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book review

4 The Pythagorean tradition

In the modern world Pythagoras is the most famous of the early Greek philosophers. The same was true in the fourth century B.C., when Plato wrote his *Republic*, some 150 years after Pythagoras left Samos in about 530, to emigrate to Croton in southern Italy, where Pythagoreanism would flourish. Plato has Socrates say that Pythagoras was “especially loved as a leader of education in the private sphere,” and that his followers

...loved him for his teaching and handed on to posterity a certain way of life...and these latter-day followers even now seem in some way to stand out among others for their manner of life, which they call Pythagorean after him (*Rep.* X 600a9-b5).

However, beginning with Plato's successors in the Academy, the reputation of Pythagoras became seriously exaggerated, and by the fourth century A.D. in the Neoplatonic tradition, he had become the greatest of all philosophers, from whom both Plato and Aristotle borrowed their central ideas.

Unfortunately, Pythagoras' distorted post-Platonic reputation has hindered an accurate appreciation of his genuine accomplishments and also those of other early Pythagoreans, particularly Philolaus of Croton. Moreover, despite Pythagoras' fame, Pythagoreanism has been poorly integrated into recent studies of early Greek philosophy. It seems to mean either too much or too little: Pythagoras has either anticipated all of Platonic metaphysics, or it is impossible to say anything about him at all. In addition, classical studies have been torn between scholars who still uphold the Greeks as models of rational inquiry and those who emphasize the irrational in Greek

culture. Pythagoras duly becomes either the first to recognize the role of mathematics in describing the order of nature, or a wonder-working shaman.¹

The Pythagorean question, the problem of determining the beliefs and activities of the historical Pythagoras, arises primarily because Pythagoras wrote nothing.² It is an even more difficult problem than the parallel Socratic question, because no younger contemporary wrote about Pythagoras as Plato and Xenophon wrote about Socrates. The first detailed accounts of Pythagoras, treatises by Aristotle and his pupils that survive only in fragments, date to the late fourth century B.C. Our earliest complete accounts of his life and beliefs are from the third and fourth centuries A.D.: the works by Diogenes Laertius, and the Neoplatonists Porphyry and Iamblichus. These latter works arose in a spiritual climate in which there was a need to identify a divine man to whom all truth had been revealed by the gods.³ Pythagoras, whose fame was great, but who had left no writings to contradict what the later tradition assigned to him, was admirably suited to play this role. Iamblichus calls him "the divine Pythagoras" (*On the Pythagorean life* 1), and Porphyry reports that "about no one else have greater and more extraordinary things been believed" (*Life of Pythagoras* 12.28). This view of Pythagoras was handed down through Proclus to the Middle Ages and the Renaissance, when Neoplatonism was widely influential.⁴

The hagiography of Pythagoras can first be traced back to a movement known as Neopythagoreanism, which started in the first century B.C. in Rome and Alexandria and flourished in the work of Moderatus of Gades in the first century A.D. and of Nicomachus of Gerasa in the next century.⁵ Nicomachus presents the Pythagoras who is common in popular imagination: the great mathematician; founder of the quadrivium of arithmetic, geometry, astronomy, and music (*Introduction to arithmetic* 1–3). Nicomachus' Pythagoras also originated Plato's distinction between the intelligible and sensible worlds, and Nicomachus quotes from Plato's *Timaeus* to illustrate Pythagoras' philosophy. This Pythagoras, in fact, originated much earlier, in the later part of the fourth century B.C. among Plato's immediate successors in the Academy.⁶ Paradoxically at this time, when, according to Aristotle's pupil Aristoxenus, the last of the followers of Pythagoras lived (D.L. VIII.46), Pythagoras himself was reborn in even greater form.

Detailed analysis of the later tradition is outside the scope of this chapter, but a grasp of its assumptions is crucial to understanding Pythagoras' true achievement. Too often Neopythagoreanism lives on in the study of early Pythagoreanism. Pythagoras is often not distinguished from his early followers, with the result that Pythagoreanism from the flourishing of Pythagoras himself (530–490 B.C.) down to Aristotle almost 200 years later is treated as a seamless whole. Pythagoras thus becomes the divine founder to whom Pythagoreanism was handed down fully formed.⁷ Again, while the influence of Pythagoreanism clearly lies behind Platonic dialogues such as *Phaedo* and *Timaeus*, passages from Plato are frequently quoted uncritically as evidence for Pythagoras' thought.⁸ Finally, granted that the later tradition must preserve some early material, the identification of what is early often proceeds without criteria other than what is commensurate with a particular scholar's conception of the greatness of Pythagoras.⁹

This modified Neopythagorean approach to Pythagoras has now been undercut by Walter Burkert's precise analysis of the later tradition.¹⁰ He distinguishes two primary traditions about Pythagoreanism in the fourth century B.C. One is represented by Aristotle; the other began among Plato's successors in the Academy, Speusippus and Xenocrates. Aristotle (1) talks about Pythagoreans of the fifth century and never about Pythagoras himself when discussing metaphysics and cosmology (*Metaph.* I. 4 985b23); (2) refers to these Pythagoreans as the "so-called Pythagoreans," indicating that this is the name in common use, but questioning the connection between their thought and Pythagoras; (3) discusses Pythagoras himself in the fragments of his specialized works, but portrays him only as a wonder-working religious leader (e.g., Aristotle, fr. 191 Rose); (4) sharply distinguishes Pythagoreanism from the Platonic separation of the intelligible and sensible realms and from the introduction of the one and the indefinite dyad as ultimate principles. Aristotle's Pythagoreans recognize only the realm of sensibles and seem to identify numbers with sensible objects (*Metaph.* I. 6 987b29 ff.).¹¹

On the other hand, the Academic tradition (1) makes Pythagoras himself the central figure rather than the Pythagoreans; (2) refers much of Plato's philosophy back to Pythagoras, including both the use of the one and the indefinite dyad as ultimate principles and also the cosmology of the *Timaeus*. It is this tradition that dominates later

treatments of Pythagoreanism. Aristotle's account of Pythagoreanism makes sense of it as a system contemporary with the atomists, but simply was not as exciting as the tradition that makes Pythagoras the originator of Platonic metaphysics and at the same time gives the authority of ancient wisdom to Plato's system. One of the fruits of the Academic tradition is the large number of treatises forged under the names of early Pythagoreans, the Pythagorean pseudepigrapha, which seem to originate largely in the first and second centuries B.C.¹² These documents are the Pythagorean "originals" from which Plato and Aristotle are supposed to have derived their central philosophical concepts.

Thus, Aristotle's presentation of Pythagoreanism, although it also needs correction, is much more likely to allow us to appreciate the actual contributions of Pythagoras and fifth-century Pythagoreans than the Academic tradition. As one of the central controls for developing an accurate account of early Pythagoreanism, Aristotle's presentation undermines the assumption that what the later tradition frequently assigns to Pythagoras must contain a kernel of truth. The Pythagoreanism of late antiquity was not motivated by documentary evidence but by Pythagoras' status as the ultimate sage. Although the later tradition may preserve some reliable information about Pythagoras, its testimony cannot be accepted unless it agrees with sources earlier than his canonization by the Academy.

One final result of Burkert's revolutionary work is the stunning news that we do, after all, have some primary texts for early Pythagoreanism. A core of the fragments assigned to Philolaus of Croton do not fit the mould of the Pythagorean pseudepigrapha and, in fact, agree with Aristotle's account of fifth-century Pythagoreanism. Rather than making the more than 150 years of early Pythagoreanism a unified system, our best evidence distinguishes between Pythagoras and fifth-century Pythagoreanism and shows that there is more precise evidence for Philolaus than for Pythagoras himself.

PYTHAGORAS

Although Burkert's approach to Pythagoras may seem to diminish his importance, the early evidence still reveals that there was no more important figure in early Greek thought. Pythagoras' greatness lies in his introduction of (1) a powerful new vision of the fate of

human beings after death, the doctrine of metempsychosis; and (2) a way of life tightly governed by a moral and religious code that took southern Italy by storm and still produced followers more than 100 years after his death.¹³ However, while there is enough reliable evidence to trace the outlines of his achievement, the details of his teachings are often impossible to recover. An unusually cautious passage in Porphyry (*Life of Pythagoras* 19 – derived from Aristotle's pupil Dicaearchus) reflects the early evidence reasonably well. Upon Pythagoras' arrival at Croton:

a great reputation grew up around him, and he gained many from the city itself as followers; not only men but also women. . . . Now the content of his teaching to his associates no one can describe reliably. . . . But the doctrines that became best known to the public were first, that the soul is immortal, then that it migrates into other species of animals. . . . (tr. after Burkert).

Our earliest evidence associates Pythagoras with this transmigration of souls, metempsychosis. His contemporary Xenophanes mockingly tells the story that Pythagoras once urged a man to stop beating a puppy saying, "It is the soul of a friend; I recognized it when I heard it speak" (DK 21 B7). Traditional Greek religion, as reflected in the Homeric poems, emphasized the shortness of human life in contrast with the immortal gods. Upon death, the shade goes down to Hades where it has only the most tenuous existence, one so bleak that the hero Achilles asserts that he would rather "be a slave on earth even to a poor man with no land, than be king of all the dead below" (*Od.* XI.489). Pythagoras offers what Achilles asked for and more, rebirth on earth, and, through a cycle of rebirths, an approach to the immortality previously reserved only for the gods. Pythagoras may have originated the doctrine himself or drawn it from Egypt (Herodotus II.123) or India (more likely), but his introduction of it into the Greek world had a widespread impact, particularly in southern Italy and Sicily where he was active.¹³ Pindar, in an ode for Theron of Acragas in Sicily written in 476 B.C., says that those who have kept free from injustice in three lives will pass to a marvelous existence in the Isles of the Blessed (*Olympian* 2.68ff.).

The details of Pythagoras' version of metempsychosis and its attendant view of the soul are impossible to recover. Common elements in later versions found in Pindar, Empedocles, and Plato provide possibilities but not certainty.¹⁴ Is everybody reborn or just a select few?

Are we reborn just into human and animal lives or also into plants? Is there a set number of rebirths or is it an endless cycle? Plato and Empedocles envisage a fall from an original blessed state followed by a fixed period of incarnations after which it is possible to return to our original condition. Herodotus talks of being reborn into every form of animal before being reborn as a man (II.123).

Is the soul that transmigrates the unified personal soul that is responsible for our consciousness and activity in this life? This is the case in Plato, but in Empedocles what transmigrates is called a *daimôn* and not a soul (*psychê*), and Pindar (fr. 131 Schroeder) calls it an image of life (*eidôlon*) that sleeps while we are awake and our soul is active. Pythagoras' view of the soul is more likely to have resembled Empedocles' than Plato's. Nonetheless, the doctrine of transmigration inevitably raises the question of the relationship between our present consciousness and that part of us that is reborn and thus is an important influence in the development of the Platonic view of the soul, even though it is unlikely that Pythagoras assumed that view.¹⁵

The other main emphasis of the early evidence is Pythagoras' vast knowledge. This reveals itself in his authority in religious matters, his ability to perform miraculous deeds, and his broad appeal as a teacher of a tightly structured way of life that was a combination of quasi-magical taboos and moral precepts. Pythagoras' religious authority is buttressed by connecting him to the ancient wisdom of Egypt. Rites in Greece forbidding burial in wool are mistakenly known as Orphic and Bacchic but are in reality Egyptian and Pythagorean (Herodotus II.81); Isocrates says that Pythagoras brought knowledge from Egypt to Greece and specifically that he "showed more evident zeal for things concerned with sacrifice and holiness in temples than others" (*Busiris* 28).

Such claims of knowledge and authority inevitably led to violently different reactions to Pythagoras. We have already seen that Xenophanes mocks the doctrine of metempsychosis, but the sharpest criticism comes from Heraclitus. He calls Pythagoras "the chief of swindlers" (DK 22 B81) and says that he "practiced inquiry beyond all other men and, having picked and chosen from these writings, made a wisdom of his own, a polymathy, an evil trickery" (B129). His most famous criticism is found in fragment B40: "Much learning does not teach understanding, else it would have taught Hesiod

and Pythagoras, and again Xenophanes and Hecataeus." On the other hand, Empedocles speaks of Pythagoras' learning in tones of the utmost respect:

There was a man among them who knew remarkable things, who possessed the greatest wealth of intelligence, who was especially accomplished at all sorts of wise deeds. For, whenever he reached out with all his intellect, easily he beheld each of the things that are in ten and even twenty generations of men (DK 31 B129).¹⁶

These "wise deeds" may have been one of the main sources of controversy. Empedocles is probably referring to the type of wonder working that he claimed for himself, the ability to control the winds and rain as well as to raise the dead (B111). The fragments of Aristotle's writings on Pythagoras confirm this suggestion by emphasizing a series of miraculous characteristics and feats, such as his ability to be in two places at one time, his golden thigh (probably a sign of religious initiation), and his killing of a poisonous snake by biting it (fr. 191 Rose). Claims to such extraordinary abilities and a reputation for vast knowledge drawn from far and wide might well have seemed "evil trickery" to an outsider like Heraclitus.

Early in the fourth century, both Plato, in the passage at the beginning of this chapter, and his rival as an educator, Isocrates, emphasize Pythagoras' impact as a teacher of a way of life. Isocrates says that:

He surpassed the other [teachers] so much in reputation that all the young wanted to be his pupils and their elders were happier to see their children associating with him than attending to the affairs of the household. And it is not possible to disbelieve this, for even now people marvel more at those who style themselves as his pupils for their silence than at those who have the greatest reputations as speakers. (*Busiris* 29)

What was the content of the teaching? The way of life must have been designed at least in part to ensure the best possible sequence of rebirths. Our most extensive body of evidence for its rules are the fragments of Aristotle's work on Pythagoras. Along with the miraculous deeds what bulks largest in Aristotle's account is a set of maxims handed down orally and known as the *akousmata* (things heard) or *symbola* (signs that distinguished Pythagoreans from others). These *akousmata* reveal a tightly structured life. There is a series of dietary taboos, such as the famous prohibition against eating beans, clothing

taboos (the gods should be worshiped in white robes), and injunctions that govern almost all aspects of life, including even the most trivial actions (e.g., "Don't pick up fallen crumbs," fr. 195 Rose).

It is not surprising that a devoted few might have found such a restrictive life attractive, but the wide appeal suggested by the passages in Plato and Isocrates requires explanation. This breadth of appeal is further indicated by the fact that some of the leading figures of Croton and other southern Italian towns were followers of the way of life so that Pythagoreans had a large impact on politics (Polybius II.39). They were not a political party in the modern sense but were perhaps analogous to clubs of serious moral purpose such as the Masons. One could pursue a number of professions (general, physician, political leader) and still be a Pythagorean. However, their regimented rules of conduct, club meetings, and fanatical devotion to fellow Pythagoreans (e.g., the story of the Pythagorean friends Damon and Phintias – Iamblichus, *On the Pythagorean life* 233, from Aristoxenus) aroused suspicion and envy. They were the object of violent attacks, one in Pythagoras' lifetime c. 510 B.C. and another in the middle of the fifth century, which led to the burning of the club house in Croton and the decline of Pythagorean influence in southern Italy.¹⁷

Part of the appeal of the Pythagorean way of life was based on the charisma of Pythagoras himself. Burkert accepted the model that makes Pythagoras a shaman, a type of religious leader first studied in Siberian tribes. The shaman's authority is based on the ability to enter an ecstatic state and journey to the beyond.¹⁸ These journeys might be the germ of the idea of the transmigrating soul, but there is no evidence for transmigration proper in shamanism. Shamanism could explain Pythagoras' miraculous deeds, but it does not account for the Pythagorean way of life. Since the way of life lasted long after Pythagoras' death, its appeal must be based on more than just his personal authority. I would suggest that its attraction, in addition to the hopes for one's soul in the next life, was the moral discipline that it imposed. The previously quoted passage from Isocrates makes a contrast between the eloquence displayed by pupils of the typical Greek rhetorical education of the day and Pythagorean silence. This might be a reference to secret doctrines. Exclusive societies are likely to have some secret doctrines (Aristotle, fr. 192 Rose), although such secrecy in Pythagoreanism is often overstated

and, as Aristotle's testimony shows, much of Pythagoreanism was common knowledge. The doctrine of metempsychosis was widely known from the time of Xenophanes onward. Isocrates' remarks have much more rhetorical force if he is referring to a pervasive Pythagorean self-discipline of silence that is attested in the tradition (a five-year period of silence for initiates, D.L. VIII.10) rather than the ability of Pythagoreans to keep a few doctrines secret.

The self-discipline represented in Pythagorean silence and in adherence to the multitude of taboos is founded on a more basic belief that our actions are under constant scrutiny by divine powers. Thus the Pythagoreans were said to be surprised if anyone claimed never to have met a divinity (Aristotle, fr. 193 Rose). Moreover, the structure of the world is related to a system of rewards and punishments. The planets are the avenging hounds of Persephone (Porphyry, *Life of Pythagoras* 41), queen of the underworld; thunder is a warning to souls in Tartarus (Aristotle, *APo* II.11 94b33); and the sun and the moon are the isles of the blessed where the good may hope to go (Iamblichus, *On the Pythagorean life* 82). There are strong parallels to the cosmological myths that Plato includes at the end of a number of his dialogues and whose function is in part to show a mythic ordering of the cosmos in which we are subject to divine judgement for our deeds. As in Plato's myths, number symbolism also played a role in the Pythagorean view of the world. One of the *akousmata* says that number is the wisest thing, and Pythagoreans may have sworn by Pythagoras as "the one who gave the *tetraktys*" (Sextus Empiricus, *M.* VII.94), the first four numbers whose total is ten, which was the perfect number for early Pythagoreans. Since another *akousma* calls the *tetraktys* "the harmony in which the Sirens sing" (Iamblichus, *On the Pythagorean life* 82), it may be that the first four numbers were also valued because they were involved in the whole number ratios corresponding to the concordant musical intervals of the octave (2/1), fifth (3/2), and fourth (4/3). However, none of the late stories that assign the discovery of these correspondences to Pythagoras are in fact scientifically possible. The harmony that the sirens sing may also allude to the influential idea that the heavens made music by their motions, the famous "harmony of the spheres."

Granted that Pythagoras had a larger impact on the society of his day than any other early Greek philosopher, in what sense is it legitimate to call him a philosopher? Metempsychosis did exercise an important influence in Greek philosophy through its adoption by

Empedocles and most importantly by its prominence in Plato. However, the Pythagorean way of life seems far removed from the “examined” life for which Socrates called. Pythagoreanism has no room for free examination of ideas and philosophical argument but is based on the authority of the founder. The later tradition reports that Pythagoreans felt no need to argue for positions and rested content with the assertion that “he himself said it” (D.L. VIII.46). Nonetheless, the primary goal of all Greek philosophy from Socrates onward was not just rational argument but the living of a good life. Pythagoras can justly claim to have been the first thinker to set forth a comprehensive plan for a good life, a plan of life based on a view of the world that influenced Plato’s myths if not the Socratic elenchus.¹⁹

EMPEDOCLES

Another way to approach Pythagoras is through his early successors, and here Empedocles is important. Since Empedocles introduced a rational cosmological scheme in response to Parmenides and was also a wonder-working sage, he is often thought to show that Pythagoras too could have combined these characteristics. Recent scholarship has shown convincingly that Empedocles strove to form a unity from these two strands of thought, and has questioned the traditional view that he wrote two separate poems, one on nature and another religious poem known as *Purifications*.²⁰ However, while the example of Empedocles shows that one thinker could attempt to combine the two strands, this provides no evidence that Pythagoras did so as well. In fact examination of the evidence for Empedocles suggests again that Pythagoras had little to say on natural philosophy.

Empedocles is frequently treated as a Pythagorean in the later tradition. Diogenes Laertius, in his *Lives of the philosophers*, includes him among the Pythagoreans (VIII.51), and some even made him Pythagoras’ pupil, although Empedocles was born about the time Pythagoras died (490 B.C.). However, neither Plato nor Aristotle regarded him as a Pythagorean and few modern scholars have done so. It seems likely nevertheless that Empedocles was influenced by Pythagoras, since two generations earlier, near Empedocles’ own home in Acragas in Sicily, Pythagoras was preaching the metempsychosis that appears in Empedocles’ poetry and since Empedocles refers to Pythagoras with such reverence (see p. 72).

However, the ancient tradition made few connections between Empedocles' physical theory and Pythagoreanism, and there is no compelling reason to do so. Empedocles advanced, for the first time, the influential theory of the four elements (earth, air, fire, and water). He introduced Love and Strife as cosmic principles, whose conflict leads to the combinations of the elements that produce the phenomenal world as a phase between the completely homogeneous mixture of the elements in a sphere under Love and complete separation of the elements under Strife. None of the antecedents of this theory is likely to be Pythagorean. The four elements have their origins in Ionian speculation: Strife is a prominent element in Heraclitus; Love seems to be Empedocles' own innovation; and the sphere has connections to Parmenides. It is true that Love is connected to harmony, which is important in Pythagoreanism (it is also Heraclitean). Harmony is in turn represented in Empedocles (B96) as combining the elements according to ratios in order to form bone (four parts fire, two earth, and two water). This reference to number as governing the structure of things is the main aspect of Empedoclean cosmology identified as Pythagorean by the later tradition, and it may be that Empedocles is here taking the first step in adapting Pythagorean number symbolism to rational cosmology and that this idea was developed fully in the next generation with Philolaus. However, the use of numerical patterns in ordering the cosmos also goes back to Anaximander at the beginnings of the Ionian tradition.

Regarding the soul and its fate, matters are different. Since Pythagoras wrote nothing, Empedocles' writings came to be treated as basic Pythagorean texts in these areas. Sextus Empiricus (*M.* IX.126-30) says that "the followers of Pythagoras and Empedocles . . . say that we have a kind of communion not only with each other and the gods but also with irrational animals," and goes on to quote two fragments of Empedocles:

Will you not stop the ill-sounding bloodshed? Do you not see that you are eating one another, in the carelessness of your thought? (B136)
 Father slays his dear son in changed form, having lifted him up in offering and praying in his great folly . . . (B137)

Sextus concludes: "This, then, is what the Pythagoreans recommended." It is no accident that stories sprang up that Empedocles was the first to break Pythagorean taboos on speaking about such things

and was excommunicated (D.L. VIII.54-5). Indeed Empedocles' fragments on the cycle of reincarnation have an intoxicating vitality and specificity:

There is an oracle of necessity, ... if someone stains his own limbs in slaughter by sin ... daimones who have as their lot a life of long ages, thirty thousand years he wanders away from the blessed ones, being born as mortal creatures of all forms, through time exchanging one troublesome path of life for another, for the might of aither pursues him into the sea and the sea spits him out into the dust of earth and earth into the rays of the shining sun which threw him into the currents of aither. One receives him from the other and all hate him. Of these I am one, an exile from the gods and a wanderer, trusting in raving strife. (B115)

Even in the area of religion, Empedocles by no means simply parroted Pythagorean doctrine. Aristotle's evidence (fr. 4 Rose) suggests that Pythagoras may only have taught abstention from certain types of meat, and it was left to Empedocles to advocate strict vegetarianism and to present the horrifying vision of a father eating his own son reborn in animal form. Moreover, Empedocles tries to integrate the discussion of reincarnation with his physical theory. The daimôn passes through each of the four elements in its reincarnations and is said to have trusted in Strife. The homogeneous mixture of the elements under Love may be the blessed state of the daimones before the fall.²¹ It would be surprising that Empedocles constructed a unique physical theory to ground metempsychosis, if Pythagoras had already presented a detailed cosmology as a framework for the migrating soul. Despite Empedocles' praise of Pythagoras, he has transformed Pythagorean influence into a creation of his own.

Nonetheless it would be wrong to see Empedocles as the genius who gave form to a primitive Pythagoreanism. There is an important difference in emphasis between Pythagoras and Empedocles. Both wielded great charismatic authority, and the opening lines of Empedocles' poem remind us of later accounts of Pythagoras' arrival in Croton.

Whenever I come to a flourishing city, I am revered by men and women, countless numbers follow along asking where the path to gain is. Some asking for oracles and others seek to hear a healing word for all sorts of diseases ... (B112)²²

However, there is no evidence that Empedocles' philosophy had anything like the social dimension of Pythagoreanism. Empedocles himself may have participated in politics, but there were no Empedoclean clubs wielding political influence, no Empedoclean way of life that lasted for generations after his death.

PHILOLAUS

It is only in the generation after Empedocles, a little before the atomists, that Aristotle finds the beginning of a natural philosophy by "the so-called Pythagoreans" (*Metaph.* I.5 985b23). No names are mentioned, but the Pythagoreans prominent in this period were Hippasus, Lysis, Eurytus, and especially Philolaus. Sometime in the fifth century B.C., there was a split in Pythagoreanism. *Akousmatikoi*, who claimed to follow the original teachings (*akousmata*) of Pythagoras attacked another group, the *mathêmatikoi*, as being in reality followers of Hippasus (Iamblichus, *Comm. math.* 76.19 – from Aristotle). Aristotle's "so-called Pythagoreans" who "first laid hold of mathematics and advanced it" (*Metaph.* I.5 985b24) seem to be this latter group. Hippasus (fl. 470?), its founder, is consistently portrayed as a rebel, in one case as a democrat challenging the aristocratic Pythagorean leadership in Croton, but more commonly as the founder of Pythagorean study of mathematics and natural science. Legend said he was drowned at sea in punishment for mathematical work on the dodecahedron. His method of demonstrating the relation between whole number ratios and the concordant musical intervals, in contrast to the methods assigned to Pythagoras, is based on sound physics. Aristotle reports that, like Heraclitus, he made fire the basic principle. Unfortunately, it is unlikely that he wrote anything (D.L. VIII.84).²³

Philolaus (c. 470–385 B.C.) was the first Pythagorean to write a book (D.L. VIII.84–85) and, after years in limbo because of questions about authenticity, the fragments of that book have now emerged as the crucial primary texts for early Pythagoreanism. Some fragments fit the pattern of the pseudepigrapha, assigning Platonic and Aristotelian ideas to Philolaus, and are thus spurious. However, a core of fragments (DK 44 B1–7, 13, 17) use precisely the concepts that Aristotle assigns to fifth-century Pythagoreanism and are therefore genuine and indications that Philolaus was Aristotle's primary

source.²⁴ They reveal Philolaus as an important thinker in the tradition of early Greek natural philosophy.²⁵

Philolaus began his book with a concise statement of his central thesis:

Nature in the world-order was fitted together both out of things which are unlimited and out of things which are limiting, both the world-order as a whole and all the things in it. (B1)

The concepts here (nature = *physis*, world-order = *kosmos*) have an important place in earlier Greek thought. Moreover, although the Pythagoreans have often been regarded as *sui generis* and, beginning with Aristotle, primarily connected to Plato, Philolaus' basic principles, limiters and unlimited, are a response to the earlier Greek tradition of natural philosophy. For Anaximander the world arose out of the unlimited (*apeiron*), Anaximenes called his basic stuff, air, unlimited (DK 13 A1 and 6) and, in the generation before Philolaus, Anaxagoras began his book by asserting that in the beginning all things were "unlimited both in multitude and in smallness" (DK 59 B1). It is opposites like hot and cold, dry and wet that come from Anaximander's unlimited and that are labeled unlimited by Anaxagoras along with materials such as air and aither. These unlimited "stuffs" (i.e., both opposites and materials) dominated early Greek philosophy of nature. However, limit too had found its champion in Parmenides, who stressed that "what is" was held fast within limits and likened it to a sphere (DK 28 B8. 26, 42).

Philolaus draws on both these traditions, but is especially emphatic in his rejection of the dominant trend that made all principles unlimited, asserting instead that they fall into one of three classes:

It is necessary that the things that are be all either limiting, or unlimited, or both limiting and unlimited but not in every case unlimited alone. (DK 44 B2)

He goes on to argue that the world-order manifestly has elements that are limits, for example shapes and structures, and that the concept of order necessarily involves the limitation of the unlimited. Philolaus' introduction of limiters as basic constituents of reality alongside unlimited stuffs leads him to redefine the essential nature of these stuffs. What makes them a unified class is not their qualitative

features, such as hot and cold, but the fact that in themselves they are not determined by any quantity. They mark out a continuum of possible quantities that is then structured by limiters. The continuum of pitch is structured by limiting notes that define a scale; continua like water or earth become lakes or rocks when limited by shapes. Here we have a bold first step toward the matter-form distinction, although Philolaus gives no hint that these two types of element exist in any different way from one another and seems to treat them both as physical components of the cosmos.

In B6 Philolaus makes another crucial point about basic principles:

... the being of things which is eternal and nature in itself admit of divine and not human knowledge, except that it was impossible for any of the things that are and are known by us to have come to be, if the being of the things from which the world-order came together, both the limiting things and the unlimited things, did not preexist.

He is arguing that we cannot specify any particular set of unlimiteds (e.g., earth, air, fire, and water) or any particular set of limiters as eternal being, but that we can be sure that some set of limiters and some set of unlimiteds preexisted, since otherwise the world we know could not have come to be. In B2 and B6 Philolaus is accepting an axiom of early Greek thought sharpened by Parmenides, in not allowing anything to come to be from what is not. If the world has both limiting and unlimited features in it, these cannot have arisen just from what is limiting or just from what is unlimited. Philolaus' point is not that earlier Greek philosophers had not seen the world as an ordered place but rather that they had failed to make limiters principles in their own right and mistakenly tried to generate an ordered-world out of basic principles that were, in their own nature, unlimited.

Philolaus refers to the limiters and unlimiteds as *archai*, "starting points." Different sets of *archai* appear in other fragments, and it appears that the method followed in B6 with regard to the cosmos as a whole was used in each of the wide variety of subjects that Philolaus discussed. He begins by identifying a minimum set of starting points (*archai*) without which it is impossible to explain the phenomena. In the case of diseases, he specifies bile, blood, and phlegm as the *archai* (A27); in the psychic structure of human beings, the brain,

the heart, the navel, and the genitals (B13).²⁶ When it comes to the sciences, geometry is the starting point from which the others develop (A7a). Much of this method remains obscure, but Philolaus is struggling towards a generally applicable methodology that resembles the axiomatization of mathematical sciences.

In B6 he argues that yet a third principle is required to explain the world. Since limiters and unlimiteds are unlike, they must be held together by some type of bond determining the specific way in which they combine to form the ordered world we see. Philolaus calls this bond “fitting together” (*harmonia*), and it involves the last central concept in his system, number. He uses the diatonic scale as a prime example of his system of principles. An unlimited (the continuum of sound) is combined with limiters (points on that continuum). However, this combination is governed by a fitting together according to whole number ratios 1:2, 2:3, 3:4 that define the central musical concords of the octave, fifth, and fourth respectively, so that the result is no chance set of notes but the diatonic scale.

Philolaus also has important things to say about epistemological questions. Fragment B6 belongs in the early Greek tradition of scepticism about human knowledge (cf. Xenophanes DK 21 B34). However, it is original in its almost Kantian thesis, that, since knowledge of “nature in itself” is not available to mortals, the best that they can do is to posit as principles what is necessary to explain the world as we know it, that is limiters, unlimiteds, and *harmonia*. Moreover, the function of number in Philolaus’ system is to solve problems concerning knowledge of our world, perhaps in response to Parmenides, as is shown by B4:

And indeed all the things that are known have number. For it is not possible that anything whatsoever be understood or known without this.

Number is taken to be the prototype of what is knowable. Nothing is more determinate and certain than a numerical relationship such as $2 + 2 = 4$. Philolaus thinks that the cosmos is held together by such numerical relationships and that Parmenides was right to object that the unlimited by itself is not a sufficient basis for human knowledge. In B3 Philolaus argues that, “There will not be anything that is going to know at all, if everything is unlimited.”

This argument, that knowing requires an act of limiting, has particular force against Anaxagoras, who both posited basic principles that are all unlimited and also asserted the existence of a cosmic knower, *nous*. Philolaus may also be responding to Parmenides, arguing that even the unlimited may be knowable in so far as it is determined by number or involved in numerical relationships and that a plural world structured by such numerical connections is also knowable.

Both the strengths and weaknesses of Aristotle's account of Philolaus and early Pythagoreanism are now evident. Aristotle's famous assertion that for the Pythagoreans things "were numbers" makes sense as his interpretation of Philolaus. Since what is knowable for Philolaus is numerical, and for Aristotle what is knowable about things is their essence, it was an easy step for Aristotle to say that for the Pythagoreans numbers were the essence of things. At the same time, Aristotle has seriously distorted the situation, by criticizing the Pythagoreans for constructing physical things out of numbers. Philolaus does not think that things are constructed out of numbers, but out of limiters and unlimiteds (B1), principles mentioned in Aristotle but which appear largely unmotivated there. But Aristotle is right not to project this system of principles back onto Pythagoras. While the contrast between limiters and unlimiteds is not impossible in Pythagoras' time, these principles as well as the strong epistemological strain make better sense after Parmenides' reflections on the conditions for knowledge and his insistence that "what is" is limited.

Philolaus' cosmogony has been similarly distorted under the influence of Aristotle. The common view is that the first thing created was a monad or point. However, the fragments of Philolaus reveal that his cosmogony began with the central fire, the "hearth" of the cosmos and archetypal example of a combination of an unlimited (fire) with a limiter (centre). "The first thing fitted together, the one in the centre of the sphere, is called the hearth" (B7). Next, the central fire draws in the unlimiteds breath, time, and void (Aristotle, fr. 201 Rose). Philolaus draws an explicit parallel between the birth of the cosmos and the birth of a human embryo which, although hot in its own nature (like the central fire), breathes in cooling breath upon birth (A27). The biological analogy is not an archaic feature

that goes back to Pythagoras himself as some have maintained but is paralleled in the atomists' cosmology, where a crucial step was the formation of a "membrane" around the embryo universe (D.L. IX.31).²⁷

Philolaus' astronomical system has long been famous as the first to move the earth from the centre of the cosmos and make it a planet. Still, the earth does not orbit the sun but rather the central fire, along with the sun, moon, five planets, fixed stars, and a counter-earth. Copernicus saw Philolaus as an important predecessor, but scholars have taken this astronomical system to show that he was not a natural philosopher but a number mystic.²⁸ Certain *a priori* principles of order do play an important role in Philolaus' system: the counter-earth is introduced to fill out the perfect number ten, and fire is put in the centre because the most valued element belongs in the most valued place. But such considerations do not make the system mere fantasy. *A priori* principles play a prominent role in most Greek astronomical schemes. A rational astronomy should include a combination of *a priori* principles and *a posteriori* information that produces a system open to challenge by appeal to the phenomena. Philolaus' system does indeed confront a series of such challenges: problems of how to explain night and day and difficulties with parallax resulting from the motion of the earth are addressed (Aristotle, fr. 204 Rose, *De caelo* II. 13 293b25 ff.). Even the explanation as to why we never see the counter-earth or central fire, that is, that our side is always turned away from the centre of the cosmos, recognizes the importance of the phenomena. Moreover, the Philolaic system was the first to include the five planets known to the ancient Greeks in correct order. Philolaus may have speculated about inhabitants of the moon (A20) but so did such staid rationalists as Anaxagoras (DK 59 A77). In fact, the testimonia for both Anaxagoras' and the atomists' astronomical systems show that the Philolaic system is comparatively more sophisticated.²⁹ Philolaus' natural philosophy may have some origins in Pythagoras' emphasis on significant numbers, but it is primarily his own response to problems raised by figures like Anaxagoras and Parmenides. Philolaus was a Pythagorean because he lived the sort of life Pythagoras prescribed, not because of his views on natural philosophy. In the modern world, we may say that someone is a Catholic without

therefore being at all clear what he believes on a whole range of philosophical issues. A Pythagorean could become a philosopher of the early Greek sort (a *physikos*), a mathematician, a physician, or even a leading general, but none of these pursuits were demanded of him as a Pythagorean. Philolaus was a natural philosopher who also happened to be a Pythagorean.

Neither Lysis, known mainly as the teacher of the Theban general Epaminondas, nor Eurytus the pupil of Philolaus, wrote anything. Eurytus illustrated the identification of man or horse with a specific number by making pebble drawings of them (Theophrastus, *Metaph.* 11). Archytas, the last great name in early Pythagoreanism, was a contemporary of Plato and therefore not properly an early Greek philosopher. Nonetheless, because of his sophisticated three-dimensional solution to the problem of the doubling of the cube and his work on musical theory, he fits the popular conception of the Pythagorean as a master mathematician better than anyone else in the early tradition.

Perhaps the most enduring legacy of the Pythagorean tradition was its influence on Plato. It is possible that when Plato went to Italy for the first time in the early 380s B.C. he met an aged Philolaus. Philolaus is mentioned in the *Phaedo* (61d), perhaps in recognition of Plato's debt to Pythagoreanism for his views on the soul.³⁰ Moreover, a Platonic adaptation of Philolaus' metaphysical system of limiters and unlimiteds is at the core of the *Philebus*.³¹ Although Archytas is never mentioned by name in the dialogues, the Platonic letters show that Plato had extensive contact with him and owed to him his final rescue from Dionysius II of Syracuse in 361. Plato in fact quotes from one of the three genuine fragments of Archytas (DK 47 B1) in *Republic* VII 530d8 where he refers to music and astronomy as "sister sciences."³² Indeed, the mathematical curriculum of the *Republic* could owe its inspiration to Archytas (B1), and Archytas himself, who was elected seven consecutive times in Tarentum and never suffered a defeat in battle, may be a model of the philosopher king. The specific functions of mathematics in Plato's philosophy (e.g., turning the soul toward the world of Forms) are largely his own creation, and the *Timaeus* is a Platonic and not a Pythagorean work. However, the conviction that mathematics could help in addressing important philosophical problems, which began with Philolaus and was shared by Archytas, and Pythagoras' own

vision of the mythic cosmos in which the migrating soul is subject to judgement for its deeds, give Platonism an undeniable Pythagorean content from the middle dialogues onward.³³

NOTES

- 1 For Pythagoras as pioneer mathematician, see A.N. Whitehead, *Science and the Modern World* (New York, 1925) 41. For Pythagoras the shaman, see Dodds [94] 143–45.
- 2 Burkert [201] 129ff., 218–20.
- 3 See P. Brown, *The Making of Late Antiquity* (Cambridge, Mass., 1978) 54–80.
- 4 O'Meara [224].
- 5 J. Dillon *The Middle Platonists* (London, 1977).
- 6 Burkert [201] 53–83.
- 7 Guthrie's great account of Pythagoreanism (in Guthrie [15]) spends 180 pages elucidating this unified Pythagoreanism and just 15 pages on individual Pythagoreans.
- 8 Guthrie [15] 206 ff.; Kahn [218] is more careful.
- 9 Guthrie [15] 181.
- 10 Burkert [201] 28–83.
- 11 Other passages (e.g., *Metaph.* VII.11 1036b8) have been misinterpreted as evidence for a Pythagorean derivation of the sensible world from more ultimate mathematical principles by the derivation sequence of one = point, two = line, three = surface, and four = solid, with physical bodies then arising from the geometrical solids. However, this belongs to the early Academy (Burkert [201] 67). Thus twenty pages ([15] 256–76) of Guthrie's account of Pythagoreanism are undercut. This sequence turns up in the *Pythagorean memoirs* (D.L. VIII.24–33) excerpted by Alexander Polyhistor (first century B.C.). Their value as a source is very doubtful (Burkert [201] 53 and Festugière [210]), but Guthrie uses them heavily. See Kahn [218].
- 12 Burkert [201]; Thesleff [202] and [199].
- 13 See Burkert [201] 126, 133; West [136] 62; Kahn [217] 166. Metempsychosis may have come into Orphism through Pythagoras (Burkert [201] 126, 133). Late sources assign it to Pherecydes (West [136] 25).
- 14 Burkert [201] 133ff.
- 15 See Laks in this volume, pp. 251–2; Burkert [201] 134, n. 78; Claus [486] 4–5, 111–21; Huffman [198] 330–31. Other early texts also stress Pythagoras' expertise on the soul (Herodotus IV.95, Empedocles DK 31 B129, Ion in D.L. I.120).
- 16 The historian Timaeus reported that these lines refer to Pythagoras.

- Diogenes Laertius (VIII.55) says that some thought they refer to Parmenides. The "generations" and "wise deeds" fit Pythagoras better.
- 17 Minar [221].
 - 18 Burkert [201] 162ff.
 - 19 Some make Pythagoras more of a natural philosopher than I have done. My interpretation is based on a strict reading of the early evidence and seems to be Aristotle's interpretation. Guthrie [15] 166–67 relies on *Republic* VII as the sole early evidence of "the scientific side." But these are fourth-century Pythagoreans (Huffman [216]). Heraclitus' reference to Pythagoras' practice of *historia* is too general to be conclusive, and the Heraclitean concept of *harmonia*, if it alludes to Pythagoras, can just as easily refer to the Pythagoras I have described as to a Pythagoras who was an Ionian-style cosmologist.
 - 20 Inwood [357]; Osborne [364]. For the interplay of cosmogonic and transcendent aspects of divinity in Empedocles' thought, see Broadie in this volume, p. 216.
 - 21 There are difficulties (e.g., How is the transmigrating *daimôn* related to the physical intelligence that Empedocles identified as a mixture of the four elements to form blood around the heart?) that Empedocles does not address directly, and modern scholarship is divided on their answers. Long [366]; Inwood [357]; Wright [358]; Kahn [365].
 - 22 For the full text of this fragment and discussion of Empedocles' profession of divinity, see Most in this volume, p. 355.
 - 23 Von Fritz [212] argued that he discovered incommensurability. No ancient source directly ascribes this to him. On Hippasus, see Burkert [201] 206–8, 377, 457 ff.
 - 24 Huffman [198] 17–35.
 - 25 For the following account of Philolaus, see Huffman [198]. See also Burkert [201]; Kahn [217]; Barnes [14]; KRS.
 - 26 For Philolaus' psychology, see Huffman [198]; Laks in this volume, p. 252; Sedley [228].
 - 27 Kahn [217] 183–85. The "breathing in" of void does not mean that it is confused with breath, as he and Furley [99] 119 maintain. The same argument would suggest that time too is confused with breath.
 - 28 Burkert [201] 240, 267, 337–50.
 - 29 Contra Furley [99] 57–58. Kingsley [105] 172ff. has interesting things to say about why Philolaus introduced the central fire.
 - 30 Sedley [228].
 - 31 Plato is simply invoking the patron of all *technai* rather than referring to Pythagoras, when he talks of a "Prometheus" (*Philebus* 16c) by whom the system was hurled down from the gods. See C. Huffman, "Limite et Illimité chez les premiers philosophes grecs" forthcoming in *Études sur*

le Philèbe de Platon, ed. M. Dixsaut, vol. 2 (Paris, 1999) and C. Huffman, "The Philolaic Method: The Pythagoreanism Behind the *Philebus*" forthcoming in *Before Plato: Essays in Greek Philosophy, Volume 6*, ed. A. Preus (Binghamton, 1999).

32 Huffman [216]. On Archytas and Plato, see Lloyd [219].

33 G. Vlastos, "Elenchus and Mathematics," ch. 4 of his *Socrates: Ironist and Moral Philosopher* (Ithaca, 1991) 107–31.