	.952694 1143.23

The nuances of the spoken word?

cascade

French

attractor

Mahur 1~Distribution of Weighted Intervals (cents vs weight)

Interval (cents)	Weight (%)	Log 2	Antilog2	Ratio	Decimal	Log2	cents
103	238.51	0.2728	.198758	1.147710	.31/27	.148148	.199309
104	157.91	0.2684	.131592	1.095502	.23/21	1.095238	.131245
105	348.79	0.2497	.290658	1.223198	.11/9	1.222222	.289507
106	181.21	0.2497	.151008	1.110345	.10/9	1.111111	.152003
107	712.75	0.2408	.593958	1.509382	.507/336	1.508929	.593525
108	372.44	0.2222	.310367	1.240023	.31/25	1.240000	.310340
109	294.91	0.2089	.245758	1.185716	.32/27	1.185185	.245112
110	1521.96	0.2089	.1268300	2.408776	.65/27	2.407407	1.267480
111	1233.09	0.2089	.1027575	2.038595	.53/26	2.038462	1.027481
112	636.00	0.2080	.5300000	1.443929	.13/9	1.444444	.530515
113	2232.29	0.2035	.1860242	3.630685	.40/11	3.636364	1.862496
114	365.90	0.1991	.304917	1.235347	.21/17	1.235294	.304855
115	416.40	0.1946	.347000	1.271913	.14/11	1.272727	.347923
116	1473.76	0.1946	.1228133	2.342637	.68/29	2.344828	1.229482
117	118.79	0.1902	.098992	1.071025	.15/14	1.071428	.099536
118	374.63	0.1715	.312192	1.241592	.36/29	1.241379	.311944
119	846.40	0.1706	.705333	1.630521	.44/27	1.629630	.704544
120	388.52	0.1626	.323767	1.251594	.5/4	1.250000	.321928
121	1187.22	0.1431	.989350	1.985290	.336/169	1.988166	.991438
122	258.25	0.1386	.215208	1.160872	.29/25	1.160000	.214125
123	457.78	0.1342	.381483	1.302681	.56/43	1.302326	.381090
124	1967.55	0.1298	.1639625	3.115848	.28/9	3.111111	1.637430
125	143.93	0.1253	.119942	1.086691	.38/35	1.085714	.118644
126	1141.40	0.1244	.951167	1.933436	.29/15	1.933333	.951690
127	192.65	0.1111	.160542	1.117707	.19/17	1.117647	.160465
128	509.22	0.1111	.424350	1.341968	.47/35	1.342857	.425306
129	514.67	0.0969	.428892	1.346199	.43/32	1.343750	.426265
130	1139.09	0.0924	.949242	1.930857	.56/29	1.931034	.949374
131	69.39	0.0835	.057825	1.040895	.26/25	1.040000	.056584
132	1461.36	0.0835	.1217800	2.325918	.107/46	1.217905	1.217905
133	800.00	0.0827	.666667	1.587401	.100/63	1.587302	.666576
134	1471.59	0.0791	.1226325	2.339702	.7/3	2.333333	1.222392
135	195.85	0.0782	.163208	1.119775	.19/17	1.117647	.160465
136	1884.39	0.0782	.1570325	2.969716	.98/33	2.969697	1.570316
137	1029.62	0.0693	.858017	1.812545	.29/16	1.812500	.857981
138	1146.32	0.0649	.955267	1.938938	.64/33	1.939394	.955606
139	891.71	0.0649	.743092	1.673759	.72/43	1.674419	.743660
140	1442.81	0.0649	.1202342	2.301129	.30/13	2.307692	1.206451
141	131.97	0.0640	.109975	1.079210	.27/25	1.080000	.111031
142	1735.76	0.0595	.1446467	2.725398	.30/11	2.727273	1.447459
143	2406.01	0.0560	.2005008	4.013910	.4/1	4.000000	2.000000
144	321.04	0.0560	.267533	1.203748	.65/54	1.203704	.267480
145	1162.27	0.0462	.968558	1.956884	.45/23	1.956522	.968291
146	1349.38	0.0462	.1124483	2.180235	.24/11	2.181818	1.125531
147	277.63	0.0462	.231358	1.173940	.27/23	1.173913	.231326
148	1375.52	0.0373	.1146267	2.213404	.31/14	2.214284	1.14684
149	958.26	0.0329	.798550	1.739352	.40/23	1.739130	.798366
150	1152.94	0.0329	.960783	1.946366	.72/37	1.945946	.960472
151	1800.00	0.0320	.1500000	2.828427	.82/29	2.827586	1.499571
152	2369.36	0.0284	.1974467	3.929829	.55/14	3.928571	1.974005
153	1500.00	0.0187	.1250000	2.378414	.88/37	2.378378	1.249978

Mahur 1~Distribution of Weighted Intervals (cents vs weight)

<u>Interval (cents)</u>	<u>Weight (%)</u>	<u>Log₂</u>	<u>(Decimal)</u>	<u>Anti log₂</u>	<u>Ratio</u>	<u>Decimal</u>	<u>Log₂</u>	<u>cents</u>
154	1321.04	0.0187	1.100867	2.144835	15 / 7	2.142857	1.099536	1319.44
155	1439.96	0.0187	1.199967	2.297344	85 / 37	2.297297	1.199938	1439.93
156	1170.64	0.0187	.975533	1.966368	116 / 59	1.966102	.975533	1170.41
157	1417.86	0.0187	1.181550	2.268203	93 / 41	2.268293	1.181607	1417.93
158	1469.04	0.0187	1.224200	2.336259	7 / 3	2.333333	1.222392	1466.87
159	66.99	0.0187	.055825	1.039453	27 / 26	1.038462	.054448	65.33
160	1032.65	0.0133	.860542	1.815720	69 / 38	1.815789	.860597	1032.72
161	1607.35	0.0133	1.339458	2.530563	43 / 17	2.529412	1.338802	1606.56

annotated by Erv Wilson
Jan 30, 2003

Mahur I, III

49/48

33,09 C
\$

1.019297

1 .019
51 .82

51/50 = 1.020000

52/51 = 1.019608

53/52 = 1.019231 — 53/26

54/53 = 1.018868

55/54 = 1.018519

5/2 38/15
43/17 2.529

31/23

99/98 = 1.010

100/99

101/100 176

102/101 4817

103/102 23
17 16

104/103 65123

105/104 82/29

106/105

107/106

108/107

109/108

110/111

111/110

112/111

113/112

114/113

115/114

116/115

117/116

118/117

119/118

120/119

121/120

7/3

44/19

51/22

20/19

21/20 1.050000

22/21

23/22

24/23 1.043478

25/24 1.041667

26/25 1.040000

27/26 1.038462

28/27 1.038037

29/28 1.035714

30/29 1.034483

31/30 1.033

32/31

33/32 1.031250

34/33 44/43

35/34 45/44 1.022

36/35 46/45 45/23

37/36 47/46 59/58

38/37 48/47 60/59

39/38 49/48 X 47/35

40/39 50/49 51/38

41/40 51/50

42/41 52/51

43/42 53/52

54/53 55/54

55/54 56/55

57/56 — 58/57

19/18 30/37 = 1.054054

20/19 19/17

10/9 10/17

7/3 29/26

44/19 6/5 35/29

51/22 41/34 1.205882

95 - 41 47/39 1.205128

53/44 59/49

65/54

4/3

35/26

39/29

21/11

23/12

25/13

27/14

29/15

31/16

33/17

35/18

37/19

39/20

41/21

43/22

45/23

47/24

49/25

51/26

53/27

55/28

31/23 57/29

59/30 D

— 11

12) dt

55/41

5/3

37/22

42/25

47/28

52/31

57/34

62/37

67/40

72/43.

77/46

Example #16 263.17 cents

263.17

÷ 1200

= .219308333

× 2 ↗ LOG

= .066018387

↖ 10⁴

1.164175316

↙ 1/2 Pattern)

→ 1 .164175316 +
↖ 6 .091
→ 10 .983
1 .017
57 .887

5 12 19 26 33

33 40 47 54 61 68

20 27 47 74

Zig-Zag Pattern

1/0

2/1

3/2

4/3

5/4

6/5

7/6 ←

1.166666667 Bingo!

266.87 cents

8/7 ↘ 15/13

↓ 22/19

29/25

36/31

43/37

50/43

57/49

64/55

71/61

78/67

149/128

57 places

263.17564

1.164179104

→ 78/67

~~256/243~~

~~Log2 .07511874963985~~

~~1/n Pattern~~

~~.075...~~

~~13 .300~~

~~3 .332~~

~~3 .008~~

~~119 .085~~

~~11 .76~~

~~1 .315~~

(256/243)

~~Log2 = 1.053497492~~

~~1/n Pattern~~

$\rightarrow 1 .053$

$\leftarrow 18 .692$

$\rightarrow 1 .444$

$\leftarrow 2 .250$

$4 .000$

SAVE! Ref Brahms lullabye

23 32 41 26 Jan 03. EW

B F A

%

9 9 9
23 32 41 50

Zig-Zag Pattern

%

$\begin{array}{c} \xrightarrow{2/1} \\ 3/2 \\ 5/4 \\ 4/3 \\ 7/5 \\ 6/5 \\ 8/7 \\ 9/8 \\ 10/11 \\ 11/10 \\ 12/11 \\ 13/12 \\ 14/13 \\ 15/14 \\ 16/15 \\ 17/16 \\ 18/17 \\ 19/18 \\ 20/19 \\ \xrightarrow{39/37} \\ 59/56 \\ 79/75 \\ \xrightarrow{138} \\ 131 \xrightarrow{197} \\ 187 \xrightarrow{254} \\ 243 \end{array}$

Bingo

Mahur #132

1461.364

$$\begin{array}{r} \underline{2.325918} \\ \rightarrow 2 \quad .325\cdots \\ \leftarrow 3 \quad .068 \\ 14 \quad .65 \\ 1 \quad .538 \\ 1 \quad .854 \\ 1 \quad .168 \\ 5 \quad .946 \end{array}$$

1/1

2/1

1/0

$$\begin{array}{l} 5/2 \\ 7/3 \\ 3/1 \\ 9/4 \\ \searrow 10\frac{1}{46} \end{array}$$

#136

$$\begin{array}{r} \underline{2.969716} \\ \rightarrow 2 \quad .969 \\ 1 \quad .031 \\ 32 \quad .021 \\ 48 \quad .065 \end{array}$$

1/1

2/1

1/0

$$\begin{array}{l} 3/1 \\ 5/2 \\ \swarrow 98\frac{1}{33} \end{array}$$

95 Mahur 1

1.244040

~~1092 315023~~

1

3/1

3/2

10

1/14 Pattern 315

3 . 174

5 . 738

1 . 354

2 . 821 2.819

1 . 21 1.22

4 . 597

1 . 673

1 . 483

2 . 066

14 . 696

1 . 003

$$\frac{13}{12} \times \frac{11}{12}$$

$$\frac{143}{144}$$

$$4/3$$

$$\frac{13}{14} \frac{13}{12}$$

$$\frac{169}{168}$$

$$\frac{3}{2} \times \frac{169}{168}$$

$$\frac{507}{336}$$

$$\frac{14}{13} \frac{14}{15} = \frac{196}{195} \times \frac{3}{2} = \frac{588}{390} \text{ no}$$

$$35/129$$

$$6/15$$

$$41/34$$

$$6/15$$

$$1.205882$$

$$\frac{65-27}{12-5}$$

$$67-32$$

1.244040

1/1

10

→ 1 . 244

← 4 . 097

10 . 237

4 . 214

4 . 661

1 . 5117

1 . 953

1 . 048

20 . 721

4/3

5/4

6/5 → 11/9

16/13

2/1

17/26/21

31/25

36/29

41/33

46

37

51

41

56

45

97 ~~1092 315023~~ .07

105/104

+ 2 = 1.009827

9/18 - 8/80

1 . 009

10/9

! 101 . 759

11/10

99/100

1.024533333

$\frac{1}{14}$ Pattern

1 .024

40 .760

1 .314

3 .181

5 .500

2 .000

$57/56$

$58/57$
 $59/60/59$

718.79 \$

1.514658

$\frac{1}{14}$ Pattern

\rightarrow 1 .514...

\leftarrow 1 .943

\rightarrow 1 .060

16 .556

1 .789

1 .252

3 .961

1 .040

24 .874

.598992

$\frac{1}{14}$ Pattern

.598...

\leftarrow 1 .669

\rightarrow 1 .493

\leftarrow 2 .025

39 .269

3 .711

0%

$\frac{1}{14}$

$\frac{1}{2}$

$\frac{2}{3}$

$\frac{3}{5}$

Bingo

$\frac{4}{7}$

$\frac{7}{12}$

$\frac{10}{17}$

$\frac{13}{22}$

$\frac{16}{27}$

$\frac{19}{32}$

$\frac{22}{37}$

$\frac{25}{42}$

$\frac{3}{2}$

16 places

$\frac{53}{35}$

Bingo

$\frac{1}{6}$

$\frac{28}{47}$
 $\frac{31}{52}$
 $\frac{34}{55}$

$\frac{1}{2}$