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Source: *Journal of the American Musicological Society*, Vol. 16, No. 1, (Spring, 1963), pp. 3-35

Published by: University of California Press on behalf of the American Musicological Society

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Hellenic Conceptions of Harmony

By EDWARD A. LIPPMAN

THAT THE WORLD is characterized by ordered structure is a feeling apparently shared by all higher cultures; and in any particular instance, the way in which this feeling is expressed, the kind of beliefs to which it gives rise, must constitute a feature of the culture that is important and distinctive, if only because it is so fundamental. In ancient Greece, the notion of natural order was shaped by thought of such vigor and universality that there could be no question of confining it within the bounds of natural philosophy; it came to be vitally important also to conceptions of man and society and art. It is doubtless because of the commanding position held by this idea that the constitution of works of art or of society was seen less as a contrivance of man than as a reflection of nature, and many aesthetic problems never came into the focus of attention. But the reverse process (which is foreshadowed in animism and myth) was important too: the natural world was viewed in terms of life and mind, its order testified to plan and reason and divinity, or to the idea of organic wholeness that is embodied in the concept of cosmos. Thus the interrelation of man and the world brought ideas of natural order into the human province and infused ethical and religious and aesthetic values into the sphere of nature. In addition, this generalized order was distinguished by a musical character, and was typically thought of as harmonic. Why this was so or how it came about is not easy to determine, but strangely enough, synesthetic and mythical factors involving actual sonority do not seem to play a major role, for the harmony of the world is a rational and abstract property that is different in principle from any concrete manifestation to sense.

Yet harmony does not necessarily involve either number or measurement. It means simply "fitting together," as manifested typically in carpentry in the joining of two pieces of wood, and the basic prerequisite of the conception is thus the existence of two or more distinguishable entities somehow capable of mutual adjustment. From the beginning the idea was connected with music. The process of fitting together is peculiarly applicable to spatial or simultaneous constituents, and Greek music was purely melodic; but in the tuning of the lyre there existed a simultaneity that was possibly not just an example but the true model of the whole conception. Given a world replete with internal relationships, music can easily account not only for the mathematical meanings of har-

mony, but for the entire generality of the term that develops as part of a progressive musicalization of every aspect of experience. For music conspicuously contains the factor of agreeable sensation; it is based on the internal adjustment of the opposites high and low; and it presents that complex example of fitting together manifested in the *harmonia*, or musical system of the octave. The consonance of the octave itself was also known as *harmonia*, as we can see in the musical discussion of harmony by Philolaus;¹ it was a harmony not only of two tones which are at once opposed and similar, but also of two consonances—the fourth and fifth—which are different rather than opposite, but which even more graphically “fit together” to make an octave. It is the peculiarity of the conception of harmony to unite this specifically musical character with the apparently contradictory feature of abstract generality, and the puzzle is compounded by the fact that a simultaneous relationship was attached to a temporal art. When “harmony” came to designate the chordal aspect of music, there occurred something like a historical solution of a paradox. In any event, music reveals the complex mathematical order of the tonal system precisely in its connection with and dependence upon the more elementary duality of high and low, as well as providing this duality itself with a rational basis in the proportions of consonance. At the same time, it is related more intimately and pervasively with the physical and visual world through the tensions of stringed instruments and the dimensions of musical instruments of all types. Finally, in its temporal character it is able to bring the whole class of cyclic events under the head of harmony, which as a notion of fitting together might otherwise have remained limited for the most part to simultaneous phenomena. It is obvious that music was strategically situated to lend elaboration and structure to the concept of harmony in a way that proved ineradicable. Indeed the term “music” becomes at times more or less synonymous with “harmony,” and takes on the same breadth of meaning. But this inherent suitability of music to its task had to await discovery and use by a culture that found it to be a natural expression of its outlook.

Etymology emphasizes the generality of the field of conceptions to which harmony belongs.² *Ar* or *har* enters a great variety of verbs in the

¹ Frg. 6. The passage in question can be found in Hermann Diels and Walther Kranz, *Die Fragmente der Vorsokratiker* (5th ed., Berlin, 1934-37), Vol. I, p. 409 (later editions through the 8th [Berlin, 1956-59], are essentially reprints with few changes and additions, and will be found to correspond). There are brief but valuable discussions of the controversy over the authenticity of the Philolaic fragments in John Burnet, *Early Greek Philosophy* (4th ed., London, 1930), pp. 279-284, and in G. S. Kirk and J. E. Raven, *The Presocratic Philosophers* (Cambridge, 1957), pp. 308-313. Burnet regards the fragments as suspicious; Kirk and Raven conclude, more definitely, that they are a skillful forgery based on Aristotle.

² See P. Bonaventura Meyer, *Armonia; Bedeutungsgeschichte des Wortes von Homer bis Aristoteles* (Zurich, 1932). The “Wortindex” of Diels and Kranz, *op. cit.*,

Indo-European languages, signifying the unification of disparate or conflicting elements into an ordered whole. Verbs in early Greek literature beginning with this etymon have a broad range of application, and encompass not only the performance of music and the tuning of an instrument, but a physical binding together and a mental pacification, a transitive fitting together and an intransitive adaptation. Greek gives full representation to the physical and logical spheres of the Indo-European prefix, but neglects the temporal one completely for centuries. Homer uses *ararisko* "connect," *aresko* "adapt, reconcile, satisfy," *arasso* "slam together, strike, play the lyre," and *harmozō* "fit together." The last verb has a purely physical meaning in Homer, with a much more restricted application than the noun *harmonia*, but in later times it exceeded the noun in the versatility and breadth of its use, encompassing the diversity of "marry, arrange, administer, tune, kiss" which is revealed in Pindar, Herodotus, Plato, Aristophanes, and Euripides. *Harmonia* developed its variety of meaning earlier, and already designates in Homer not only a physical "connecting link" but a mental and qualitative "agreement."

Duality is a universal motif of myth; in Greece, the duality issues in harmony, which is revealed as the outcome of opposed but reconciled forces. The Boeotian myth makes Harmonia the daughter of Ares, the God of War, and Aphrodite, the Goddess of love and beauty, while the Attic version develops the musical element: Harmonia is not only the daughter of Zeus and the Atlantide Elektra, but she is also the mother of the Muses.

Paired opposites remain as fundamental to scientific cosmogony as they are to theogony and myth; thus a path is provided along which harmony enters into philosophic thought. But the importance of the cosmological role of harmony is guaranteed by additional factors that lend themselves readily to harmonic treatment: the motions of the heavens, the cycle of the seasons, and the idea of primary physical materials or elements. If we examine them closely, however, we find that these factors are all related. At first the elements are thought of not so much as general constituents, but as large masses that have particular locations in the world, and that may come into existence successively, like the divinities in a theogony. Earth is typically surrounded by concentric spheres of water, air, and fire, for example, or one of the elements will be treated as the source of the others. Thus the relationship between the spheres can become a basis for the relationship between the elements, while on the other hand the elements themselves can be reduced to more fundamental qualitative opposites, such as hot and cold, and wet and dry. Again, these are not only general forces, but can succeed one another in a seasonal cycle. Often qualities are not distinguished from ele-

contains a useful, compact guide to the occurrence of the word in Presocratic philosophy (Vol. III, p. 72).

ments; the quality "hot," for example, will be identical with the object "fire," rather than one of its components. Traces of such an origin are preserved in the tendency of elements—even in the classical system of Empedocles—to fall into pairs of contraries. The most conspicuous natural foundations of this whole pattern of thought—and the closest to myth—are the polarities of heaven and earth, male and female, and day and night. And at the other extreme stand the ultimate philosophic versions of duality: the abstract opposites sameness and otherness, or limited and unlimited, which are capable of serving in the generation of number or of the soul.

The history of harmony, however, is by no means coincident with the history of elements and opposites, or even with the history of the basic concept of cosmos. Only in particular schools of thought are cosmogonic processes and cosmic structures regarded as specifically harmonic, although in other cases we are often confronted with descriptions that are in fact if not in name essentially those of harmony. In the course of time, words such as *isonomia* are replaced by *harmonia*, while other concepts, such as those of mixture and measure and proportion, become charged with a musical significance. In order to explain the expansion and success of the concept of harmony we must identify the way in which it differs from other notions of order. Its distinctive feature is its aesthetic connotation, in particular its rich musical values, and their emotional and structural appropriateness to their task.

Early Ionian cosmology is too imperfectly preserved for us to determine the precise nature of its theories.³ That it was to some extent harmonic in conception, however, is suggested by its systematic and geometrical nature, and also by the fact that it was the central source of later Greek ideas. Anaximander, the most important of the natural philosophers of Ionia in the 6th century B.C., described the birth of paired contraries from the boundless *apeiron*. Cosmic process was legal rather than harmonic: a divine justice controlled coming to be and passing away, exacting retribution for the illegal excesses of cold and hot, and wet and dry. The sun, the moon, and the stars were three wheels filled with fire and spaced according to mathematical proportions, very much as in later systems of cosmic harmony.

In the latter part of the 6th century, as a result of the Persian conquest of the Greek cities of Asia Minor, Ionia gave way to Southern Italy as the main seat of philosophic thought, and various natively Ionian philosophers migrated to this new location, where, at Croton and in other Italian cities, the Pythagorean school was the first to achieve prominence.⁴

³ See the excellent study by Charles H. Kahn, *Anaximander and the Origins of Greek Cosmology* (New York, 1960).

⁴ The literature on early Pythagoreanism is vast; its extent corresponds to the importance of the subject but is inversely proportional to the amount of dependable information available. Reliance on Neopythagorean sources is dangerous, recourse

According to tradition from Herodotus to Iamblichus, Pythagoras of Samos acquired both his mystical and mathematical wisdom from Babylonian and Egyptian sources, during an extended period of foreign travel, and there can be little doubt that the foundations of both his religious code and his scientific theory must be sought in these ancient Mediterranean civilizations as well as in Orphism. But as difficult as it is to specify the older constituents of Pythagorean thought, it is still more difficult to determine the precise achievements of Pythagoras himself. We may safely say, however, that no one in Western musical philosophy has had an influence equally powerful. With the early Pythagoreans, active toward the end of the 6th century, the notion of harmony acquired its epochal connection with mathematics, and also its more specifically musical character. They imparted to Greek and to European thought a lasting prejudice that tied music to the cosmos, to rational order, and to ethical value as well, and these ties dominated the musical outlook of both Antiquity and the Middle Ages. Although philosophy was typically a way of life in ancient times, it was especially so for the Pythagoreans. The movement was primarily religious, social, and political, and perhaps the true greatness of its founder was that of providing inspiration and leadership. The brotherhood practiced a type of Orphic religion characterized by an elaborate doctrine and an associated rule of behavior; the code was severe, and involved taboos, discipline, and asceticism. A central doctrine was the immortality and transmigration of the soul, which could travel from human to animal; that abstinence from meat was enjoined may very well have been a consequence. The silence kept by the Pythagoreans may have been disciplinary rather than secretive, but whatever the reason, much of their belief and practice remained unknown to outsiders. Certainly their chief concern was with purification, but this is no more than a corollary of their conception of the soul.

Joined to this basic religious outlook and not merely existing side by side with it was a profound interest in mathematics and in a metaphysics founded on mathematics. The significant association of religion and mathematical speculation created a fostering climate for a powerful and purely theoretic interest in science, which in its religious motivation and

to Plato's *Timaeus* less so. Aristotle is concerned with the later Pythagorean mathematicians rather than with the original sect. Works of particular value are Armand Delatte's *Études sur le littérature pythagoricienne* (Paris, 1915), and B. L. van der Waerden's "Die Harmonielehre der Pythagoreer," *Hermes* LXXVIII (1943). Representative accounts of Pythagoras and his school are those in Burnet, *op. cit.*, Ch. II, and in Thomas Little Heath, *A History of Greek Mathematics* (Oxford, 1921), Vol. I, Chapters III and V. The political history of the early Pythagoreans has been reconstructed, largely on the basis of Aristoxenus, Dicaearchus, and Timaeus of Tauromenium, by Kurt von Fritz, in his *Pythagorean Politics in Southern Italy* (New York, 1940). On ancient mathematics in general and the question of the originality of the Pythagoreans see Otto Neugebauer, *The Exact Sciences in Antiquity* (2nd ed., Providence, R. I., 1957).

freedom from practical concerns could easily stray into numerology and magic. The theory of numbers and geometry were developed in close association; the proportional theory of vibrating strings was a central scientific discovery; and the Pythagorean cosmogony and cosmology were almost certainly based on a variety of harmonic relationships. That numbers are in some fashion constituents of reality is the fundamental metaphysical notion of the Pythagoreans. Unfortunately it is impossible to determine the precise form of this belief; whether all things were held to be numbers literally or simply to be numerical in their form and properties we do not know, but in either case the conception remains important and fruitful. It can be understood only by keeping in mind the fact that number was represented in concrete physical form: geometrically, by arrays of ciphers, and notably by the arrangement of pebbles. Thus number was not abstracted from physical reality as it is in more modern thought. The conception obviously contained two inherent difficulties: zero could not exist, and incommensurable physical and geometrical magnitudes had a peculiar "irrational" status. Prime numbers were arranged in rows, and those with two and three factors in various plane and solid figures according to their properties. Another restriction here was the impossibility of exceeding three dimensions. The most important of the Pythagorean numbers was the tetractys of the decad, a quaternary consisting of the first four integers. This was sacred; it yielded the perfect number 10, and thus provided the underlying reason for the decimal basis of counting. It had a musical implication in that all sets of four were regarded as somehow harmonious and controlled in the relationship of their elements, and more specifically in that it furnished the ratios for the basic consonances of octave, double-octave, twelfth, fifth, and fourth (2:1, 4:1, 3:1, 3:2, and 4:3). Also of great importance musically was the theory of means and proportion. The early Pythagoreans knew that the musical consonances involved the subcontrary as well as the arithmetic and geometric relationships, and the subcontrary mean was named "harmonic," possibly by Hippasus. Specifically, string lengths arranged in the pattern 12,9,8,6 gave the intervals of fourth, fifth, and octave, so that the consonances which were the framework of the scale could be derived from the arithmetic and harmonic means between two quantities in the ratio of 2 to 1.

The early Pythagoreans doubtless found consonant relationships in the macroscopic structure of the world also, and they may have thought of cosmic harmony as in some sense actually sounding, although it is possible that they would not have seen any importance or even any meaning in such a question. The suggestiveness of acoustic phenomena was undoubtedly very great; like rows of pebbles, strings present numbers as lengths, and they make their properties audible as well as visible and tangible. Most important, however, is the easily discovered fact that con-

sonances, and therefore numerical properties, do not reside only in relationships of length. Strings differing in tension or in physical qualities contain harmony in a much more mysterious way, and tend to suggest that number is of the essence of reality even when it is imperceptible.

The diverse factors of the Pythagorean outlook seem originally to have been part of a unified picture provided by an important cosmogonic theory, which can be reconstructed hypothetically in outline from later reports.⁵ The fundamental principles were the paired contraries, the Limited and the Unlimited. From these number was generated, 1 representing their initial combination and containing in itself, as a result, both the Odd and the Even. A second similar process gave rise to 2, and successive repetitions to 3 and 4. This constituted the tetractys of the decad; after 10 the series simply repeated itself. Numbers gave rise to geometric figures: a second unit placed alongside the first generated a line from a point, a third unit placed so as to form a triangle produced the basic two-dimensional figure, and a fourth unit placed on top of these made a tetrahedron, the first three-dimensional figure. Thus geometry too was derived from the tetractys. And from geometry the physical world was generated, for the tetrahedron, the basic solid form, became the physical element fire, which was situated in the center of the world and drew upon the Unlimited surrounding it to complete the cosmogonical process. The crucial point, the relationship between the mathematical and physical entities, we are unable to determine; we do not know whether mathematics was conceived as giving the form of the physical world, in which case there would be a true problem of genesis, or whether the two were identified, so that the tetrahedron and fire were one and the same. And this ambiguity arises again in the relationship of arithmetic and geometry; as we have indicated, a genesis of figures from pebble-like material constituents is certainly unable to account for incommensurable lengths. The closest view we can secure is given by the cosmogony of Plato's *Timaeus*, a monument to the human imagination that is undoubtedly an elaboration of the Pythagorean tradition and that strongly emphasizes the harmonic nature of the cosmos, although it does not entirely remove the enigma surrounding the issues we have mentioned.

A conception of harmony very different from those of the early Pythagoreans, but equally profound, was advanced by Heraclitus of Ephesus,⁶ active around 500 B.C. Heraclitus finds certainty in self-knowl-

⁵ The evidence is marshalled by Francis M. Cornford in *Plato and Parmenides* (New York, 1957), Ch. I.

⁶ There are recent detailed studies of Heraclitus by G. S. Kirk: *Heraclitus; The Cosmic Fragments* (Cambridge, 1954), and by Philip Wheelwright: *Heraclitus* (Princeton, N. J., 1959). The fragments can also be found in Burnet, *op. cit.*, Ch. III, in Diels and Krantz, *op. cit.*, Vol. I, Ch. XXII, and in Kirk and Raven, *op. cit.*, Ch. VI; so many of them come into question here that there is little point in singling any out for mention.

edge rather than in the examination of nature and the amassing of learning. His combination of reason with the empiricism of the Ionians appears to anticipate Plato; but Heraclitus does not believe in changeless ideal entities behind perceptible phenomena; the interrelation is more intimate, and indeed his dynamic conception of harmony was easily misunderstood. The critique offered by Eryximachus in Plato's *Symposium*⁷ conspicuously fails to do it justice, Plato depicting the physician as hopelessly misled by Heraclitean paradox. Love and harmony both present the same problem: are their constituents opposite, or similar? or are they necessarily related in any way even before their harmonization? In other dialogues of Plato also, considerable complication arises over the relationship of opposites; those of the phenomenal world flow into one another and only in the world of forms are opposites irrevocably distinct. But this kind of machinery is not necessary to Heraclitus, for his picture of the world is only superficially similar to Plato's, and is not actually dualistic at all. The world is one of ceaseless change, but it contains a harmony that controls both spatial and temporal phenomena. Enmeshed in the process of the world, hidden somehow in the very midst of the change and transience typified in fire, is a divine Logos, a measure and proportion. The river is constant change, but it is permanence as well; it is always the same river, and by measure, the arrival of water is balanced with its passage at any point. This element of regulation and order in the world is not found simply in external nature nor is it simply subjective; indeed this distinction has no importance, and the order is as omnipresent as the change: it is at once cosmic and ethical. Harmony is perhaps a more adequate description of its nature than either measure or logos, for harmony shows the inevitable relation to opposites, the holding in balance of forces at odds with one another; in a word, the central connection of permanence with transience. We can come to know the divine order of harmony more readily in ourselves than in the external world, and it is the knowledge of this universal but secret logos that gives Heraclitus his superior and cryptic manner and his scorn for the rest of mankind, philosophers included. On the other hand, the very nature of his conception of harmony accounts for the paradox and enigma in the writings of "the dark one." This hidden harmony is more important than any known by the senses, for without it the world would fall to pieces. Yet conflict and opposition are also essential everywhere; they can be called not prerequisites but co-requisites. But things at variance really agree; unity is bestowed by harmony, or if we wish, harmony is really unity. Significantly, it is a musical instrument, the lyre, that Heraclitus uses, along with the bow, to exemplify his conception. In both, opposed forces are connected with one another and adjusted, while from a dynamic point of view, when the strings are drawn back, the restoration of harmony produces music in the one case and

⁷ *Symposium* 187a-187b.

marksmanship in the other—parallel and really equivalent manifestations, for both overcome distance, whether with sound or arrow, to reach their target, both are outcomes of action that is at the same time harmonious and accurately directed, and both are symbols of a life correctly lived so as to achieve its goal. Even literally, whether in instrument or in weapon, music and accuracy are present together, for the bow is not silent in action, and like the flight of sound, the arrow is audible in travel. The depth of the concept reaches back to the identification of musical bow and hunting bow in prehistory. In addition, although its work is death, the bow (*biós*) is life (*bíos*); and in this Heraclitus continues the primitive tendency to find metaphysical significance in sonorous resemblance. Temporal events too, reveal the same principles; night is succeeded by day, winter by summer, and every aspect of the world has its opposite, even where we do not perceive it. A comprehensive concept of harmony is consequently a central feature of Heraclitus's philosophy.

The Eleatic school, which developed in the first half of the fifth century and is represented mainly by Parmenides,⁸ had its basis in reason rather than sensory experience or number, and produced a strict ontology grounded on logic. While the indivisibility and immutability that it deduced as the properties of Being left no room for harmony, Parmenides recognized in addition to a changeless reality, a world of sense and seeming, for which the question of cosmogony again became meaningful. Here were to be found sensible contraries, such as light and darkness, and hot and cold, along with a guiding goddess of harmony who ruled over the union of male and female, and who devised a theogony starting with the creation of Eros. But Parmenides took an extreme stand with respect to the relation of truth and appearance; he saw no point of contact between them, and both this separation and his emphasis on the superior reality of Being were obviously of great importance in the constitution of Plato's metaphysics.

The Sicilian philosopher Empedocles,⁹ who flourished about 450 B.C. and who resembles Pythagoras in combining science with a cult of purification, established the canonical system of four elements, or "roots" (*rhizomata*): earth, water, air, fire; and of two cosmic forces that act on them: love and strife. Everything in the world is a mixture of the elements harmonized by Aphrodite. When constituents are most similar, harmony and love are strongest, and this is particularly the case in the connection of Earth, Sea, Heaven, and Sun with their own parts. Generation and destruction also, after Parmenides, could be conceived only as mixture and separation, but they are controlled by the dominance of love

⁸ See Cornford, *op. cit.*, Burnet, *op. cit.*, Ch. IV, Diels and Krantz, *op. cit.*, Vol. I, Ch. XXVIII, and Kirk and Raven, *op. cit.*, Ch. X.

⁹ Burnet, *op. cit.*, Ch. V, Diels and Krantz, *op. cit.*, Vol. I, Ch. XXXI, Kirk and Raven, *op. cit.*, Ch. XIV. See especially frg. 6, 8, 9, 11, 12, 17, 20, 22, 23, 35, 36, 71, 98, 107.

and hate respectively. Empedocles's cosmogony, in which elements and forces are still identified with divinity, is thus conceived as a harmonic process, and the distinguishing feature of his conception of harmony is its dependence on the similarity of the harmonized constituents. This is a characteristic that undoubtedly is due to his emphasis on the role of love. There is also an alternation of love and hate; in turn the elements unite to form a unity and separate to form a multiplicity; but this oscillation does not seem to have been thought of as a temporal version of harmony.

The later Ionian philosopher Anaxagoras of Clazomenae,¹⁰ whose writings come somewhat after those of Empedocles and who is important in having made Athens the center of his philosophic activity, was the originator of the important concept of *Nous*, or mind, as an ordering force in the world. As Anaxagoras conceived it, however, *Nous* was not immaterial, but rather a distinctively tenuous and pure kind of matter. Both in its nature and its function, it was thus a logical successor of the Heraclitean *Logos*, the divine fire. Like the love and strife of Empedocles, *Nous* in effect produced an analysis of the hylozoistic idea of primitive material, extracting the causal components of force and motion and life, and leaving an inert matter conceived in the form of basic qualitative elements, or "seeds" (*spermata*). Sensible things and even the elements of Empedocles became harmonic mixtures of these seeds produced by the action of *Nous* and then by a resultant series of mechanical events. One type of seed predominates in each mixture and is responsible for the quality of the whole.

Towards 400 B.C., about a century after the time of Pythagoras, we come upon the first of the later Pythagoreans whose ideas have been preserved in some detail. Nicomachus tells us¹¹ that Philolaus demonstrated harmonic proportion by making use of the cube, which has twelve edges, eight vertices, and six faces. And the Philolaic fragments¹² testify to an interest in harmony that is both ramified and deep. Philolaus called the octave *harmonia*, described it as containing the fifth and the fourth, and gave the ratios of all three intervals; he also defined the tone as the difference between fifth and fourth, so that its ratio becomes 9:8, and considered the system of the octave as filled in with such tones—of which the fourth contains two and the fifth three—plus the two remaining semitonal intervals. This gives the basic theoretical pattern underlying the scales and modes of Greek music; if it is expressed in tone just as it stands, the result is a Dorian scale of the diatonic genus. In addition, Philolaus deals with the metaphysical nature of harmony, making use of

¹⁰ Burnet, *op. cit.*, Ch. VI, Diels and Krantz, *op. cit.*, Vol. II, Ch. LXIX, Kirk and Raven, *op. cit.*, Ch. XV. See especially frg. 12 and 17.

¹¹ *Introduction to Arithmetic* II, 26.

¹² Diels and Krantz, *op. cit.*, Vol. I, Ch. XLIV; see note 1, above. There is a good account of the Philolaic cosmology in J. L. E. Dreyer, *A History of Astronomy from Thales to Kepler* (2nd ed., New York, 1953), Ch. II.

the concept that the world and everything in it are made up of two kinds of elements, the limiting and the boundless. These two fundamental elements or principles are structurally insufficient, however, for they are unequal and unrelated; harmony is also required. Here we learn the vitally important fact that the Pythagorean contraries were combined by a harmonic process. If harmony has an ontologic function, number has an epistemological one, for it belongs to everything that can be known; its very nature is such as to give knowledge. Without number, things would not be clear either in themselves or in relation to one another; but number brings them into agreement with perception and makes them cognizable and capable of interrelationship. Like knowledge, truth is inherent in number and specific to it, while falsehood is hostile to number and irreconcilable with it, belonging instead to the nature of the boundless, the senseless, and the unreasonable. Philolaus stresses the universality of number: it plays a role everywhere—not only in divine things, but in all human works and words, including music. An interesting feature of the discussion is that harmony appears both as a result of number and as its foundation.

Although he may not have devised it himself, Philolaus transmitted what was widely accepted as the standard Pythagorean cosmology, but unfortunately we have no information about the mathematical details of its structure. An important feature of the system is that the earth is not placed at the center of the universe; this position is occupied by a central fire which is surrounded by ten wheels bearing successively a counter-earth, the earth, the sun, the moon, the five planets, and the fixed stars. Aristotle believed that the counter-earth had been introduced solely to bring the number of wheels to ten;¹³ that is, as a manifestation of the holy tetractys, but it could just as well have been invented to account for eclipses. On the other hand, the number 10 has been taken to exclude the possibility that harmonic notions are part of the Philolaic cosmology, since there were only seven tones in the Greek scale. The earliest Greek systems of planetary harmony that have come down to us, however, reveal a concern with consonances rather than with the scale, and the number of wheels is determined by other factors. This by no means proves that Aristotle was right in his explanation of the ten wheels, but he certainly might have been, and in any event, it is difficult to believe that Pythagorean astronomy could have been unrelated to harmony. The musical cosmology of Plato's *Timaeus*, which is expounded in the dialogue by a Pythagorean, is almost proof of the point, although we really do not have sufficient evidence to establish the matter either way.

Of Eurytus,¹⁴ who was active in southern Italy around 400 B.C., we

¹³ *Metaphysics* I. 5 (985b. 23-986a. 13).

¹⁴ See Burnet, *op. cit.*, pp. 99-100; Diels and Drantz, *op. cit.*, Vol. I, Ch. XLV, and Kirk and Raven, *op. cit.*, pp. 313-317.

have only Aristotle's report that he decided what was the number of what—of man or of horse—by imitating the figures of living things with pebbles, as some people bring numbers into the forms of triangle and square. But about Archytas of Tarentum, a pupil of Philolaus and a friend of Plato, we are again considerably better informed.¹⁵ He concerned himself with the traditional group of Pythagorean studies that later became the quadrivium, discussing the kinship of geometry, arithmetic, astronomy, and music, which he mentions in this order; he admires the work of mathematicians in these disciplines, and especially in music. The studies are *mathemata*; they are all related because they deal with the two primary forms of Being, by which he presumably means multitude and extension. Music, here identified with harmonics, is thus explicitly recognized as one of the mathematical sciences. That Archytas wrote on all of these sciences himself is more than likely; what we know of his work points in this direction, and the disciplines were so intimately associated in the Pythagorean outlook that they probably were always studied together. Indeed Vitruvius mentions Philolaus and Archytas of Tarentum among the men "on whom nature has bestowed so much skill, acumen, retentiveness that they can be thoroughly familiar with geometry, astronomy, music, and other studies."¹⁶ In his analysis of the physical nature of sound, Archytas comes close to the true state of affairs, correctly connecting higher pitch with speed and power, but he falls into errors of detail by failing to take vibration or wave length into account. Ptolemy regards him as the most important of the Pythagorean writers, and both Ptolemy and Boethius discuss his calculation of the intervals of the musical genera, a detailed interest in tuning he might easily have taken over from his teacher Philolaus. Boethius has also preserved his proof that no geometric mean exists between two numbers in superparticular ratio,¹⁷ that is, between two successive integers, a theorem that appears to be his outstanding contribution to musical theory, and has its specific application in demonstrating that the whole tone cannot be rationally divided into two equal intervals. The proof is also found considerably later than Archytas in Euclid's *Division of the Monochord* (c. 300 B.C.).¹⁸ It has an additional interest in revealing something of the interconnection of the mathematical sciences, for it rests on various arithmetical propositions which can be found in Euclid's *Elements* (Book VII); thus at

¹⁵ See Diels and Krantz, *op. cit.*, Vol. I, Ch. XLVII, and Heath, *op. cit.*, Vol. I, pp. 11, 14, 85-86, 90, 212-216, 246-249.

¹⁶ *De architectura* I. i. 16.

¹⁷ *De musica* III. 11.

¹⁸ Theorem III. See Vol. VIII of the *Opera omnia*, ed. by I. L. Heiberg and H. Menge (Leipzig, 1916), pp. 162-163. There is an English translation, "Section of the Canon," in Charles Davy's *Letters upon Subjects of Literature* (Bury St. Edmunds, 1787), Vol. II, pp. 264-304.

the same time we learn that the discipline of arithmetic was known to Archytas in something like the form in which we find it in Euclid. Another problem that Archytas solved brilliantly by a three-dimensional construction is that of duplicating the cube, or of finding two mean proportionals between two straight lines; this theorem similarly shows the interrelation of the *mathemata*, for it enters into the harmonic cosmogony of Plato's *Timaeus*. More specifically musical is Archytas's discussion of the arithmetic, geometric, and harmonic means; he defines the three, and considers all to belong to the subject of music, which doubtless signifies that he conceives of this as the general study of relative number; although it is true that the means are all used in the relationships of actual music, so that the mathematical discipline is not so distant from the specific theory of the art. Finally Iamblichus reports that both Philolaus and Archytas were familiar with the "musical" proportion 12, 9, 8, 6, which the Neopythagoreans regarded as the most perfect of all.

There can be no doubt that the scientific conception of harmony and music was well established by the time of Plato. In the *Theaetetus*¹⁹ we learn that this mathematician and his teacher studied the traditional *mathemata*, and essentially the same group of sciences is discussed in the *Republic* (Book VII), the *Laws* (Book VII), and the *Epinomis*. It might seem that the Sophists would oppose such studies on principle or at least not find them useful except possibly for purposes of refutation, but even they taught and studied them (although Protagoras was an exception), as we can see in *Protagoras* and in *Lesser Hippias*.²⁰ More specifically, we are told that under their tutelage pupils reviewed these disciplines, or learned them for a second time; mathematics must have been to some extent a general feature of private education, and it was taught in public schools as well, although from a more practical point of view.²¹

Plato's interest in the discipline of harmonics is grounded partly in his conviction that harmony and music have a close relation to the cosmos. One of the ironic etymologies of the *Cratylus* specifically couples music with the harmony of nature.²² In support of the thesis that the name Apollo means "moving together," Socrates points to the fact that Apollo is the god of harmony; musicians and astronomers both declare that he makes all things move together by a harmonious power, whether in the harmony or concord of song or in the poles of heaven. The discussion links music, prophecy, medicine, and archery, as the four attributes of Apollo, and also points to harmony as the unifying factor, since Apollo is the god of harmony. This suggests not only the Heraclitean coupling of lyre and bow, but also the connection of harmony with wisdom (in

¹⁹ *Theaetetus* 145a-145d.

²⁰ *Protagoras* 318d-318e; *Lesser Hippias* 363b-368d.

²¹ See Heath, *op. cit.*, Vol. I, pp. 18-22.

²² *Cratylus* 404e-406a.

the attribute of prophecy) and the concept of medicine as the art of bringing about harmony in body and soul.

The impressively broad scope of the conception of harmony is revealed in the important discourse of the physician Eryximachus in the *Symposium*.²³ The speech is compounded essentially of Hippocratic and Empedoclean theories of the harmony in man and in nature, including the harmony of the seasons, and of wet and dry, and hot and cold. It also contains the criticism of Heraclitus that we have mentioned above, and maintains that harmony is the reconciliation not of opposite elements, but of elements that disagreed once and are now harmonized. Presumably then, harmony is possible only if some alteration in the elements takes place upon harmonization so that they come to possess something in common. If two strings are harmonized, for example, assuming for simplicity that they may differ only in length, we adjust the relationship of the two lengths so that there is a unit by which both strings can be measured. The argument is clearly in line with Empedocles's emphasis on similarity as a prerequisite of harmony. And the fundamental theme of the discourse, the association of harmony and love, also derives from the same philosopher.

Of the most striking expression of the musical constitution of the world, the harmonious properties of the heavens, we really have no clear evidence until Plato's *Republic* and *Timaeus*. Sensory and synesthetic elements are a distinctive feature of the myth of Er in *Republic* Book X;²⁴ the vision of the rotating wheels of the world is a *post-mortem* experience of a warrior killed in battle. The music actually sounds, and the tones are connected with visual impressions, particularly with colors. Appropriately, the Sirens and not the Muses preside over the cosmic music. The intrusion into a cosmological picture of perceptible rather than purely intelligible factors can be explained without great difficulty. It is due doubtless to the fact that to the soul freed from the body, rational apprehension takes on the character of immediate perception. Also the myth of Er is not a straightforward cosmology, but a pedagogical device teaching the ultimate rewards of justice; it is poetry in a more immediate sense than the philosophical dialogue itself, and thus capable of serving a more elementary educational purpose. Accordingly it uses the method of sensory appeal; it is imitative art, but a true imitation.

There are eight wheels in the vision; their appearance is described in respect of the width of their rims, their color, and their speed, but each of the three lists mentions the wheels in a succession that reflects the

²³ *Symposium* 186a-188e.

²⁴ *Republic* 614b-621e. See the discussion of this passage in James Adam's edition (Cambridge, 1902), and in the Introduction (by A. Diès) of the Budé edition (Paris, 1947). Pierre Boyancé has also dealt instructively with the myth in *Le culte des Muses chez les philosophes grecs* (Paris, 1937), and in "Les Muses et l'harmonie des sphères," *Mélanges dédiés à la mémoire de F. Grat* (Paris, 1946).

balanced order underlying them. On each wheel sits a siren singing one tone, and the eight together form one harmony. In view of the clearly simultaneous nature of the "harmony," it is unlikely that Plato intends to designate a scale. Furthermore a scale is possible, although still unlikely, only if the tones were connected with the widths of the rims of the wheels, or with hypothetical orbital speeds. The angular speeds of the wheels were more or less accurately known, and palpably did not yield a scale. (In addition, since three of the angular speeds are given as identical, there could be only six different pitches; a complete scale, at any rate, would be impossible.) On the other hand, the radii of the wheels, which are doubtless what the tones represent, were simply not thought of as scalar in their relationship (this can be determined from the account in the *Timaeus*). To complete the picture of simultaneous harmony, the three fates join in the singing. They sing of the past, present, and future respectively, so that the music itself includes temporal events in a highly explicit form. There is a relation between this depiction of time and the time embodied in the rotation of the wheels, for the Fates touch the various wheels at certain intervals and influence their motion: Clotho, who sings of the present, helping with her right hand the revolution of the outer wheel; Atropos, who sings of the future, guiding with her left hand the inner wheels, which all revolve slowly but at various speeds in the opposite direction; and Lachesis, who sings of the past, touching first the one and then the other, with each hand in turn. Plato has here provided an ingenious device to "save the appearances" of the complex motions of the stars, and in addition, he makes time subservient to divine control, so that its structure, as revealed in the heavens, becomes significant for human destiny. The Fates represent the connection between human temporal existence and the cosmos, so that the choice of a type of life by each soul, which is described next in the myth, becomes a decision set in the context of cosmic justice. Quite apart from questions of scientific cosmology, the whole vision is intended to depict justice on a cosmic plane; it is not so much an allegory of justice, but a characteristic union of the cosmological and legal notions in the tradition of Anaximander. Thus each Siren keeps to her own tone, a counterpart in the universe of justice in the state, which consists in each citizen doing his own business. And this in turn is a parallel of justice within the individual. Appropriately reflecting the concept of justice, the array of relationships in the cosmos is characterized by balance, and this takes on sensible beauty and order for the soul that achieves a vantage point giving direct insight. Injustice is then seen to be only apparent—a momentary deviation that does not disturb the whole.

The cosmology of the *Timaeus* has a considerably more detailed musical character, and also encompasses the problem of genesis.²⁵ The cosmos,

²⁵ Since numberless philosophical, theological, and mathematical works are com-

as a perfect whole of perfect parts, is constructed throughout by a method based on a conception of harmony: intermediates—geometric, arithmetic, and harmonic means—connect its various parts and the opposites it contains. The world is a living organism with a soul as well as a body. Both of these are created by a divine Artificer who is producing in effect a master work of art, a huge spatial and temporal music. Pythagorean and Ionian traditions are combined in a masterful synthesis that encompasses the mathematical harmonies of the soul and the physical harmonies of the body. The question of the status of number and the Ideas is answered by compounding the soul of their likeness in the form of an impalpable material and its articulations and motions. The soul transcends the body but is intimately connected with it. The Ideas themselves remain without the attribute of location, but the soul explains how they can be relevant to the sensible world and how they can become objects of knowledge. Every constituent of a complete metaphysics is incorporated in a single narrative. Mathematics is divided: number finds its place in the soul and so does the geometry of circles and spheres and rotation; but the rest of geometry—straight lines and all the angular figures—belongs to the physical world as its ultimate basis.

The Artificer first creates the soul of the world, mixing together materials that are related to the general classes of existence as we find them discussed in the later dialogues. The psychogony represents a transformation of Pythagorean cosmogonical ideas which Plato effected through his critique of Parmenides. Existence, Sameness, and Otherness

mentaries on the *Timaeus* in fact but not in name, the total volume of writing based on this dialogue is incredibly large. While older commentaries have become historical documents that express the musical thought of their time, more recent commentaries are of less interest in this respect, and serve instead as the immediate background of our own analysis. Thus we may logically mention here the most useful scholarly commentaries of the 19th and 20th centuries: August Boeckh, "Über die Bildung der Weltseele im 'Timaios' des Platon," *Gesammelte kleine Schriften* (Leipzig, 1858-74), Vol. III (first published shortly after the beginning of the century); T. Henri Martin, *Études sur le Timée de Platon* (2 Vols., Paris, 1841); Paul Shorey, "The Interpretation of the *Timaeus*. I," and "The *Timaeus* of Plato. II," *American Journal of Philology* IX-X (1888-89); Albert Rivaud, "Notice," in his *Timée* (Paris, 1925: Vol. X of the Budé edition of Plato), and "Études Platoniciennes," *Revue d'histoire de la philosophie* II-III (1928-29); Alfred Edward Taylor, *A Commentary on Plato's Timaeus* (Oxford, 1928); and Francis M. Cornford, *Plato's Cosmology* (New York, 1937). The musical details of the structure of the soul were restudied recently by Jacques Handschin in "The 'Timaeus' Scale," *Musica disciplina* IV (1950). The most debated passages of the *Timaeus* have been precisely those that deal with harmony, and in particular with the creation of the soul; but while some of the details are problematical, they are also unimportant, and do not affect the general significance of Plato's discussion. More serious is the question of the nature of his concepts, of the correct balance of literal and figurative meaning in the notions of the Artificer, the materials of the soul, creation in time, and so forth. Each age and each exegete has given different relative weight to the components of poetry and philosophy. It is my feeling that this peculiarly Platonic compound has its own unique eloquence and import, and I have tried to leave it undisturbed so that it might speak for itself.

are blended in a process that involves various notions of a harmonic nature. Existence itself, for example, is compounded out of two constituents—Indivisible Existence and Divisible Existence—which are contraries, and it is thus intermediate between them. In addition, Existence then mediates the combination of Sameness and Otherness. But the harmonic aspect of the world soul is not limited to the constitution of its material, for after this is blended, it is divided into parts that have the relationships of the tones of a vast Dorian musical scale of the diatonic genus. The range is nearly five octaves—much greater than that of practical Greek music. To derive the scale, Plato makes use of two numerical sets—1, 2, 4, 8 and 1, 3, 9, 27—which employ the first three powers of 2 and 3 respectively and have 1 as a common term; the seven integers are arranged in ascending order to form a scalar framework. The two constituent sets represent opposites again, this time of odd and even number—a duality that is another version of the contraries Sameness and Otherness. There are three powers because the soul is tridimensional. Two portions of the material are then placed in each successive interval of the framework, the size of these portions being equal in each case to the arithmetic and harmonic means between the two terms defining the interval. Finally all the resultant musical intervals of a fourth are filled up with whole tones in the ratio 9:8, leaving over in each fourth the diesis 256:243. This scalar series of magnitudes, which we can take as connected one to the other, is then split lengthwise and formed into two strips, which are bent into circles and arranged like a representation of the celestial equator and the ecliptic. These are set into rotation, the outer motion being called the motion of the same and the inner motion that of the other. Rotation is the geometric counterpart of a recurrent algebraic operation, in this case of the successive doublings and triplings in the original numerical framework, and the octave-experience in particular calls for a circular representation. At the same time, of course, Plato is expressing the important theory that immortality is characterized by circular motion. The inner circle is divided into seven concentric parts, and these are in turn spaced according to the same double tetractys, so that the intervals between them are given by the series 1, 2, 3, 4, 8, 9, 27. They are then made to move at speeds which are various but which again are determined by proportional relationships. The soul of the world, as Plato tells us, partakes of reason and harmony.

Having made the soul, which is invisible, the creator constructs the sensible body of the cosmos. The visible planets and stars are placed in the circles of the other and the circle of the same respectively, and thus are arranged in the same mathematical-musical relationship as the soul itself. In the construction of the body the creator must deal with the realm of necessity, which fundamentally is the unformed extension in which the world is made. Impressed upon this extension but subservient

to its inherent tendencies are the elementary geometric patterns of which the primary materials, the so-called elements, consist. These elements are originally fire and earth, but it is necessary to bind them together, and for this purpose geometric proportion is employed. This provides the most perfect bond, for the geometric mean fuses completely with the extremes. Since the world is to be tridimensional, however, two means are required, and thus two additional elements, air and water, are placed between fire and earth in such a way that the four constitute a continuing geometric progression. Thus the body of the world "was harmonized by proportion." But the elements must actually have some common substratum, for—with the exception of earth—they can be transmuted one into another. They are made up not of qualitative contraries but of geometric atoms too small to be seen. Basically then, the sensible world consists not of gross matter but of mathematical structures imprinted upon space, a view which finds remarkable confirmation in 20th-century science. Four of the Platonic solids—tetrahedrons, octahedrons, icosahedrons, and cubes—are the seeds of fire, air, water, and earth respectively, and different species of the elements are caused by seeds of different sizes. The ultimate atoms are really two types of triangles, the isosceles right triangle and the scalene right triangle that is half of an equilateral triangle, for these make up the faces of the regular solids. They also provide an explanation of transmutation, since the second type of triangle is a constituent common to fire, air, and water. The constitution and properties of the elements also, then, are "perfected and harmonized in due proportion" by the creator.²⁶ Finally in addition to the fundamental proportional relationship between the elements as a whole, particular proportions characterize their combination to make up the various objects of the world, both animate and inanimate. Thus all the compounds of the elements—the whole sensible world of becoming—are comparable to the material of the world soul, which is a proportioned mixture of components; and in their overall arrangement too, soul and body follow the same musical principles of order.

The mathematical instrument used to combine materials is the geometric mean; accordingly geometric progression is common to soul and body. But also, the particular aspect of the soul that corresponds to the perceptible courses of the heavenly bodies is appropriately patterned on a combination of two continuing geometric progressions of opposed nature. On the other hand, the detailed structure peculiar to the soul involves all three types of mean. The harmonic mean may very well have been regarded as the most fully adequate representation of harmony, and thus, since harmony was typical of perfect structures, as specifically characteristic of the realm of purpose and the true knowledge of being. In any event, the mathematical construction of the soul comprises progres-

²⁶ *Timaeus* 56c. The translations of Plato are by Jowett.

sions of every type, all welded together in the unity of the musical scale.

The importance of the number four as a basis of harmonic order is seen once more in the tetrachord, the fundamental unit of the musical system and thus of the soul. And it is found also in the peopling of the world with four types of creatures constituted—apart from the matter of soul—of combinations of the four elements. The first are the immortal gods, who are the planets and stars themselves, and the other three are the mortal air, sea, and land animals. This provides a tetractys not mathematically defined, but correlated with the elements, each of which is peculiarly appropriate to one species of creature: fire, air, water, and earth are the most important if not the sole constituents of the species of the heavens, air, water, and earth respectively.

As far as the general analysis of harmony is concerned, the importance of the *Timaeus* consists in making explicit a more advanced theory of the harmony of opposites, and then generalizing it so that it applies also to more than two components. In this theoretical respect, the dialogue is actually an elaborate harmonic study, but because it contains as well an essentially universal treatment of the metaphysical, ethical, and aesthetic implications of harmony, its scope is still more remarkable. As we have seen, the *Symposium* advances the idea—which the *Philebus* later takes up in more explicit terms—that opposites require modification before they can be harmonized; some principle applied to both must make them compatible. (Their actual attraction can then be explained by the force of love.) But in the *Timaeus* the idea of binding the contraries with some third entity is made basic. The bond is mathematically conceived as a mean, and it is of the same nature as the elements to be harmonized. Thus the concept of opposites that are compatible and held together by an attractive force is replaced by the more abstract and general concept of a number of elements standing in a determined relation to one another. But this notion of harmony gives rise to its own ethical qualities of love and goodness; it is also applicable to more complex structures, such as the internal constitution of living beings; and it produces aesthetic values as well.

The cosmogony of the *Timaeus* is in essence a story of the creation of harmonic order, a concept that now includes ordered arrangement of a great many kinds; "when all things were in disorder, the Demiurge created in each thing in relation to itself, and in all things in relation to each other, all the measures and harmonies which they could possibly receive."²⁷ But in addition, it becomes obvious that the harmonic view of the world is not purely an objective picture of structure. Value is apparently an inevitable feature of cosmology, as it is of myth and to some extent of natural science as well. Divine embodiments of natural forces are the rule in theogony, and the same procedure even enhances the value

²⁷ *Ibid.*, 69b.

of ethical forces. In philosophical thought, Eros is gradually transformed into the cosmic force of love, which manifests itself in the harmony of opposites. Harmony itself, once a goddess born of divine opposites, remains a valuational concept; and this is part of the reason that it increasingly replaces more colorless descriptions of combination, such as equilibrium, balance, and mixture, and even comes to control the temporal concepts of measure and rhythm, as it does in the *Timaeus*. Paired principles, again descended from gods, are no less charged with value. The divinities of Heaven and Earth become the forces of Light and Dark, and distant descendents like Sameness and Otherness still contain transformed concepts of good and bad. Even the apparently distinct conception of mind bears a relation to the traditional contraries, for it is opposed to matter somewhat as fire is to night, as good is to bad. But like love, which is paired with the evil of strife, mind becomes an ordering force separate from paired elements, concealing its history in its positive character. In any event, the incorporation into the world of a rational principle of order means the attribution to nature of purpose and also of beauty in a deeper sense than unreasoned symmetry.

Wherever we look the role of value in cosmology is confirmed. If it is mind in the case of Anaxagoras, it is justice in Anaximander, love in Empedocles, and harmony itself in Heraclitus. To the Pythagoreans in much greater degree than to other philosophers with the possible exception of Plato, the order of the cosmos was ethical and religious as well as physical and metaphysical. Number itself was valuational, for it was either the essential or the sole constituent of everything, apparently even of justice; the "holy tetractys" is simply the most prominent example of a general outlook. Perhaps more important still was the faith with which the Pythagoreans pursued the traces of number in the world; their search for harmony was part of a belief, and their science an expression of mysticism. There are remnants and counterparts of this attitude in the religious faith with which many scientists regard the mathematical order of the world, and in human dedication to science; the search for truth, although dispassionate in one sense, can become a way of life, and research a moral value.

Under the influence of the predominantly ethical outlook of Socrates, considerations of the good affected every department of Plato's thought, and the outspoken teleology of his world endows its order with profound value. Cosmic harmony is the direct expression of the Artificer's desire that the world be good. The place made for the cosmic soul is especially important, for in its very conception the soul is both good and beautiful, and it embodies these values in its harmony. Goodness characterizes not only the soul, however, but the whole cosmos; the creator wanted everything to be as like himself as possible, an end which he achieves through harmonious order in every part of his work. Even if the cosmogony of the

Timaëus—unlike those of myth and religion—is actually an allegory that expounds a cosmology by the fictional device of narration, the good in the cosmos is one of the properties that Plato earnestly seeks to explain. The ordered and ordering intelligence of the world soul will still be both good and a force for good, and this value will inform the material sphere also. But if the teleological conception of the cosmos is the most prominent basis for the value that inheres in its harmony, the conception of the cosmos as alive is important too, for only an organism can fully incorporate purpose and goodness. The cosmic soul, like the Artificer himself, is a transposition of an anthropological discovery; it carries over into the universe the consciousness of the human power of artistic creation. In terms of the cosmogonic narrative, only a cosmos that is alive can be made close in goodness to the creator.

The theory of classes and their interrelationship that Plato expounds variously in the *Sophist* and the *Philebus* contains a conception of harmony that more or less frees itself from cosmogony, and thus achieves an even greater generality than the harmonic ideas of the *Timaëus*. The kind of theory involved is an outcome of the critique of the *Parmenides*, which exposed defects in the conception of the Platonic Ideas and also in the Eleatic doctrine of Being that is fundamental to the Ideas. The denial of reality to anything but a monolithic Being that admits no opposite or difference also obstructs a positive result in the epistemological investigation of the *Theaetetus*: the definition of knowledge appears to demand the existence of non-being and falsehood. The difficulties reappear in the *Sophist*, where a solution is found in the notion of the mingling or communion of classes of existence.²⁸ The Ideas have lost their transcendental character and become general conceptions or classes; and the possible relationships between such classes are defined: a given class may communicate or intermix with no other, with some others, or with all others. In particular, Plato selects five of the principal classes—being, rest, motion, the same, the other—and investigates their communion with one another. This undertaking is the proper subject of the art or science of dialectic. Music, or harmonics, is the science of knowing what mingles and what does not in connection with sound, and philosophy pursues the same kind of science with respect to classes.

The harmonic nature of dialectical inquiry becomes much more conspicuous in the related discussion of classes in the *Philebus*.²⁹ Plato does not select classes from those of importance, but instead undertakes to apply division to the whole of existence, and arrives at four classes: the infinite, the finite, the compound, and the cause. The class of the finite (or the definite or limited) includes the equal and the double, and any other ratio of number and measure; it is consequently able to end dif-

²⁸ *Sophist* 252e-257a.

²⁹ *Philebus* 23c-27b.

ference and opposition, and to create harmony and proportion among different elements by the introduction of number. As a result, the compound or mixed class, which is the union or offspring of the first two, is essentially the class of the harmonious. The generation of this class is brought about by the fourth one, that of cause. The whole system is nothing more or less than a scheme of the generation of harmony, and it makes harmony the central characteristic of existence as well as of philosophy. In keeping with the notion advanced in the *Symposium* that opposed elements must be modified before they can be harmonized, the account in the *Philebus* does not combine opposed elements, but mingles the various opposites of the class of the infinite with the class of the finite to produce certain forms of harmonic nature. When heat and cold prevail, for example, the introduction of the principles of the limited takes away excess and indefiniteness, and infuses moderation and harmony. But of greater importance than the seasons, or than health and strength, are the ethical examples of harmony, for the *Philebus* is concerned primarily with determining the good, and the harmonic conceptions are completely general. Socrates, whose exceptional appearance in a late dialogue is undoubtedly due to the subject matter of the discussion, is particularly concerned with the applications to ethics: "O my beautiful Philebus, the goddess, methinks, seeing the universal wantonness and wickedness of all things, and that there was in them no limit to pleasures and self-indulgence, devised the limit of law and order. . . ." ³⁰ To the mixed or harmonious class belongs the mixed life of pleasure and wisdom, acknowledged as the best; and this class also contains the origin of bodily pleasures and pains, for living beings are made up of the natural union of the finite and infinite. They are, in a word, harmonic structures. When the harmony in animals is dissolved there is also a dissolution of nature and a generation of pain, while the restoration of harmony and return to nature is the source of pleasure. An analysis of the different kinds of pleasure and wisdom permits a more detailed determination of the constitution of the mixed life; and with the results of such an analysis as materials, Socrates mixes together the components of this best life after the fashion of artistic creation. The finished work would appear to be characterized most importantly by harmony, for the most precious element of the mixture and therefore the highest good of all is found in the appropriate proportions of the constituents. Without measure and the mean and the suitable, the mixture would not be a mixture, but only a confused medley. The second highest good also, which consists in the class of the symmetrical, the beautiful, and the perfect, has something of a harmonic nature; what is more, symmetry possesses aesthetic as well as ethical value, if we can characterize as aesthetic the highly abstract beauty of a category of the good. There can be no doubt, however, that the role

³⁰ *Ibid.*, 26b-26c.

in which Plato has cast Socrates is very close to that of a musical composer. The answer to hedonism in ethics is not the denial of pleasure, but the application of harmony.

The Greek philosophy of man is long in developing principles and concepts peculiar to the human sphere; it borrows heavily from cosmology and natural philosophy, and as a result, the conceptions of harmony found in anthropology are often not original to the field. In their new setting, however, the borrowed ideas take on a new significance, and this in turn can affect cosmological thought. Anthropological ideas develop chiefly in the field of medical theory, which appears first in close association with Pythagoreanism. Alcmaeon of Croton,³¹ a physician of southern Italy who was active in the early 5th century B.C., described health as a balance and a proportionate mixture of qualities in the body; the commensurability of the paired opposites in the mixture was based on the simple relation of equality. On the other hand, he conceived the soul as continually in motion; it was immortal because it was similar to the immortal heavens. But could this motion of the soul have been circular? Alcmaeon seems to imply that it is in holding that man dies because he is unable to join the beginning to the end. Accordingly, this philosopher may have influenced the Pythagorean theory of both body and soul, for Simmias's concept of the harmony of the body in the *Phaedo* could very well have been derived from the simpler notion of health as *isonomia*, just as the description of the soul in the *Timaeus* could easily go back to an earlier concept of circular motion. At the same time, neither bodily *isonomia* or harmony nor circular motion in the soul can be discovered in Pythagorean thought before Alcmaeon.

In the physical realm, of course, any general theory of harmony will apply equally to man and nature. In Empedocles's view, for example, man too is a harmony of the four elements caused by love.³² Temporal and social and qualitative concepts of harmony are suggested also: love is responsible for harmonious actions and friendly thoughts.³³ In the Hippocratic writings,³⁴ health is discussed as a balance of the four qualities—cold, hot, wet, dry—which, like the Empedoclean elements, are also found in nature, specifically in the seasons. Hippocratic medicine typically viewed health against the background of physical environment, and regarded climate as the determinant of bodily constitution. This was actually a cosmic connection, since antiquity knows no distinction in principle between meteorology and astronomy. Thus the cyclic predominance of the qualities in man follows their succession in the seasons, and the

³¹ See Burnet, *op. cit.*, pp. 193-196, Diels and Krantz, *op. cit.*, Vol. I, Ch. XXIV, and Kirk and Raven, *op. cit.*, Ch. VIII.

³² Frg. 20, 21, 23, 26.

³³ Frg. 17.

³⁴ Much of the Hippocratic corpus is conveniently available in the *Loeb Classical Library* edition.

correspondence between world and man is deepened into a causal connection. Similarly in the *Nature of Man*, which according to Aristotle was written by Polybus, the son-in-law of Hippocrates, health is described as an equilibrium of four humors—black bile, yellow bile, blood, and phlegm—and in each season a different humor predominates. In later times, these theories were complemented by Galen's somewhat different conception of the four temperaments, each of which was a blend of qualities and elements and humors.

Temporal concepts of harmony are more at home in the human than in the natural province; the Hippocratic writings often bring rhythm under the head of harmony. There are examples in the progress of fevers, which revealed distinctive numerical patterns in the recurrence of critical days, thus permitting confirmation of the symptoms of the disease and making prognosis possible. Such patterns were specifically conceived as ordered numerical progressions of a harmonic nature. Health too was brought within the sphere of temporal harmony, for it was signified to the physician when he judged the rhythms of the pulse and of breathing to be harmonious. Most striking of all is the Pythagorean element that enters the discussion of embryology.³⁵ The growth of the embryo followed a harmonic pattern of days; particular stages of development were reached in specified times. The embryo was viewed as a musical instrument, and embryonic development became a musical performance.

The concept of the harmony of the body, as it developed in the Pythagorean-Empedoclean-Hippocratic tradition of philosophical medicine, receives its most systematic exposition in the speech of Eryximachus in Plato's *Symposium*.³⁶ Since the *Symposium* deals with various types of love and their relative values, Plato's physician advances the notion of two kinds of love, only one of which knows moderation and thus leads to harmony while the other (which is clearly Empedoclean strife in disguise) is evil and leads to excess. But the important point here is the generality of this ethical basis of harmonic structure; although love is a specifically human concept in origin, it becomes the foundation for harmony of every type. The theoretical analysis of harmony also, which we have discussed above, applies with equal force both to the harmony of nature and the harmony of man. If we add to these factors the causal role of the seasons and the weather, and the harmonic conception of rhythm, the full breadth of the medical theory of harmony becomes apparent. The generalization of this theory—which reaches here and there into astronomical, religious, social, and qualitative concepts of harmony—is the main achievement of the discourse.

An important theory of the harmony of the soul is advanced in Plato's

³⁵ Armand Delatte, "Les harmonies dans l'embryologie hippocratique," *Mélanges Paul Thomas* (Bruges, 1930).

³⁶ See note 23, above.

Phaedo ³⁷ by the Theban Simmias, who is a disciple of Philolaus. He maintains that the soul is a harmony of the body, and illustrates his meaning by comparing the body to a lyre. Although the idea is materialistic, it is not completely unable to account for certain cherished properties of the soul; even though Simmias makes harmony dependent upon physical materials, he recognizes its incorporeal and divine nature. The conception is thoroughly Pythagorean as far as number and harmony are concerned, but it is quite the contrary in its insistence on the soul's mortality, curiously contradicting the Pythagorean belief in metempsychosis. The physical world becomes a basis of explanation in a realm long since recognized as fundamentally different, and that is why Socrates (the man chiefly responsible for formulating the Western concept of the soul) advances a series of detailed refutations.³⁸ These cannot be taken to imply, of course, that he opposes the notion that the soul is harmonic or harmonious in nature; he takes issue only with the particular idea that the body furnishes the elements of such a harmony.

In the *Republic* Plato regards the soul as tripartite;³⁹ it consists of rational, spirited, and appetitive principles. Temperance is a harmony between these three parts, a condition in which the rational principle exercises control over the other two. Discord is equivalent to evil. The structural aspect of the conception becomes still clearer in the comparison between the principles and the strings of a musical instrument.⁴⁰ Plato also considers just the relation between the rational and spirited parts.⁴¹ Ostensibly he is then concerned with a different kind of harmony, that between soul and body, which is effected by the action of music on the one and gymnastics on the other; but he actually regards the body only as a tool by means of which gymnastics affects the spirited principle of the soul, while music acts on its rational or philosophical principle. Thus the spirited part of the soul is brought into harmony with the rational part; it is adjusted—like the string of a musical instrument, Plato says—through gymnastics.

A much more elaborate picture of the harmony of the soul is found

³⁷ *Phaedo* 85e-86d. It is a considerable step from Alcmaeon's concept of bodily health as an *isonomia* of pairs of opposed qualities to Simmias's concept of the soul as a *harmonia* of the body; for one thing, the simple balance of equals must be supplanted by the proportions of harmonic theory. Yet in his account, Simmias clearly leans on medical theory, and it is quite possible that the influence of Alcmaeon or of Hippocratic medicine on Pythagorean thought is responsible for his views. Medicine could logically bring about a materialistic transformation of religious ideas. As far as the general notion of the mixture of opposites is concerned, even Aristotle is doubtful whether Alcmaeon or the Pythagoreans may be credited with priority (*Metaphysics* I.5: 986a.22-986b.4).

³⁸ *Phaedo* 91c-95a.

³⁹ *Republic* 439-444.

⁴⁰ *Ibid.*, 443d-443e.

⁴¹ *Ibid.*, 410b-412a.

in the *Timaeus*.⁴² Like the world soul, the human soul is blended of Sameness, Otherness, and Existence, which is itself a compound of Indivisible Existence and Divisible Existence; but in man these constituents are somewhat diluted. Again as he did in the case of the cosmic soul, the Artificer divides the compounded material into a series of quantities arranged in order and size according to the double tetractys and the Dorian diatonic scale, and sets up the group of revolving circles spaced according to the same tetractys. This operation does not complete the construction of the human soul, however, as it does that of its cosmic counterpart, but yields only its rational or divine part; the work is then given over to the created gods (who in general are the artisans of the realm of necessity) so that they may complete it by constructing the mortal parts of the soul—its emotional and appetitive parts—from a harmony of the four sensible elements. The three sections of the soul, housed appropriately in the head, thorax, and abdomen, form an additional harmony among themselves, which, as in the *Republic*, is characterized by the control of reason over emotion and appetite. Dominance of one of the constituents of the harmony is found in the rational part of the soul also, where the circle of the Same, the outermost one, is given dominance over the circles of the Other.

Attention need hardly be called to the valuational aspect of harmony in man. While nature is generally equated to the physical world and even thought of as inanimate, man is conceived of at least as early as the 5th century B.C. as a combination of the two vastly different entities of body and soul, and the large place of ethical values is consequently insured. The ordered state of the body means physical health; the ordered state of the soul means mental and emotional health, and also reason. Thus harmony is more obviously a good in man than in the cosmos, where its full value hinges upon our acceptance of a teleological and organic view of nature.

The ethical value of human harmony takes its most prominent form in the harmony of virtue, which is discussed frequently by Plato. To the extent that virtues are considered as residing in the soul, they are part of the conception of the harmony of man; but such a conception is very readily transferred to society and to the world, and in its extreme form becomes the abstract ethical harmony of the *Philebus*. Another tendency of the harmony of virtue is that it easily loses its structural and quantitative character and turns into a generalized equilibrium and quieting of conflicting desires and feelings in the soul, and finally into a purely qualitative "harmony of life" associated typically with a feeling of joy or happiness. Harmony is called joy as early as Empedocles, although in his case the explanation lies in the basic role of love. And in the fragmentary writings of Democritus, both social harmony and also the joy that results

⁴² *Timaeus* 41c-42a, 69c-72d.

from a harmonious life appear in a completely figurative light, since they are unaccompanied by any cosmological or mathematical conceptions of harmony. Yet Plato often harmonizes and weaves virtues in a quite specific sense; the harmony of the virtues in the *Republic* has a literal meaning, and justice and temperance consist in fact of harmonized constituents.⁴³ The consideration of virtue even uncovers the theoretic fact—so wonderfully illustrated in musical concord—that the components of a harmony (in this case justice) must preserve their individuality in spite of their relationship; harmony is not fusion.⁴⁴ In the soul itself, the harmony of the principles is a close parallel to the harmony of qualities, elements, or humors in the physical world.

Society can be thought of as occupying a middle ground between man and the world of nature. Modes of thought and conceptual models flow back and forth among all three fields, and ideas of harmony are inevitably imported into the social sphere from both the others. If the connection between society and the natural world appears to be especially influential in early Greek thought, the relationship between society and man becomes more important in classical times. A conspicuous concept deriving from the legal sphere and entering cosmology is that of justice and retribution; but conversely, Solon's concepts of justice were formulated partly as a parallel to his notions of law in nature. But as far as the harmony of society is concerned, concepts are derived mostly from anthropology. Plato regards society and the individual as parallel; in general, if harmony characterizes the relationships within man, it equally characterizes those between men. Lovers pass their lives in harmony,⁴⁵ but the bad, because they are at variance and enmity with themselves, are not in union or harmony with one another.⁴⁶ The harmony of society is especially important in the *Republic*, where it occurs in a variety of forms. There are four classes of society: gold, silver, bronze, and iron; and in these are to be found the larger social counterparts of the principles contained in the individual human soul. Indeed the whole motivation of the dialogue depends upon this parallel, for virtue is to be examined as it occurs in the state, in the hope of better comprehending it in its more conspicuous form. Plato projects a detailed correspondence between individual and state. In both spheres, harmony is defined in much the same terms; the musical scale provides the formal basis, with its connection between high, low, and middle tones, and its fitting together of all the intermediate degrees. This type of relationship characterizes the natural order of the principles in man, and it has a particular illustration in the order of the three parts of the soul. Temperance in the individual is a

⁴³ See note 40, above.

⁴⁴ *Republic* 441d-443e.

⁴⁵ *Phaedrus* 256b.

⁴⁶ *Lysis* 214c-214d.

harmonious relationship; justice in human nature, both in body and soul, means that the elements within man cooperate and do not mutually interfere. And in society also, temperance "runs through all the notes of the scale, and produces a harmony of the weaker and stronger and the middle class, whether you suppose them to be stronger or weaker in wisdom or power or number or wealth, or anything else."⁴⁷ Like musical tones, which have their specific identities and functions in music, each element of man or of the state does its own work, not interfering or coalescing with the others, but cooperating to form the harmony of temperance and justice. Throughout the dialogue the conceptions of harmony are so numerous and so important that they actually govern the argument and provide a basis for its organization and aesthetic form. Even mathematical details, such as the law according to which human births are best regulated, are often in some degree harmonic in nature; but most symptomatic of all, the central concept of justice, traditionally conceived as a temporal balance and compensation, turns out upon investigation to be a form of harmony. Thus the *Republic* arrives at a view of society that is parallel to the view of macrocosm and microcosm achieved later in the *Timaeus*.

Accordingly it is possible for conceptions of harmony to facilitate the transfer of concepts between these fields, giving structure and substance to borrowed models of thought and making them more precisely suited to their explanatory purpose. But the correspondences between man and society and nature, and those between body and soul also, come to be regarded as additional types of harmony, such as the harmony between society and cosmos, or between man and cosmos, or between body and soul. If we take into account as well the harmonic conceptions of the arts, the world of experience assumes a remarkable symmetry, the detailed form of which is due to the almost numberless ramifications of harmonic ideas. Both the multitude of meanings and the extent to which they correspond are remarkable. The musician creates harmony in the pitch and duration of tone and in gesture; man creates harmony in the conduct of his life; the statesman creates harmony in society; the Demiurge creates harmony in the cosmos; the philosopher creates the harmony of dialectic and the music of discourse. These are all artists or scientists—the meaning is the same—proceeding on the basis of knowledge and imposing order on their materials. They all have a clear purpose in mind; and, in this context, they neither rely on inspiration nor imitate mere appearance. Instead they have probable opinion, based on experience, of the nature and properties of their materials; and true knowledge, based on reason, of the models to which they work.

Heraclitus's words, the hidden harmony is better than the visible one, can be taken to express the anti-sensuous tendency of harmony; while in

⁴⁷ *Republic* 432a.

terms of the Platonic conception of Ideas, the highest value will reside in a harmony that transcends the material world altogether. In such a setting, ideas of harmony in art become strangely equivocal with respect to aesthetic value. That sense will give way to reason follows almost as a corollary from Plato's abstract concept of beauty, which paradoxically is itself expressed by Socrates with great emotional power and sensuous beauty in the *Phaedrus* and the *Symposium*. Here the artist and the philosopher in Plato are at odds, and they meet only in the more severe beauty of the later dialogues.

As concrete species of harmony, all the sensible arts must manifest the abstract features of harmonic order, almost in spite of their perceptible nature. There was no difficulty about applying notions of harmony to visual art; in the middle of the 5th century, Empedocles already describes the painter's mixture of pigments as a harmony.⁴⁸ Plato's discussions of harmony in art are often completely general. In the *Statesman*, for example, the highest class of the good—which the *Philebus* determines to be that of measure and the mean—is revealed as the foundation of art.⁴⁹ The very existence of the arts depends on the possibility of measuring more or less, and of measuring them not only with respect to one another but also with a view to attaining the mean; while the excellence or beauty of every work of art is due to the observance of measure. Thus in its application to art, the conception of harmony can give rise to aesthetics; the superior beauty of rational harmony comes to reside in the sensible work, and provides the ultimate basis of perceived beauty. This has a counterpart in the inherence of absolute beauty in the physical beauty of a human being, which is described in one of the most moving passages of the *Phaedrus*. The same aesthetic is applied to music in the *Philebus*: "And whereas the high and low, the swift and the slow are infinite or unlimited, does not the addition of the principles aforesaid introduce a limit, and perfect the whole frame of music?"⁵⁰ Since the discussion is designed to illustrate the harmonic division of existence into classes, music is understandably so apt an illustration that it has the force of the general conception as well as of a particular instance. The *Philebus* identifies not only metaphysics with aesthetics, however, but regards the highest ethical values also—measure and the mean and symmetry—as aesthetic in nature. Even the element of pleasure is present, for the mixture of the finite and infinite yields not only the beauties of body and soul, but all the delights of life.

If the *Philebus* is concerned with the inherently harmonic nature of metaphysics and ethics, the *Gorgias* points to the possible ethical implications of harmony. All artists dispose things in order, and compel one part

⁴⁸ Frg. 23.

⁴⁹ *Statesman* 284a.

⁵⁰ *Philebus* 26a.

to harmonize and accord with the other parts; but when the artist's activity affects man in substantial degree, it understandably loses its purely aesthetic character. The trainer and physician give harmony and order to the body, where they have the effect of health and strength; and similarly, the true rhetorician and the man who is morally good give harmony and order to the soul, where their effect is temperance and justice, or in a word, virtue.⁵¹ Thus we arrive again in the familiar territory of the ethical nature of harmony.

But art often suffers by comparison with the precise qualities of abstract harmony. In the *Philebus*, for example, music appears as the paragon of dialectic method, as the science of tone; and during the division of pleasure and wisdom into their species, it is placed, quite consistently, not among the pleasures, but among the sciences and arts, the classes of wisdom and knowledge. But this context is its undoing, for it is assigned to the impure variety of the productive or handicraft class of knowledge (which is opposed to the educational class).⁵² As compared to carpentry, for example, music is less exact in its results, and full of empiricism. "Sounds are harmonized not by measure but by skillful conjecture; the music of the aulos is always trying to guess the pitch of each vibrating note and is therefore mixed up with much that is doubtful, and has little which is certain."

Many of Plato's conceptions of harmony can conveniently be brought under the head of the general notion that philosophy itself is harmonic or musical. A simple instance is that harmony can become a criterion of consistency in reasoning, as this is manifested in the agreement of ideas. "Certainly there should be harmony," says Socrates humorously in the *Phaedo*,⁵³ "in a discourse whose subject is harmony." And in the *Gorgias*⁵⁴ this conception is combined with the idea that discourse or dialectic in general is music; Socrates warns Callicles that if he does not refute the thesis that has been advanced he will never be at one with himself, and his whole life will be a discord, while Socrates, on the other hand, would rather that his lyre be inharmonious and that there be no music in the chorus he provides, or that the whole world should be at odds with him and oppose him, than that he should be at odds with himself and contradict himself. The abstract nature of the conception of harmony is revealed here in the lower value placed on the musical as opposed to the logical variety. This is also a feature of the reference to harmony in the *Laches*:⁵⁵ the true musician is attuned to a fairer harmony than that of the lyre, for he has arranged in his life a harmony of words and deeds which is in the Dorian mode, the true Hellenic one. The concept so ingeniously developed

⁵¹ *Gorgias* 503-504.

⁵² *Philebus* 55c-56c.

⁵³ *Phaedo* 92c.

⁵⁴ *Gorgias* 482b-482c.

⁵⁵ *Laches* 188c-188e, 193d-193e.

here is really a variant of the notion of consistency in argument. As these examples show, the agreement of ideas, or of words and deeds, can also become a harmony in human life, thus furnishing a parallel—although it lacks the suggestion of mathematical structure—to the harmony of the parts of the soul, which is equated in the *Republic* to a harmonious life. The philosopher in particular is thought of as having a harmonious nature.⁵⁶

Actually the whole method of division in discourse, of the determination of genera and species, which Plato comes to regard as central to dialectic, is also a harmonic process; as we have seen, the application of the method in the *Philebus* is probably the most all-embracing and abstract example of harmony in the whole of Plato's writings. Preceding this harmonic division of existence there is a methodological discussion that makes use of music as a remarkably appropriate illustration,⁵⁷ and thus serves to confirm the inherently harmonic nature of philosophic method.

With the conception of philosophy as an example of harmony, or more typically, as the highest music, a circle closes in the history of harmonic ideas, and the abstract meaning of harmony, which music so importantly determined, leads back to the concept of actual sonority; for philosophy can be thought of as music almost as much in a literal as in a figurative sense. The study of harmonics crystallizes the conception of harmony in its abstract significance; Socrates complains insistently in the *Republic*⁵⁸ about those who limit the discipline to relationships that are audible, and he characterizes the subject as fundamentally different from the study of music. But harmonics, which scorns sonority, leads to the ultimate goal of education, the "hymn of dialectic." That this peculiarly equivocal conception of harmony and music had a central position in Plato's thought is suggested by the number of times it occurs in his writings and by the large variety of forms it takes. Socrates is an aulos player whose art of dialectic is a peculiarly persuasive music; a potential victim must stop up his ears as he would to the song of the sirens.⁵⁹ The last essay of Socrates in the art of dialectic is his swan song.⁶⁰ He at first could not understand the injunction he often received in his dreams to compose music, for he had always practiced philosophy and this was certainly the

⁵⁶ *Republic* 486. Ideas of harmony often emphasize pleasure and neglect structure. The underlying conception can be that of a mean value itself as a harmony; thus a harmonious voice is one that has a well chosen intermediate nature in respect of pitch and loudness, although it can also be one that is simply pleasant in quality. In such qualitative conceptions of harmony, which proliferate endlessly, there are generally some vague implications either of mean values or of compatible constituents, but the mathematical structure is really of no importance and cannot be specified.

⁵⁷ *Philebus* 16c-17.

⁵⁸ *Republic* 531a-531c.

⁵⁹ *Symposium* 215b-216a.

⁶⁰ *Phaedo* 84e-85c.

highest and best music.⁶¹ Similarly, in the myth of the grasshoppers that Socrates narrates in the *Phaedrus*,⁶² Calliope and Urania are the Muses concerned with philosophers and their music, with heaven and thought, and they themselves have the sweetest utterance. Invocations to the Muses are in fact common in the dialogues, and Plato undoubtedly regarded his works as a superior kind of poetry.

That these conceptions of the musical nature of philosophy have a literal meaning is indicated by their concern with musical effects upon man, for it is primarily in acoustic qualities and the significance of sung words that the influences of music reside. Thus music and harmony can separate in meaning, and the role of actual sound will become vastly different in the two concepts. In the case of harmony, intervals and scales exist merely as the example *par excellence* of a conception of order to which the question of sonority is typically irrelevant; while in the case of music, whether as the concrete composite of melody and poetry and dance, or as the broad sphere of the Muses (which encompasses also astronomy and forms of prose, and becomes synonymous with culture as a whole), tone is present almost without exception as an essential constituent. These are certainly the arts of rhythm, or of time; but the fact that space is subsumed in the classification by the inclusion of dance and astronomy does not mean that tone is an accidental feature. Not only is tone the most tangible embodiment of temporal rhythm, but there is very little evidence of a separate art of pure dance in Greece, while language is almost exclusively still spoken, and even astronomy is concerned with phenomena often conceived as tonal. Thus the harmony of the spheres is silent, but the music of the spheres is sonorous, which is to say that there are two sides to the Greek conception of the cosmos, just as there are two aspects of the Pythagorean outlook: scientific and poetic. As a corollary, the Greek division of the arts was not into the categories temporal and spatial, but into temporal and static, of which the first group can equally well be called rhythmic or tonal, and there is a profound significance in the tradition that makes Mnemosyne the mother of the Muses. The distinction exists in its most distilled form in the difference between the concept of philosophy as music, which is characteristic of Socrates and the mature Plato, and the concept of dialectic as harmonic, which we find in the *Philebus*. The one points to concrete music, with its ethical effects, while the other has an abstract beauty that derives from its metaphysical background. It is as though the temporal aspect of harmony gave rise to all the musical arts, this branch of development coming under the head of rhythm (which always tended to be an idea coordinate with harmony rather than an acclimated part of it), while the static aspect of harmony (which is connected with the pitch component of music and

⁶¹ *Ibid.*, 60d-61a.

⁶² *Phaedrus* 258e-259.

more faithfully transmits the meaning of the word) became increasingly identified with science and metaphysics.

In the writings of Plato, Greek conceptions of harmony achieve their maximum diffusion and influence, leaving no major sphere of philosophy unaffected, and in a sense fulfilling Heraclitus's thesis of the universality of the harmonic logos. This universality is no longer a characteristic of the outlook of Aristotle and the Peripatetic philosophers; harmony remains a versatile conceptual tool, but various factors—an increased empiricism, the denial of the transcendental nature of numbers and the Ideas, a more objective comprehension of philosophic problems—conspire to contract its meaning, and to restrict it to a particular kind of mathematical pattern useful in analysis.

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