pendulum

A **pendulum** swings to and fro. On the left side is the Negative side or pole. On the right side is the Positive side or pole. When swinging to the right the action is positive until the swing begins to come back to the **center** or **Neutral** point. During the swing back to the **center** the positive **polarity** takes on a Negative modulation because Negative **polarization** is a "center seeking" force whereas the Positive is an expanding force. The same holds true but in reverse for the Negative half of the pendulum's swing.

"The time period of a **pendulum** with a moveable **weight** is most easily ascertained by experiment and not by calculation. Theoretically, in the case of a "simple" pendulum - that is, an imaginary pendulum **without** weight except at the bob - the period of oscillation varies inversely as the square root of the length, i.e., if the length be increased four-fold, the time period will be one half what it was before. A simple pendulum does not however, exist practically, and though the law above enunciated may serve to give a general **idea** of the lengths corresponding to different time periods, these are really only to be arrived at with accuracy by trial." [Harmonic Vibrations and Vibration Figures, page 37]

**Russell**

"The **pendulum** which swings one way has its invisible counterpart which swings the other way. This drawing illustrates a sun at the **crest** of its wave which will eventually be voided by its counterpart, awaiting at its **trough**, and reborn again from the same point. See Fig. 66." [Atomic Suicide, page 257]

**Ramsay**

"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]

"The numbers which express the **motions** of these twenty-five **quantities** have among themselves nineteen different **ratios**, or rates of meeting; and when these **ratios** are represented by the **oscillations** of twenty-five **pendulums**, at the number of 64 for the highest one, they will all have finished their **periods**, and meet at one for a new series. This is an illustration, in the low silence of pendulum-oscillations, of what constitutes the **System of musical vibration** in the much higher region of vibrating strings and other elastic bodies, and determines the number of undeveloped sounds which form the harmonious halo of one sound, more or less faintly heard, or altogether eluding our dull mortal ears; and which determines the number of sounds which, when developed, constitute the **System of musical sounds**." [Scientific Basis and Build of Music, page 16]

"Things are not always what they seem. **Common sense**, so very valuable in every-day life, goes but a very little way in **science**. **Common sense** could not have told that, when a uniform body is suspended at one end and oscillated as a **pendulum**, the **oscillations** would be the same if suspended at one-third from the end. Much less could common sense have told that suspension at a point between these two points, namely, at two-thirds of this one-third from the end, would give the highest rate of speed of oscillation of which the body is capable, a point which we shall call the **center of Velocity**." [Scientific Basis and Build of Music, page 18]

Playfair, in his *Outlines of Natural Philosophy*, p. 282, says- "It is usual to reckon the vibrations of a **string** different from those of a **pendulum**; the passage from the highest point on one side to the highest point on the other is reckoned a vibration of a **pendulum**; the passage from the farthest distance on one side to the farthest distance on the other and back again to its first position, is the accounted a **vibration** of a musical **string**. It is properly a double **vibration**." Holden, in his *Rational System of Music*, says- "Mr. Emerson reckons the complete **vibration** the time in which a sounding **string** moves from one side to" [Scientific Basis and Build of Music, page 22]

"the other, like as we also reckon the vibrations of a **pendulum**." Holden adds that Dr. Smith, in his *Harmonics*, reckons the complete **vibration** to be double of this. Lees, in his *Acoustics*, says- "The travel of a vibrating elastic body from one extreme to the opposite and back again is called a **vibration**. Continental writers define a **vibration** to be the travel of a vibrating body from one extreme position to the opposite. This corresponds to our definition of the **oscillation** of a **pendulum**." [Scientific Basis and Build of Music, page 23]
"To suppose that the vibration of a string is the same as the oscillation of a pendulum is like adding equals to unequals, and supposing the wholes to be equals." [Scientific Basis and Build of Music, page 24]

"If we take a pendulum which goes from side to side 60 times in a minute, and another which goes from side to side 120 times in a minute, these two pendulums while oscillating will come to their first position 30 times during the minute. Now, if an oscillation is to be considered a natural operation, like the revolution of a wheel, or that of a planet in its orbit, which is completed when it returns to the place where the revolution began, then the pendulum's oscillation is not completed till it returns to the place of starting; and thus defined the oscillations of these two pendulums in the minute are not 60 and 120, but 30 and 60; 30 is the unit of measure in this case - 30 is the 1, and 60 is the 2; and this would establish the ratio of 1 to 2 in these two pendulums. And what is true in the ratio of 1 to 2 is true also of every other ratio, in this respect. This is a natural basis to work on, and defines the oscillation of a pendulum to be its excursion from extreme to extreme and back." [Scientific Basis and Build of Music, page 25]

"So the vibration of an elastic string and the oscillations of a pendulum have different definitions, though they do, with regard to their ratios illustrate each other." [Scientific Basis and Build of Music, page 25]

The mathematical scales, if followed out regardless of other laws which rule in music, would read like a chapter in Astronomy. They would lead us on like the cycles of the moon, for example. In 19 years we have 235 moons; but the moon by that time is an hour and a-half fast. In 16 such cycles, or about 300 years, the moon is about a day fast; this, of course, is speaking roughly. This is the way seemingly through all the astronomical realm of creation. And had we only the mathematical ratios used in generating the notes of the scale as the sole law of music, we should be led off in the same way. And were we to follow up into the inaudible region of vibrations, we should possibly find ourselves where light, and heat, and chemical elective motions and electric currents are playing their unheard harmonies; or into the seemingly still region of solid substances, where an almost infinite tremor of vibrations is balancing the ultimate elements of the world. Music in this case would seem like some passing meteor coming in from among the silent oscillations of the planetary bodies of the solar system, and flashing past with its charming sound effects, and leaving us again to pass into the higher silence of those subtle vibrations to which we have referred, having no infolding upon itself, no systematic limit, no horizon. But music is not such a passing thing. Between the high silence of these intense vibrations, and the low silence of oscillating pendulums and revolving planets, God has constituted an audible sphere of vibrations, in which is placed a definite limit of systematic sounds; seven octaves are carried like a measuring line round twelve fifths; and motion and rest unite in placing a horizon for the musical world, and music comes [Scientific Basis and Build of Music, page 39]

pendulum where fourth the length is double the oscillations. A third condition in this order is in springs or reeds where half the length is four times the vibrations. If we take a piece of straight wire and make it oscillate as a pendulum, one-fourth will give double the oscillations; if we fix it at one end, and make it vibrate as a spring, half the length will give four times the vibrations; if we fix it at both ends, and make it vibrate as a musical string, half the length will produce double the number of vibrations per second. [Scientific Basis and Build of Musics, page 80]

"To say that I was surprised at what Mr. Keely has discovered would be saying very little indeed ... It would appear that there are three different spheres in which the laws of motion operate. 1 - The first is the one in which Nature plays her grand fugue on the silent harp of Pendulums. In one period of Nature's grand fugue, as illustrated by pendulums, there are 19 ratios in 25 circles of oscillations ranging over 6 octaves; but all in silence. [Scientific Basis and Build of Music, page 86]

The sympathy of one thing with another, and of one part of a thing with another part of it, arises from the principle of unity. For example, a string requires to be uniform and homogenous to have harmonics producing a fine quality of tone by the sweet blendings of sympathy; if it be not so, the tone may be miserable ... You say you wish I were in touch with Mr. Keely; so do I myself ... I look upon numbers very much as being the language which tells out the doings of Nature. Mr. Keely begins with sounds, whose vibrations can be known and registered. I presume that the laws of ratio, position, duality, and continuity, all the laws which go to mould the plastic air by elastic bodies into the sweetness of music, as we find them operative in the low silence of
oscillating pendulums, will also be found ruling and determining all in the high silence of interior vibrations which hold together or shake asunder the combinations which we call atoms and ultimate elements, but which may really be buildings of wondrous complexity occupying different ranges of place and purpose between the visible cosmos and Him who built and evermore buildeth all things. The same laws, though operating in different spheres, make the likenesses of things in motion greater than the differences. [Scientific Basis and Build of Music, page 87]

Six Octaves required for the Birth of the Scale

EXPLANATION OF PLATES.

[BY THE EDITOR.]

PLATE I.

"NATURE'S GRAND FUGUE."

THIS plate is a Pendulum illustration of the System of musical vibrations. The circular lines represent Octaves in music. The thick are the octave lines of the fundamental note; and the thin lines between them are lines of the other six notes of the octave. The notes are all on lines only, not lines and spaces. The black dots arranged in these lines are not notes, but pendulum oscillations, which have the same ratios in their slow way as the vibrations of sounding instruments in the much quicker region where they exist. The center circle is the Root of the System; it represents F1, the root of the subdominant chord; the second thick line is F2, its octave; and all the thick lines are the rising octaves of F, namely 4, 8, 16, 32, and 64. In the second octave on the fifth line are dots for the three oscillations which represent the note C3, the Fifth to F2, standing in the ratio of 3 to 2; and the corresponding lines in the four succeeding Octaves are the Octaves of C3, namely 6, 12, 24, and 48. On the third line in the Third Octave are 5 dots, which are the 5 oscillations of a pendulum tuned to swing 5 to 4 of the F close below; and it represents A5, which is the Third of F4 among musical vibrations. On the first line in the Fourth Octave are 9 dots. These again represent G9, which stands related to C3 as C3 stands to F1. On the seventh line of the same octave are 15 dots; these represent the vibrations of E15, which stands related to C3 as A5 stands to F1. On the sixth line of the Fifth Octave are 27 dots, representing D27, which stands related to G9 as G9 stands to C3, and C3 also to F1; it is the Fifth to G. And last of all, on the fourth line of the Sixth Octave are 45 dots, representing B45, which, lastly, stands related to G9 as E15 stands to C3, and A5 to F1; it is the Third to this third chord - G, B, D. The notes which arise in each octave coming outward from the center are repeated in a double number of dots in the following Octaves; A5 appears as 10, 20, and 40; G9 appears as 18 and 36; E15 appears as 30 and 60; D27 appears as 54; and last of all B45 only appears this once. This we have represented by pendulum oscillations, which we can follow with the eye, the three chords of the musical system, F, A, C; C, E, G; and G, B, D. C3 is from F1 multiplied by 3; G9 is from C3 multiplied by 3; these are the three Roots of the three Chords. Their Middles, that is their Thirds, are similarly developed; A is from F1 multiplied by 5; E15 is from C3 multiplied by 5; B45 is from G9 multiplied by 5. The primes 3 and 5 beget all the new notes, the Fifths and the Thirds; and the prime 2 repeats them all in Octaves to any extent. [Scientific Basis and Build of Music, page 102]

PLATE IV.

OSCILLATION AND VIBRATION.

Fig. 1 - The pendulums in this illustration are suspended from points determined by the division of the Octave into Commas; the comma-measured chords of the Major key being S, 9, 8, 9, 5; T, 9, 8, 5, 9; D, 8, 9, 5, 9. The pendulums suspended from these points are tuned, as to length, to swing the mathematical ratios of the Diatonic scale. The longest pendulum is F, the chords being properly arranged with the subdominant, tonic, and dominant, the lowest, center, and upper chords respectively. Although in "Nature's Grand Fugue" there are 25 pendulums engaged, as will be seen by reference to it, yet for the area of a single key 13 pendulums, as here set forth, are all that are required. It will not fail to be observed that thus arranged, according to the law of the genesis of the scale, they form a beautiful curve, probably the curve of a falling projectile. It is an exceedingly interesting sight to watch the unfailing coincidences of the pendulums perfectly tuned, when started in pairs such as F4, A5, and C6; or started all together and seen in their manifold manner of working. The eye is then treated to a sight, in this solemn silent harp, of the order in which the vibrations of sounding instruments play their sweet coincidences on the drum of the delighted ear; and these two "art senses," the eye and the ear, keep good company. Fig. 2 is an illustration of the correct definition of a Pendulum Oscillation, as defined in this work.
In watching the swinging **pendulums**, it will be observed that the coincidences [Scientific Basis and Build of Music, page 104]

are always when they have returned to the side from which they were started. The Pendulugrapher, also, when writing the beautiful pictures which the **musical ratios** make when a pen is placed under the control of the **pendulums**, always finds his figure to begin again when the **pendulums** have finished their **period**, and have come for a fresh start to the side from which the **period** began. This confirms our author's definition of an oscillation of a **pendulum**. Fig. 3 is an illustration of the correct definition of a Musical Vibration, as also given in this work. Although the definition of an oscillation is not identical with that of a vibration, yet on account of their movement in the same ratios the one can be employed in illustration of the other as we have here done. Fig. 4 is a uniform rod suspended from the end as a **pendulum**; it will oscillate, of course, at a certain speed according to its length. In such a **pendulum** there are three centers related in an interesting way to the subject of Music in its three chords - subdominant, tonic, and dominant, which roots are F, C, and G. The center of gravity in the middle of the rod at 2, suspended at which the rod has no motion, corresponds to F, the root of the subdominant, in which there is the maximum of musical gravity. The center of oscillation at 3, which is one-third of the length of the rod from the end, is like the root of the tonic whose number is 3 in the genesis of the scale from F1. In this point of suspension the oscillations are the same as when suspended from the end at 1. The point at 9 is at a ninth from the center of oscillation. Our author discovered that, if suspended at this point, the **pendulum** had its highest rate of speed. Approaching the end, or approaching the center of oscillation from this point, the rate of speed decreases. Exactly at one-ninth from the center of oscillation, or two-ninths from the end, is this center of velocity, as Ramsay designated it; and it corresponds in some sort also to the root of the dominant G, which is 9 in the genesis of the scale from F1; its rate of vibration is nine times that of F1. The dominant chord is the one in which is the maximum of levity and motion in music. [Scientific Basis and Build of Music, page 105]

**PLATE V.**

**PROXIMATE AND DIFFERENTIAL OSCILLATIONS.**

When 25 **pendulums** are arranged and oscillated to represent the different **musical ratios** in their natural marshalling, they will all meet at 1 when 64 of the highest is counted. This plate is intended to show that there are two kinds of meeting and passing of the **pendulums** in swinging out these various ratios. In the ratio of 8:9 the divergence goes on increasing from the beginning to the middle of the period, and then the motion is reversed, and the difference decreases until they meet to begin a new period. This may be called the differential way. In the ratio of 45:64 there is an example of what may be called the proximate way. In this kind of oscillations meet and pass very near to each other at certain points during the period. In 45:64 there are 18 proximate meetings; and then they exactly meet at one for the new start. This last of the ratios, the one which finished the system, is just as if we had gone back to the beginning and taken two of the simplest ratios, [Scientific Basis and Build of Music, page 105]

Fig. 3. - This is a set of pendulum lengths for three octaves, given merely to assist any tyro who might wish to try them, but might find difficulty in calculating them. [Scientific Basis and Build of Music, page 120]

**PLATE XXX.**

**VIBRATION-RATIOS AND PENDULUM PROPORTIONS.**

The curved lines enclose the three chords of the major mode of the scale, with the ratio-numbers for the vibration in their simplest expression, counted, in the usual way in this work, from F1, the root of the major subdominant. The chords stand in their genetic position of F F C A, that is F1 by 2, 3, and 5; and so with the other two. The proportions for a set of ten **pendulums** are then placed in file with the ten notes from 1 to 1/2025 part of 1. Of course the one may be any length to begin with, but the proportions rule the scale after that. [Scientific Basis and Build of Music, page 121]

See Also

**1.3 - Brain Strung as a Harp**
Cosmic harp
cosmic pendulum
double compound pendulum
Figure 2.7 - Swinging Pendulum showing equal but opposed Polar States
Figure 8.9 - Four Fundamental Motions of a Pendulum
Harmonograph
harp string
harp
nine octave harp
Pendulograph
Pendulum Oscillation
pendulum
Ramsay - Pendulum Illustrations of Ratios
Ramsay - PLATE IV - Oscillation and Vibration
Ramsay - PLATE XXVIII - The Two Modes Notes Pendulums
Ramsay - PLATE XXX - Vibration Ratios and Pendulum Proportions
Ramsay - The New Way of Reckoning a Pendulum Oscillation
Ramsay - The Sharp and the Flat - Pendulum Illustration of Ratios
Ramsay - The Three Centers in a Uniform Pendulum
Silent Harp of Pendulums
Sympathetic Harp
Sympathetic Oscillation
system of motions in pendulums