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Maintains that even though the Pythagoreans did not pursue aesthetics as an independent philosophical discipline, their conception of the universe and their vision of reality as a whole were decisively influenced by their idea of beauty. Contends that the Pythagorean notions of measure, order, symmetry, and harmony are the true constituents of their understanding of cosmic beauty. Concludes, accordingly, that their conception of the *kosmos* as a thoroughly structured reality is a grand aesthetical conception which rests on the idea of beauty. Ref. 100.

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APHRODITE ALEXANDRAKIS

THE NOTION OF BEAUTY IN THE PYTHAGOREAN STRUCTURE OF THE UNIVERSE

I. Greek civilization, whether of the Minoan or the Hellenistic period, reflects the worship of nature's beauty in its art works and theories. It is true that the Pythagoreans did not pursue "aesthetics as an independent science."¹ But their interest in beauty is reflected in their study and analysis of aesthetic elements such as harmony, rhythm, and symmetry. This, however, does not mean that they did not think of beauty as such. In fact, as has been said, for the Pythagoreans harmony is beauty, and beauty arises from symmetria.² This approach to beauty is, of course, formal.

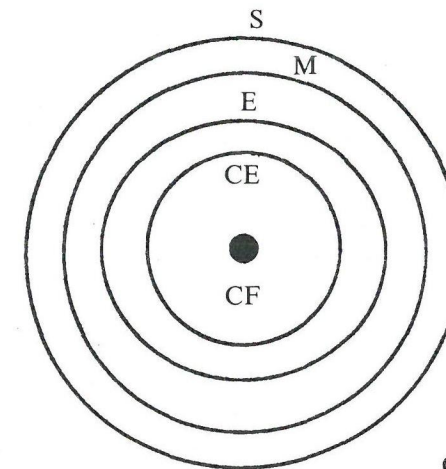
As will be shown in this paper, the concepts of *symmetria* and *harmony* were essential in Pythagorean cosmology. If so, the following question arises: Were the Pythagorean 'scientific' concepts concerning the structure of the universe directly related to their understanding of what beauty is? I contend that if the Pythagoreans were thinking of nature and its phenomena in terms of *symmetria* in constructing their mathematical and 'scientific' theories and for defining the structure of the universe, then they were influenced by the notion of beauty. The notion of beauty goes hand in hand with its logical construction. *Something symmetrical is also beautiful*. The beauty which is hidden behind everything beautiful stimulated the Pythagoreans into thinking of terms such as harmony, symmetry, and order. Naturally, they first thought of the beauty which surrounded them: the beauty of nature. But the term "*harmony*" was used in place of "*beauty*."³

I shall first discuss the Pythagoreans' mathematical consideration of the universe's structure. This will lead to the discussion of two main Pythagorean concepts which are linked to their notion of beauty: the concepts of harmony and symmetry and their relationship to beauty. This will point out the importance of

these concepts in the Pythagorean system. Finally, on the basis of the above, I will attempt to show that the concept of beauty played a fundamental role in the Pythagorean theory of the universe.

II. The Pythagorean theory of the universe starts with the basic premise that the world is constructed mathematically. According to Aristotle, the Pythagoreans thought that the principles of mathematics (numbers) were "the principles of all things."⁴ They conceived the universe as being "a musical scale and a number." They arrived at their theory by recognizing that there are numerical properties in all things.⁵ Furthermore, they observed empirically that the properties and ratios of harmonious musical scales depend upon numbers.⁶ Thus, "Number was for them the ἀρχή that the Ionian philosophers sought."⁶ It has been said that the Pythagorean recognition of the cosmic significance of number and its application is perhaps different from what we understand today and it instead represented Pythagoras' fascination with "a basic secret of nature."⁸ The cosmic significance that the Pythagoreans attributed to number arose from their attempt to "discern kosmos within chaos."⁹ The term "kosmos" suggests order. The main characteristic of order is measure. Measure leads to balance, and this suggests symmetria (proportion). As will be shown, the concepts of order and symmetria in the kosmos coexist with the concept of harmony.

The importance of number and of concepts such as order, measure, symmetry and harmony is indicated in the Pythagoreans' conception of the structure of the universe. The cosmic structure was conceived as consisting of the central fire, counter earth, moon, sun, the five planets, and "the outer sphere of the universe which carried the fixed stars."¹⁰ The symmetric and orderly structure of the universe is indicated in the following diagram.¹¹



S = sun
M = moon
E = earth

CE = counter-earth
CF = central fire

According to the above Philolaic diagram, ten bodies are moving in ten orbits around the central fire.¹² For Pythagoras, "the qualities of numbers exist in the heaven," as is indicated in the diagram, but they also exist in musical scale (Meta. 1090a 23).

There are five stuff elements in ten world elements, or the proportion 1:2. Such proportion is called an octave, or harmonia. This world harmony contains also all the other musical proportions, such as, 2:3, 3:4, etc.¹³

III. In addition to the mathematical concepts, two concepts were of great importance to Pythagorean cosmology: symmetry, and harmony. Symmetry seems to be the result of the order which exists in the Pythagorean kosmos as indicated in the diagram¹⁴ above. Plato, whose Pythagorean influence is apparent, confirms the importance of measure and symmetry in beauty.¹⁵ He says:

...any compound, whatever it be, that does not by some means or other exhibit measure and proportion, is the ruin both of its ingredients and, first and foremost, of itself.¹⁶

It may be said that order cannot be conceived without measure,

which involves both definition (marking the boundaries of things) and analysis of the interrelationships of discrete forms.¹⁷

It is precisely by this effort they make to maintain the due measure that they achieve effectiveness and beauty in all that they produce.¹⁸

Plato goes even further by suggesting that measure and beauty are identical.¹⁹ Plato's definition of order (*τάξις*) is rooted in the Pythagorean theory. It means "how correctly is the object produced,"²⁰ in other words, how correctly its parts are arranged.²¹

The concept of symmetry is deeply rooted in Greek thought, both from a philosophical and an artistic point of view.²² The Presocratics' aim was to discover and construct order behind their experience of the world of natural phenomena. Later on, in classical Greece, the concept of *symmetria* was applied to the arts, specifically sculpture, and it became the core of Polycleitus' *Canon*. In order to achieve beauty (*κάλλος*) there has to exist *symmetria*, "the perfect commensurability of all the parts of the statue to one another and to the who-

le."²³ Finally, as Galen (second century A.D. physician) suggests, beauty arises from *symmetria*.²⁴

IV. Let us now turn our attention to the other important Pythagorean concept, that of harmony. Most philosophers agree that Philolaus' fragments are the only direct sources of Pythagorean philosophy.²⁵ According to these sources, Pythagoras conceived of a universal harmony produced by the movements of the planets. In their movement the planets followed a geometric pattern, an astronomical order "conceived both geometrically and musically."²⁶ This is the doctrine of the "Music of the Spheres" according to which

...the movement of the stars produces a harmony, i.e., that the sounds they make are concordant...²⁷
...as the eyes are framed for astronomy so the ears are framed for the movements of harmony.²⁸

The Pythagorean belief that "the whole heaven is harmony and number" is expressed in the following passage:

Since the principles or origins (*archai*) <namely, those from which the world order was formed, the limiting and unlimited in numbers as the odd and even> were not similar nor of the same kind, it would have been improbable for them to be set in order, if there had not supervened a fitting together (*harmonia*). It was necessary that they be fastened together by a *harmonia* such that by it they could be held in order.²⁹

As indicated in the above passage, the notion of *harmonia* has more than one definition. On the one hand, it is a "fitting together,"³⁰ on the other, it is tied up with mathematics. The Pythagorean thought that the universe consisted of numbers and that numbers are tied up with harmony resulted in a harmonic conception of the universe. This harmonic conception of the universe was also tied to the musical scale which they named harmony. Philolaus explains the intervals of the musical scale in terms of ratios, 1:2 (octave), 3:2 (fifth), and 4:3 (fourth). This proportional theory was based on the theory of vibrating strings. According to Philolaus, "these ratios are the fundamental principles of cosmic order."³¹ Thus, harmony takes on a 'scientific' character. As a result, it may be said that the Pythagorean cosmology was based on harmonic relationships, some of which are contained in the *tetractys* of the *decad* which is a system of numbers. "It symbolizes the 'elements of number' which are the elements of all things."³² The *tetractys* has been explained as being the discovery

of the chief musical intervals, the octave, fourth, and fifth, expressed as the numerical ratios 2:1, 4:3, 3:2, of the fact that the first four integers add up to ten, and that the diagonal of the square is incommensurable with its side.³³

The *tetractys* has been identified by Iamblicus with the cosmic harmony, and was called by Plutarch *kosmos*, *ouranos*, *pan*.³⁴ Thus, harmony brought together and put in a certain order the "mixed elements" of the universe. The Pythagorean principles of the limiting and the unlimiting were "combined by a harmonic process"³⁵ of a metaphysical nature. The result is an orderly, harmonious universe.

We have seen that harmony is tied up with mathematics, music, and their components: symmetry, order, measure. Consequently, harmony is a scientific, metaphysical, and practical notion.³⁶ In addition to the above meanings, harmony has a moral connotation also. According to Philolaus, the soul is a harmony.³⁷ In man,

there are four stuff elements in eight world elements. This too, is a proportion of octave, or harmonia, or 1:2, and likewise also the musical proportions are contained in it.³⁸

Plato informs us that virtue is concord (*symphonia*), that is, "peace of the soul gained by the mastery of passion and animal desire."³⁹ If virtue is *symphonia*, then the soul is "the harmonia which contains it."⁴⁰ Since harmony is the compound of mixed, opposing elements, the soul is also a compound of good and evil parts. The question is: How is harmony or the good achieved? The answer is not found in the Pythagoreans but in Plato. In Plato's theory of imitation, which is also a moral theory, the "formal elements" are basically of a Pythagorean nature. It is through formal elements such as symmetry, order, harmony, and rhythm, which are found in music, that one recognizes beauty and the good. Therefore, Plato emphasizes the study of music. When a child grows up in an environment of "pure beauty and grace," that is, when his education consists of *Mousike*, his sense of hearing and sight will be sensitive and able to recognize the good, and will be capable of good reasoning.⁴¹ Thus, through the study of music man develops love for the beautiful, and for Plato love for the beautiful is love for the good.⁴² The latter seems to be rooted in Pythagoras' doctrine. Though there is no use of the term "beauty" in his theory, it is possible that the Pythagoreans "employed rather the term 'harmony' in place of beauty."⁴³ Hence, the scientific and religious "character of the Pythagorean movement is reflected in its aesthetics."⁴⁴ As a consequence of all the above, the following question may be asked: Were the Pythagorean 'scientific' concepts

concerning the structure of the universe directly related to their understanding of what beauty is?

V. 1. We saw that for Plato *measure* and *beauty* are identical (see above 4). But it has been shown that the same can also be said of the Pythagoreans. For *measure* and *symmetry* are not only the most important ingredients of *beauty*, but without them there is no beauty (see above 4). Hence, mathematics and geometry take on an "aesthetic character". This "aestheticomathematical" notion of the universe can also be experienced visually, as the Pythagoreans conceived it (see diagram).

2. It is likely that the Pythagoreans employed the term "harmony" in place of "beauty" (see § II.). Let us reflect on the Pythagorean belief that "the whole heaven is harmony," which was mentioned earlier. Philolaus informs us that it is the presence of *harmonia* which puts in order the *archai*, (*ἀρχαί*) principles of the limiting and the unlimited. This order, the perfect structure and appearance of the planets and the heavenly bodies, result in beauty which can also be detected visually. It was, perhaps, this beauty which was the basis and motive for the Pythagoreans' wonder about the structure of the universe. As a result, harmony, or beauty, takes on a metaphysical aspect which Plato, later on, calls the "Idea of Beauty."

3. The Pythagoreans' main purpose in life was self improvement.

Their concern was with the practice of a sort of *mental* and *physical hygiene* in which science and self examination, taboos of various kinds, music, and mathematical studies were all ingredients.⁴⁵

This lifestyle concerned the moral aspect of the soul, and, as has been mentioned above, for the Pythagoreans "the soul is a harmony." This concept, which occupied Plato extensively, was rooted in the Pythagorean doctrine. If the soul is a harmony, and if harmony is beauty, then the soul is beautiful, harmonious. Furthermore, if "the love of the beautiful is the love of the good", then the soul is not only beautiful but also good. Thus, the notion of harmony gives its moral and aesthetic character to the soul.

VI. In conclusion, this paper has shown that according to the Platonic and Aristotelian sources, the Pythagorean concepts of *measure*, *order*, *symmetry* and *harmony*, are the constituents of beauty. Furthermore, beauty at times is identified with these concepts. It was also shown that the Pythagoreans thought of nature and its phenomena in terms of symmetry. If so, then their motive for searching for, constructing, and defining the structure of the universe was their concern for beauty. For as has been said, the term "harmony" was used in place of "beauty," and there was no distinction between measure and beauty. The concept of harmony, therefore, was not only a cosmological and an ethical concept, as has been held,⁴⁶ but an aesthetic one as well. Thus, for the Pythagoreans, the order of the *kosmos* was not only physical, metaphysical, religious, scientific,

and ethical, but also aesthetic. For, as we have seen, order leads to symmetry, which is related to harmony, and harmony is beauty. Beauty, in turn, is the result of symmetry, measure, number, and the combination of the Platonic formal elements.

NOTES

1. W. Tatarkiewicz, *History of Aesthetics*, v. I (Paris, Mouton, 1970), p. 80.
2. H. Diels, *Fragmente*, 40a3 (Galen, *De Placitis Hippocratis et Platonis*, Ed., Muller, 5:425).
3. *Ibid.*
4. *Metaphysics*, 985b 26, 968a 1,2, 1080b 19, 1090a 21-23.
5. *Meta.*, I, 5, 955b 23-35, 986a 1-3.
6. *Meta.*, 1090a 23-24.
7. D.R. Dicks, *Early Greek Astronomy* (Cornell Univ. Press, 1970), p. 64.
8. M.L. West, *Early Greek Philosophy and the Orient* (Oxford: Clarendon Press, 1971), p.216.
9. J.J. Pollitt, *The Ancient View of Greek Art* (Yale Univ. Press, 1974), p. 16.
10. Dicks, p. 66.
11. *Ibid.*, p. 69.
12. *Ibid.*, p. 68.
13. F.M. Cleeve, *The Giants of Pre-Socratic Greek Philosophy*, v. II (The Hague, 1965), p. 478.
14. The same notion of order is found in Plato's *Philebus* 55e, 65d, and *Politicus* 283d.
15. In the *Philebus* 55e, 64d, and 65d, Plato refers to *metron*. In the *Politicus* 283d, he refers to measure, *metron*, and measurement, *metritike*, as "Length and shortness, excess and deficiency in general."
16. *Philebus*, 64e.
17. Pollitt, p. 15.
18. *Politicus*, 284b.
19. *Philebus*, 64e, *Politicus*, 284a-b.
20. *Laws*, 669b.
21. In the *Laws* (669), Plato's requirements for a work of art are, symmetry, order, and harmony (the correct shapes and colors).
22. Pollitt, p. 15.
23. *Ibid.*
24. Diels, *Fragmente*, 40A3.
25. C.H. Kahn, *Pythagorean Philosophy before Plato* (The Pre-Socratics, Ed. A.P. Mourelatos, Anchor Books, 1974), p. 172.
26. Ph. Wheelright, Ed., *The Presocratics* (New York, Odyssey Press Inc., 1966), p. 208.
27. Aristotle, *De Caelo*, II, 9, 290b12.
28. *Republic*, 530b.
29. W. Burkert, *Lore and Science in Ancient Pythagoreanism*, Tr. by E.L. Minar Jr (Cambridge, Mass., Harvard Univ. Press, 1922), Philolaus B6.
30. G.S. Kirk, *Heraclitus* (Cambridge Univ. Press, 1954), pp43-44. The noun appears in Homer in reference to concrete fittings together.
31. Kahn, p. 177.
32. F.M. Cornford, *Mysticism and Science in the Pythagorean Tradition* (Ed. Mourelatos), p. 147.
33. Dicks, p. 65.
34. Cornford, p. 147.
35. E.A. Lippman, *Musical Thought in Ancient Greece* (Columbia Univ. Press, 1964), p. 14.

36. It means the "tuning of an instrument."
37. Cornford, p. 145. *Phaedo* 85e, *De Anima* I 4.407b, and *Politicus*, VIII5, 1340b 18.
38. Cleeve, p. 494.
39. Cornford, p. 145.
40. *Ibid.*
41. *Republic*, 401d-402a.
42. *Rep.*, 401a-402e.
43. Tatarkiewicz, p. 80.
44. Diels, *Fragmente*, 40A3.
45. D.J. Furley & R.E. Allen, Ed. *Studies in Presocratic Philosophy*, v. I (Humanities Press Inc., N.Y., 1970), p. 18.
46. Tatarkiewicz, p. 85.

APHRODITE ALEXANDRAKIS
PROFESSOR OF PHILOSOPHY
BARRY UNIVESITY
MIAMI - FLORIDA