relative motions

"In the laws of quantities and motions there are three primary ratios from which the musical system of vibrations is developed.
Pendulums, from the slowness and continuance of their motions, are well adapted to give an ocular demonstration of the **relative motions** of each of these three primary ratios when compared and combined with the unity and with each other. The numbers 2 and 4 express the first condition in the first ratio; as, in falling bodies, when the times are 2 the distances are 4. In the case of two pendulums, when the length of the one is one fourth part of the other the motions are 1:2; and when two is counted for the upper one, the oscillations of these two pendulums will meet at one. The numbers 3 and 9 express the first condition of the second ratio; as, in falling bodies, when the times are 3 the distances are 9. In the case of two pendulums, when the length of the one is the ninth part of the other, the motions are 1:3; and when three is counted for the upper one, the oscillations of these two pendulums will meet at one. The numbers 5 and 25 express the first condition in the third ratio; as, in falling bodies, when the times are 5 the distances are 25. In the case of two pendulums, when the length of the one is twenty-fifth part of the other, the motions are 1:5; and when five is counted for the upper one, the oscillations of these two pendulums will meet at one.
In the system of motions in pendulums, the three primary ratios indicated in the foregoing paragraph, namely, 2:4, 3:9, and 5:25, are compared and combined with three different units. In their comparison, 1 is the unit of quantities, that is lengths, and 1 is the unit of motions. The numbers 1/4, 1/9, and 1/25, when taken together with 1 as unity, express the first comparison and combination of quantities; and the numbers 2, 3, and 5, taken together with 1 as unity, express the first comparison and combination of motions." [Scientific Basis and Build of Music, page 15]

"When the lengths of four pendulums are 1, 1/4, 1/9, and 1/25, their **relative motions** are 1, 2, 3, and 5; and when 5 is counted for the highest, the oscillations of these four pendulums will meet at one." [Scientific Basis and Build of Music, page 16]

Different writers have put forth different views of what constitute a musical vibration, but their various views do not make any difference in the ratios which the notes of this sound-host bear to each other. Whether the vibrations be counted as single or double vibrations, the ratios of their **relative motions** are the same. Nevertheless, a musical vibration is an interesting thing in itself, and ought to be correctly defined.
A string when vibrating musically is passing and re-passing the central line of its rest or equilibrium with a certain range of excursion. Some writers have defined a vibration to be the passage of the string from one extreme of its excursion to the other, while some have preferred to define it as the passage of the string from the one extreme of its excursion to the other and back again. D. C. Ramsay has been led in his researches to define a vibration as the movement of the string from its central line of rest to the extreme of its excursion on one side, and back to the central line of rest; and from the central line of rest to the extreme of its excursion on the other side, and back again to the "right line," as he calls it, as a second vibration. His reasoning on this will be seen in what follows. (See Fig. 3, Plate IV.) [Scientific Basis and Build of Music, page 21]

See Also

Distance
Motion
Number
Period
Ratio
Relativity
Time