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## The Structure of Pythagorean Reality

Leah Niess  
Spring 2000

In some very significant ways, mankind has not changed much in the last couple thousand years. We are still searching for the secrets of the universe. We still press on to what we perceive as the outer limits of our world and make speculations about what lies beyond our reach, beyond our sight. The difference is that today we speak of atmospheres, gravity and black holes, while Classical civilizations thought in terms of gods, impassable mountains, and uncrossable seas. We may think the ideas of the past are primitive, or even silly, but essentially they are attempts at doing the same things we do now, that is, search for order and, therefore, stability in our physical existence.

Pythagoras was an ancient Greek mathematician who greatly contributed to the evolution of mathematics in classical civilization, but his contributions extended beyond the geometrical proofs he is known for today. In fact, he attempted to define reality and in doing so influenced the way humanity conceived reality. For Pythagoras, “the sudden realization of the potentialities of mathematics proved so overwhelming that [he] was content to explain everything in its terms”(Pollard, 112). His attempts to define the universe in terms of numbers not only gained him many followers but also influenced the likes of philosophers such as Plato and Socrates.

Pythagoras’ seeks to decipher the mathematical code by which reality is structured. The mathematical heart of Pythagorean structure is the number three, called the triad. The triad symbolized such concepts as proportion, harmony, and perfection—all of which are imperative in maintaining the order that was a part of Pythagoras’ idealized concept of structure (Guthrie 322).

Since mathematics is the basis for Pythagorean structure, and ideal structure is represented as tripartite, it is important to understand the mathematical functions of the

triad and the progression of its mathematical significance to its cosmological significance. The meanings associated with the number three —proportion, harmony, and perfection—can be applied to the simplest mathematical contexts as well as to the most complex. A simple representation would be three's role in the comparison of numbers where all numbers are divided into three evenly proportioned groups—greater, lesser, and equal. A more complex mathematical representation of the triad is planar geometry. The number three is connected with planar geometry in a number of ways that map a path from mathematical significance to cosmological significance. On the simplest level, planar geometry is connected with three by the fact that it is based on triangles. Eventually, though, planar geometry was used by Classical civilization to calculate planetary movements, which were divided into three categories—direct motion, retrogression, and stationary (Iamblichus 52). The progression of planar geometry from paper to the sky represents well the evolving cosmological existence, but the ultimate progression of the applications of planar geometry is evidenced by the fact that planar geometry is the basis for the conception of three-dimensional space. Perhaps finding an orderly way to represent such a complex idea as spatiality became the metaphorical basis for Pythagoras' belief that all reality could be ordered in terms of mathematics.

Though Pythagoras' concept of structure is ideal, all structure, even perfect structure, creates limits. What makes up a structure is a set of rules, definitions, or dimensions that create the basis for the structure. The existence of these standards implies that there is also that which is not structured, and from which structure must be created. Pythagoras recognized the fact that structure cannot be defined without defining non-structure as well. He also understood structure and non-structure to be at odds with

each other, each trying to take over the other. To explain the relative stability of reality, Pythagoras envisioned a reconciling factor that limits the movement of structure into non-structure and vice-versa, thus it is the third factor that completes Pythagoras' triadic cosmological archetype.

Classical civilization incorporates this cosmological archetype into its literature.

The creation story in Ovid's Metamorphosis is an excellent example:

Nothing was able to maintain its form  
Because each thing was at odds with the other.  
Contained in this sphere, heat fought with coldness  
And moisture with dry, and hard fought with softness,  
And things with weight fought with things having none...  
And then some god, a higher nature,  
Stopped this controversy, and cut  
The sky from the land and from land the water  
And the thickened air was distinguished from clear.  
Then after he had detached that heap  
And divided it up in its proper order,  
He bound each part tight into place,  
Forming a peaceful harmony.

Colavito describes this passage as one where "the active principle represented by the number three is expressed by Ovid as the demiurge...[who] represents the separating and distinguishing force...The demiurge here is the active principle. He cuts, detaches, and binds the shapeless mass of possibilities into a harmonious system"(Colavito, 19). It is important to note that in this passage, one sees Ovid personifying the third factor.

Though Pythagorean triadic themes can be found throughout classical culture, classical civilization does not represent these themes in the abstract way in which Pythagoreans do, but, instead, personifies these concepts copiously throughout mythology.

Another mythological representation of the Pythagorean triad is the ocean, personified as the god Oceanus (Okeanos) or simply Ocean. The Greeks and Romans believe that their universe was divided into two major parts: the realm of the living and

another realm that only the gods or the dead could enter. What separates these two worlds is Oceanus. At this point in time, the ocean was not perceived as crossable, and so provided a perfect third element, a barrier between the two realms. In this way, Oceanus maintained cosmological order.

In mythology, the lineage of the gods is important because it shows the perceived relationship between the things that are being personified. By examining the lineage of Oceanus, one sees the Pythagorean function of Oceanus passed on to his descendants. Though Oceanus passes on his characteristic border role to all of his children, who are all springs and rivers, Oceanus' most important child, Styx, is the most like him in a Pythagorean sense. When humans died, they went to an underworld through which they could only enter by passing over the river Styx. Under normal circumstances only the dead could cross the river. Thus, like Oceanus, the river Styx maintains cosmological order by separating the living from the dead.

There are exceptions to the rule of crossing the Styx, one being Aeneas in Virgil's Aeneid. Through Aeneas' eyes, we are given a description of Styx. Virgil's vision of the underworld is one where the dead wish to return to the world of the living, "but iron law/ Stands in the way, since the drear and hateful swamp/ Has pinned them down here, and the Styx that winds/ Nine times around exerts imprisoning power"(Book VI, 216-219). In this passage we see the number nine associated with Styx. Though Styx fits into the scheme of the Pythagorean triad, the third limiting factor of the triad is, in itself, represented by the number nine, or the ennead. Ocean, himself, is also associated the ennead (Hesiod 77). Just as important to this passage, though, is the "iron law" and

“imprisoning power” of Styx<sup>1</sup>. Here the concept of Styx’s function as a boundary is recognized as a natural law, just as modern society recognizes gravity.

One sees natural law also associated with the triad in mythology through the Fates. This group of three divine beings determines the fate of both man and god. Iamblichus presents the importance of the Fates in terms of their participation in the dynamics of existence. He says that, “the whole life of both divine and mortal beings is governed by emission and receiving and thirdly requital, with the heavenly beings fertilizing in some way, the earthly beings receiving, as it were, and requitals being paid by means of those in the middle, as if they were a generation between male and female”(53). In other words, the dynamics of existence involve the gods giving, mankind receiving, and the Fates taking away. Iamblichus represents male and female as entities with complimentary functions, which he relates back to the relationship between gods and man. But he also says that the dynamics of existence go beyond that of giving and receiving to include “requital”, which represents law in the form of justice. Additionally, one can also make a connection to the finite nature of things.

The relationship of time with the Pythagorean concept of the triad is present beyond its representation in the existence of the Fates, though it is somewhat more vague than the triad’s relationship to spatiality. Like numbers, time is compared through its tripartite division, which, in the case of time, is past, present, and future. Also, time can be recorded by natural phenomena, such as the through the observation of the three cycles of the moon, or through the observation of the stars and planets, whose connection

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<sup>1</sup> The Styx’s dual association with law and the ennead is further demonstrated in mythology. The Styx was the river by which the gods swore oaths. If this oath was broken, the god who swore it would be “without any share in the life of the immortals for nine years” (Hesiod 77).

with the triad we have already discussed. In this way Pythagoras' concept of reality is consists of space and time, terms which mankind still uses to describe reality.

Mankind, though, has never been satisfied in conceiving reality as purely physical, a fact which is demonstrated by the presence of religion throughout history. In general, one of the central features of religion has been the concept of the soul. It has been said that "Pythagoras was the first Greek to regard the human soul as something of moral importance," and the soul is one of the most significant expressions of the triad in classical times (Pollard, 115). The Platonic doctrine of the tripartite division of the soul spoke of dualism in human nature "which could only be resolved by effecting a reconciliation between the two warring parts". The reconciling factor became the third part of the soul, thus its representation as tripartite. Furthermore this tripartite division was extended to an "analogy of these [three] parts with the gods and the beasts, with man as the mean between the two." This was an analogy that "was alluded to by both Plato and Aristotle in a manner which suggests that they were quoting on earlier and familiar doctrine, which could well have been Pythagorean."

Pythagoras and his followers, referred to as the Pythagorean school, incorporated their philosophies into their religion. One of main features of Pythagorean philosophy is portraying "the victory of Limit and perfection over the Unlimited and random disorder," which is equivalent to the victory of bounded over unbounded space (Ballew 29). Furthermore, the personal embodiment of order was also important to the Pythagoreans, thus they were ascetics (Pollard 114). This was to make their life as orderly and therefore as close to divine as possible: "the more one knows the cosmos in all its perfection, the



more like it he will become: the study of order engenders orderliness in the student, and to become perfectly human thus means to become divine”(Ballew 29).

In keeping with the personal embodiment of order, Pythagoreans regard childbirth as extremely taboo. To touch a women giving birth or coming into contact with body fluids that were part of a birth render a Pythagorean ritually unclean.<sup>2</sup> This was so because pregnancy was the boundary between disorder and order, between nonexistence and living existence. This had mathematical resonance with the Pythagoreans in that pregnancy was a nine-month, or enneadic period. Therefore, Pythagoreans closely associated childbirth with disorder, which was too distant from the principles of divine order to be an event with which they could associate themselves.

Another practice considered taboo was the consumption of beans. This was for a number of reasons which include the following: “[beans] resemble the gates of Hades, or the whole universe: their stems were throughout and unjointed; Pophry connected this fact with the return of souls from beneath the earth: they are of a windy or breathy nature and hence full of life-force: they contain the souls of the dead”(Guthrie, W. 185). Furthermore, beans were used in rituals to wards off ghosts: “the officiant...making a magical sign to keep unholy things at arm’s length...took nine<sup>3</sup> black beans into his mouth...because...they are connected with ghosts and the realm of darkness generally”(Rose 33)<sup>4</sup>. Hence, the consumption of beans, like pregnancy, is too closely related to disorder, in this case the disorder of death, for a Pythagorean to consume. This is one of a number of examples of Pythagorean ritual, or perhaps mere superstition, that “betray their origin in sympathetic magic, which assumes a close, quasi-physical

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<sup>2</sup> Rose, H. J. Ancient Greek Religion.

<sup>3</sup> Again we see an enneadic reference representing the boundary between realms.

<sup>4</sup> Rose, H. J. Ancient Roman Religion.

relationship between things that the civilized mind have no such connection at all”(Guthrie, W. 185), much the same as is demonstrated in the assigned lineage of the Greek and Roman gods.

Besides superstitious representations of Pythagorean religion, there are some rituals that better demonstrated pure Pythagorean concepts. One of these is the tripartite wedding ritual. In ancient Greek wedding ceremonies, “the fundamental parts of a true wedding ceremony are three; the bride must cease to be her father’s daughter, she must be protected against evil influences during this short time when she is neither daughter nor wife, and therefore has no household gods of her own, and she must be assimilated to the family of the bridegroom”(Rose, 32)<sup>5</sup>. Here, again, we see the theme repeated of two opposing parts being reconciled by a third; the bride’s transition from life with her parents to life with her husband is buffered by a period when she is neither.

Pythagorean concepts are also present much later in Christian texts, such as Dante’s Divine Comedy. The Divine Comedy is highly influenced by traditional Greek and Roman mythology and shares with it certain Pythagorean cosmological features, though these features have been altered to fit Christian purposes. The Ocean is present in Dante’s cosmology as a boundary around the mountain of Purgatory just as it is a boundary around the earth in mythology. Dante cosmology, though, is supposed to be divinely created by the Christian God. In order to demonstrate the Greeks and Roman misunderstanding of the world, Dante relegates Ulysses (Odysseus) to Hell after his final adventure in which he reaches the ocean around Mount Purgatory, but is unable to go any farther (Inferno XXVI). In this scene, Dante shows us Ulysses’ ignorance of the existence of God. This ignorance is common to all figures of Greek and Roman

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<sup>5</sup> See note 4.

mythology and history and so even those who are considered by Dante as virtuous heathens find themselves in Hell, albeit a relatively comfortable part of Hell (Inferno IV).

Representations of the Pythagorean triad are common in the Divine Comedy, as well. Dante's work is mathematically ordered in nearly every aspect from the meter to the division of cantos<sup>6</sup>. The first division of the overall work, though, is in three parts<sup>7</sup>: Inferno, Purgatorio, and Paradiso, or Hell, Purgatory, and Heaven. In this work, Purgatory is the buffer zone between damnation and salvation, two worlds that, by definition, can never meet. This is quite similar to Greek and Roman cosmology that preceded it. Furthermore, we see the concept of the triad adapted to the Christian doctrine of the Trinity. In "Paradiso", Dante gives us a picture of God: "In the deep and bright/ essence of that exalted Light, three circles/ appeared to me; they had three different colors,/ but all of them were of the same dimension"(Paradiso XXXIII, 114-117). Dante represents the presence of the single Christian God, himself, as tripartite<sup>8</sup>. Christianity, however, does emphasize the dualism that exists between Good and Evil, God and Satan. Therefore, one can explain the trio of traitors in the deepest level of Hell—Brutus, Cassius, and Judas—as the evil counterpart to the holy trinity. By this design, Dante can maintain the duality between Good and Evil and incorporate the concept of the triad while still giving the edge to God, since Satan himself is not manifested in tripartite form.

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<sup>6</sup> For further explanation of the intricately mathematical construction of the Divine Comedy, see Joan Ferrante's article "A Poetics of chaos and harmony" in The Cambridge Companion to Dante. Ed. Rachel Jacoff. Cambridge: UP, 1998.

<sup>7</sup> Furthermore, each of these three parts is divided into nine parts that recalls the "iron law" and "imprisoning power" of the enneadic Styx.

<sup>8</sup> Worth noting is that Dante also says in Canto XXXIII of Paradiso, "As the geometer intently seeks/ to square the circle, but he cannot reach,/ through thought on thought, the principle he needs"(133-135). As the editor of the edition used here notes (see works cited), Dante is referring to the fact that "the problem of constructing a square equal in area to a circle is a proverbially insoluble math problem". This underscores the mathematical resonance of the Divine Comedy.

Though our “civilized minds” no longer prohibit the consumption beans or shun contact with a pregnant woman, some of us still accept the tripartite representation of a single God. Furthermore, we commonly understand our reality in terms of space and time, though we leave the mathematical representation to the scientists. It is ironic that we remember Pythagoras only for the simple equation of right triangle while his idea to mathematically represent reality is one that remains central to modern life. Our society, perhaps now more than ever, relies on the basic ideas of Pythagoras. We are so dependant on computers, whose entire language is based on numbers. In this sense, we have attempted to prove the Pythagorean concept of mathematical reality by demonstrating it in terms of virtual reality. Though countless people have contributed to the evolution of mathematics and its scientific applications, we should appreciate the influence a pure idea such as Pythagoras’ can have on the consciousness of mankind.

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