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World Philosophers and Their Works

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Ockham, William of — Zhuangzi
Indexes

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citly paid tribute to the pragmatists in the part of the twentieth century, and it would difficult to attribute this revival in pragmatism to Putnam alone.

James C. Griffith

Additional Reading

os, George, ed. *Meaning and Method: Essays in Honor of Hilary Putnam*. Cambridge, England: Cambridge University Press, 1990. Boolos presents a series of papers by several of Hilary Putnam's colleagues and former students. The papers cover a wide variety of philosophical subjects, reflecting Putnam's own interests and his pervasive influence on contemporary thought.

, Peter, and Bob Hale, eds. *Reading Putnam*. Cambridge, Mass.: Blackwell, 1994. Papers from nine philosophers presented at an international conference on Putnam's philosophy at the University of St. Andrews in 1990 are collected in this volume. They represent a broad range of issues to which Putnam has contributed significantly. Two essays in particular, Simon Blackburn's "Enchanting Myths" and Michael Dummett's "Wittgenstein on Necessity: Some Reflections," focus on Put-

nam's internal realism. Blackburn tells us what internal realism *is not*.

Goldberg, Sanford, and Andrew Pessin, eds. *The Twin Earth Chronicles: Twenty Years of Reflection on Hilary Putnam's "The Meaning of 'Meaning'."* Armonk, N.Y.: M. E. Sharpe, 1996. This is a good initiation to one of Putnam's major ideas, "semantic externalism." This collection begins with an introduction, followed by "The Meaning of 'Meaning,'" Putnam's article challenging traditional views of the philosophies of language and mind. The remainder of the work is dedicated to arguably the best of many responses the article generated.

Harman, Gilbert. "Metaphysical Realism and Moral Relativism: Reflections on Hilary Putnam's *Reason, Truth, and History*." *The Journal of Philosophy* 79, no. 10 (October, 1982): 568-575. This is a useful critique of internal realism, based on a defense of the fact-value distinction. This is one of two papers that generated Putnam's own "A Defense of Internal Realism" in *Realism with a Human Face*. The other, also in this issue, along with Putnam's brief responding comments, is Hartry Field's "Realism and Relativism" on pages 553-567.

James C. Griffith

Pythagoras

Pythagoras set an inspiring example with his energetic search for knowledge of universal order. His specific discoveries and accomplishments in philosophy, mathematics, astronomy, and music theory make him an important figure in Western intellectual history.

Principal philosophical work: No extant fragments. Primary source: Aristotle

Born: c. 580 B.C.E.; Samos, Ionia, Greece

Died: c. 500 B.C.E.; Metapontum, Lucania (now Metaponto, Italy)

Early Life

Pythagoras, son of Mnesarchus, was born about 580 B.C.E. His birthplace was the island of Samos in the Mediterranean Sea. Aside from these details, information about his early life—most of it from the third and fourth centuries B.C.E., up to one hundred years after he died—is extremely sketchy. Sources roughly contemporary with him tend to contradict one another, possibly because those who had been his students developed in many different directions after his death.

Aristotle's *Metaphysics* (second Athenian period, 335-323 B.C.E.; *Metaphysics*, 1801), one source of information about Pythagorean philosophy, never refers to Pythagoras himself but always to "the Pythagoreans." Furthermore, it is known that many ideas attributed to Pythagoras have been filtered through Platonism. Nevertheless, certain doctrines and biographical events can be traced with reasonable certainty to Pythagoras himself. His teachers in Greece are said to have included Creophilus and Pherecydes of Syros; the latter (who is identified as history's first prose writer) probably encouraged Pythagoras's belief in the transmigration of souls, which became a major tenet of Pythagorean philosophy. A less certain but more detailed tradition has him also studying under Thales of Miletus, who built a philosophy on rational, positive integers. In fact, these integers were to prove a stumbling block to Pythagoras but would lead to his discovery of irrational numbers such as the square root of two.

Following his studies in Greece, Pythagoras traveled extensively in Egypt, Babylonia, and other Mediterranean lands, learning the rules of thumb that, collectively, passed for geometry at that time. He was to raise geometry to the level of a true science through his pioneering work on geometric proofs and the axioms, or postulates, from which these are derived.

A bust now housed at Rome's Capitoline Museum (the sculptor is not known) portrays the philosopher as having close-cropped, wavy Greek hair and beard, his features expressing the relentlessly inquiring Ionian mind—a mind that insisted on knowing for metaphysical reasons the *exact* ratio of the side of a square to its diagonal. Pythagoras's eyes suggest an inward focus even as they gaze intently at the viewer. The furrowed forehead conveys solemnity and powerful concentration, yet deeply etched lines around the mouth, and the hint of a crinkle about the eyes, reveal that this great man was fully capable of laughter.

Life's Work

When Pythagoras returned to Samos from his studies abroad, he found his native land in the grip of the tyrant Polycrates, who had come to power about 538 B.C.E. In the meantime, the Greek mainland had been partially overrun by the Persians. Probably because of these developments, in 529 B.C.E. Pythagoras migrated to Croton, a Dorian colony in southern Italy, and entered into what became the historically important period of his life.

At Croton he founded a school of philosophy that in some ways resembled a monastic order.

Its members were pledged to a pure and devout life, close friendship, and political harmony. In the immediately preceding years, southern Italy had been nearly destroyed by the strife of political factions. Modern historians speculate that Pythagoras thought that political power would give his organization an opportunity to lead others to salvation through the disciplines of nonviolence, vegetarianism, personal alignment with the mathematical laws that govern the universe, and the practice of ethics in order to earn a superior reincarnation. Pythagoras believed in metempsychosis, the transmigration of souls from one body to another, possibly from humans to animals. Indeed, Pythagoras claimed that he could remember four previous human lifetimes in detail.

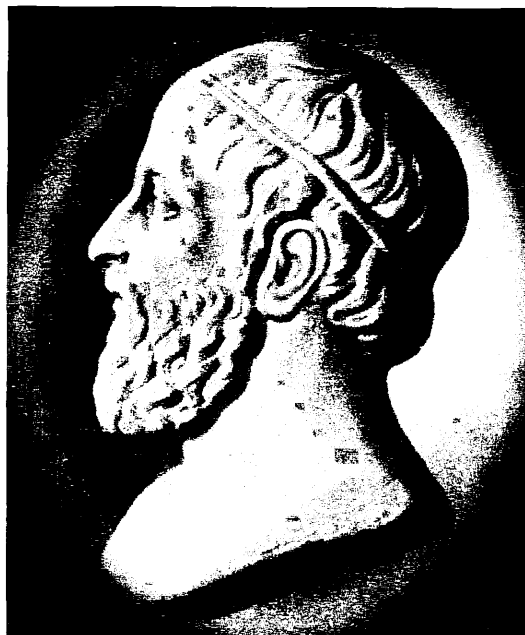
His adherents he divided into two hierarchical groups. The first was the *akousmatikoi*, or listeners, who were enjoined to remain silent, listen to and absorb Pythagoras's spoken precepts, and practice the special way of life taught by him. The second group was the *mathematikoi*, students of theoretical subjects, or simply "those who know," who pursued the subjects of arithmetic, the theory of music, astronomy, and cosmology. (Though *mathematikoi* later came to mean "scientists" or "mathematicians," originally it meant those who had attained advanced knowledge in a broader sense.) The *mathematikoi*, after a long period of training, could ask questions and express opinions of their own.

Despite the later divergences among his students—fostered perhaps by his having divided them into two classes—Pythagoras himself drew a close connection between his metaphysical and scientific teachings. In his time, hardly anyone conceived of a split between science and religion or metaphysics. Nevertheless, some modern historians deny any real relation between the scientific doctrines of the Pythagorean society and its spiritualism and personal disciplines. In the twentieth century, Pythagoras's findings in astronomy, mathematics, and music theory are much more widely appreciated than the metaphysical philosophy

that, to him, was the logical outcome of those findings.

Pythagoras developed a philosophy of number to account for the essence of all things. This concept rested on three basic observations: the mathematical relationships of musical harmonies, the fact that any triangle whose sides are in a ratio of 3:4:5 is always a right triangle, and the fixed numerical relations among the movement of stars and planets. It was the consistency of ratios among musical harmonies and geometrical shapes in different sizes and materials that impressed Pythagoras.

His first perception (which some historians consider his greatest) was that musical intervals depend on arithmetical ratios among lengths of string on the lyre (the most widely played instrument of Pythagoras's time), provided that these strings are at the same tension. For example, a ratio of 2:1 produces an octave; that is, a string twice as long as another string, at the same ten-



Pythagoras. (Smithsonian Institution)

sion, produces the same note an octave below the shorter string. Similarly, 3:2 produces a fifth and 4:3 produces a fourth. Using these ratios, one could assign numbers to the four fixed strings of the lyre: 6, 8, 9, and 12. Moreover, if these ratios are transferred to another instrument—such as the flute, also highly popular in that era—the same harmonies will result. Hippasus of Metapontum, a *mathematikos* living a generation after Pythagoras, extended this music theory through experiments to produce the same harmonies with empty and partly filled glass containers and metal disks of varying thicknesses.

Pythagoras himself determined that the most important musical intervals can be expressed in ratios among the numbers 1, 2, 3, and 4, and he concluded that the number 10—the sum of these first four integers—comprehends the entire nature of number. Tradition has it that the later Pythagoreans, rather than swear by the gods as most other people did, swore by the "Tetractys of the Decad" (the sum of 1, 2, 3, and 4). The Pythagoreans also sought the special character of each number. The tetractys was called a "triangular number" because its components can readily be arranged as a triangle.

By extension, the number 1 is reason because it never changes; 2 is opinion; and 4 is justice (a concept surviving in the term "a square deal"). Odd numbers are masculine and even numbers are feminine; therefore, 5, the first number representing the sum of an odd and an even number (1, "unity," not being considered for this purpose), symbolizes marriage. Seven is *parthenos*, or virgin, because among the first ten integers it has neither factors nor products. Other surviving Pythagorean concepts include unlucky 13 and "the seventh son of a seventh son."

To some people in the twentieth century, these number concepts seem merely superstitious. Nevertheless, Pythagoras and his followers did important work in several branches of mathematics and exerted a lasting influence on the field. The best-known example is the Pythagorean Theorem, the statement that the square of the hypotenuse of a right triangle is equal to the sum of the squares of the other two sides. Special applications of the theorem were known in Mesopotamia as early as the eighteenth century B.C.E., but Pythagoras sought to generalize it for a char-

acteristically Greek reason: This theorem measures the ratio of the side of a square to its diagonal, and he was determined to know the *precise* ratio. It cannot be expressed as a whole number, however, so Pythagoras found a common denominator by showing a relationship among the *squares* of the sides of a right triangle. The Pythagorean theorem is set forth in book 1 of Euclid's *Stoicheia* (c. 300 B.C.E.; *The Elements of Geometry of the Most Auncient Philosopher Euclide of Megara*, 1570, commonly known as *Elements of Geometry*), Euclid being one of several later Greek thinkers whom Pythagoras strongly influenced and who transmitted his ideas in much-modified form to posterity.

Pythagoras also is said to have discovered the theory of proportion and the arithmetic, geometric, and harmonic means. The terms of certain arithmetic and harmonic means yield the three musical intervals. In addition, the ancient historian Proclus credited Pythagoras with discovering the construction of the five regular geometrical solids, though modern scholars think it more likely that he discovered three—the pyramid, the tetrahedron, and the dodecahedron—and that Theaetetus (after whom a Platonic dialogue is named) later discovered the construction of the remaining two, the octahedron and the icosahedron.

The field of astronomy, too, is indebted to Pythagoras. He was among the first to contend that the earth and the universe are spherical. He understood that the sun, the moon, and the planets rotate on their own axes and also orbit a central point outside themselves, though he believed that this central point was the earth. Later Pythagoreans deposed the earth as the center of the universe and substituted a "central fire," which, however, they did not identify as the sun—this they saw as another planet. Nearest the central fire was the "counter-earth," which always accompanied the earth in its orbit. The Pythagoreans assumed that the earth's rotation and its revolution around the central fire took the same amount of time—twenty-four hours. According to Aristotle, the idea of a counter-earth—besides bringing the number of revolving bodies up to the mystical number of ten—helped to explain lunar eclipses, which were thought to be caused by the counter-earth's interposition be-

tween sun and moon. Two thousand years later, Nicolaus Copernicus saw the Pythagorean system as anticipating his own; he had in mind both the Pythagoreans' concept of the day-and-night cycle and their explanation of eclipses.

Like Copernicus in his time, Pythagoras and his followers in their time were highly controversial. For many years, the Pythagoreans did exert a strong political and philosophical influence throughout southern Italy. The closing years of the sixth century B.C.E., however, saw the rise of democratic sentiments, and a reaction set in against the Pythagoreans, whom the democrats regarded as elitist.

Indeed, this political reaction led either to Pythagoras's exile or to his death—there are two traditions surrounding it. The first account, which is the more probable story, is that a democrat named Cylon led a revolt against the power of the Pythagorean brotherhood and forced Pythagoras to retire to Metapontum, where he died peacefully about the end of the sixth century B.C.E. According to the other tradition, Pythagoras perished when his adversaries set fire to his school in Croton in 504 B.C.E. The story is that, of his vast library of scrolls, only one was brought out of the fire; it contained his most esoteric secrets, which were passed on to succeeding generations of Pythagoreans.

Pythagoras's followers continued to be powerful throughout Magna Graecia until at least the middle of the fifth century B.C.E., when another reaction set in against them and their meeting-houses were sacked and burned. The survivors scattered in exile and did not return to Italy until the end of the fifth century. During the ensuing decades, the leading Pythagorean was Philolaus, who wrote the first systematic exposition of Pythagorean philosophy. Philolaus's influence can be traced to Plato through their mutual friend Archytas, who ruled Taras (Tarentum) in Italy for many years. The Platonic dialogue *Timaeos* (last period works, 360-347 B.C.E.; *Timaeus*, 1793), named for its main character, a young Pythagorean astronomer, describes Pythagorean ideas in detail.

Influence

"Of all men," said Heraclitus, "Pythagoras, the son of Mnesarchus, was the most assiduous in-

quirer." Pythagoras is said to have been the first person to call himself a philosopher, or lover of wisdom. He believed that the universe is a logical, symmetrical whole, which can be understood in simple terms. For Pythagoras and his students, there was no gap between the scientific or mathematical ideal and the aesthetic. The beauty of his concepts and of the universe they described lies in their simplicity and consistency.

Quite aside from any of Pythagoras's specific intellectual accomplishments, his belief in universal order, and the energy he displayed in seeking it out, provided a galvanizing example for others. Although the details of his personal life are sketchy, his ideals left their mark on later poets, artists, scientists, and philosophers from Plato and Aristotle through the Renaissance and down to the twentieth century. Indirectly, through Pythagoras's disciple Philolaus, his ideas were transmitted to Plato and Aristotle, and, through these better-known thinkers, to a much larger audience.

Pythagoras's systematic exposition of mathematical principles alone would have been enough to make him an important figure in Western intellectual history; however, the spiritual beliefs he espoused make him also one of the great religious teachers of ancient Greek times. Even those ideas that are seen as intellectually disreputable have inspired generations of poets and artists. For example, the Pythagorean concept of the harmony of the spheres, suggested by the analogy between musical ratios and those of planetary orbits, became a central metaphor of Renaissance literature.

Thomas Rankin

Pythagoras: Philosophy

Type of philosophy: Metaphysics, philosophy of mathematics

First transcribed: No extant fragments. Primary source: Aristotle

Principal ideas advanced:

- ◊ The principles of numbers are the principles of the cosmos and all things: All things are numbers.

- ◊ Ten is the essence of number, the perfect number.
- ◊ There are ten basic principles of being and ten heavenly bodies; the movement of the heavenly bodies gives rise to the music of the spheres.
- ◊ Fire is the center of the universe; the earth is a star.
- ◊ By number the unlimited was limited; the world soul breathes the air of the unlimited.
- ◊ All living things are akin.
- ◊ The virtues can be understood mathematically: justice is four.
- ◊ The soul is immortal and is reincarnated; one should aim at the purification of the soul through emulating the divine order and harmony.

Although there are no extant fragments of the writings of Pythagoras, his views were influential in the ancient world and have been referred to by a number of philosophical writers, among them Plato, Aristotle, Porphyry, and Diogenes Laërtius. As one might expect, the accounts are not entirely consistent, and it is often difficult to determine precisely or even approximately what view Pythagoras held on a question under discussion, but there is a body of beliefs that critics generally attribute to Pythagoras or to his followers. The followers are generally assumed either to have inherited the master's views or to have been inspired by his philosophy and practice to develop their ideas along lines that have a distinctive inherited character.

Pythagoras (like many ancient Greek philosophers) did not distinguish his metaphysical convictions from his beliefs about the physical world: His ontology (theory of being), cosmology (theory of cosmic origin and development), epistemology (theory of knowledge), theology, and ethics appear to be grounded in certain abstract mathematical ideas and beliefs and to be interrelated.

Number as a Basis

According to Aristotle, the Pythagoreans believed that all things are numbers in the sense that the principles of numbers are the principles of all things. "There is but one number, the mathematical," is a view attributed to Pythagoras by Aris-

totle, together with the related propositions that all objects of sense are numbers and that numbers are prior, both in power and existence, as well as logically, to physical objects. Accordingly, the Pythagoreans differed from the Milesian philosophers, who found in water, fire, or earth the fundamental substance and cause of things; for the Pythagoreans, the primary cause and substance of all things is number. Not only physical things but also justice and the other virtues, as well as the soul and reason, are in principle and composition numbers. The early writers attributed this philosophical tendency of Pythagoras and his followers—the tendency to take number as primary, creative essence and substance—to the Pythagoreans' having noticed similarities between numbers and objects of sense (although it is not clear what sorts of relationships counted as similarities). Thus, Aristotle writes, "They see many qualities of numbers in bodies perceived by sense" and "in numbers, . . . they thought they saw many likenesses to things that are and that are coming to be."

No doubt part of the belief in the creative power of numbers stemmed from the discovery of the numerical ratios involved in musical harmony. If numbers can so order sound as to achieve harmony, then it is credible that numbers so order the unlimited as to achieve a harmonious universe and that numbers so order the things within the universe as to endow them with distinctive numerical natures and to make physical harmony possible. Thus, since the Pythagoreans regarded ten as "the very nature of number" (Aetius) and as perfect (Aristotle), they declared that the number of heavenly bodies must be ten (although they had observed only nine and thereby presumed the tenth to be an unobservable body between the earth and the sun, a "counter-earth").

One is tempted to suppose that the Pythagoreans regarded number as the nature of things because they discovered constant and harmonizing arithmetical ratios in nature; it is as if they fastened on the abstract relationships that contemporary physics attempts to fix by mathematical equations. According to Aristotle, however, number for the Pythagoreans was not only the "first principle" of all things—the formal aspect or essence—but also "as it were the matter in

things and in their conditions and states." Hence, number was not only form but also matter; the numbers themselves were quantities or magnitudes, not simply the formal aspects of that which has quantity. Pythagoras (or the Pythagoreans) believed that the odd and the even are the elements of numbers; the even is unlimited and is identified with the infinite; the odd is limited. Unity (the number 1) is the product of the odd and even, and all number arises from this original unity.

According to Aristotle, some Pythagoreans—proceeding from a dedication to ten as the perfect number—maintained that there are ten fundamental principles of all being, each principle consisting of a pair of opposites: the limited and the unlimited, the odd and the even, the one and the many, the right and the left, the male and the female, the resting and the moving, the straight and the crooked, the light and the dark, the good and the bad, the square and the oblong. Here again, Aristotle surmises, the principles appear to have been ranged "under the category of matter, for they say that being is compounded and formed from them, and that they inhere in it."

The Origin of the Universe

The Pythagorean account of the origin of the universe as an ordered system consistently accords to numbers the power of generation and the essential determination of the direction and quality of world order. According to Aristotle in *Physics* (second Athenian period, 335-323 B.C.E.; *Physics*, 1812), the Pythagoreans argued that void entered into heaven, which breathed it in from the Unlimited. Somehow "void defines the nature of things," and first of all defined numbers. Void is described as "a kind of separating and distinguishing factor between terms in a series." (It is not clear from Aristotle's account—and perhaps it was not clear to Aristotle—whether the Pythagoreans believed that number was somehow in void and then drawn out of void by a movement, like breathing, stemming from a resolution of tension between the limited and the unlimited, or that void somehow actually gave rise to number. In any case, the universe results from the forming power of number, according to the Pythagoreans.)

Aristotle remarks that although the common belief is that the earth is at the center of the universe, the Pythagoreans (who were dedicated astronomers) believed that a central fire is the center and that the earth creates day and night by circling about this fire. Fire as the center of space, matter, and nature also was regarded as the authoritative guard of all being, "the guard of Zeus."

Aristotle also comments on the Pythagorean view that there is a music of the spheres, a harmony of sound produced by the movement of the heavenly bodies in accord with the intervals determined by numbers. The belief in this heavenly music followed from their assumptions about the effect of the determination of all things by numbers (just as the belief in the tenth planet, the "counter-earth," was required by their belief in ten as the perfect number). The Pythagoreans accounted for the fact that human beings are not aware of the heavenly sounds by pointing out that because this sound is part of the nature of things and has been with us from birth, it is part of our lives, a constant background, and hence not noticeable.

Even the virtues can be understood mathematically, the Pythagoreans believed, according to the sources. Aristotle remarks in the *Ethica Nicomachea* (second Athenian period work, 335-323 B.C.E.; *Nicomachean Ethics*, 1797) that the Pythagoreans regarded the good as the limited and the evil as unlimited. (The idea of moral virtue as involving constraint within limits and even as exhibiting a kind of harmony was characteristic of the Greeks, including Plato and Aristotle.) Aristotle also mentions that the Pythagoreans defined the just as that which is reciprocal. Aristotle declares that Pythagoras was mistaken in attempting to discuss goodness by reference to numbers. Such a reference is inappropriate, Aristotle asserts; after all, he insists, "justice is not a square number."

Hippolytus's View

Hippolytus speaks of the Pythagoreans as combining astronomy, geometry, and music in their study of nature. He reports that Pythagoras claimed that God is a monad, and he mentions the Pythagorean belief that the universe is melodic and that the stars move rhythmically and

hence melodiously. For the Pythagoreans, Hippolytus continues, number is the first principle, and this first principle is a male monad in substance, "begetting as a father all other numbers." The dyad is female, the triad male; that is, even is female; odd is male. All numbers are fours, and four generates ten, the perfect number. (If one adds the numbers 1, 2, 3, and 4, the total is 10.) The four parts of the decade—number, monad, power, and cube—by combining, account for all growth.

Hippolytus also calls attention to the Pythagorean belief in the immortality of the soul and in the soul's moving from one body to another. (He mentions the Pythagorean prohibition against the eating of beans because "at the beginning and composition of all things when the earth was still a whole, the bean arose.")

Others on Pythagoras

The Neoplatonic philosopher Proclus alludes to the Pythagorean discovery that the square of the hypotenuse of a right-angle triangle is equal to the sum of the squares of the other two sides. (The Pythagorean practice of arranging units or "dots" in squares may have contributed to some of their mathematical discoveries as well as to their metaphysical conviction that all things are numbers. As the Greek philosopher Speusippus points out, for the Pythagoreans 1 is the point, 2 is the line, 3 is the triangle, and 4 is the pyramid. The *tetraktys*, a triangle with a four dot base, then a line of three, then two, then one dot—making ten in all—was a key figure.)

Religious Beliefs and Practices

The Pythagoreans were subject to a number of rules of considerable moral and religious importance but hardly of philosophical significance (such as "Stir not the fire with iron," "Speak not of Pythagorean matters without light," and "Let not a swallow nest under your roof"). These rules, together with others—such as the prohibitions against the eating of flesh and beans and against the sacrifice of animals—stem from certain beliefs involved in the religion of the Pythagoreans as influenced by Orphism (the cult of Orpheus). The strictures against the eating of flesh and the sacrifice of animals, for example, are required by the belief in the transmigration of souls.

The moral emphasis in religious beliefs and practices of the Pythagoreans was on the purification of the soul. Porphyry writes of their beliefs that the soul is immortal and changes into other kinds of living things, that events recur in cycles, and that all living things be regarded as kin. Herodotus also speaks of the cyclical theory and applies it specifically to the transmigration of souls: From a human body, the soul enters the body of an animal born at the time of death of the human organism; the soul then makes the rounds of land and sea creatures; finally after three thousand years, it enters a human body again. Diogenes Laërtius tells a tale in which Pythagoras calls upon someone to stop whipping a puppy because Pythagoras had recognized in the yelping of the dog the voice of a departed friend.

Through philosophy, the use of reason, music, religious observances, and the inculcation and development of a spirit of universal sympathy, the Pythagoreans sought the purification of the soul. (Because of the fundamental metaphysical belief in the ultimate reality and power of numbers, these various routes to purification were unified; the reliance on music, for example, was due at least in part to the discovery of the arithmetical proportions exhibited in musical harmony.) The soul, then, was to be educated, trained, ordered, and harmonized. Through the restraint of desire, the soul was to find its proper limits and balance; it could thereupon fit into the universal scheme of things, the universe itself exhibiting the beauty of harmony resulting from its essence in sacred numbers. As Aristotle wrote, for the Pythagoreans "the whole heavens were harmony and number."

Although the Pythagoreans apparently meant literally to claim that all things are numbers and that harmony is achieved through the proper arithmetical relationships, their philosophy probably could not have elicited the kind of dedication it did had not the emphasis on numbers been made "mystically"—that is, in such a way as to transform a mathematical metaphysics into a Greek ethos. Number as first principle was regarded as indefinable (according to Hippolytus); hence, it lent itself to symbolic extension as the possibility of order in life and to moral application in the form of injunctions calling for the attainment of inner harmony and the recognition of

a universal harmony that provides an ideal, a ten. Although the discovery of the theorem that bears the master's name was a magnificent intellectual accomplishment, the moral use of metaphysics by the Pythagoreans contributed to the distinctive Greek emphasis on the use of reason, the recognition of opposites, the attainment of the mean, the setting of proper limits, and the harmonizing of the self and the world.

Ian P. McCreall

Additional Reading

- Barnford, Christopher, ed. *Homage to Pythagoras: Rediscovering Sacred Science*. Hudson, N.Y.: Lindisfarne Press, 1994. This collection of essays touches on Pythagoras's ideas as they affect architecture and religion, among other topics. Includes bibliography.
- Boudouris, K. I., ed. *Pythagorean Philosophy*. Athens: International Center for Greek Philosophy and Culture, 1992. This volume examines Pythagoras and the Pythagorean school. Includes bibliography.
- Burkert, Walter. *Love and Science in Ancient Pythagoreanism*. Translated by Edwin L. Minar, Jr. Cambridge, Mass.: Harvard University Press, 1972. This study, translated from the German, attempts to disentangle Pythagoreanism from Platonism and to describe the various aspects of Pythagoreanism, from music theory to what is called shamanistic religion. Includes extensive bibliography.
- Godwin, Josceelyn, ed. *The Harmony of the Spheres: A Sourcebook of the Pythagorean Tradition in Music*. Rochester, Vt.: Inner Traditions International, 1993. This volume examines the effect that the philosophy and aesthetics of Pythagoras, particularly the concept of the harmony

of the spheres, had on music. Includes bibliography and indexes.

Guthrie, W. K. C. *The Earlier Presocratics and the Pythagoreans*. Vol. 1 in *A History of Greek Philosophy*. Cambridge, England: Cambridge University Press, 1962. Contains an excellent, nearly two-hundred-page chapter on Pythagoras and a half dozen Pythagoreans.

Kingsley, Peter. *Ancient Philosophy, Mystery, and Magic: Empedocles and Pythagorean Tradition*. Oxford: Clarendon Press, 1995. This book illuminates Pythagorean philosophy by showing how it influenced Empedocles. It demonstrates the Pythagorean origin of Plato's myths. It examines connections between ancient magic, science, and religion, tracing a line of transmission from Empedocles and the Pythagoreans into the world of Islam.

Kirk, Geoffrey S., John E. Raven, and M. Schofield. *The Presocratic Philosophers*. 2d ed. Cambridge, England: Cambridge University Press, 1983. One chapter contains a scholarly account of Pythagorean philosophy; includes Greek text of testimony (no fragments).

Mourelatos, Alexander P. D. *The Pre-Socratics: A Collection of Critical Essays*. Princeton, N.J.: Princeton University Press, 1993. This volume includes two essays on Pythagoreanism. F. M. Cornford argues that the early Pythagorean school exhibited two radically opposed systems of thought, the mystical and the scientific, which have been mistakenly conflated. Charles H. Kahn addresses the question of how much of the Pythagorean doctrine can be traced back to some earlier period of the school and specifically to Pythagoras.

Thomas Rankin, updated by Priscilla K. Sakzesles

W. V. O. Quine

Variously called the father of post-World War II American philosophy and the greatest philosopher of the second half of the twentieth century, Quine created a new framework or paradigm of philosophy, one that describes the way knowledge is actually obtained.

Principal philosophical works: *A System of Logistics*, 1934; "Truth by Convention," 1936; "New Foundations for Mathematical Logic," 1937; *Mathematical Logic*, 1940; *Elementary Logic*, 1941; "Steps Towards a Constructive Nominalism," 1947 (with N. Goodman); "On What There Is," 1948; *Methods of Logic*, 1950; "Two Dogmas of Empiricism," 1951; *From a Logical Point of View*, 1953; "Camap on Logical Truth," 1960; *Word and Object*, 1960; *The Ways of Paradox and Other Essays*, 1966; *Ontological Relativity and Other Essays*, 1969; *The Web of Belief*, 1970 (with J. S. Ullian); *The Roots of Reference*, 1974; *Theories and Things*, 1981; *The Time of My Life: An Autobiography*, 1985; *Philosophy of Logic*, 1986; *Quiddities*, 1987; *Pursuit of Truth*, 1992; *From Stimulus to Science*, 1995.

Born: June 25, 1908; Akron, Ohio

Early Life

Willard Van Orman Quine was born into a self-made, upper-middle-class family, the younger of two sons. In his autobiography *The Time of My Life*, Quine wrote that his passions for foreign travel and intellectual discovery began when he was a boy. For him, the thrill of discovery in theoretical science and the discoveries and knowledge gained from foreign travel were both appealing. As a youth, Quine undertook a number of small ventures to earn money and to exploit his interests in travel and journalism. He sold postage stamps, created maps of Akron, and sold advertising for his own publication.

Quine's interest in philosophy predated his high school education. He said it was sparked by Edgar Allan Poe's essay "Eureka." His interests in philosophy and science were driven by his desire to understand how the universe works. Toward the end of high school, Quine developed an interest in the origins of words and how they are used in ordinary language. He would later investigate the role of language in a variety of philosophical disciplines.

As a student at Oberlin College in Ohio, Quine majored in mathematics and graduated with

honors. He wrote his thesis on mathematical philosophy, especially as it was developed and practiced by the English thinker Bertrand Russell. A poker companion introduced Quine to Russell's work in college. Russell derived the world from experience by logical construction. No one at Oberlin was familiar with the revolutionary developments in logic as developed by Gottlob Frege, Russell, and others. Quine's professors at Oberlin, however, encouraged him to explore the works of these thinkers on his own.

Life's Work

Quine chose to do his graduate work at Harvard University because of the strong reputation of its philosophy department, which excelled in logic. Alfred North Whitehead, the coauthor with Russell of *Principia Mathematica* (1910-1913), was then a Harvard professor. Whitehead eventually became Quine's dissertation adviser. Under the guidance of Whitehead, Quine completed his doctoral studies and dissertation in two years. Quine analyzed and advanced Russell's systems in his doctoral dissertation, "The Logic of Sentences: A Generalization of *Principia Mathematica*."

Russell had a profound influence on Quine's intellectual development. Quine used Russell's