

# Pythagorean Philosophy

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*“Music is the pleasure the human mind experiences from counting without being aware that it is counting.”*

Gottfried Leibniz

The interaction between mathematics, physics, and music is in a way obvious as matter is a wave structure of the space. The Pythagoreans were one of the first philosophers who tried to decode the complexities of nature using mathematical and musical mechanisms.

Doxographical tradition portrays Pythagoras as a quasi-mythical figure while the modern scholars debate about his existence as a philosopher. [Pythagoras](#) is said to have been born on the island of Samos, Greece around 569 BC. He migrated from Samos to Croton and set up a religious cult there. He is said to have died between 500-475 BC in Metapontum.

For the Milesians, the motive for philosophy was wonder and a strong desire to unravel the mysteries of the universe. They were constantly in search of "???" which could then explain the origins of the cosmos. The Pythagoreans can be imputed for recognising a way of life through which humans could relate to the cosmos they inhabit. A path that could help humans align with the cosmos or be in harmony with it.

In Croton, Pythagoras instituted an exclusive community composed of his followers who were called the "Brotherhood." The Pythagoreans led a peculiar way of life which elicited from their religious and philosophical beliefs. The Pythagoreans were further bifurcated into two schools of thought. The Akousmatikoi examined the ritualistic and religious part of Pythagoras's teaching. The Matematikoi were the ones who made advancements in the field of science and mathematics. Thus, Pythagoras was a mathematician, philosopher as well as a religious and moral reformer.

Aristotle claimed that the early Pythagoreans were the first ones to make huge leaps in the understanding of mathematics. They asserted that all things are made up of numbers and tried to generate a cosmogony based on this assertion. The Pythagoreans believed that Harmonia was the most alluring thing. The word Harmonia meant fitting together or joining. The claim that Harmonia is the most beautiful thing isn't limited simply to music. Rather it was beautiful because the musical intervals could be articulated mathematically. In the case of the string instrument lyre, there are limitless possibilities when it comes to positioning the bridge, thus a limitless number of possible pitches. When it came to Music Theory, they recognised the arithmetic, geometric and harmonic means that underlie the music scale, as well as the perfect musical consonances, which can be expressed as mathematical ratios: octave (1:2), the perfect fifth (2:3), and perfect fourth (2:5). Thus they discovered that the intrinsic characteristics of music could be expressed mathematically.

The "Tetractys of Decad" was a diagram by which the Pythagoreans took their oaths. It was supposed to encompass the entire nature of numbers.

*“The Tetractys is a certain number, which is composed of the four first numbers produces the most perfect number, ten. For 1 and 2 and 3 and 4 come to be 10. This number is the first Tetractys and is called the source of ever-flowing nature since according to them the entire Kosmos is organised according to Harmonia, and Harmonia is a system of three concords, the fourth, the fifth, and the octave, and the proportions of these three concords are found in the aforementioned four numbers.”*

Sextus Empiricus, Against the Mathematicians

In Pythagorean thought, numbers beget proportion, and proportion begets harmony.

Pythagoras was the first one to have used the word "Kosmos (order or beauty)." The universe can be thought of as a "Kosmos" as all things in nature have an underlying geometry and proportion associated with them. Thus "Kosmos" and "Harmonia" are intertwined in a complex fashion. The Pythagoreans understood the world by dividing it into "Peiras" and "Apeiras." Thus the two contrasting principles of limited and unlimited from which the whole world emerged. " They assigned numbers to everything right from justice, harmony, man, animal to cosmogony.

*“In numbers, they thought they observed many resemblances to the things that are and that come to be . . . such and such an attribute of numbers being justice, another being soul and*

***intellect, another being decisive moment, and similarly for virtually all other things . . . since all other things seemed to be made in the likeness of numbers in their entire nature.”***

Aristotle, *Metaphysics* 1.5 985b28–33 = DK 58B4

They believed that numbers are mystical and divine, thus responsible for harmony. Pythagoreans were also the first ones to come up with the notion of odd, even, prime and composite numbers. The odd numbers were considered to be bounded while the even numbers were unbounded.

***“The Pythagoreans also said that void exists and enters the universe from the unlimited breath the universe is supposed in fact to inhale the void, which distinguishes things. For void is that which separates and distinguishes things that are next to each other. This happens first in numbers; the void divides their nature.”***

Aristotle, *Physics* 4.6 213b22–27 = DK 58B30)

They believed that Kosmos was formed by imposing a limit on the unlimited. Thus the idea of limit, continuity, and definiteness was eminent in their idea of Kosmos. Just as the musical scale is formed by imposing certain musical relations on the continuous spectrum of sound in the very same way, Kosmos was formed by imposing limits on the boundless. Order began at the nucleus of the universe and, it outstretched itself by taking in all the unlimited and unordered stuff into the ordered universe.

We can compare this with the idea behind number one. The Pythagoreans held the belief that the number one was both odd and even. Thus it could draw in the boundless and then limit it. The same process which generates numbers is responsible for the generation of the Kosmos. Hence we can conclude that numbers are the Kosmos. Since all things are composed of numbers, thus numbers were considered to be a valid choice for "?????" by the Pythagoreans.

***“Although the assertion that harmony arises from the motion of the heavenly bodies since the sounds that are produced are concordant, is expressed cleverly and remarkably by its proponents, it does not contain the truth. For some think a sound must be produced when bodies of such great size are in motion since it happens with bodies on earth too which do not have so great a bulk and do not move with so great speed. And when the sun and moon and the stars, which are so great in number and size, move so quickly, there must be a noise***

*overwhelming in loudness. Assuming these things and that the speeds, which depend on the distances, have the ratios of the concords, they declare that the sound of the stars in a circular motion is harmonious. But since it appeared illogical that we do not hear this sound, they declare that the reason is that the sound is present to us from birth and so is not evident in contrast to the opposing silence, for noise and silence are recognised by contrast to one another.”*

Aristotle, *On the Heavens* 2.9 290b12–29 = DK 58B35

The Pythagoreans came up with a theory known as the Harmony of spheres which claimed that the sun, moon, and all planets emit a piece of music based on their orbital revolutions. The pitches of the various notes were directly proportional to their speed and thus to their distances. This doctrine was based on harmonics, cosmology, and mathematics. Therefore we can say that the Pythagoreans believed in an intimate relationship between the Kosmos and Harmonia.

Kepler was motivated by the belief that divine harmonies animate the celestial order, and thus at last he could provide proof for Plato’s assumption that there is an exquisite mathematical order underlying planetary motion. The Pythagoreans were one of the first ones to believe that mathematics describes the universe in the best way possible. This belief is still carried out in modern-day science. Right from general relativity to Hawking radiations to String theory and black holes, all of these theories are based on intricate mathematical ideas. Archimedes has rightly said *“Mathematics reveals its secrets only to those who approach it with pure love, for its own beauty.”*

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