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NUMBERS

Pythagoras: the whole thing is a number

Internet, 2004. 3 p

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2004



Pythagoras: The whole thing is a number

Michael Lahanas

Πυθαγόρας ο Σάμιος

*The whole thing is a number*Pythagoras

We do not know what exactly was the opinion of Pythagoras saying “The whole thing is a number”. We know that he was impressed discovering a relation between music (harmony) and numbers.



I don't know also the exact origin of the modern Greek statement “you are a big number (*eisai megalou noumero*)” i.e. “a very important or great person” Is it possible that the world is a number? If the laws of physics can explain everything using mathematical equations then is it possible to simulate everything in all details? You have just to run a computer that simulates the entire universe and finally the program that runs can be expressed by a single number X (of course a very large number). Are we just a program of the Great programmer?

I believe that the numbers and functions of analysis are not the arbitrary products of our spirits; I believe that they exist outside of us with the same character of necessity as the objects of objective reality; and we find or discover them and study them as do the physicists, chemists, and zoologists. **Charles Hermite** in **M. Kline, Mathematics: The Loss of Certainty, Oxford University Press, New York, 1980.**

What is the difference between the world and the number and if numbers exists like Plato imagined then also the number of our Universe.



The Theorem of Pythagoras, Greek Stamp 1955 (Scott 583, Michel 633), actually his greatest achievement is the idea that everything can be expressed by numbers.

The beginning of all is unity (monas); unity is a cause of indefinite duality as a matter; both unity and indefinite duality are sources of the numbers; the points are proceeding from numbers; the lines - from the points; from the lines are plane figures; from plane are volumetric figures; from them - sensibly acceptable solids, in which four elements are - fire, water, earth, and air; moving and changing totally, they give rise to the universe - inspired, intelligent, spherical, in the middle of which is the earth; and the earth is also spherical and inhabited from all sides. **Alexander Polyhistor** about the Pythagoreans according to Diogenes Laertios

*Travelling back in time, one notes the historic role of Pythagoras — in realizing that qualitative differences in sense perception are based on mathematical reasoning. Significantly Professor S. Chandrasekhar adverts to just the relationship derived from scientific exactitude and aesthetic meaning in his Lecture, "Shakespeare, Newton and Beethoven or Patterns of Creativity": "The discovery by Pythagoras that vibrating strings, under equal tension sound together harmoniously, if their lengths are in simple numerical ratios, established for the first time a profound connection between the intelligible and the beautiful. I think we may agree with Heisenberg that this **is one of the truly momentous discoveries of mankind**."* [A. Ranganathan, Transmutation from One Form to Another, The Interaction of Colour and the Elements, Some Scientific and Aesthetic Considerations](#)

Pythagoras actually suggests that every truth can be expressed by mathematics and probably a majority of scientists today believe or at least hope this to be true. I. V. Volovich in his paper "Number theory as the ultimate physical theory" in the CERN theory preprint CERN-TH 4781/87 (1987) adopts Pythagoras view. As he says "at the Planck scale doubt us cast on the usual notion of space-time and one cannot think about elementary particles. Thus the fundamental entities of which we consider our Universe to be composed cannot be particles, fields or strings but numbers."

The first to devote themselves to mathematics and to make them progress were the so-called Pythagoreans. They, devoted to this study, believed that the principles of mathematics were also the principles of all things that be. Now, since the principles of mathematics are numbers, and they thought they found in numbers, more than in fire and earth and water, similarities with things that are and that become (they judged, for example, that justice was a particular property of numbers, the soul and mind another, opportunity another, and similarly, so to say, anything else), and since furthermore they saw expressed by numbers the properties and the ratios of harmony, since finally everything in nature appeared to them to be similar to numbers, and numbers appeared to be first among all there is in nature, they thought that the elements of numbers were the elements of all that there is, and that the whole world was harmony and number. And all the properties they could find in numbers and in musical chords, corresponding to properties and parts of the sky, and in general to the whole cosmic order, they gathered and adapted to it. And if something was missing, they made an effort to introduce it, so that their tractation be complete. To clarify with an example: since ten seems to be a perfect number and to contain in itself the whole nature of numbers, they said that the bodies that move in the sky are also ten: and since one can only see nine, they added as tenth the anti-Earth.

[Aristotle, Metaphysica A 5. 985 b 23](#)

Aristotle considered some logical problems of the Pythagorean ideas for example how numbers could produce a material world: *how to make weightless entities (numbers) the elements of entities which had weight.*

Pythagoras and his school had researched the physics of Music. Music happens to be a case of Artificial Quantization: the violin string is held at both ends (Yourgrou et al), so that denoting its length by L, its vibrations are automatically constrained to wavelengths $\lambda = L/n$; $n = 1; 2; 3$; (an integer). Harmonics, octaves, etc - everything in this case is thus "artificially quantized". As a result of the effective quantization, all significant descriptions of musical phenomena (e.g. frequencies of the same note in consecutive octaves, harmonics, etc) end up being expressed as dimensionless ratios between integers, like $1 : 2 : 3 : 4$, henceforth known as pythagoreanisms. ... Pythagoras is known to have conjectured that it should be possible to express the whole of physical science as pythagoreanisms. There was no direct evidence for his conjecture; it was just a very wild guess. This conjecture became known as "the music of the spheres". ...If Pythagoras understood the mechanism producing these pythagoreanisms, his conjecture must have meant that he believed that the world is quantized. Between 500 BC and 1500 AD, the search for the Music of the Spheres was on, but sterile, just because macroscopic physics does not reflect quantization. However, when spectroscopy developed to the extent of measuring the lines of hydrogen or helium, a mathematics high school teacher in Basel, Johann Balmer, was the first person to hear and recognize that "music". Considering that in truth the world is quantized and classical physics just decoheres because it undergoes a large number of scatterings with dust particles, etc, we have to concede that Pythagoras' guess was a real hit. (References: Yourgrou, W. and Mandelstam, S., Variational Principles in Dynamics and Quantum Theory, Dover Pub., New York (1968), 201 pp.)

[Yuval Ne'eman in Symmetry and "Magic" Numbers or From the Pythagoreans to Eugene Wigner, Proceedings of the Wigner Centennial Conference](#)

Pythagorean philosophy introduced a very important idea central to the whole development of science: all complex phenomena must reduce to simple ones. The cosmos exists because there is a mind that can think it." In other words, mathematics (*holos*) is the real reality, while the world (*cosmos*) is just an invention of our minds.

[Review of the Book A Mathematical Mystery Tour: Discovering the Truth and Beauty of the Cosmos by A. K. Dewdney John Wiley & Sons, 1999 ISBN 0-471-23847-3](#)

Even religious personalities are influenced by the ideas of Pythagoras about the numbers. It seems that even God has to finish the creation in six days since this number is perfect:

Six is a number perfect in itself, and not because God created the world in six days; rather the contrary is true. God created the world in six days because this number is perfect, and it would remain perfect, even if the work of the six days did not exist. St. Augustine (354-430) in The City of God, who according to Bernal (1965) was "turning from wicked learning to holy nonsense." Perfect numbers are those numbers that equal the sum of all their divisors including 1 and excluding the number itself. 6 is perfect because it can be divided by 1,2,3 and their sum is also 6.

Arignote, Pythagoras daughter also expressed the opinion of her father:

"the eternal essence of number is the most providential cause of the whole heaven, earth, and the region in between. Likewise, it is the root of the continued existence of the gods and daimones, as well as that of divine man" which exemplifies the belief that the universe is mathematical in nature (Kersey [8]). She echoed her mother in saying that all things that exist can be distinguished through enumeration. Numbers identify things, and also express orderly relationships among things (Waithe [7]). The essence of numbers relates to the harmonious existence of all things. Greek Women Philosophers, Women's Studies Department University of Arizona

Cumulative evidence suggests that arithmetic is "anchored in our genes" [3], that infants are born with a capacity for recognizing and distinguishing among small numerosities [1], and that mathematical objects are the "residue" (a Darwinian term) of objects that have been "selected for their fitness and their coherence" [2]. According to this evolutionary hypothesis, natural selection has acted through phylogenetic evolution to ensure that the brain constructs internal representations that are "advantageously adapted to the regularities of the universe" [3]. The brain, equipped by evolution, translates these structures into mathematics.

As Rocha and Massad point out [4] this is true for patterns and not only for numbers if we accept the definition of Steen of Mathematics as the science of patterns [5]. Edward Nelson, describes in his paper "Confessions of an Apostate Mathematician" how the idea of the numbers existing has influenced Mathematicians and how Eudoxus provided an approach to eliminate the dualism of magnitude and number. (See <http://www.math.princeton.edu/~nelson/papers.html>)

Maybe we have to consider also Kurt Gödel's Incompleteness theorem. Hao Wang said that the Incompleteness theorem shows that either: **the Human "spirit" is superior to any computer, or that Mathematics is not a construction of the human spirit or both.**

QUOTATIONS

I believe that the numbers and functions of analysis are not the arbitrary products of our spirits; I believe that they exist outside of us with the same character of necessity as the objects of objective reality; and we find or discover them and study them as do the physicists, chemists, and zoologists. Charles Hermite in M. Kline, Mathematics: The Loss of Certainty, Oxford University Press, New York, 1980.

Poetry is the only place where the power of numbers proves to be nothing
[Odysseas Elytis, Nobel Prize Literature 1979](#)

[The Power of Number: Riemann for Anti-Dummies Part 51](#)

[THE POWER OF SYMBOL: A MATHS TOOL FOR ANTI-MATHS PEOPLE](#)
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[Karlis Podnieks, PLATONISM, INTUITION AND THE NATURE OF MATHEMATICS](#)

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