Mathematics of sound

Steve Taranovich - December 20, 2012

Julian Treasure, in his work on “Sound Affects” states, “Almost every sound we hear comprises rich harmonics—overtones that we may not notice, but that are essential in producing the timbre and the meaning of sound.”

It is said that one day while meditating upon the problem of harmony, Pythagoras chanced to pass a brazier's shop where workmen were pounding out a piece of metal upon an anvil. By noting the variances in pitch between the sounds made by large hammers and those made by smaller implements, and carefully estimating the harmonies and discords resulting from combinations of these sounds, he gained his first clue to the musical intervals of the diatonic scale. He entered the shop, and after carefully examining the tools and making mental note of their weights, returned to his own house and constructed an arm of wood so that it extended out from the wall of his room.

At regular intervals along this arm he attached four cords, all of like composition, size, and weight. To the first of these he attached a twelve-pound weight, to the second a nine-pound weight, to the third an eight-pound weight, and to the fourth a six-pound weight. These different weights corresponded to the sizes of the braziers' hammers.

The key to harmonic ratios is hidden in the famous Pythagorean tetractys, or pyramid of dots. The tetractys is made up of the first four numbers—1, 2, 3, and 4—which in their proportions reveal the intervals of the octave, the diapente, and the diatessaron. While the law of harmonic intervals as set forth above is true, it has been subsequently proved that hammers striking metal in the manner.

The Pythagorean meaning of the Tetractys

The Greek philosopher and mathematician Pythagoras, from which we got the Pythagorean Theorem in geometry, once called the tetractys the symbol of the musical, arithmetic and geometric ratios upon which the universe is built. For Pythagoras and his followers, each line of the tetractys holds these meanings:
The first row is made of a single point. This point is the divine dimension from which everything is created. Because of the nature of this point, it is usually associated with the virtue of wisdom.