HISTORY OF THE 37

The purpose of the history is to prove that the ear is capable of the 37 monophonic intervals by showing how they were and are used and appreciated in other musical systems. To be sure, the entire 37 were not found in another single system, but if it can be shown that we as a race are susceptible to them even in partial usage the basis of conviction will be laid.

The source of the major part was an appendix to Hermann L. F. Helmholtz' Sensations of Tone, compiled by the translator, Alexander J. Ellis (Appendix XX, Section D; also Section K). The only other source was Modes of Ancient Greek Music by David Binning Munro, in which several scales of the cithara after Ptolemy, Egyptian scientist of the second century B. C., are given in exact ratios.

~~The order of~~ Intervals ~~is according to~~ are grouped in the classes, Intervals of 1, 3, 5, 7, 9, 11, which presents them largely according to their simplicity and musical importance. Usages of intervals that are approximate to the ratios but not exact are denoted by "~~within~~ 2 cents" or "~~within~~ 3 cents". A cent is the hundredth part of an equal semitone. It is the generally accepted unit measure of intervals. (See Appendix XX, Section C, Sensations of Tone.) The number of cents in an interval is given immediately after it.

Interval of 1:

$\frac{2}{1}$ -- 1200 -- The interval within which all scales are built. Being the simplest and strongest it has been used by all peoples, and by the more cultured in simultaneous sounding of its tones, at least since the beginning of recorded history.

Intervals of 3:

3/2 -- 702 -- Found in the music of all peoples since the dawn of history. ~~Of the many~~ There are three important scales constructed from successive 3/2s transposed within the 2/1 three are important: first, the scale of Pythagoras having a series of six 3/2s moved into one compass--1, 9/8, 81/64 (21 cents above true E in key of C), 4/3, 3/2, 27/16 (21 cents above true A in key of C), 243/128 (21 cents above true B in key of C); second, the ancient Chinese pentatonic according to Sze-ma Ts'ien (145-85 B. C.), with a series of four 3/2s--1, 9/8, 81/64, 3/2, 27/16; and third, the medieval Arabic, having a series of 16 3/2s brought within the compass of a 2/1.

3/2 was not used in simultaneous sounding of its tones until the 10th century, when it was introduced by Hucbald, Flemish monk, and called organum. The claim is made for Arabic music at its height, between 600 and 900, by Julian Ribera in his La Musica de las Cantigas (translated into English by Eleanor Hague) that harmony was used. If so, this interval was certainly a part of it.

4/3 -- 498 -- The inversion of 3/2. Necessarily accepted with 3/2, whether consciously or not, since with 3/2 it completes the 2/1.

Intervals of 5:

5/4 -- 386 -- Ancient Greek (hereafter "Greek" will describe the ancient civilization); interval of Indian chromatic, a variety of Chinese pentatonic, Arabic (2 cents) scales.

In the 16th century Zarlino, mentioned in connection with undertones, established 5/4 as consonant, after which the other intervals of 5 were quickly accepted in the simultaneous sounding of their tones. There is a strong probability these intervals were used harmonically in Arabia many centuries before, according to Hibera.

$\frac{8}{5}$ -- 814 -- Greek; Chinese heptatonic (1 cent).

$\frac{5}{3}$ -- 884 -- Greek; Arabic (2 cents).

$\frac{6}{5}$ -- 316 -- Greek; Indian chromatic.

Intervals of 7:

$\frac{7}{4}$ -- 969 -- Greek; Indian chromatic (3 cents).

$\frac{8}{7}$ -- 231 -- Greek; Bagdad.

$\frac{7}{6}$ -- 267 -- Greek; Indian chromatic (3 cents).

$\frac{12}{7}$ -- 933 -- Greek.

$\frac{7}{5}$ -- 583 -- Chinese heptatonic (3 cents).

$\frac{10}{7}$ -- 618 -- Greek (1 cent)

Intervals of 9:

$\frac{9}{8}$ -- 204 -- Greek; Arabic; Indian chromatic, Chinese. (This interval, the result of two 3/2s, and its inversion, 16/9, the result of two 4/3s, are found in every important musical system.)

$\frac{16}{9}$ -- 996 -- Greek; Arabic; Indian vina; Chinese.

$\frac{9}{5}$ --1018 -- Greek; Indian (1 cent); Khurasan (2 cents).

$\frac{10}{9}$ -- 182 -- Greek; Bagdad.

$\frac{9}{7}$ -- 435 -- Greek; Indian chromatic.

$\frac{14}{9}$ --765 -- Greek.

Intervals of 11:

$\frac{11}{8}$ -- 551 -- Greek; Indian chromatic (2 cents); Burmese (1 cent).

$\frac{16}{11}$ -- 649 -- Arabic lute; Greek (2 cents); Indian chromatic (2 cents); Chinese pentatonic (2 cents).

$\frac{11}{6}$ --1050 -- Modern Arabic 24-tone.

$\frac{12}{11}$ -- 151 -- Greek; Arabic lute; Indian chromatic.

$\frac{11}{10}$ -- 165 -- Greek.

$\frac{20}{11}$ --1035 -- Harmonicon of West Africa (4 cents).

$\frac{11}{7}$ -- 783 -- Indian chromatic (4 cents).

$\frac{14}{11}$ -- 418 -- Greek.

$\frac{11}{9}$ -- 347 -- Greek.

$\frac{18}{11}$ -- 853 -- Arabic lute; Indian chromatic; certain Highland bagpipe.

Intervals the result of two within 11:

$\frac{49}{48}$ -- 36 -- Arabic.

$\frac{33}{32}$ -- 53 -- Indian chromatic (2 cents).

$\frac{22}{21}$ -- 81 -- Greek (4 cents).

$\frac{16}{15}$ -- 112 -- Greek

$\frac{15}{8}$ --1088 -- Greek; Indian chromatic.

$\frac{21}{11}$ --1119 -- Unidentified.

$\frac{64}{33}$ --1146 -- Arabic lute (1 cent); Indian chromatic (2 cents).

$\frac{96}{49}$ --1164 -- Arabic lute; Greek (2 cents).

A quick survey of the table shows 29 of the 37 intervals exactly identified, two of the remaining eight to an accuracy of 1 cent, one to an accuracy of 2 cents, one to 3 cents, three to 4 cents, and one admittedly unidentified. Of the eight, four, including the unidentified one, are among those of the last group, having no place in the tonalities of the system.

Of the 37, 28 are Greek, 24 identical with the ratios given, and four others accurate within a few cents. 19 are Indian, 11 identical and 8 approximate. 14 are Arabic, 11 identical and three approximate. The few other identifications are from scales of China, Bagdad, Khurasan, and of a Highland bagpipe. Only one is weak, that of 20/11, from a harmonicon of West Africa.
