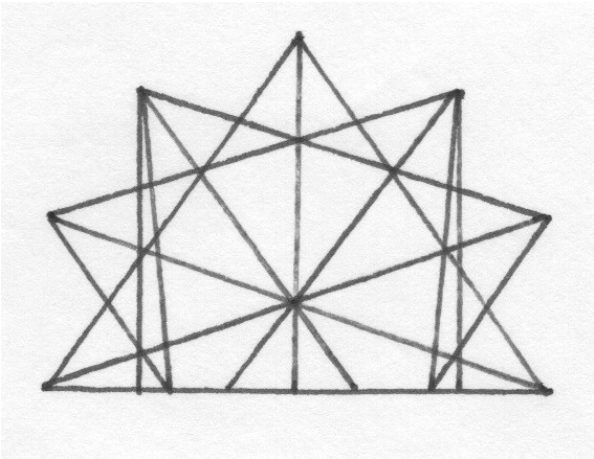
Restoring the Muse

Just what is Early Greek Philosophy all about?



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ABSTRACT

The author critically examines Aristotle's ubiquitous interpretation of what early Greek philosophy is all about. He introduces an alternative paradigm for the movement, a framework that better accords with the evidence of the fragments. He lays out the motivation for the movement, its main concerns, and the factors that facilitate its demise. Thus he makes a compact distillation of his book on early Greek philosophy.

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PRELIMINARY APOLOGIES

In this essay I intend a concise summary of the essential material of my book: **Separating Earth and Sky—A Musical History of Early Greek Philosophy**. I want an overview of the main themes and issues, a presentation of the editorial stand that I pursue in the book. Such a condensed version of my study is a commendable and valuable project, but it has its inevitable costs. In the interest of brevity I must make sacrifices.

For one thing, I will suppress scholarly footnotes and references to source authorities. This information must be accessed from the book, where contending authorities must be carefully weighed.

Also, I mostly avoid making actual quotes from the philosophers themselves. Although, I cannot eliminate such quotes entirely, they must be severely curtailed. This prohibition on quotes also applies to the many commentators on the fragments, both ancient and modern. Of course, in the book I make a careful (rather forensic) examination of all the ancient evidence, including representative samples of modern interpretative approaches. Since there are roughly two dozen philosophers in the movement, my book must necessarily be quite large (roughly a thousand pages). It is fair to say that the precious fragments themselves and the ancient commentaries on them form the very heart of my book. But here I will restrict myself mostly to paraphrases and explanations.

Another feature of this essay is a restriction on the use of Greek language terms, although again a small number of them are necessary. I want to sidestep various controversies and also show that one can understand the movement without being an expert in the ancient Greek language. This paper is written for a general audience rather than for specialists. That being said, a small number of terms are indispensable to understanding.

In addition, I largely ignore current modern controversies. Anyway, many of them are really only pseudo-controversies that arise from the old paradigm.

This essay largely downplays the real differences between individual philosophers in favor of their common features. I am more interested in an overview of the movement as a whole than in the quirks of personality and specialty.

Additionally, I must focus only on the central issues, unfortunately ignoring many fascinating but peripheral side channels. This situation may give the mistaken impression that the movement has a rather narrow scope, when in fact their field of interests are quite wide.

Finally, when I make a statement I aim to confine my examples to a minimum, or even skip an example altogether. Consequently this paper may sometimes appear to be a rather dogmatic harangue. The tight format requires it. I hope that you the reader will trust that I have good reasons and evidence for my interpretations, but it requires a book to lay them all out.

THE PREVAILING PARADIGM

Now, with my apologies done, we can dive in. Just what is early Greek philosophy all about? The standard answer is this, the orthodox interpretation.

The philosophers are seen as the earliest rational scientists. They leave behind the old mythical stories of the poets and replace them with increasingly abstract naturalistic

speculations about the world. Specifically, they focus on the identity of matter and how it behaves.

The movement is conventionally divided into two groups, roughly coinciding with the sixth and fifth centuries. Scholars call the earlier group substrate *monists*. With boldness but naivete they contend that everything is and/or originates in one thing—the primary substance or 'ur-stuff.' The latter group (*pluralists*) is more sophisticated and complex. They contend that everything arises out of either a small handful of basic substances or else a large indefinite number of them.

According to the prevailing paradigm each philosopher develops his own unique system which is generally incompatible with the others. They compete with each other. They also have followers who establish 'schools' that defend one position over another. After the middle of the fifth century the Sophist movement gains strength and fosters a growing skepticism about the older theories. But the great divide in ancient philosophy comes around the end of the fifth century with Socrates. Henceforth physics is downplayed in favor of ethics and other issues. This shift leads to mature philosophy (Plato, then Aristotle) in the fourth century.

Socrates is deemed so important that scholars label the early philosophers 'the Presocratics.' Even though they have conflicting views they are united in their quest to find the material cause of the world. To this end they exhibit definite progress or evolution in thinking between the somewhat more primitive cosmologies of the Milesians and the increasingly complex systems of Anaxagoras, Empedocles, and Democritus.

The two groups of philosophers (monist and pluralist) are conventionally separated by the enigmatic figure of Parmenides. To a large extent the fifth century is seen as a reaction to his conundrum. Parmenides is used as a 'pivot' and means to organize the movement.

The philosophers supposedly also group themselves on a geographical basis. The easterners on the Ionian coast (Milesians, Heraclitus, Anaxagoras, Democritus) are thought to be more atheistic or strictly scientific. The westerners in southern Italy and Sicily (Xenophanes, Pythagoras, Parmenides, Empedocles) are seen as more religious or at any rate more concerned with religious issues.

The philosophers can also be grouped in another way, but this classification has lesser importance. Some write in prose, some in poetry. Each philosopher has distinctive features that set him apart from the others.

This is the standard paradigm in a nutshell.

I sometimes call this interpretation the *materialist paradigm* or the *physical paradigm*, since the quest to understand matter as a cause supposedly unites the movement. I also call it the *isolationist paradigm*, since it assumes that every philosopher inhabits his own island in competition with the others. Occasionally I call it the *evolutionary paradigm* because it assumes that the movement exhibits some sort of progress. Then it is also the *orthodox paradigm*, since one sees it repeatedly in any and every textbook. Scholars tinker around the edges and put their own spin on it, but everywhere I see the assumption that the early philosophers focussed on matter. Finally, I sometimes call this interpretation the *Aristotelian paradigm*, because we find its main features first in Aristotle. Plato laid some of the groundwork but never commited himself to any one position about early philosophy.

DOUBTS

Aristotle's model seems judicious enough on the surface, but doubts about its veracity appear when we try to fit the fragments themselves into his framework. The fit is rather messy, to say the least. Nevertheless, the history of commentary on the fragments universally consists of repeated efforts to improve the fit, often doing even more damage to the intelligibility of the fragments themselves. For the gulf between Aristotle and the early philosophers looms large indeed.

Aristotle never claimed to be an objective historian of philosophy. He looks to his predecessors mainly for a justification of his own positions. He found it convenient to approach early philosophy as a stumbling evolutionary process toward his own system. Most of his pronouncements on the Milesians and their followers come from the first book of his Metaphysics, a place where he can naturally be expected to 'blow his own horn' or promote his own agenda. Of course, we cannot blame him for this. At least he took the trouble to directly discuss issues and name his sources, something Plato rarely ever did. Aristotle's apparent forthrightness awards him a lot of goodwill—we have a natural tendency to *want* to believe him. But it went too far. His enormous influence on all later writers, not only through his own work but also that of Theophrastus and his school, means that the doxographical literature has a strong Aristotelian slant or filter. Unfortunately, it has become a strait-jacket for early philosophy.

Aristotle is first of all a working research scientist with wide interests. He wants to reground philosophy on the best available science of his own day. He is more interested in the physical world and biology than in the old paradigm with its Orphically-inspired complexity. We cannot blame him too much for projecting his own interests onto the old philosophers. He is simply recycling the materials. He aims to downplay the importance of Harmonics and accent Biology. To this end he always uses biological examples for his explanations of the early writers. In doing this he was being modern and progressive.

Aristotle wrote very little on the art/science of Harmonics, but he certainly was not ignorant of the field. What little he did say confirms his fluency. His star-pupil Aristoxenus righted the oversight with a major treatise. We cannot say how much of this treatise reflects the views of Aristotle, but probably quite a lot. At any rate Aristotle wants to de-couple the old poetic connection between music and cosmic concerns. Consequently, instead of using a ready explanation in Harmonics he uses (sometimes forces) one in Biology. Often it works, but then sometimes it doesn't. The situation is complicated because the early philosophers also use a biological metaphor, among many others, but it refers to a different underlying model.

Aristotle believed that a philosopher should say what he means and mean what he says. He should speak plainly. He complains (rightly) that the early philosophers refuse to speak plainly. They love riddles and paradox. For example, he treats the Eleatic arguments as simply less evolved versions of his own logic—logic is, after all, his speciality. But this treatment only shows how little sympathy he has with the old poetic mindset. For Parmenides in his mystical poem uses only a form of crypto-logic, which isn't really logic at all, mainly as a poetic device and means to accentuate a paradox.

Aristotle wants to bring philosophy back to the common everyday world around him. However, if we want to understand early philosophy within its own world, *we must*

get behind Aristotle. There's an old saying that he who would know the gods must welcome riddles. The mindset of Parmenides and his cohorts is not remotely that of Aristotle.

Aristotle rarely ever directly quotes the early philosophers themselves. He doesn't let them speak with their own voice. Without the precious report of Simplicius we would have almost nothing of Parmenides and Anaxagoras. Instead of quoting them, Aristotle presumes to speak for the old philosophers—to explain what they mean to say but can't, or won't. Inevitably, he projects his own terminology over them, a terminology not used by the early philosophers themselves. Hence he translates their work into his own conceptual framework.

Moreover, he sometimes creatively manipulates the materials in various ways to suit his own aims. He must have learned such tactics from Plato who uses them in a more intense and pervasive manner. Neither is Aristotle always consistent with his interpretations, especially regarding Anaxagoras, with whom he had much difficulty. Once in a while Aristotle even deliberately misrepresents him. He was particularly unfair to Anaxagoras, but also to Parmenides, Heraclitus, Pythagoras, Xenophanes, Anaximander. But then, this treatment only highlights how difficult it is to shoe-horn these giants into Aristotle's framework.

This essay may sometimes read like an anti-aristotelian tirade, but I should put it into perspective. In spite of my complaints, Aristotle (with Simplicius) is nevertheless our *best* source on early philosophy. On the whole he is much more even-handed and balanced than Plato who is more polemical, circumspect and satirical. Plato rarely ever says anything directly or name his sources. He does not speak plainly. After Plato, Aristotle is a breath of fresh air! Several corners of early philosophy would have remained forever unknown without his work. We know them almost solely through him alone. Perhaps the most spectacular such example is his 'accusation' (amply seconded by Simplicius) that Anaxagoras held what I call the musical principle of *Omni-divisibility* (everything comes out of everything), a close cousin of the musical principle of *Universal Mixture* (everything is in everything). Such pronouncements are extremely difficult to defend within the context of matter, but in the musical context they prove indispensable. Aristotle is thus a good source, but he must be treated carefully, his biases adjusted. Once we shift to the musical paradigm Aristotle (and Plato) can be read more profitably.

THE POETIC DIVIDE

In what is perhaps his most famous line, the poet Hesiod states that the Muses can just as well deceive as inform. Heraclitus says much the same thing when he contends that the oracle neither speaks nor conceals, but rather gives a sign or clue. In both the poets and the early philosophers we must dig down below the surface in order to find essential meaning. It is not to be found in the type of 'plain talk' and logic that Aristotle cherishes.

Aristotle makes a sharp distinction between the poets and the '*physiologists*.' He divides the Muses' gift. For he assigns 'falsity' to the poets and 'truth' to the philosophers. Aristotle claims that the poets only make mythological stories about Night, Heaven, the Chasm, Ocean and so on in a misrepresentation of nature. The philosophers on the other hand try to tell it like it is, propounding first generating principles. In short,

the difference lies between mythology and rationality. Aristotle wants the early philosophers to be rational scientists like himself.

However, this orthodox stand has always been problematic. For the philosophers (even Plato) have no qualms about creating mythological stories when it suits them. Moreover, the poets themselves are to a certain extent systematizers. Significantly, a number of very important philosophers (Xenophanes, Parmenides, Empedocles) are themselves poets. Even those philosophers who write in prose (eg. the Milesians, Anaxagoras) are prone to using very distinctive language and colorful images in a very poetic manner. Meanwhile, Heraclitus writes short gnomic statements packed with ambiguity and open to alternative interpretations. Most important of all, both the poets and the philosophers use an overlapping stock of themes and images that reflect a common musical conception of the world.

In other words, the neat Aristotelian division between the mythological poets and the rational philosophers is either entirely illusory or reflects only a change of emphasis within a common discourse.

Aristotle's separation of the poets and the philosophers as had deleterious effects on understanding. The orthodox interpreter treats the philosophical fragments in the most bloodless, literalist and fundamentalist manner possible. Scholars assume that the early philosophers are entirely incapable of metaphor, allegory, or any other poetical device and expression. The very identity itself of the philosophers is bound up in them *not* being like the poets.

On the other hand, within my interpretation I use the working assumption that the poets and the philosophers inhabit the same intellectual world. The philosophers pursue more rigorously various problematic and paradoxical aspects of the world-view, but the same perspective can also be witnessed in the poets. Such a perspective favors roots and compounds, limits and their transgressions, opposites within various contexts, and the interplay between the One and the Many.

Just as the separation between the poets and the philosophers is an Aristotelian anachronism, so is the geographic split between eastern atheistic scientists and western religious sages. Two of the westerners (Pythagoras and Xenophanes) are really transplanted easterners. Moreover, the westerners also have scientific interests, while the Milesians have a religious dimension that is artificially ignored. After all, Anaximander's initial Seed is hardly distinguishable from the Orphic Egg. In short, we should see early philosophy as having both scientific and religious sides that are compatible with each other, both in the east and the west. The geographical classification is meaningless.

The period of early Greek philosophy (the sixth and fifth centuries) coincides with the highest flowering of the ancient Greek musical culture. It is the exalted time of the Orphic poets, the lyric poets, the great dramatists, and the most famous musicians. In the fourth century, standards declined and never again reached the old classical heights. We are mistaken to separate early philosophy from this cultural milieu. We moderns marvel at Greek architecture and sculpture, but the Greeks themselves considered music to be their highest art form. We should appreciate that ancient Greece is largely pre-literate. Only a minority of people can read or write. Books (scrolls) are generally meant to be read *out loud*. Moreover, the Greeks make no distinction between poetry and song, since poems are intoned as 'song-speech' and often accompanied by a musical instrument.

Stories and song form the repository of the cultural heritage, both its innovation and its continuity.

Hence it is not surprising or far-fetched that the old philosophers assume a musical sense of order—an order that puts sound first and develops first principles from it—an order whose logic makes sense from that perspective. Historically, we moderns have become more and more visual in orientation. We project it over the ancients. We mistakenly impose an abstract and 'metaphysical' framework over the materials. This shift away from the musical was greatly assisted by Aristotle, but he lies much closer to the old perspective than we do.

My thesis essentially states that we cannot know the cosmic ***genera*** without understanding the musical ***genera***, which forms its conceptual basis.

THE PYTHAGOREAN PROBLEM

The isolationist model tries to confine ***logos*** to Heraclitus, ***nous*** to Anaxagoras, and so on. Music is strictly confined to Pythagoras, as if it has absolutely no relevance to the rest of the movement. And yet within the meager surviving pile of fragments two more major philosophers (Heraclitus and Empedocles) say openly that the world is or is like a ***harmonia***. The rest also use a conceptual framework (of opposites, limits, and so on) that fits like a glove within the context of ***harmonia***. Due to the inordinate authority of Aristotle, a musical model has never been approached or appreciated. Instead, music is banned to the periphery and confined to Pythagoras alone.

Even Pythagoras is put into a rather awkward position. On the one hand he is championed as *the* expert and the very originator of the field itself. But on the other hand, since he is the first, he must not know very much at all. He seems to sit at the very dawn of history. Hellenistic writers and their followers contend that he discovered the very science of musical tuning itself, but also that he knows only one division of the monochord—the famous 3-limit sequence 6:8:9:12.

However, these theories are highly suspect. For contemporary with Pythagoras famous musicians like Epigonus of Sicyon and Lasus of Hermione were already exploring microtonal tunings. Pythagoras was born into a culture already musically sophisticated. Moreover, the contention that he knows only one monochord division is extremely unlikely. Given that he found this harmony interesting it is rather obvious that he would also have tried others as well. We know that the ancient Greek musical culture was *intonationally pluralistic*. That is, musicians do not recognize one 'correct' way of tuning. Instead, many options are available within a pool of possibilities, each division having its own ethos or character. Each tuning also has its associated melodic formulae and even rhythms and performance contexts. The great Hellenistic scientist Ptolemy enumerated some of these old tunings but he himself admits that his list is just a representative sample of a complex musical culture. Pluralism was not confined to the Greeks alone but formed the norm throughout the middle east and Asia. To a large extent it still does. For this reason it is highly unlikely that Pythagoras knew only one division.

Then we have the improbable notion that Pythagoras invented the monochord itself. Yet the monochord principle is so simple and fundamental that it is like the multiplication table—it could be discovered over and over in different times and places. The earliest published material on monochords comes from China, not Greece. The

monochord principle simply involves an intelligent judgement over fret placement on fretted lutes. We have pictures of microtonally fretted lutes from Old Kingdom Egypt and Babylonia. Moreover, these civilizations also had complex music cultures stretching far back through the Bronze Age. How likely is it that they knew nothing about musical tuning?

The monochord has an associated arithmetic (called Harmonics or Canonics) whose essential features can be found already well developed in the earliest strata of Sumerian-Babylonian mathematics. It involves the relationship between numbers by multiplication-division (i.e. ratios), the awareness of prime and composite numbers, and the use of reciprocals and least common multiples. Ancient cosmology is unusually saturated in significant musical numbers. Base 60 is ideally suited to monochord work since it clears fractions for 5-limit numbers (most traditional harmonies are 5-limit). Moreover, the archaic Egyptian arithmetical procedure of using repeated doubles for calculation is peculiarly well suited to monochord arithmetic.

In short, Pythagoras is most likely just a transmitter or defender of cultural lore from the east rather than the discoverer of the monochord itself. The ancient Greeks themselves claim to get their instruments and scales from the east.

Most of what is written about Pythagoras is only literary fiction from the Hellenistic era hundreds of years after the period. By this late era overall musical standards had generally deteriorated. Ptolemy relates that in his own day the monochord was omitted from the Greek educational system, where it once had an honored place during the classical era. Ptolemy himself was quite erudite, the best single surviving ancient writer on musical tuning, but nevertheless overall standards were poor. Commentators on Pythagoras' expertise gave only bits of puerile Numerology that they pass off as Harmonics. Henceforth the arithmetical game of Numerology has been confused with the tight and unambiguous arithmetic associated with monochords—as if they amount to the same thing.

This confusion leads to an attitude that monochord arithmetic is superfluous to an understanding of Pythagoras. Being the very first practicioner of tuning science Numerology is considered good enough for him. The Hellenistic writers also assume that they know more than Pythagoras. Yet Ptolemy enumerates a sample of the old tunings mainly out of antiquarian interest, relating how in his own times the variety has become restricted and the system of octave-species cruder. In other words, we should expect higher standards from Pythagoras himself. Unfortunately, Pythagoras never wrote a book, so everything is second hand or worse. Also, it's difficult to sort out what is original to Pythagoras and what comes from his many followers. At any rate Pythagoras became the 'dump' for all things musical.

Aristotle didn't help matters when he misrepresented Pythagoras—a convenient means to attack Plato, who often seems to favor a Pythagorean orientation. But Plato is also no refuge. He can also be very satirical in his treatment of Pythagoras. He is not to be entirely trusted as an impartial reporter of Pythagorean issues. Aristotle aimed to make Pythagoras look silly when he said that Number functions as a primary substance in Pythagoras. This dubious doctrine is obviously a send-up. Number refers to the monochord and not some original physical stuff.

When we strip off Aristotle and Plato and focus on early sources, Pythagoras comes across mainly as a supporter of Orphic values—the reincarnation cycle and so on.

The Orphics had a hymn to Number. For the Babylonians the first sixty numbers are gods.

The Pythagorean community split between a conservative and a progressive faction, oriented around the rejection or acceptance of irrational numbers. Evidently Pythagoras forms the conservative front, Hippasus the progressive faction. But from my perspective, the status of irrationals has a deeper significance in the movement as a whole. The inclusion of irrationals (by the Milesians) tends to precipitate the poetic remodeling of the old concept of ***harmonia***. Irrevocably, it leads to the central problematic of early philosophy: the question of infinite divisibility, the void and the plenum.

THE SCOPE OF MUSIC

We moderns conceive music narrowly as organized sound, but the ancients conceive it on a much broader canvas. It includes all the activities fostered by the Muses, who are the habitual companions of Apollo Musagetes, the god of Music (with a capital 'M'). In the literature the nine Muses rule over wind music, string music, percussion, dance, epic poetry, lyric poetry, love poetry, the theatrical arts (Tragedy, Comedy, Mime), eloquence in recitation, excellence in memory, story telling, history and astronomy. And that's only the 'official' surviving mythological list!

The classical Greeks divided their educational curriculum into two parts, called Gymnastic and Music—physical and intellectual arts. Consequently, Music pertains to practically *any* intellectual pursuit. Even practices such as medicine also have close ties, if indirect, since ancient medicine mixes diagnosis with prophecy. Apollo is also the god of prophecy and the Muses lend support. Thus the Muses foster more than just poetic inspiration. Originally they probably served as goddesses of memory and feats of recitation—the hallmark of a musical culture. The Greek educational system consists mainly of 'reading' Homer and other poets. This is the milieu that gave birth to Greek philosophy.

Aristotle claims that the early philosophers mainly ponder the properties of brute matter, but the evidence indicates an extremely wide field of interests—as divergent as astronomy, politics, and medicine. Moreover, they tend to use the same metaphorical language whether discussing such disparate topics as magic, psychology, meteorology or whatever. What framework can possibly unite such a disparate group of arts and sciences? Only one answer makes sense: musical tuning—the simple arithmetic of monochords. It provides the foundation, the generator of principles, the means to illustrate the principles, and the springboard for problematics. It grounds all this talk of elements, opposites and limits into a context that makes sense of the fragments.

By various means the poets put themselves into a state of madness or 'enthusiasm' through which the Muse hopefully bestows some secret for their 'song-path.' The Muse provides some insight or at least some sign along the way. The philosophers act like the poets. Empedocles invokes the goddess Muse. The prologue in Parmenides' poem forms an extended tribute to '*the goddess in the middle*' who recites the poem to him. The wide variety of interests among the philosophers closely reflects the domain of the Muses. They constitute a sort of umbrella over the arts and sciences, uniting them under one over-arching perspective. That perspective has its origins and

ideal lunar cycle for the Babylonians is 30 days, not the more accurate 29 and a half. They prefer these numbers because of their high musical status. Numbers that become prominent in the measurement of time (such as 30, 36, 60, 72, 360, 432 etc.) are the very numbers that stand out within monochord arithmetic.

SOME IMPORTANT TERMS

Musical concepts permeate the very terminology of early philosophy. The most telling example is the noun ***genus*** (kind, type) and its plural form ***genera***. I will outlay its features later in connection with the Progression of Means. Here we consider some of the musical associations of the terms ***kosmos***, ***logos***, ***harmonia***, ***physis*** and ***nomos***.

The noun ***kosmos*** has come to mean the universe, but this term demands multiple translations. It unites notions of order, efficient arrangement (both spacial and temporal as process), formal or structural perfection and aesthetic beauty. The word has definite aesthetic connotations, related to its meaning as the ordered adornment, the harmonious ornamentation, as in a woman's necklace. Hence the modern term 'cosmetics.' Old mythological stories claim that Heaven was created to adorn and beautify Earth, as an ornament of its perfection. Its beauty derives from its order. The temporal order is itself a ***harmonia***. This order comprises a single integrated *whole* or system that embodies all of its ordered sub-systems. Consequently the noun ***kosmos*** also refers to the form or structure of something. The Greek word for form has direct use within the musical literature to mean a musical structure.

Like ***kosmos***, the noun ***logos*** has multiple meanings. Most of them are tied to the notion of *relation* or correspondence or comparison between unlike entities, components, or situations. It can mean a treaty or agreement between parties. It can refer to worth, value, reputation or fame. A comparison is implied in all of these cases. ***Logos*** can mean taking thought or weighing the pros and cons. One makes a comparison between alternative options. Related to this, it can mean an opinion or estimation, something arrived at by one's own reasoning.

Logos can also mean reason or cause. By some argument one makes a relation between events or issues. It can refer to any account or explanation, even a statement about something. In the fourth century reason was extended to include the faculty of reason itself. Plato and Aristotle expanded the meaning to include any definition as well as any strict formula or recipe. Often they took ***logos*** to mean a general principle or rule, a law or a natural law. For Stoics, it became the rational principle of the cosmos. Of course, Heraclitus called it '*the one divine law.*'

Another group of meanings comes from the verbal form of the word, ***legein*** (to speak). It can mean anything said or even written. Thus it refers to any statement or any story. Related to this, it can mean the Word or spoken sound, and here supports the ancient notion that the world began in sound. And so we approach its musical associations. For even many of the more abstract meanings of ***logos*** as relation preserve associations to its musical core. For example, it can mean measure or due measure. Here a comparison is made between two numbers.

Logos has a long-standing musical-mathematical meaning: *ratio* and *proportion*. A proportion is simply a relation between two or more ratios. It is a more complex architectonic manifestation of ratio. Thus ratio is the core meaning: a relation between

unlike elements (numbers), expressed through division. This relation is itself a unity, even though the entities are separable. Ratios are abstractly written as a:b or as a/b. I use the colon for its convenience in laying out monochord sequences. The musical-mathematical meaning of ***logos*** as ratio can be found right through the entire history of Greek thought. I find it amazing that modern scholarship suppresses or ignores it, perhaps through sheer unawareness. But even in the fourth century we see Plato and especially Aristotle downplaying musical aspects in favor of abstract or metaphysical 'general principles.' Philosophical history has not been kind to musical sensibilities.

Logos is often found in the company of the noun ***harmonia***. These two words sit at the heart of the musical paradigm. Their partnership isn't surprising since their meanings largely overlap. Both terms refer to a *relation between unlike elements*. The difference is simply one of emphasis. ***Logos*** highlights the relation itself, while ***harmonia*** points to the unlike elements in its unique pattern. The noun ***harmonia*** also has a set of different meanings. It can mean what is familiar to us moderns—any musical scale or pattern of harmony. It can also refer to the interval of the musical octave (1:2) which is the first and strongest ***logos***. Sometimes it is used to mean the music wire itself, because it connects the two fixed bridges of an instrument. It also designates the crossbar of the traditional lyre, which connects the two arms of that instrument.

The etymology of ***harmonia*** signifies primarily a 'fitting together,' a joining or connection between dissimilar things. Homer once used it for the fitting of a peg into a stool. Differing entities are connected or related to each other. Although it can serve for any connection, musical contexts predominate.

Physis and ***nomos*** came to form a tight pair. However, ***physis*** is the more important of the two terms and ***nomos*** usually derives its meaning by contrast to ***physis***. As usual, the two words have a variety of meanings. The archaic use of ***physis*** is best gleaned from the etymology. It refers to 'that which grows' and always associates itself with birth and natural growth. It can denote the origin, source, beginning or foundation of something. Here the meaning overlaps with the term ***arche***. ***Physis*** is always closely accompanied by *Necessity*. Within the musical context of early philosophy it refers to the natural and necessary arithmetical process whereby the One becomes the All. Aristotle redirected it to the biological context where it refers to that inner force that compels things to be as they are. It is the impulse that causes development, change, natural process or activity from some origin toward a developed form.

Physis can also refer to the finished form itself. Here it overlaps with ***kosmos.*** Aristotle also used it in this way. It refers to the composition, the constitution, the structure of something. It can be the substratum or underlying essence, the permanent characteristics or innate qualities of something. By contrast, ***nomos*** refers to secondary qualities—what is contingent, accidental, artificial or not natural. ***Nomos*** refers to what is man-made and impermanent, while ***physis*** connotes the natural which is necessary, universal, permanent and independent of human manipulation. ***Physis*** came to mean nature itself.

The meaning of ***physis*** as form includes kind, type and class. Here the meaning overlaps with ***genus***. Within the old philosophical movement ***physis*** is closely associated with the ***genera*** and the Progression of Means outlined later. It obviously has close ties to the Milesians and their successors.

The meaning of ***physis*** as substratum tends to take on metaphysical attributes. It sometimes refers to the ultimate reality underlying mere appearances. Plato used it in this way for his realm of Ideas. Such mysterious implications also permeate the old philosophers. ***Physis*** is not obvious. It must be uncovered by investigation. Heraclitus wrote '*Nature (**physis**) loves to conceal itself.*'

The etymology of ***nomos*** exhibits its sense as the arbitrary. It refers to the feeding place for animals—some arbitrary location. It came to mean a district or province within a political system. It refers to an assigned dwelling place or anything assigned. Hence it refers to any usage, custom, or man-made law as opposed to natural law. Such laws come about by common agreement and have an implied proscriptive force. But they are also variable and change from one society to another.

The contest between ***physis*** and ***nomos*** began among the skeptical Sophists in the later fifth century. Thus the contest has little to do with the early philosophers themselves. The Sophists claimed to be champions of ***nomos*** in contrast to the old philosophers who elevate ***physis***. To this end the Sophists titled the old philosophical books 'On Nature.' The philosophers themselves left their scrolls untitled, but ***physis*** (in the archaic sense of birth and growth) is clearly a major concern. Later, Aristotle elevated it's meaning as substratum to become 'substance.' Nature becomes physical nature or matter. Consequently, the early philosophers are reduced to mere investigators of the physical world.

The Sophist contest between ***physis*** and ***nomos*** proceeded to dominate the fourth century. Its context is mainly ethical. Should actions be performed in accordance with man-made arbitrary laws or natural law? Convention or nature? Within ethics, ***physis*** came to mean how things actually are as opposed to how they ought to be. As usual, the musical context of early usage is largely buried, though not entirely.

Among various musical writers one sees the implication that traditional (just) tunings are natural, while temperaments are man-made artificialities. The argument is spurious, since all tuning arises from unambiguous arithmetic and is therefore ***physis***. Nevertheless, one must also make choices between alternatives, a place for ***nomos*** to hold sway. The old musical associations of ***nomos*** are brought out in one more of its traditional meanings, a meaning generally ignored by most scholars. The plural form ***nomoi*** refers to the traditional melody types or formulas used to recite the classics. It was in this sense that Plato uses it in the pun '*our songs have become laws.*' Plato aside, we again see terms that have rich musical associations redirected in the fourth century.

PSYCHOACOUSTICAL CONSIDERATIONS

It proves helpful to make a short comparison between a visual and a sonic sense of order. If one is asked to generate some order from chaos, a practical visual approach would go something like this: take some random jumble of pieces and make a pattern of them—say a circle or a triangle. The order is something distributed in space. Moreover, the sensorium is perceived as objectively existing apart from the self. The given pattern many be divided into pieces, but the parts remain separate from the whole. The orientation of the sensorium is decidedly spacial.

A sonic approach is quite different. On a practical level it would go something like this: take that old guitar in the corner and put it into tune. In other words, set up some pattern of harmony or relatedness between the strings.

This procedure is generally perceived in two different ways, subtractive and additive. One way views the harmony as a foreground distillation of order (ratio simplicity) out of a background chaos or noise (ratio complexity). Ordered simplicity is rescued from random complexity. The background chaos may also be some underlying complex field-matrix of possibilities. Either way, order results by a sort of 'subtractive' process whereby dissonance is reduced to consonance. The other way to perceive the process replaces the initial chaos with a pre-existent Silence (Not-Being). In this case we proceed in a kind of 'additive' process whereby the harmony is generated by emanation out of the One that arises from the Silence.

Although the sound may originate in something outside the self, the sonic sensorium tends to be more inner-directed than the visual. Perhaps it comes from the fact of the human voice—we don't even need that guitar to set up a harmony. The voice creates a sense of embodiment, a sense that we bring the harmony into being, yet it is not separate from ourselves. This perspective underlies the theme of 'sacred speech' that appears both in Greek and Indian philosophy. The world begins in some primordial sound (the One). Of all the traditional senses, hearing has the highest status.

The sonic perspective is much more temporal than spacial in its orientation. After all, musical tuning involves the setting of a pattern of temporal relatedness between vibratory events. It is naturally oriented toward a matrix (relation-based) model. It also differs from visual order by being architectonically wholistic—parts are also wholes. These special characteristics of the sonic realm generate appropriate images, ideas and processes that permeate the poetic discourse of the culture. They are natural to it. Early Greek philosophy fits this pattern.

A MONOCHORD PRIMER

In this section I introduce some fundamental features of monochord arithmetic. The aim is to clarify a few principles—the numbers themselves are just deliberately simple examples.

In order to make this subject as accessible as possible, I have introduced some simplifications. For one thing, I examine only one octave, while traditional monochords used two octaves. Also, monochords usually had multiple strings (in spite of its name), so that one can compare one ratio with another. Here I'm using just one string. In addition, I will sidestep the complicated Greek musical notation that involves the tetrachord name as well as the position within the tetrachord. Instead I'm using the familiar modern notation slightly altered to reflect the comma-shifts of just intonation tuning. I have arbitrarily defined the open string as 'C' purely out of convenience. I hope that this makes the arithmetic less intimidating, and I encourage the reader to make his/her own monochord in order to verify everything. It's not difficult, and the rewards are great.

A monochord can de divided in innumerable ways. As an example let's use the simple division 4:5:6:8 (in pitches the harmony C Ab F C). This sequence means that I have divided the active length of the string (between the fixed bridges) into eight equal-sized segments, traditionally called an *arithmetical division*. We number them one to

eight with position eight sitting on the open string. When we put the moveable bridge at position 4, 5, and so on we get the simple harmony indicated.

I should note here that there occurs a slight inaccuracy to the actual sounding ratios due to string deflection, caused by the height of the moveable bridge. Hence the position must be slightly 'tweaked' in order to give the accurate sounding ratio. The deflection can be minimized by using a long string length and a shallow bridge, but it cannot be eliminated completely. This situation has given rise to the distinction between *theoretica* (the arithmetical position) and *practica* (the application on an instrument with adjustment). Monochord manipulation is thus both a mathematical science and an art involving the tuner's ear. In what follows we will ignore these minor discrepancies. Note that even with these limitations, one can explore ratios down to very tiny microtones.

Our sample pattern is profitably described as a 5-limit harmony because all of the numbers and ratios involved are multiples of the prime numbers 2, 3, and 5. Higher primes are excluded. The vast majority of traditional harmonies are indeed 5-limit. We can easily convert our sample sequence into a 7-limit harmony by using the expanded sequence 4:5:6:7:8 (C Ab F D+ C). In practice 7-limit harmonies are rather unusual, an esoteric extension of the 5-limit norm. Ptolemy presented a couple of 7-limit divisions that he associated with the Pythagorean philosopher Archytas. Plato, who was a friend and contemporary of Archytas, also gave one—his 'city' of Magnesia. Of course, we can also convert our sample into a 3-limit harmony as 4:6:8 (C F C), although this sequence then collapses into 2:3:4. Monochord sequences are expressed in the smallest whole numbers possible while avoiding fractions.

All of the harmonies presented here are divisions of the octave, sequence 1:2. The numerosity has been increased to 2:4 and 4:8 simply in order to bring more members into the set, more notes for the scale. It is the special property and power of the octave double to act as a matrix or home where alternative harmonies can be placed.

Of course, our sample sequence ruled by the double 4:8 is not the *only* possible division. Take as an alternative the 5-limit division 3:4:5:6 (C G Eb C). It generates a different harmony. Many more divisions could also be given, but we already have enough here to illustrate the practice of intonational pluralism. Ancient music cultures courted many alternatives and used a fairly large set of popular tunings as well as others that were less appreciated or even esoteric. Indeed, according to the literature, a famous musician (such as Euripides) was praised for introducing a *new* harmony.

Harmonies can be integrated with each other to form more complex harmonies. For example, we can combine our two 5-limit harmonies ruled by 3:6 and 4:8 using the *least common multiple* between them. It unites the two scales into one grand scale. I refer to the 5-limit division ruled by 12:24. The sequence goes 12:15:16:18:20:24 (C Ab G F Eb C). Note that the numbers have gotten larger only to eliminate fractions. If we make one more double to get 24:48 we now have the division for a valued diatonic (seven note) scale. The sequence goes 24:27:30:32:36:40:45:48 (C \Bb Ab G F Eb Db C).

This process of progressive integration illustrates the important musical principle of *Wholeness*. Harmonies form wholes within wholes at every architectonic level. Parts are also wholes. This feature becomes the basis for various poetic paradoxes.

This principle of Wholeness also explains the ambiguous paternity of a given harmony. We could derive our 24:48 diatonic scale directly from 1:2 by using a multiplication factor of 24, or from 2:4 using factor 12, or from 3:6 using factor 8 and so

on. When dealing with very large numbers the paternity becomes even more variable, a useful characteristic when searching for a Great Year division.

Although a monochord can theoretically be divided by any number at all, high prime numbers are generally avoided. The reason is simple. 3-limit and 5-limit numbers tend to maximize the inventory of consonant ratios in the scale. If we use a division of 30:60 (an excellent diatonic scale) we get many consonances, but try using the division 31:62. It generates an exotically dissonant complexity. The reason 30:60 works so well is that the number 60 can be divided by many 3-limit and 5-limit factors: 1, 2, 3, 4, 5, 6, 10, 12, 15, 30, and 60. Monochord work, and the division of time in general, generates a *hierarchy in the number field.* Some divisions have a higher status than others. For example, after an investigation of the arithmetic, one can state quite objectively and demonstrate that the three best 5-limit diatonic scale divisions sit at 24:48, at 30:60, and at 36:72. There are others that form a second tier in value, and a lot more that are mediocre or just too weird.

Notice that all of the sequences presented here define a 'falling' scale in which the largest number gives the lowest pitch on the open string. This is characteristic of the monochord environment and a norm in Greek musical theory. The scale is first of all a falling scale. However, they also recognized the existence of the *reciprocal* pattern or 'rising' scale, even if one can't multiply the monochord string instead of divide it.

For the vast majority of useful harmonies, the rising scale gives a different harmony from the falling scale. For example, our 5-limit sequence 4:5:6:8 yields the rising scale C E G C. A harmony that differs in its upward and downward structure is called an *asymmetrical* harmony. The Harmonic Series, or overtone series, is itself asymmetrical and makes a different pattern of intervals than its reciprocal—called the Sub-harmonic Series. The reader may already have noticed that the 'up' oriented sequence generates aspects of the Harmonic Series, while the 'down' oriented monochord sequence presents aspects of the Sub-harmonic Series.

A minority of harmonies are structurally *symmetrical*. That is to say, they make the same scale both in the upward and the downward orientation. Being a minority they are accorded special status. The first such example is the octave (the only 2-limit harmony). The very first symmetrical 3-limit harmony is the famous 'pythagorean' sequence 6:8::9:12. The double connectors conventionally indicate the place of symmetry. As a monochord it yields the falling scale C G F C and as its reciprocal the rising scale C F G C. Surely its symmetry defines its *true* significance, and not the mistaken and absurd notion that it is the *only* possible monochord division. By the way, the next symmetrical 3-limit harmony sits in the octave 72:144, then comes 432:864. The first symmetrical 5-limit harmony sits in the octave 60:120. Note the presence of prominent cosmological numbers.

We have covered a lot of ground, but another issue also needs clarification. The two orientations (up and down) seem to refer to two separate 'worlds' since they usually make different scales, but in actual fact these worlds have a strange interconnectedness. One can always find a division in which the scales reverse positions. I will illustrate using our 5-limit example 4:5:6:8. As we have seen, the down scale yields C Ab F C, the up scale C E G C. Now look at the 5-limit sequence 15:20:24:30. As a down scale it gives C G E C, as an up scale C F Ab C. These two divisions have a peculiar 'coupled' relation

with each other, a relation that I call *complimentarity*. Such coupling in the presence of symmetry ties into the hierarchical nature of monochord arithmetic.

Finally, we must take note that the two orientations also connect with the two traditional *Musical Means*; the Arithmetic Mean (applied to a monochord) and the Harmonic Mean (its reciprocal). More must be said about the Means later, and especially the progression of Means, which forms the central Musical metaphor of emanatory process. But we have enough orientation now to make sense of various issues dear to the old philosophers.

ONE AND MANY

What is early Greek philosophy all about? Well, it's about the relation between the One and the Many. So far so good, but the context is crucial to understanding. Within Aristotle's materialistic paradigm that relation is necessarily 'either-or.' A thing is either one whole or else it is divided into segments. It cannot be both at once. However, a close examination of the old fragments reveals that the relation is not 'either-or.' Rather it is 'both-and.' Only a musical model fulfils the requirements, due to its principle of Wholeness. Here is the first of many instances in which the fragments accord better with a musical model than with the orthodox one.

Within the body of fragments the relation between One and Many is always defined as one of *division*—another strong endorsement of the musical perspective. The One (*Unity*), the open string of the monochord and the ultimate reference point, is divided to make some *Multiplicity*, some scale. Yet the scale and the One form two sides of the same coin. The scale is just a more architectonically complex version of the One in action. The relation is one of *emanation*, in which the Many embody the One rather than negate it or replace it in some crude way. With this perspective in mind we can finally make sense of Heraclitus' revealing fragment: '*Things taken together are both whole and not whole, being brought together and brought apart, in tune and out of tune; out of all things there comes a unity, and out of a unity all things.*'

The musical perspective shows that the categorization of the early philosophers into monists and pluralist is essentially meaningless. It is an Aristotelian anachronism. We can more profitably categorize the philosophers into conservatives and progressives. The entire movement recognizes the One, the Few, the Many, and the All. Specifically, it is the issue of the All that provides the central problematic for early philosophy. It appears very early on in the movement, at least with Anaximander and potentially with Thales. For some philosophers (conservatives) the All includes only traditional musical numbers, but for some others it also includes irrational numbers. The acceptance of irrationals opens the gateway to a contemplation of the plenum, '*full of what-is.*'

OPPOSING FORCES

The musical perspective arranges 'things' on a spectrum between consonance and dissonance. Consonance denotes ratios that have simple numbers, the simpler the stronger. Dissonance denotes complex numbers and/or high primes. I use the word 'spectrum' because the difference between consonance and dissonance is not crudely black and white. Rather, one sees degrees of consonance and dissonance.

The poets and philosophers describe consonance and dissonance by various metaphors, the most important being Love and Strife (Parmenides, Empedocles), also Peace and War (Heraclitus), and blending or not blending in a mixture (Anaxagoras, Empedocles). These terms are also used in a more subtle sense as *opposing forces* or tendencies. Strife describes that proclivity for simplicity to become complexity. It rules the emanation of the Many from the One. It is also sometimes poetically called friction, separation, discrimination and 'scattering apart.' On the other side, Love describes that tendency for complexity to resolve itself into simplicity. It rules the return of the Many to the Few and the One. It is also poetically called union, synthesis and 'gathering together.'

The spectrum between ratio simplicity and complexity, or unity and multiplicity, can easily be mapped out at the simplicity end. Here we can see the force of Strife gradually turn small numbers into big numbers. However, the complexity end of the spectrum is an issue, since we find no end to the varieties of dissonance. The sequence of numbers is boundless. Hence consonance is like a small island surrounded by a vast sea of dissonance.

The most consonant ratio is 1:1 (unison), the fundamental basis for diminishing degrees of resonance. I sometimes call the musical perspective the *Resonance Paradigm*. The ratio 1:1 has such unique properties that ancient musical writers declined to even consider it a ratio at all. By definition, a ratio is a relation between *unlike* elements. Hence the first official ratio is 1:2 (octave). 1:1 is not so much a relation as an identification—it is the One itself, the open string of our monochord.

The octave also has a group of unique properties that set it apart. Consequently, this ratio as been given several names in the musical literature. One of these names is simply ***harmonia***. This term then came to mean any ratio or more complex sequence of ratios—a chord or scale in musical terms. At high architectonic levels of complexity a ***harmonia*** is properly defined as any mixture of prime roots and their compounds made to co-habit together in the same 'house' or family or octave set, through the use of a least common multiple.

The status or strength of a consonance decreases as the numbers grow larger, following the diminution of resonance. The concept of resonance accounts for the ancient notion that 'like knows like,' the basis for traditional sympathetic magic. The complimentary ancient notion that 'like feeds on unlike' arises from the need for unlike elements. Without difference the generation of complexity is impossible.

After1:2 comes 1:3 (twelfth), then 2:3 (fifth), then 1:4 (double octave), and 3:4 (fourth). We moderns call this set of intervals 'perfect consonances,' but they can be better classified as the core 3-limit consonances. Next comes the set of 5-limit consonances, such as 3:5 (major sixth), and 4:5 (major third). Finally we see 7-limit or septimal consonances like 4:7 and 5:7, whose status is more controversial. Due to the clashing of difference tones, summation tones, and other matters, ratios that involve numbers larger than eight are always forms of dissonance. Thus while 6:7 (septimal minor third) is a lesser consonance, 7:8 (septimal wholetone) sits on the fence and the 3-limit ratio 8:9 (major wholetone) is definitely a dissonance. Like consonances, dissonances also have varying grades. Hence we speak of 8:9 and 9:10 as 'soft' or wholetone dissonances, while ratios like 15:16 and 24:25 form 'hard' or semitone dissonances. In short, consonance shades off into dissonance, and dissonance becomes more acute dissonance.

Any ***harmonia*** of decent complexity contains both Love and Strife in varying degrees. Every unique case has its individual characteristics. A harmony with too much Love becomes static. It becomes empty euphony. A harmony with too much Strife tends to lose its integrity. The most useful harmonies have a balance (***isonomia***) between Love and Strife, but this balance can be adjusted in various ways.

I offer as examples two tetrachord harmonies illustrating varying degrees of Love and Strife. The popular diatonic tetrachord 15:16:18:20 (C B A G) embodies both Strife (e.g. in 15:16) and Love (e.g. in 16:20=4:5) in a pleasing 5-limit framework. Now consider the enharmonic tetrachord 27:34:35:36 (C Ab+ Abb+ G). Although this harmony is quite useable, it embodies a lot more Strife because it has more dissonant ratios. Moreover, it employs the 17-limit. The ratio 27:34 is, to say the least, quite exotic. In the classical literature, writers refer to the degree of Strife with the term *color* (***chroma***), from which we derive our musical term 'chromatic.' The second harmony has more color. It is spicier.

The reader may be a bit confused here, as I've broken my own rule regarding high prime numbers. I recommended that we avoid them. At this point it helps to clarify the three classical Greek tuning cultures. The conservatives (e.g. Pythagoras, later Euclid) hold to the traditional 3-limit and 5-limit tunings, with some tentative extension into the 7-limit. On the other hand, a group of progressives (e.g. Anaxagoras, later Ptolemy) approach the concept of ***n-limit*** tuning. Use whatever is appropriate to the aesthetic context, even high prime numbers. Ptolemy offered, among others, his famous 11-limit hemiolon tetrachord 9:10:11:12 (C Bb A- G). A second group of progressives (e.g. Anaximenes, later Aristoxenus) would go even further. Scrap traditional ratios altogether in favor of irrational ratios (tempered tuning). These three tuning orientations contend with each other in the musical literature. They also define the main fault lines within early Greek philosophy. They reflect differing judgements on the balance between Love and Strife.

Love and Strife always appear together. Their interplay is another example of the *unity of opposites*. Nor are these terms confined to the speculations of philosophers. They sit within the old mythological stories themselves. The fanciful tale relates how Aphrodite (goddess of Love) married Ares (god of War). Through their union came a daughter, appropriately named Harmonia.

LIMITS

The important topic of Limits illustrates something that fits only awkwardly within Aristotle's physical model, but comes home within the musical paradigm.

Only with difficulty can we interpret 'the limited' as a primary substance or even associate it with such a thing. Yet most scholars try their best, just as they interpret Anaximander's 'unlimited' (***apeiron***) as an indefinite substance. They try to squeeze Anaximander into the mold of a substrate monist. The notion of limits is often isolated to Pythagoras, but this isolation is itself problematic. Rather, it has widespread relevance. Many interpret Pythagoras as posing a classic numerological dualism between Limited and Unlimited, or between an abstract Monad and Dyad. Some tie the dualistic pair to odd and even numbers. The whole topic is so fraught with confusing difficulties that it is

generally presented as something vague and metaphysical, to be sidelined or pushed to the periphery as much as possible.

Within the musical model the notion of limits is fundamental. When setting a harmony we must choose between alternatives. But whatever choice we make the harmony imposes some limit upon the potentially unlimited. The division number enforces a limit. Moreover, the traditional restriction to 3-limit or 5-limit numbers provides a further means to winnow out unwanted complexities. A harmony is defined by what is eliminated from the set just as much as what is included. As we use larger numbers in order to add more members or increase the internal resolution, more numbers must also be rejected. One can already see this situation in our example, when we move from our simple division of 4:8 to the scale 24:48. If the criterion for membership in the family is not strictly enforced, over complexity can burden the harmony with too much Strife.

The imposition of limits assumes a background of infinite possibility, the Unlimited. The Boundless surrounds the harmony and the harmony acts as its representative. It is an ambassador from the infinite. When we put a musical instrument aside it tends to go out of tune over time. By the laws of entropy ordered simplicity naturally decomposes into ratio complexity. We must make an effort to put the instrument back into tune, to distil some desired simplicity out of the background complexity. To do so we limit the complexity and create a balance between Love and Strife.

The topic of limits swirls around the dominant problematic of early philosophy. What is early Greek philosophy all about? It concerns how we should tweak our conception of ***harmonia*** so that it accommodates the All. The traditional monochord environment presents us with a discontinuous *digital* framework, summarized as: numbers (fret positions) and the void (the spaces between). Progressive philosophers tend to replace the void with the continuum or the plenum, and they generalize number to include irrationals. In other words, they strive toward an *analog* conception of ***harmonia***. This analog conception provides the platform where the poets can court paradox.

JUDGEMENT

Central to the musical environment is a judicial decision between alternatives. A good portion of the surviving fragments concern the issue of judgement and it is prominent in the very terminology of early Greek philosophy. We see this terminology most explicitly expressed in Anaxagoras, but it can already be found in Anaximander. I refer to the compounds of the verb ***krinein***, ***krinesthai***, ***krisis***. The verb means to separate, to distinguish, to judge, to decide, to choose. All such actions involve discerning aspects between alternatives and distinguishing one from another or from a background. The compounds of this term preserve the essential meaning of discernment or differentiation between alternatives.

The compounds of this verb seen in Anaxagoras employ the prefixes ***apo***, ***sug***, ***pros***, and ***dia***. The most used prefix is ***apo*** and the term ***apokrisis*** accompanies a number of philosophers spanning the whole movement. The prefix ***apo*** has a definite spatial connotation, implying that some original whole is divided or differentiated into segments. The translation 'divide' is entirely appropriate. It can also be translated as 'separating

out' or 'separating off' in the sense that some foreground is distinguished from a background. In practical terms, the use of ***apokrisis*** (among some other terms) refers to the division number of the ***harmonia***. For example, in our sample scale ruled by the double 24:48, the number 48 is the ***apokrisis*** number of the harmony. 24 acts as the ***mese*** (middle) number that sits at the mid-point (octave) of the music wire.

The ***apokrisis*** number is a vitally necessary feature in the definition of a traditional harmony, but it is not sufficient. Within the division we also need to know what is allowed inside the set and what is excluded. The prefix ***sug*** (and in one Anaxagorean fragment, ***pros***) refers to the grouping within the division, some 'bringing together' of what is initially divided. It defines the integrity of the set, and associates itself closely with the notion of a mixture.

Finally, the prefix ***dia*** describes everything that is *not* in the set. This term is a bit more complex because it can have a number of references. For example, position 29 is not in our 5-limit scale 24:48. A completely different division is obviously another example of exclusion. The term ***diakrisis*** refers to what is excluded at every architectonic level.

The terms ***apokrisis*** and ***sugkrisis*** express the power of Limit. They define a specificity, a specific mixture. ***Diakrisis*** is more akin to the Unlimited. Anaxagoras naturally opposes ***sugkrisis*** to ***diakrisis*** and relates them to the notion of mixture and separation. All of this makes perfect sense from the musical perspective, but it becomes vague and metaphysical within Aristotle's paradigm.

The term ***apokrisis*** goes right back to the Milesians. The theme of judgement pervades Anaximander's seminal surviving fragment. One must judge and make compensations relevant to our decisions concerning '*innumerable worlds*,' his poetic description of alternative harmonies. In an environment of intonational pluralism the various alternatives '*pay penalty and retribution to each other for their injustice, in accordance with the ordering of Time*.' Whatever choice we make has consequences for the balance between Love and Strife. Such patterns of Justice and Injustice occur '*according to necessity*' because the arithmetic concerning temporal phenomena is unambiguous. The goddesses Justice (Dike) and Necessity (Ananke) figure prominently within Orphic circles.

THE NATURE OF THE ELEMENTS

The essential difference between Aristotle's paradigm and the Musical model revolves around the conception of the elements. For Aristotle they refer to *primary substances* that give rise to the multiplicity of the physical world. For the early philosophers they refer to *prime numbers*, the true powers that rule the vibratory realm and give rise to harmonic complexity. The physical world is just an aspect of this wider viewpoint.

The term 'element' (***stoicheion***) was never actually used by the early philosophers, who employed various poetic terms that are much more transparently musical in import. The term 'element' first surfaces in Democritus, but of course he is a special case—he is not really a presocratic philosopher at all. The notion that elements refer to primary substances is pure Aristotle. Plato, as usual, was unclear and uncommitted, but he prepared the ground.

The original meaning of the term 'elements' offers a clue to the old usage, for it refers to the letters of the alphabet. The Greeks were accustomed to use letters to represent numbers; hence numbers are indicated in an indirect way. In spite of Aristotle, the musical conception of elements has proved historically persistent. We moderns still refer to the elements of a musical scale and we use letters to name musical pitches. When we transfer to a musical conception of the elements, the early Greek philosophical fragments become both intelligible and self-consistent with each other.

The early Greek poets and philosophers used a large variety of metaphors for the notion of elements. Perhaps the most musically transparent is Empedocle's *Roots* and their compounds. Then he have *Seeds* and their growths in the Orphic poets, Pythagoras, Anaxagoras and the early medical writers. Also prominent are *Parents* and their offspring. We see *Ancestors* and their tribes or descendents. In Parmenides and Empedocles we have *Limbs* of the cosmic person. Poets also refer to *Powers* that rule domains. Some refer to them as gods.

Another important metaphor is the ***genera***, which describes *Kinds* or sorts or special births. In orthodox philosophy they have become classes of abstract objects that can be divided into further subclasses. However, the ancients also used the term ***genus*** in a strictly musical sense. It refers to the centerpiece of classical Greek music theory: the three ***genera***—diatonic, chromatic, and enharmonic. As we will see, these terms also have close ties to the vibratory root numbers.

Various sources also describe the elements as the ***archai***, the primary archetypes that cause everything else. Occasionally they are accurately designated as the Monad, Dyad, Triad and so on. Finally, the elements are also described within a poetic context as Fire, Earth, Air, Water and Aither, among yet more synonyms. These terms form an image language for poetic discourse.

The notion that Fire and Water refer exclusively and literally to 'great world masses' or primary substances is an Aristotelian anachronism. Plato was more circumspect and coy. He never openly committed himself to any one position. Instead he uses the dialogue form to distance himself from any particular doctrine. Meanwhile, he preserves a lot more musical associations in the banter, but subjects them to satirical ridicule and mutation. For Plato, the terms Fire and Earth mean different things in different places, even within the same dialogue.

Aristotle wanted exactly four elements so that he could arrange them in an astrological manner. In this way he was being modern and progressive. He used them as constructs of the underlying orthodox *powers* hot and cold, dry and wet. Specifically, Fire is hot and dry, Water cold and wet, Earth cold and dry, and Air hot and wet. In this neat topological scheme Fire and Water form opposites, as do Earth and Air. Aristotle conceived the elements in a democratic manner as having equal power to encroach upon each other, though they cannot eliminate each other completely.

Although scholars want to superimpose this tidy scheme over the early philosophers, the fragments consistently give an entirely different picture. The various elements are *not* equal or democratic in power. Rather, they prove to be hierarchical in a typically musical manner. Moreover, they consistently fall into two camps.

In the first camp, Air and Water always couple as elements of the *mixture*. The poetic term ***Aer*** traditionally meant mist or even clouds—in other words, already some

mixture of Air and Water. Similarly, the element Water has complex poetic associations that include changes of density—again a mixture of Air and Water.

The other camp of elements also forms a tight pair that has higher status and priority as well as a characteristic bi-polar relationship. The relationship between Fire and Earth is a proxy for Heaven-Earth and other poetic forms such as Aither-Earth and Sun-Moon. Crucially, the early philosophers never restricted themselves to the four orthodox Aristotelian powers hot-cold and dry-wet. They also used rare-dense, light-dark, white-black, and yet more metaphors that *always* refer to the same (and only) polarity. This polarity is derived from the old widespread mythical tale of the separation (by division) of Heaven and Earth.

In consideration of this evidence, only one arrangement is consistent with musical realities. Fire (Heaven, Aither) refers to the MONAD—the vibratory power of the number One. Earth refers to the DYAD—the musical power of the prime number Two. Air refers to the TRIAD—the power of the prime number Three, and Water refers to the PENTAD, the prime number Five as a vibratory source. Although these associations may seem to be arbitrary at first, they are not. They reveal and support a widespread poetic discourse that surfaces among poets even before the period of the philosophers. This musical-numerical interpretation of the elements provides the key to a musical understanding of the ancient literature.

SOME CHARACTERISTICS OF THE ELEMENTS

The essential power of the MONAD lies in its *omni-presence* and absolute unchangeability. It rules the unchanging realm. Every number is divisible by One and it is present in every multiplicity. It is generally presented as a sphere and demonstrated by the open string (the reference pitch) of the monochord.

The essential power of the DYAD derives from its nature in expressing *cyclical identity*. Modern musicians use the notion of 'octave equivalence' and give every octave of a pitch the same name. The octave forms the *temple* (house, matrix, womb) where every further harmony is birthed. It is the mythical '*mixing bowl*' where the elements of mixture have their play. It grounds the ancient conception of the *microcosm* within the macrocosm, since the contents of one octave can represent any octave. It supports the poetic principle of *macranthropos*: the ancients conceive the universe as a macrocosmic person who is the subject of sacrifice (the One becomes the Many). The universe is imagined as a grand musical scale between Earth in the middle, the ***mese*** on the monochord, and Fire (Heaven, Stars) on the periphery or the outer circle—symbolically the open string.

The DYAD is generally represented as female, the central goddess, the weaver and spinner of the vortex, the maker of complexity. She underlies the poetic term ***nous***. She has various proxies, such as the goddesses Necessity and Justice. The number Two is the first and only even prime number. It is also the first number to exhibit gender, since the number One is androgynous. The number Three forms the first male number. The DYAD has a unique and special relation with the MONAD, an archetypal example of the *unity of opposites*. The numbers One and Two have such special status in the field of Harmonics that the ancients called them the *principles of number*. The first prosaic number is Three. For good reason the octave is sometimes called the miracle of music.

The monochord sequence 1:2 defines the first active division of the open string, the act of separating Earth and Sky. It also forms the first symmetrical harmony. Note how much more complex and rich the harmonic associations of the number Two are than the crude dualistic statements of Numerology.

The essential power of the TRIAD is *diversity, activity*. 2-limit harmony provides only 'empty' octaves. It has a certain static nature that makes the DYAD the gateway between the changing and unchanging realms of music. As soon as ratios of Three are included into the mixture the octave space fills with endless variety. This occurs because no power of Three divides evenly into a power of Two—the numbers are mutually prime. The capacity to generate diversity makes this number metaphorically male. Its association with movement ties it to the poetic metaphors Air and *Soul* (***psyche***). Musically, 3-limit harmony makes a line of fifths-fourths, the metaphorical 'arrow.'

The essential power of the PENTAD is *fullness* and *completion*, since 5-limit harmony is traditionally sufficient for practical purposes. The metaphor Water has wider and more complex associations than the above three elements. The poets speak of the 'waters above' and the 'waters below.' The first image relates to the primordial Silence of pre-manifestation or Not-Being, sometimes called ***Okeanos***, among other terms. The waters below are divided from the waters above to provide the fullness of manifestation, the complete harmony. Water also universally appears paired with Air, since both 3-limit and 5-limit ratios tend to be found together in traditional harmonies. They naturally cooperate to form a mixture, but one also sees rivalries, most notably between a 3-limit and 5-limit version of the diatonic ogdoad scale. Hence Air and Water also generate the 'warring' archetypes of the mythological literature.

3-limit harmony can also be properly treated as an essential subset of 5-limit harmony. While 3-limit harmony forms a line of fifths, the 5-limit forms a hexagonal-triangular surface or *tri-axial matrix*, described by the poets as a cloth or a weave. Additionally, the element Water is placed in a complex opposition with Fire, since Fire represents the simplicity of the original One and Water the complexity of the full harmony. For this reason, among others, the Great Year or cosmic cycle has a polarity between a Great Summer (dominated by Fire) and a Great Winter (dominated by Water).

The PENTAD also has certain esoteric associations that come from the Golden Section in geometry. Thales, who made commentaries on Water, was referred to as the father of Greek astronomy and geometry. He has an important role to play in the initiation of the philosophical problematic.

THE FIFTH ELEMENT

Since Aristotle wanted four elements, he had to somehow neutralize the fifth element. He treats Aither as a sort-of meta-element that underlies and supports the other four. It takes on some of the characteristics of the MONAD. Meanwhile, Fire is demoted to just another of his democratic elements. Like the others, Fire is shorn of its musical powers and steered toward an astrological context.

Among the old philosophers the element Aither has even more complex associations than Water. We can find all three traditional referents within the copious fragments of the poet Empedocles. In the majority of his surviving fragments it acts as a stand-in for Air. Here we have the dominant usage during the fifth century. However, one

also finds fragments in which Aither refers to Fire or Heaven. This usage forms a secondary referent during the fifth century, but it became the dominant usage during the fourth century. Both of these possibilities make perfect sense, since the poetic image of Aither originally came from the clear upper atmosphere above the clouds—between Air and Fire. Here dwell the Sun, Moon and Stars. Aither sits right next to the outer stellar realm.

The referents to Fire and Air account for most of Empedocles' fragments that use the term 'Aither.' However, a few stubborn fragments cannot refer to either of them. Now we see Aither as the fifth element—the HEPTAD, a rather esoteric extension of the 5-limit mainstream. In Anaxagoras one finds yet another referent related to the fifth element. He uses it to refer to any sort of 'colored' harmony beyond the traditional 5-limit norm. In other words, it stands for the n-limit in tuning.

The conservatives tend not to countenance a sixth element, since 11-limit ratios prove a step too far for traditional tuning culture. Pythagoreans revered the numbers up to Ten. But progressives were willing to go even beyond the Eleven and contemplate the prolific n-limit, in order to court the infinite. Meanwhile, those progressives who invite irrational ratios would scrap this whole approach and replace it with 'parts.' Within this tempered environment prime roots lose their relevance, to be replaced by more abstract entities.

The Musical paradigm supports all of the various traditions concerning the number of elements in ancient philosophy. One tradition says that there is only one element, since the All is One. It is the One in action, a mirror for the One. Another tradition poses two elements, based on the two sides of the mirror and also on the two realms of Music: unchanging (1, 2) and changing (2, 3, 5…). Another strong tradition poses three elements, based upon the primes 2, 3, and 5 as fundamental masks of the One. Here the numbers 1 and 2 fuse due to their special relation. Then we have the dominant mainstream tradition of four elements, based on 1, 2, 3 and 5. The appearance of five elements shows a willingness to consider as a foundation all of the grades of consonance. At this point we encounter a natural boundary marker, since the next prime is 11. Only progressives were willing to step over this line.

Long before the Greeks the Babylonians were already accustomed to handling numerical ratios as 'things' in their mathematics, even though musical ratios consist only of temporal relations between vibratory events. These 'things' are fundamentally different from mundane physical objects, although something must physically vibrate. In my book I argue that conceptions of the elements mutated in the second half of the fifth century, away from the poetic-musical model toward a physical model.

The vanguard of this shift can be traced in the medical literature—and we must remember that medicine was not a peripheral issue among the early philosophers. During the time of Anaxagoras and Empedocles (mid fifth century) a musical conception of the elements still prevailed. However, by the end of the century, the time of Hippocrates and Democritus, the physical *humors* have replaced the elements in the medical model. Aristotle, whose father was himself a doctor, absorbed the latest medical models and took them further. For the doctors, humors are like juices or flavors controlling bodily functions. They stand in for the elements. For Aristotle the elements and powers become the basic building blocks of inert matter.

SOME ELEMENT TRIADS

Although the four-element model is perhaps dominant, it has a strong contender in the three-element metaphor. The musical characteristics of the prime numbers 2, 3, and 5 appear in many disguises. We can summarize these musical features thus: 2—cyclical identity, unity of opposites. 3—movement, power. 5—fullness, completion, beauty.

One sees it reflected in the fifth century writer Ion of Chios. He says that all things are threefold: intelligence, power and fortune (or beauty).

It underlies Plato's three-part psychology of the soul. The highest part is rational, the second part spirited or emotional, and the lowest part desirous or appetitive. Plato classified people into three kinds: philosophic, victory-loving and profit making. Aristotle also reiterated the same scheme: the three types are theoretic (the philosopher type), apolaustic (the warrior type who seeks honor), and practical (the craftsman or merchant who seeks gain). We also see it in the three dominant preoccupations of people: learning, fame (power, domination), and money (desire for riches, luxury). It also underlies the old story of the 'three lives' which was attributed to Pythagoras. Life is like a gathering at the Olympic games. Some come to observe the scene, some come to compete for glory, and some come to buy and sell.

The seminal archetypes 2, 3, and 5 also have distant metaphysical descendents in the neo-platonic scheme for the emanations. We see ***nous*** (mind) or the intelligible realm, ***psyche*** or the soul realm, and ***physis*** or nature. One can even associate the archetypes with the three traditional subjects of ancient philosophy: logic, ethics, and physics.

This three-fold model is not confined to Greeks alone. In fact, the common social organization amongst Indo-European cultures involves three ruling classes: priests, warriors, and craftsmen or merchants. They rule over the serfs or laborers and the slaves. Sometimes the three ruling classes are called the magical, the knightly, and the agricultural. They generate the gods of shamanism, war, and fertility—as can be seen in most ancient mythologies. They reflect the fundamental needs of society: moral or spiritual, military or executive, and economic.

As an example of the element triad apart from the Greek context, take Vedic India. It is ruled by the three classical castes: *Brahmanas*, *Ksatriyas*, and *Vaisyas* ,who dominate the *Sudras*. Each caste has its own mythology and even its own cosmogony. The 'learned' caste is epitomized by Mitra-Varuna and imagines that the cosmos began through a cosmic sacrifice. The 'warrior' caste is guided by Indra and sees the cosmos begin as a battle between forces of order and disorder. The merchant class is ruled by the Ashvins and forms a cosmogony based on the work of a cosmic craftsman. This widespread three-part classification can also be found in ancient Persia, Greece, Rome and other Indo-European cultures.

While on the example of India, note that the triadic scheme is not confined to sociology. Within the early (Upanishadic) strand of their philosophical tradition, the three psychological-cosmological principles called the *Gunas* have great importance. *Sattva* is clear, pure, in repose, and illuminating. *Rajas* is an active power, passionate, attached, stimulating, and pain inducing. *Tamas* is dark, inertial, and indifferent. These three principles have application in many contexts.

The three Gunas illustrate the very many crossovers or similarities that exist between ancient philosophy in India and Greece. Although I cannot pursue the topic here,

it forms an important side-channel in my book. Commonalities include a preoccupation with the One and the Many, opposing Forces, belief in ethical reincarnation, various mythological images (e.g. the cosmic egg), macranthropus, and elements—in fact, the same five elements. Like Greece, India birthed philosophy out of an intensely poetic context. Unlike Greece where the musical perspective was eventually set aside, it lived on in India through various philosophical schools.

In my book I argue that the isolation of early Greek and Indian philosophy from each other is highly artificial, unjustified, and damaging to our understanding of both traditions. I also ague that they had ample room to interact through the Persian court. It can also be shown that the influences moved in both directions. To a certain extent, Greek philosophy is like Indian philosophy filtered through the Persian cultural sphere.

THE PROGRESSION OF MEANS

The procedure of taking the *Arithmetic Mean* forms the heart of monochord work. The ancients called it 'taking the mean' or 'taking the middle.' As an example from the report of Ptolemy, consider the practice of the progressive tuner Didymus. When he wanted a quarter-tone for his enharmonic tetrachord he simply began with the large diatonic semitone 15:16 (C B) and took the Mean to give the sequence 30:31:32 (C B+ B). Simply double the numbers and insert the mid-term. There's nothing particularly complicated in this procedure. It amounts to placing a new fret halfway between two existing frets on the instrument.

The Arithmetic Mean (AM) is the simplest or most 'primitive' mean. It can always be demonstrated on a monochord, even with big numbers. Its reciprocal partner, the Harmonic Mean (HM) shows a bit more complication and cannot always be demonstrated on an actual instrument except for simple numbers. The ancient musical writers presented rather complicated arithmetical formulas for achieving the two *Musical Means*, reflecting its fundamental theoretical importance. However, in the interest of ease and intelligibility, I offer a convenient simplification. If one wants the two Musical Means of, for example, the octave 1:2, simply double the numbers and insert the middle position, thus 2:3:4. Now the first ratio (2:3) gives the HM and the second ratio (3:4) the AM. This method works for any ratio. Of course, a ratio of the sort 3:5 proves even easier since the doubling isn't necessary. Still, the characteristic order of HM and AM always works.

The concept of Means is fundamental to a Musical conception of order. Hence the progression of Means defines the very process of *emanation* whereby simplicity approaches complexity. It rules the route from the One to the Many. When we look at the first few members of this progression, they generate the crown achievement of ancient musical theory: the ***Genera***—*diatonic, chromatic, enharmonic*. These terms don't represent just a random resolution of harmony. They demonstrate that ancient tuners actually knew what they were doing. Their terminology betrays competence.

Let's look a little more closely at the progression of Means. We start with the open string of the monochord, before the moveable bridge is even applied. It has two states, passive and active. In the passive state the string is unsounded, representing pre-manifestation, Not-Being, the number 0. In the active state the string is sounded, giving the One, the MONAD. Now we do the first monochord operation: put the moveable

bridge in the middle of the active string length, giving the monochord sequence 1:2 (octave). We have now birthed the DYAD and generated 2-limit harmony, modelled as a point on the matrix, since octaves are 'empty.' Because 1:2 is a symmetrical harmony, both the HM and the AM yield an octave. The AM is demonstrated on the monochord as a downward scale from position 1 (on the ***mese***) to 2 on the open string. The HM is demonstrated by touching harmonic Two (or the first overtone) on the music wire, showing the upward scale from the open string to the harmonic. The octave is the only ratio in which the HM equals the AM.

The progression of Means 'proper' begins when we take the Means of the octave 1:2. As we've seen, it yields the HM 2:3 (fifth) and the AM 3:4 (fourth). These are the foundation ratios of 3-limit harmony, which is modelled as a line of fifths-fourths. Now we have birthed the TRIAD. The HM and AM relate to each other by the 3-limit ratio 8:9, the large or major diatonic whole-tone. It is generally divided into large or *diatonic* semitones and grounds the *diatonic* ***genus***.

Next in order we take the means of 2:3, yielding the HM 4:5 (major third) and the AM 5:6 (minor third). Now we have given birth to the PENTAD. These musical intervals lay the foundation for 5-limit harmony, which is modelled on the matrix as a surface or triangular array. Our two Means relate to each other by the 5-limit ratio 24:25, the small or *chromatic* semitone and rules a small-semitone or *chromatic* resolution of harmony.

Then follows the Means of 3:4, yielding the HM 6:7 and AM 7:8. We have birthed the HEPTAD and laid the foundation for 7-limit harmony. As an extension of the sequence point, line, and surface, 7-limit harmony is modelled as a solid or tetrahedron on the matrix. The two Means relate to each other by the 7-limit ratio 48:49, an *enharmonic* semitone or 'quarter-tone,' and it rules an *enharmonic* resolution of harmony.

The progression of Means is open-ended and we can proceed so far as we want, but one crosses a natural boundary with the next member, 4:5. It yields the HM 8:9 (major diatonic whole-tone) and the AM 9:10 (minor diatonic whole-tone). They relate by 80:81, a small interval called a *comma*. It rules a *commatic* resolution of harmony. We can easily hear comma shifts in intonation, but it is too small an interval to act as an independent scalar element. A boundary has been crossed into a sort-of *atomic* realm.

An examination of the history of music cultures around the world confirms that forms of quarter-tones make the smallest practical scalar components. That being said, a comma resolution forms a useful vantage point to the ***Genera***, since an enharmonic semitone is two commas in size, a chromatic semitone three commas, and a diatonic semitone five commas. Note the numbers 2, 3, and 5 again! Be that as it may, the progression of the ***Genera*** traditionally stops with the enharmonic, even though we have evidence that tuners were aware of the comma in ancient China, India, and Greece.

The other reason that a boundary is reached stems from the fact that, for the first time, we do not have a higher dimension in the harmony. For the number 9 is the first odd number which is *not* a prime. In order to achieve 11-limit harmony we must take the Means of the next member 5:6, yielding 10:11 and 11:12. They relate by the 11-limit ratio 120:121, a *double-clismatic* resolution of harmony. However, I have not been able to find evidence that practical ancient tuning cultures stepped beyond the commatic level, except in theory among some progressives. So the progression of Means naturally stops with the enharmonic resolution.

I have connected the progression 2-limit, 3-limit, 5-limit and 7-limit harmony with the matrix progression point, line, surface, solid and also with the ***Genera***. I call them *dimensions* of harmony because every higher member contains the former as a subset. One more interesting fact emerges when we look at the progression of *relation* ratios and factor them. The 3-limit ratio 8:9 is equal to 8*1:3 squared. The 5-limit ratio 24:25 factors to 8*3:5 squared. The 7-limit ratio 48:49 gives 8*6:7 squared. And the 5-limit ratio 80:81 yields 8*10:9 squared. Note the presence of the triangular number sequence (1, 3, 6, 10…) whose image is the Tetractys beloved of the Pythagoreans. The hidden presence of this important series within the seminal progression of Means reveals the *real* significance of the Tetractys—not the rather stupid Hellenistic notion that the number 10 equals 1+2+3+4. Numerology is irrelevant to the arithmetic of musical tuning.

Our progression of Musical Means can also be derived directly from the very first few simple monochord sequences. I call them the 'elemental divisions' of the monochord. 3-limit harmony comes from the sequence 2:3:4. Similarly, 5-limit harmony comes from 3:4:5:6 and 7-limit harmony from 4:5:6:7:8. Various ancient musical writers refer obliquely to the elemental divisions. Most notably, Plato talks about the importance of successive duplications of unity from 1:2 to 2:4 to 4:8, which he calls '*spacial and tangible*.' In fact, in his post-humous dialogue *Epinomis* (which may come from a student) I found an explicit description of the progression of Means. It is worth quoting parts of it.

'*In fact, what is divine and marvelous for those who understand it and reflect upon it is this—that through the power which is constantly whirling about the Double and through its opposite, according to the different proportions* (i.e. through the Means), *the pattern and type of all nature receives its mark.*' He goes on to recommend that we take the Means of 1:2, then 2:3, and finally 3:4, saying that the Means '*presented to mankind melodious consonance and measured charm of play, rhythm and harmony, abandoned to the blessed dance of the Muses.*'

This quote, among others, demonstrates that Plato, in spite of his satirical and polemical stance, is no dummy concerning Harmonics. Indeed, Plato proves to be *the last of the great musical philosophers*, even though he approaches it from an entirely skeptical, post-sophist position. His ouvre is densely infused with musical imagery, concepts and innuendo that usually lies just below the surface. Once in a while he says something directly, but mostly he masterfully plays a coy game of '*mixing comedy with tragedy*;' for the entertainment of his musically astute audience. Without the musical key much of his writing becomes ambling conversation with no unifying thread.

Even though my book is about early Greek philosophy, I also argue for a transformed understanding of Plato. Every chapter presents some examples of how he treats (mostly mutilates) a particular philosopher. Make no mistake. There is practically *nothing* original in Plato, only satirical or skeptical reworkings of material from the early philosophers. In spite of his maddening lack of transparency, he proves to be a gold mine of information on the ancients. The joy and irritation in reading Plato stems from the almost continual need to separate the wheat from the chaff. As Heraclitus said, one must dig up much earth to find gold.

Aristotle was fed up with Plato's complex and sometimes esoteric musings. He wanted to put philosophy on a new footing. Out with Harmonics, in with Biology.

THE IRRATIONAL MEAN

So far I have been describing the two traditional Musical Means (HM and AM). With them one can generate any traditional harmony and a lot more. However, the literature also gives a third classical Mean, called the *Geometric Mean* (GM). It alone generates irrational ratios. Rather than burden the reader with yet more musical arithmetic, I will forego a presentation of the progression of the GM here and look only at the very first example, the GM of the octave. It yields the square root of two—a tritone interval. This ratio has some peculiar properties shared by all irrational ratios.

For one thing, it forms a never-ending decimal point. Consequently, it cannot be expressed through whole-numbered ratios in a monochord sequence—except as an approximation. For example, we can roughly approximate our tempered tritone with the 7-limit ratio 5:7. We can get better accuracy with the 5-limit ratio 32:45, yet better with the large 3-limit ratio 55296:78125. But you see what is happening. The numbers must approach *infinity* to get an exact fit. Alternatively, we can also make a better approximation if we court exotic primes, for example the 11-limit ratio 70:99. However, the purist can always contend that such methods amount to 'cheating.' Irrevocably, one cannot find the accurate fret position for an irrational ratio using traditional monochord techniques. For this reason alone the conservatives would ban them altogether from musical tuning and from philosophy.

A number of writers, both ancient and modern, contend that setting a tempered harmony on the monochord is an impossibility. However, this is simply not true. We *can* do it, but we must abandon the traditional *arithmetical* approach and use instead a *geometrical* method. Modern tuners, of course, use logarithms, but these tools were not available to the ancient Greeks. For them the geometrical method is the only avenue. This approach uses a ***gnomon***, a perpendicular to the line segment. This term also has an astronomical meaning and was closely associated with the Milesians in the doxographical literature. The musical technique is a direct application of the *Geometric Mean construction*. Without going into the details here, let me just say that four theorems in Euclid's collection concern this construction. Euclid attributes all of these theorems to Thales, the father of Greek geometry.

Yet more converging circumstantial evidence also supports the notion that the Milesians were the vanguards of progressive musical thinking. To a certain extent the whole movement of early Greek philosophy consists of various reactions to Milesian radicalism.

The GM has certain special properties that I will not pursue here. However, I must say that it acts essentially as a *mediator* between the two traditional Means. Moreover, tempered harmony cannot be meaningfully isolated from just harmony. They share many overlapping structural features. Tempered harmony also exhibits the seminal progression of the ***Genera*** in the four best equal-tempered divisions of the octave: 12-equal temperament (12-et) presents a tempered resolution of the octave into large or *diatonic* semitones. 19-et resolves it into small or *chromatic* semitones. 31-et resolves it into *enharmonics*, while 53-et gives a scale of *commas*. These are the 'big four' equal temperaments.

The architecture of the temperaments also mirrors the 'boundary crossing' character of the comma resolution, since the other three belong to the same family (called

meantone-related temperaments), while 53-et does not. Moreover, the other three orient themselves along the three axes of the tri-axial matrix. Last but not least, 12-et has a strong structural association with the square root of Two, 19-et with the square root of Three, and 31-et with the square root of Five. There's our magic numbers 2, 3, and 5 again! 53-et presents a special case that need not concern us here.

The irrational roots of the numbers 2, 3, and 5 form the three families of geometric constructions that arise from the One. These families define the traditions of Sacred Geometry. Although it is not possible to pursue this topic here, one can lay out various issues that concern crossovers between musical tuning and geometry. In both cases the arithmetic is dominated by the numbers 2, 3, and 5 as masks of the One.

The subject of tempered tuning has always been contentious. Euclid, a conservative, took pains to prove that you cannot divide the octave into six wholetones of ratio 8:9. True, but he neglected to mention that you *can* do it if you temper your 8:9 slightly. The situation is complicated because Euclid's collection also gives a number of theorems that involve the irrational division of a line segment, that is, tempered ratios. Thus his stand is more a matter of anti-temperament *attitude* than innate capability. All through European tuning history one sees a heated polemic over the merits of temperament versus 'pure' tuning. Indeed, the two greatest classical writers on tuning, Ptolemy and Aristoxenus, sit on opposite sides of the fence. Ptolemy favors just intonation, all-be-it an expansive n-limit. Aristoxenus favors temperament, specifically 72-et (quarter-tone with inflections). Again, his choice is not arbitrary but indicates great sophistication in choosing a system (a spin-off of 12-et) with certain special structural features.

The teacher of Aristoxenus, Aristotle, in one of his few pronouncements concerning Harmonics, gives the classic argument in favor of temperament. He says that a proportion can be '*relaxed*' or adjusted and still maintain its character. Aristotle clearly understood the concept of musical *Tolerance*. Simple ratios act as powerful norms that are subject to manipulation. The simpler the ratio the narrower the band-width of tolerance. The octave (1:2) traditionally cannot be miss-tuned at all. The fifth (2:3) has a narrow band of adjustment. The major third (4:5) has a wider berth, and a dissonant interval like 15:16 much wider. This means that one can considerably miss-tune a 15:16 and still get something that sounds like a diatonic semitone, while a 2:3 can only be adjusted a small amount without damage. A consideration of these tolerances leads to the 'big four' best choices. Each tempered system puts the compromises in different positions, just as different just divisions exhibit patterns of Justice and Injustice, Love and Strife. In other words, tempered systems also exhibit the compromises cautioned by Anaximander.

BETWEEN RATIONAL AND IRRATIONAL HARMONY

It's worthwhile to make a brief contrast and comparison between tempered and untempered harmony. First of all, just intonation presents the *maximum variety* of interval types. Temperament homogenizes this diversity into some limited number of standard interval components, usually called steps or '*parts.*' For example, take the wholetone. In just intonation we note the archetypes 7:8 (septimal), 8:9 (major) and 9:10 (minor). By contrast, both 12-et and 19-et have only one variety of wholetone that must stand for all

three, although in 12-et it's closest to 8:9 in size. 31-et has two varieties: an excellent simulation of 7:8 and a meantone—so named because it's about half way in size between 8:9 and 9:10. Thus the meantone homogenizes these two archetypes. 53-et has all three varieties in a good simulation. Thus deeper tempered resolutions bring out more features of just intonation. Once the resolution is fine-grained like 53-et it begins to take on the character of just intonation. Nevertheless, the overall variety will still be less than that of pure or rational harmony. In short, temperament limits the possibilities.

Moreover, tempered harmony increases the inventory of symmetrical patterns. Just harmony, though it also has symmetrical patterns, maximizes asymmetry. The Harmonic Series forms the ultimate asymmetrical harmony.

Pure tuning also presents the most marked and delineated *contrast* between dissonance and consonance. On the other hand temperaments diminish and somewhat blur the contrast. Again, a deep resolution like 53-et behaves more like just intonation than a shallow resolution like 12-et. For this reason 53-et is sometimes called a 'quasi-just' temperament.

We see that temperaments can be made to simulate just intonation. It works the other way as well. If we are willing to accept exotic high prime numbers we can use them to simulate a shallow temperament like 12-et. In other words, once we admit a high enough level of complexity both tempered and untempered harmony tends to converge and have a similar psychoacoustical character. This complex convergence is most evident when the scale has many components, expresses an atomic division, or approaches a plenum or continuum of ratios—whether rational or irrational. This psychoacoutic fact has important implications for the Milesian conception of ***harmonia***.

The progressive philosophers strive to integrate rationals and irrationals into a more comprehensive conception of harmony. They seek an *analog* perspective associated with the All. One approaches it both through infinite divisibility and the inclusion of irrationals. The tuners inherited an old *digital* perspective whose main features I have outlined. We can summarize digital ***harmonia*** in Pythagorean fashion as 'Roots and their compounds.' The analog conception de-emphasizes roots and compounds in favor of more generalized abstract replacements for the elements. In the literature they are usually described as 'part' or 'portions' in sympathy with the irrational context. Digital harmony can be pictured as a discontinuous pattern like 'beads on a string.' One starts with simplicity and produces some level of complexity. The analog perspective tends to see the space between Heaven and Earth (the octave) as a continuum whose extremities are poetically described by the opposing powers hot and cold, rare and dense, and so on. From the analog perspective, the setting of a harmony is more a 'subtractive' process whereby some foreground is distilled from the background All.

We should not treat the digital and analog perspectives as somehow incompatible. They are entirely compatible and share many features. For example, both involve mixtures within a bi-polar framework. In one the mixture consists of numbers as components (roots and compounds), in the other parts or powers as 'quasi-elements.'

We need to put this whole movement into a long-term perspective. The subject of tempered tuning has always been a rather esoteric pursuit. The vast majority of tuners simply perpetuated the old traditional tunings. Indeed, by the end of the Hellenistic era tempered tuning largely died out, in spite of Aristoxenus. However, it never died

completely—it went underground. It would not be revived again until fifteenth century Europe instituted meantone tuning as the mainstream.

The esoteric nature of the ancient musings have not made the old philosophers easily comprehensible to us moderns, with our visual bias and our monistic tuning culture. We have long assumed that music has no relevance to philosophy, except perhaps to Pythagoras. And even for him it amounts to little more than primitive numerology, a sham of Harmonics.

DIMENSIONS AND CIRCLES

I have recently explained the *dimensions* of just tuning: 2-limit (point), 3-limit (line), 5-limit (surface) and so on. Although in theory we can neatly isolate one dimension from another, in practice they have a peculiar relation to each other that has profoundly influenced the history of tuning, as well as the conceptions of the philosophers. This structural feature is yet another context for the potent issue of limits. I call this feature *inter-dimensionality*.

Take 3-limit harmony, a line of fifths-fourths. In order to preserve its 3-limit character one must restrict the line to eight members or less. Beginning with the ninth member we get an interval that is extremely close in size to a prominent 5-limit interval norm. They differ by a *very* tiny interval called a *schisma*. This step is so small (much smaller than a comma) that it can be largely ignored in practice, especially since tuning errors are accumulative in our line of fifths. In other words, any extended line of fifths takes on the character of 5-limit tuning. It becomes a 'quasi-5-limit' or a 5-limit simulation. Here is another reason why the elements of mixture (Air and Water) are inseparable in the poetic discourse.

Again, take the 5-limit tri-axial matrix. Any extensive expansion of the 'cloth' encounters intervals that are 'quasi-7-limit,' separated by another very small interval called a *clisma*.

In short, the various dimensions of harmony bleed though each other or inhabit the territory of each other. Hence they cannot be meaningfully separated from each other in practice, although we make the distinction in theory.

This situation has had a major effect on the history of tuning. By the end of the ancient period in the Middle East and Asia theorists modelled tuning by a very extensive line of fifths. The Hindus used 22, the Arabs 17. In this way they preserved a large pool of comma-shifted alternatives, the essential materials of 5-limit harmony, within a 3-limit theoretical language. Using this toolkit many tunings are possible. However, in the west the Romans restricted the line of fifths to only eight members, expressly in order to exclude 5-limit materials. They cite as their authority good old Pythagoras, supposing that he knew (or sanctioned) only 3-limit harmony. Later in the Middle Ages European tuners expanded the line out eventually to 12. Then they encountered the dreaded comma and stopped.

Here we witness the source of the schism between European and Asian tuning cultures. The Asians celebrated the comma and the variety of scales that can be formulated through it. They envision an underlying comma resolution of harmony. Consequently they preserved a complex culture of intonational pluralism. On the other hand, in the west the comma has been regarded as a problem to be eliminated. When

Europeans turned to meantone temperament in the renaissance period they did so partly to 'kill' the comma—and also to improve the major third. The comma became a bogey. Some named it after (you guessed it) Pythagoras who, some contend, discovered it.

The musical fifth and fourth intervals dominate structural models, as chains of fifths-fourths in 3-limit harmony, and significantly as the largest or most important segment of the octave. The tetrachord is surely a suitable scalar segment. Hence the element Air is the best possible candidate for a 'quasi-element' or irrational analog to generalize roots and compounds. We find this very approach in Anaximenes, who is the most sophisticated and influential of the Milesians within the movement itself. Anaximenes uses Air as a sort-of 'meta-element' referring to phase changes within the continuum between Heaven and Earth. Employing the appropriate metaphor of 'rare-dense' as well as 'hot-cold' he says that Air thickens to Water and thins out to Wind and Fire. This retooling of the old poetic language suits the environment of musical temperament.

When we employ an expanding line of tempered fifths something peculiar happens. The line of pure fifths is open-ended, but some chains of tempered fifths bend round into a circle or closed loop. Most modern musicians know this feature in relation to 12-et. By tempering the fifth flat by a very small amount (a tempered schisma, roughly one twelfth of a comma) the chain is transformed into a closed circle. Similarly, by using a fifth about one-third of a comma flat we get the closed circle of 19-et. A temperament of about one-quarter of a comma flat yields the circle of 31-et. Finally, the closed circle of 53-et results when we use a temperament so tiny that it sits well below our hearing threshold. In other words, a chain of pure fifths, though *theoretically* open-ended, is practically identical to a closed circle of fifty-three fifths. The oldest surviving published disclosure of this feature came from a writer in China who was a contemporary of Eratosthenes. While computing a long line of sixty fifths (60 being an important cosmological number in China) he noticed that the fifty-fourth member is practically identical to the first. Consequently, the division of the octave into fifty-three commas makes something very much like pure tuning.

Historically, a 3-limit language of interval *chains* became more and more dominant. Musicologists use the term *cyclical* tunings. However, it never entirely displaced the old alternative that musicologists call *divisive* tunings. That's a code word for 5-limit harmony and beyond—essentially a monochord orientation. At any rate the difference between cyclical and divisive methods is only academic or theoretical. Within their members they differ by nothing more than schisma shifts.

THE UNITY OF OPPOSITES

The topic of opposites has always been difficult to square with the Aristotelian model. For one thing, it proves hard to isolate it to one philosopher, since its use is so widespread. Moreover, only with considerable problems can we interpret it as a primary substance or integrate it into the physical context. It has never been clear if the opposites somehow *are* substances or if they consist of qualities or components of substances. If so, what is the relation between opposites and substances? The topic leads to awkward notions and even contradictions.

Like the topic of limits, the notion of opposites finds a natural place within a Musical model. Musical materials are particularly prone to this issue. It comes to the fore in at least five contexts: the Realms, the Forces, the Limit, the Reciprocals, and the House.

The two *Realms* of music, changing and unchanging, form a unity of co-dependent opposites. In spite of their opposition they are always found together with a mediator.

Opposites also pertain to the bi-polar *Forces* of Love and Strife. These tendencies are also found together in some sort of balance. Thus they also form a unity of opposites.

The imposition of *limits* presupposes the notion of the Unlimited. Some followers of Pythagoras equated Limit with the MONAD and the Unlimited with the DYAD. However, like so much late Pythagorean lore, this is just a corruption of the old musical notion. Instead it properly connects with the Realms. The MONAD rules the unchanging aspect of music. The DYAD acts as a gateway and controller of the changing aspects. The Pythagorean corruption illustrates the unfortunate fourth century tendency to impose an inappropriate dualism over the philosophers.

Another context for the notion of opposites arises from the *reciprocal relation* between the Arithmetic and Harmonic Means. It reflects the inverted relation between the upward and downward oriented scales, as well as the asymmetry of the Harmonic Series. This reciprocity is equivalent to expressing a ratio as n/1 or as 1/n. The first ratio gets larger, the second smaller. Within the fragments of Anaxagoras and Zeno one finds this reciprocity appropriately called '*the large and the small*' or '*the greater and the lesser.*' Plato uses the notion of the '*Dyad of the Great and the Small.*' The important point here is that the reciprocals also form a unity of opposites, due to the presence of symmetry as well as the special coupled relation of complimentarity between asymmetrical pairs.

The final context for a unity of opposites involves the *House* or Temple of harmony. The octave between Heaven (Fire) and Earth is poetically described as a polarity of values or powers between hot-cold, rare-dense, dry-wet, bright-dark, and so on. Yet it also exhibits a unity of opposites due to the special relation of cyclical identity between the MONAD and DYAD. This relation is brought out in the mythological story of Fire at the center of the Earth, seen among others in Empedocles and Plato. It also underpins the peculiar 'counter-earth' astronomy of Philolaus.

We see the special relation also acknowledged by the poets. For example, the poet Hesiod puts an interesting twist on the common story of the separation of Heaven and Earth. He writes that the Earth came first and surrounded herself by Heaven '*equal to herself, to cover her completely round about, to be a firm seat for the blessed gods forever.*' Logically the MONAD comes first but the relation between the MONAD and the DYAD is like that between a circle and its center. They are inseparable.

THE ELEATIC PERSPECTIVE

Anaximenes rules as the most influential Milesian within the movement itself, but Anaximander is probably more profound. At any rate Anaximander represents the progressive forward thrust of what I call in the book the *radical strain* of early Greek philosophy. He handed the baton to Xenophanes, who founded the Eleatic school or perspective. His student Parmenides gave the most comprehensive expression of this

problematic. Parmenides in turn passed it to his student Zeno, famous for generating paradoxes. All of these philosophers want to uncover paradoxical features of the One as the All.

The poet Xenophanes is undoubtedly the most under-rated of all the early philosophers, due to the abuse of Plato (e.g. in the *Sophist*) and the shabby treatment of Aristotle. Aristotle dismissed him as a confused thinker who makes nothing clear. He didn't like Parmenides either, but had more trouble sidelining him due to the very power of his poem. He found it convenient to treat Xenophanes as a 'primitive' whose logic is less cohesive than that of Parmenides. Yet even Aristotle had to acknowledge that Xenophanes also used that peculiar 'quasi-logic' that is the hallmark of the Eleatic philosophers.

Xenophanes loves riddles and paradox. He passed on this tendency to the next generation. For Heraclitus and Parmenides are masters of the obscure, of the intentionally ambiguous. Xenophanes is reported to have riddled that 'it' is neither (or both) limited nor unlimited, neither in motion nor at rest. He seems to step right outside of the sensible world and inhabit some place of pure logic. But the logic always defends the impossible in some paradoxical way. This seeming logic is first and foremost a poetic gesture in support of the ineffable.

Another powerful feature of Xenophanean radicalism concerns his satirical stance. In various surviving fragments he satirizes the traditional or conventional religions, but he is not against religion per se. Instead he appears to be a religious non-conformist who wants to bring out deeper and more elusive aspects of the divine One. The satirical stance of Xenophanes also touched the next generation and beyond, especially the skeptical Sophists of the late fifth century and Plato in the fourth century.

Xenophanean radicalism also surfaces within an epistemological context. In the background lies the discrimination between divine knowledge and human knowledge. The latter is judged less valuable or certain. This discrimination pervades the whole movement. Explicit references appear in the surviving fragments of Xenophanes, Heraclitus, Parmenides, Alcmaeon, Anaxagoras and Empedocles. In one Pythagorean tradition the number Three is judged divine while Five is human (Seven is bestial). The discrimination between monochord theory and practice also supports the notion. Ptolemy valued the theory over the practice, but also realized that they cannot be ultimately separated—they need each other. Indeed, one can also argue that practice is the more valuable. The theory is just an indispensable guide or norm. After all, the tuner must finally make it work, make it real and sounding.

This ambivalence in our estimation also pervades the discourse over divine and human knowledge. Normally the divine trumps the human, but one can also support the notion that human knowledge is the more secure. In this argument divine knowledge is more problematic, approachable only by riddles and conjecture. This ambivalence of valuation forms an important poetic theme running through the early writers. Note that the relation between divine and human knowledge is *not* dualistic. One has less value than the other, but the lesser still has some value.

Xenophanes and Parmenides pushed this theme toward a more extreme position in order to concentrate its power, thereby to make the paradox even more forceful. Divine knowledge becomes what is true (***alethiea***) and certain. Human knowledge represents a seeming (***doxa***), an appearance, less certain. Note that the relation is still not

simplistically dualistic. In his extra-ordinary poem, Parmenides argues that what seems to be true (the commonsense world of time and motion) is truly a seeming. What is true proves to be an impossible seeming (no time, no motion). Truth and seeming form a complex poetic interaction.

This tit-for-tat game between Truth and Seeming perpetuates Hesiod's famous dictum that the Muse can both enlighten and deceive. For Seeming in Parmenide's poem is not the simplistic negation of Truth. Parmenides confines the contradiction (Falsity) to the realm of Not-Being. Philosophy concerns itself with the realms of Being and Becoming.

The Eleatics identify the One with the All, or the *Whole*. Their grand paradox emerges out of the musical principle of Wholeness. The All (every division) results paradoxically in the equivalent of no division (the One). Plato called the Eleatic tribe the '*partisans of the Whole.*' For them, the All means something like the 'All-at-once' or the 'All-together-now.' Make every division, both rational and irrational. What do we have? A solid plenum or continuum, no void, full of 'what-is.' It makes something that is paradoxically independent of Time, a notion in which all motion is banished, since everything is present at once. This is a poetic description of the analog (continuous) background from which discontinuous digital ***harmonia*** is discriminated. The power in the paradox comes from the seeming antithesis to the musical model, which is after all ruled by Time and characterized by the Milesian principle of *eternal motion* in a cycle. Thus Parmenides brings out an aspect of the musical model that is paradoxically unmusical. And he does it by *seeming* to use logical argument!

The early philosophers, and not only the Eleatics, modelled the One as an infinite sphere, the cosmic Egg. It is both limited (the end bridges of the monochord) and unlimited (in its divisibility). In the Eleatic state of the All-at-once, it exists immovable, unchangeable and imperishable. It holds the 'innumerable worlds' of the Milesians. The Eleatics lay bare the implications of the One in the realm of the unchanging.

The denial of movement and change constitutes the very hallmark of the Eleatic perspective. And yet they do not negate its converse. Most of Parmenides' poem upholds the Milesian process philosophy of Becoming. Only one section of his poem, which is perhaps less than a quarter of the entire poem, defends the peculiar Xenophanean philosophy of Being. Later scholarship has divided his poem into two dualistic halves, appropriately called the Way of Truth and the Way of Seeming. But the division is artificial. Many fragments could go into either section. Moreover, the poet also uses a particularly mystical prologue that negates the simple dichotomy. In fact, the relation between Truth and Seeming in his poem is exquisitely complex—not the proper, simple and logical 'either-or' relation that Aristotle insists upon. Is it any wonder that Aristotle found the Eleatics irritating?

Xenophanes also affirms the Milesian perspective of Becoming in his poetry. His all-purpose metaphor of 'clouds' for the mixture of Air and Water is highly appropriate. But, like Parmenides, he also puts stress on the One as an immovable All. Most famously, he said that '*without toil, he shakes* (or shivers, sways) *all things by the thought of his Mind.*' The musicality of this statement is obvious. The statement expresses the interplay between Being and Becoming and the role of Mind as mediator.

Most scholars rightly give to Parmenides the prize for being the most difficult and obscure of all philosophers. He is generally followed by Anaxagoras and Heraclitus. In

my estimation Xenophanes, Heraclitus and Parmenides form a particularly tight family—the masters of ambiguity. Their fragments often require a variety of different translations in order to unpack their riches. Heraclitus and Parmenides sit in the very center of the movement, and not only chronologically (both being active around 500 B.C.). They also provide the highest expression of what can be called the radical 'left-wing' and the center ground of the movement.

THE THREE WAYS

Simplicius was a very careful scholar. He had the whole library of books by the early philosophers at his disposal. Even for this reason alone we need to take his reports seriously. Unfortunately, he works within Aristotle's material paradigm and sometimes he runs into trouble because of it. Nevertheless, Simplicius tried to be impartial and take an independent position. He points out a number of places in which Aristotle is unfair to his predecessors. Best of all, he makes extensive quotes from the early philosophers, something that Aristotle and Plato would not do. He lets them use their own words. Moreover, he seems to have had a special interest in the obscure and paradoxical. For he translates some of the juiciest moments of the giants Parmenides, Anaxagoras and Empedocles. Even when he is paraphrasing, his work is not easily dismissed.

Perhaps his single most spectacular contribution to our understanding of ancient philosophy comes from a report concerning Anaxagoras. He says that Anaxagoras conceives of all the forms in three different ways. He goes on to describe the first two ways and leaves sufficient clues to successfully construct the third way. As it turns out, this issue is not only relevant to Anaxagoras. It provides a valuable perspective to the whole movement.

Simplicius himself believed in a two-fold world. One realm is intelligible, derived from ***Nous***, unchanging and eternal. The other realm is a changing perceptible or material world that emanates from the intelligible sphere. He inherited this philosophy from the Neoplatonists and ultimately from Plato. In Simplicius' day these two realms were often conceived in a dualistic and crudely numerological manner. ***Nous*** became the proxy for the Monad, and the changing world a proxy for the indefinite Dyad. Moreover, the conception of ***nous*** had become quite abstract and metaphysical, its musicality long forgotten.

Aristotle also poses a dualism between Mind (***Nous***) and Matter. He claims to have gotten this theory from Anaxagoras, but it was really a deliberate falsification of the three-part scheme in Anaxagoras. Anaxagoras' work is actually not about matter at all, nor is his ***nous*** that of Aristotle. Simplicius inevitably tried to project the familiar dualistic ideology onto Anaxagoras, but he was astute, honest and brave enough to report a discrepancy between Anaxagoras and Aristotle's version of Anaxagoras.

So here are the three ways that all forms (i.e. musical structures) can be rendered. The first way we define as *Unchanging Atemporality.* Now all structures are gathered together in what Simplicius calls an 'intelligible unity,' meaning the Whole or the All-together-now. Here we have the Eleatic perspective and the philosophy of Being. The second way is the gateway realm defined as *Unchanging Temporality*, cyclicity or periodicity. Here the All is poetically dissociated into a polarity through the power of the DYAD, to create the House of harmony—the mixing bowl where every 'recipe' is made.

It forms a unity of opposites. This House is poetically called ***nous*** and partakes both of the changing and the unchanging realms. The mixing bowl still contains the All, but as the microcosm within the octave. The All has not yet been specified into particular harmonies. The third way we define as *Changing Temporality*. Here the power of ***apokrisis*** and ***sugkrisis*** takes hold and gives birth to specific harmonies. This is the realm of name-and-form, of seeds and parts, of rational and irrational harmony. The first way is paradoxically nameless. In the third way complexity arises from simplicity. This is the realm of Becoming and alteration, the realm where temporality rules. These three ways exhaust the manner in which forms can be taken.

In short, one sees an interpenetrated Unchanging and Changing Realm, giving rise to simultaneous philosophies of Being and Becoming which are *not* in a simplistically dualistic relation to each other. Moreover, these two modalities meet in a gateway Realm (***nous***) that communicates between the two modalities.

When I examine the poetic use of the term ***nous*** in the other early philosophers, they suit this scheme consistently. For example, the prologue in Parmenides is but an extended ode to the 'goddess in the middle,' whose functional equivalent is ***nous***. The scheme goes back at least to the Xenophanean notion that Mind shakes all things without the need of any motion herself. Early Greek philosophy embraces *both* Being and Becoming together with ***nous*** as the mediator between them. Here we have the core of the old Musical perspective.

That perspective was torn apart or mangled by the Sophists and Plato. Ultimately, Plato stole his theory of forms from Anaxagoras, although he never gave him credit for it. Instead he mutilates the theory and satirically belittles Anaxagoras, largely ignoring him. Plato set Being *against* Becoming in an incipient dualistic either-or relation. Forms now belong only to the unchanging realm of Being, roughly derived from the Eleatics. Meanwhile, the changing realm is utterly divested of musical forms altogether, reduced to a form of chaos in 'Heraclitean' flux. Thus his notions of Being and Becoming are derived from satirical mutations of Parmenides and Heraclitus. Then Plato adds his finishing touch: Becoming is also less real than Being—a mutation of the old poetic distinction between divine and human knowledge. The subtle musical relation between Being and Becoming with ***nous*** as 'controller' becomes the dualism between the intelligible and the perceptible worlds.

UNIVERSAL MIXTURE

Of all the philosophers Anaxagoras proves to be our best single teacher regarding the musical principles underpinning Harmonics. Through his fragments and the commentary by Aristotle and Simplicius we have several instances of note. They also exhibit self-consistency and inter-workability. Inevitably, they bring out aspects derived from the core musical principle of *Wholeness—parts form wholes within wholes*.

The first principle I call the musical principle of *Integration—every part forms a mixture like the whole*. One can see this principle at work in our sample integrated harmony 12:24 with its sources 3:6 and 4:8. Not only is the whole a mixture of roots and compounds, but also the source components. In short, mixture is everywhere. A harmony involves a mixture at every architectonic level.

The second musical principle I call *Omni-divisibility—everything comes out of everything.* For any ratio can act as a reference point for further division. Harmonies have ambiguous paternity. We can arrive at them through various channels that lead to the same place. Harmonies form subsets and supersets of each other by division. By integrating irrationals anything can become anything with the appropriate division. According to the report of Aristotle and Simplicius, Anaxagoras supports this principle.

Last but not least Anaxagoras gives the musical principle of *Universal Mixture—everything is in everything.* This one is the most subtle of all. Anaxagoras intends us to relate these principles to the context of the three ways for handling forms. Simplicius made an effort to lay it out but admitted to be at a loss. He was handicapped by Aristotle's paradigm. For the substitution of substances in place of ratios makes the principles break down. It no longer works.

Universal Mixture is implicated in a notorious controversy often called the single most intractable problem in early Greek philosophy. Some call it the curse of Anaxagoras. The problem is this: one finds clear support for Infinite Types, for Infinite Divisibility, and for Universal Mixture in Anaxagoras. But these three factors are mutually incompatible within the orthodox paradigm. Try making it work. It leads to various logical regressions and impossibilities. Aristotle takes Infinite Types to mean an infinite variety of substances. This is the path to perdition. Instead, use Infinite Types as a referral to the n-limit, the ongoing sequence of prime numbers. Now all problems disappear. It works because parts are wholes in the musical context, while in the physical context parts are definitely not wholes.

Universal Mixture has always been the badge of Anaxagoras' notoriety. The isolationist orthodoxy has tried to confine the doctrine to him alone, but it's simply not workable. It surfaces among various poets and philosophers whenever they use the statement that the All is 'steered' through the All. It appears explicitly in Heraclitus with his celebrated statement '*Wisdom is the One, to be skilled in true judgement, how all things are steered through all things.*' In Parmenides the central goddess (***nous***) steers all. According to the doxographers, the distinctive and colorful term 'steerage' comes from Anaximander.

In order to understand the workings of Universal Mixture, we must apply it to the three ways that forms can be handled. In the first way, the Eleatic perspective, it finds an obvious home. For in the One-Whole everything is present at once. Everything (the All) inhabits the same place and time. Hence everything is in everything. Perhaps the notion of Universal Mixture was originally intended for this context alone. However, the same sort of argument applies to the second way. Here ***nous*** holds the All within the microcosm of the octave as a unity of opposites between Heaven and Earth. Within this space everything also sits in everything.

In the third way, ***sugkrisis*** and ***diakrisis*** rule and individual harmonies are specified. One would think that here at last Universal Mixture can be banished because harmonic sets clearly specify what is included and what is excluded. However, even here one can detect the workings of Universal Mixture within at least four contexts.

The first instance involves the relation between the *reciprocals.* The Harmonic Series and the Sub-harmonic Series form complete opposites. Yet any rational harmony found on one side can also be found on the other side by using the appropriate division. This form of coupling that I call complimentarity was illustrated by using the two

divisions 4:8 and 15:30. Even though the reciprocals form different worlds they interpenetrate each other with a type of 'everything-in-everything' that I term *Inter-complimentarity*. Anaxagoras refers to this context for Universal Mixture in his sixth fragment.

In the second instance, the various *dimensions* of rational harmony (3-limit, 5-limit, etc.) would seem to be quite distinct from each other. 3-limit harmony consists of a line of fifths, 5-limit harmony a tri-axial matrix, and so on. Each dimension has its own unique and characteristic ratios. Yet a long line of fifths closely simulates 5-limit intervals. Thus the dimensions bleed into each other or co-habit a common psychoacoustical inter-zone. In this way, everything is in everything in a manner that I call *Inter-dimensionality*. Anaxagoras refers to this context for Universal Mixture in his comparison between a 'human' world (5-limit) and a more highly 'colored' world, referring to the n-limit.

In the third instance, rational (just) harmony and irrational (tempered) harmony form separate continents in the universe of ***harmonia***. Yet once we reach a certain level of complexity the other camp can be well simulated. The psychoacoustical effect again converges. Consequently the experience of *Tolerance* (the perception of the miss tuning of norms) applies equally well to both camps. Again, the two continents interpenetrate each other in a strange loop. We find a form of Universal Mixture that I have named *Universal Tolerance*.

In the fourth instance, various specific regular systems of irrational harmony (commatic, enharmonic, etc) exhibit different characters and different levels of resolution. Each system has its own peculiar features unique to it. Yet they also sit within each other or inhabit each other like Russian dolls. I call this property *Nesting*. Each system forms a variant of the same thing and of each other. What is found in one system can also be found slightly modified in another system. Here we have yet another way in which 'everything is in everything.'

These examples show that the principle of 'everything in everything' applies to harmonic materials in a peculiarly intense manner. Harmonies are prone to this characteristic because they constitute wholes within wholes. These principles break down and become vague 'metaphysics' when taken away from the harmonic context and applied to material substances.

ORPHIC ROOTS

So far my essay has focussed on the main issues of early Greek philosophy. I began with the easier concepts, such as the opposing forces of Love and Strife. I left the more difficult issues, such as Universal Mixture, until later. For the rest of my essay I want to change tack, introducing a historical perspective. What follows is more in the nature of a synopsis and a brief look at the dominant personalities.

We begin with the roots of the movement. What motivated early Greek philosophy? How and why did it come about?

A typical orthodox answer is this: Bronze Age mentality employs concrete mythological imagery and specific narratives to describe a clash of wills between a welter of gods and heroes. The old polytheism represents the Many without the One. Late in the Bronze Age, myth was straining at the limits of its expressiveness. Consequently it began

to lose its cogency. Political developments such as the growth of empires also contributed to the view that all the gods and goddesses represent attributes of a single meta-god or an 'everything-god' (***pantheos***) that becomes increasingly abstract. This meta-deity is the *macranthropus* or Cosmic Person. Out of this development the old polytheism melts down and the notion of monotheism arises—a One without the Many. This evolution lays the stage for the Milesians to make the grand leap from concrete mythological narrative to abstract scientific principles. They emphasize the One over and *against* the Many, looking for the unifying factor that explains diversity.

This widely believed theory hinges on the notion that the old polytheism represents a chaos of competing gods. But it isn't so. The relations prove to be quite hierarchical in a typically musical manner. One can always find a high or hidden god, as well as a small set of prior gods who take on the nature of the musical elements. The 'competition' between groups of gods mirrors the 'battle' between alternatives in a culture of musical pluralism.

Ancient cosmology grew out of a cultural matrix of story telling and song. Over a very long period of time a poetic language of images and processes developed that conveys an underlying musical perspective about the world. This perspective was probably largely subconscious for a very long period. As the visual sciences, especially astronomy, evolved the related mathematics left the relatively simple mathematics of Harmonics far behind. Seventh century Assyria already had decent ephemeride tables of the planetary movements, even rudimentary eclipse tables. Due to these strides the sonic sense of order became more self-conscious and began to defend itself.

Out of this cultural situation a reform religious movement called Orphism arose during the seventh century. It had its florescence in the sixth and fifth centuries—the very time of the highest musical excellence and the writings of the early philosophers.

The notion of macranthropus is mistakenly confined to the end of the Bronze Age. But it also appears much earlier in Egypt, Mesopotamia, and India. It arises out of a poetic description of the cosmic harmony as a cosmic person to be sacrificed (the One becomes Many). Moreover, the orthodox assumption that the One and the Many relate as 'either-or' is a seriously bad judgement. We can already see an implicit version of a musical perspective in the macranthropic theology of the Egyptian god Amon-Re, celebrated in New Kingdom Karnak. In a wonderfully paradoxical manner (the earliest appearance of such paradox), the god's names are countless, for he is described as the god of many forms. And yet his name is also hidden. In other words, he is both immanent (as in the realm of Becoming) and transcendent (as in the realm of Being). Other Bronze Age versions of macranthropus, such as Marduk in Babylonia and Purusha in India, have similar features. Musical perspectives have deep roots in the Bronze Age.

The early Greek philosophers were undoubtedly influenced by the notion of macranthropus. Important metaphorical terms such as ***nous*** and ***psyche*** were originally derived from parts of the cosmic person. The Milesians and their followers inherited these matters and uncovered first principles underlying the model. They also critically examined these principles. Most importantly, they emphasized problematic and paradoxical features, which led eventually to the demise of the old musical perspective.

Seventh century Greece had come out of its Dark Age, adapted the Phoenician alphabet and renewed old trade links with the Near East. Scholars call it the 'orientalizing period,' when Greece took over many cultural features from the east, such as weights and

measures, calendars, mathematics and more. In time they made their own important contributions to mathematics, especially in geometry and astronomy, but these contributions cannot be meaningfully isolated from their Babylonian-Egyptian roots. The Orphic movement was probably also imported. Perhaps it came from India, because it has so many resonances with Jain thought—especially the notions of ethical reincarnation and escape from the wheel.

The Orphic movement is highly musical in orientation. Orpheus, a legendary figure, represents the cosmic musician whose playing can influence nature. His playing mirrors the dance of the universe. He also stands for the cosmic ***mediator***, pointing to the musical progression of Means. He mediates between Dionysus (an earth god of excess) and Apollo (a sky god of moderation). Thus he is implicated in the old musical and mythological story of the separation of Heaven and Earth. Orpheus is also the patron of all rituals and rites, an arch-magus, and the patron of the Mysteries at Delphi.

The central Orphic doctrine declares that the One is the source and goal of the Many. All things are born of the One and resolve back into it. As in much Indian philosophy of the contemporary Upanishadic period, a divine immortal principle dwells in people. In Greece it is usually called the ***diamon***. It is poetically related to Soul (***Psyche***) and the elements Air and Aither. This immortal spark akin to Fire dwells among the stars (Heaven), but it then falls into a body (Earth) because of an original fault—the doings of Strife. Then it is destined to be reincarnated a number of times in successive bodies in order to cleanse the fault. To this end Orphic followers practice various purifications and initiations such as vegetarianism and the Mysteries. The fate of the soul reflects the central doctrine. The One becomes Many, goes through a cycle like the Great Year, and returns to the One in the end, there to dwell again among the stars.

Orphism appears first and foremost as a literary movement. Various poets write 'sacred discourses' (***hieroi logoi***) that they attribute to Orpheus and his proxies, such as Musaeus, Linus, Epimenides and others. Sometimes they take existing cosmogonies, such as that of Hesiod, and reinterpret them. Often they invent novel cosmogonies—stories about the birth of the gods and the world. Varieties of these creative cosmogonies have survived, but they all relate to the underlying issue of the One and the Many.

The orthodox view of early philosophy tries to marginalize Orphism, usually isolating it to southern Italy and the philosophers Pythagoras and Empedocles. This theory perpetuates the interpretation of Aristotle, who wants to see atheistic scientists in the Milesians and only vestiges of religion in the westerners.

Orphism may have arisen in the seventh century, but its literary apogee covers the sixth and fifth centuries. Then it went out of fashion during the fourth century with the rise of athenocentrism (Plato and Aristotle). During later times and the Roman period Orphism made a comeback and regained prominence. However, by that time it had somewhat mutated into variant forms perhaps better called Neo-Orphism, with its links to Hermetic and Gnostic philosophies. It was no longer the original Orphism of the early philosophers.

A musical perspective no longer marginalizes Orphism from philosophy. The paths converge. Most of the issues that animate early philosophy can be entirely integrated with Orphic concerns. Indeed, the books of the early philosophers form the intellectual wing of Orphic religiosity.

THE MILESIAN HEGEMONY

Aristotle's notion of an abrupt dichotomous shift from a pre-rational mythological poetic cosmology to an abstract rational scientific one written in prose is just wrong. The vagueness of the line between the poets and the prose writers can be seen in the case of Pherecydes, a prose writer roughly contemporary with the Milesians. In his own version of the Orphic ideology, he says that the world began due to three eternal principles: ***Chronos*** (Time) coupled with Zas and Chthonie, equivalents of Heaven and Earth. Chthonie takes the alternative name Ge when she receives a cloth (the matrix) as a wedding gift. Elsewhere he speaks of the mythological battle between Kronos (equivalent of Chronos) and Ophioneus (the Snake), bringing up the old theme of Love and Strife. According to some reports, his book was called '*The Recesses*,' hinting at the progression of Means. Thus Pherecydes, who may have been a teacher of Pythagoras, mixes mythology and science in support of an Orphic agenda.

Greek philosophy 'proper' begins with the three great Milesians: Thales, Anaximander and Anaximenes. They lived close enough together in place and time to have studied with each other and influenced each other. Later Greeks speak of a Milesian School with a common cosmology. Even though the three personalities are quite different from each other, their doctrines prove entirely compatible. The language, concepts and the problematic of the whole movement was set in place by the Milesians. Later philosophers react to it, make implicit aspects of it more explicit, and spin out various implications already present in the Milesians themselves. Their influence within the movement itself cannot be overestimated.

Thales, the first Milesian, was active early in the sixth century. He proves very elusive because he never wrote a book. Apparently he had connections with Egypt, and his own ancestry ties him to Phoenicia. Thales had a wide field of interests, including astronomy, mathematics, engineering and politics. Such wide interests became the norm in early philosophy. The later Greeks honored him (not Pythagoras) as the father of astronomy and mathematics, especially geometry. Euclid attributed to him the theorems relating to the Geometric Mean, which is the gateway to the esoteric aspects of musical tuning. Thus it is reasonable to credit him as the source of the important long-lived debate between rational and irrational harmony. Like Pythagoras, who also refused to write a book, he had an esoteric side, seen not only in the Geometic Mean but also in his commentaries on the musical element Water—one of the most multifarious and difficult of the elements. In him we already see the Orphic-Milesian notion of a World-Soul that dominates Anaximenes.

Anaximander must have studied with Thales. One of the greatest of all the Greek philosophers, he was brilliant, profound and progressive. He dressed theatrically, like Pythagoras and Empedocles, and wrote in a distinctive prose rich in colorful images and metaphors. His book (the earliest Greek philosophical book) covers a large variety of topics and sets the pattern and standard for the whole movement. His doctrine supports Orphic notions. The One, which he calls the Seed (equivalent to the Orphic Egg), splits into the primal opposites based on Heaven and Earth. The opposites then generate the *vortex* or matrix of relations, ruled by ***apokrisis***. Motion is eternal and cyclical, ruled by Time and Necessity. The power of ***apokrisis*** creates the possibility of 'innumerable worlds.'

Anaximander faced the deeper and more problematic aspects of the musical paradigm. Due to the possibility of infinite divisibility, one must move beyond the old digital conception of ***harmonia*** and aim for an analog conception. One must include as generators not only the traditional elements but also the n-limit and the irrationals, the All. Hence the octave space between Heaven and Earth is reconceived as a continuum or plenum of 'elements' abstractly described as 'hot and cold.' Every harmony consists of some mixture of the primal opposites, exhibiting patterns of justice and injustice, ruled by the necessity of the arithmetic and the power of Time. Anaximander applies this framework to any context, for example, that of the planetary pattern and the interplay between Air and Water in meteorology.

Anaximenes was active around the mid sixth century. His work is entirely consistent with that of Anaximander, a refinement of the same world-view. Anaximander's 'hot and cold' is further refined to 'rare and dense.' The metaphorical language of musical meteorology reaches a high level of development. Anaximenes wanted a 'super-element' to replace the traditional elements. It would describe the phase-changes within the analog continuum bounded by the original opposites. He chose the most appropriate element, Air, as his 'meta-element' because 3-limit harmony can simulate 5-limit harmony, indeed, the n-limit. He describes the analog phase-changes poetically as the modifications of Air. When rarified it becomes Fire, when thickened it becomes Clouds, Water and Earth. Thus he has presented the analog continuum but preserved the old poetic descriptive language of the traditional digital elements. This compromise or softened radicalism gives his cosmology great power and influence. Later philosophers equated Anaximenes with the Milesian school as a whole. Within the movement itself, most philosophers considered themselves followers of Anaximenes. It was only due to the abuse of Plato and the shabby treatment by Aristotle that Anaximenes was demoted to secondary status.

Anaximenes also explored the various related poetic meanings between Air, Wind, Breath and Soul—the TRIAD. He emphasized the Orphic doctrine of the World-Soul and the relation between the microcosm and the macrocosm. Aristotle wanted to see him as a naïve but scientific atheistic monist, but he is rather an eclectic and syncretic figure with a strong religious side. He had an enormous influence, especially on Pythagoras, Heraclitus, Anaxagoras and Empedocles.

Within the overall progressivism of the Milesians, Anaximenes represents a centrist perspective more willing to compromise with the old poetic language. Anaximander is less compromising, more insistent on the radical implications of the One as the All. He spearheads the progressive tendency among the writers. In the next generation of philosophers we see Pythagoras and Xenophanes, who were both born around 570 B.C. and active later in the sixth century. In this crucial generation the differentiation between conservative and progressive tendencies becomes more pronounced. Pythagoras presents a conservative reaction to the seminal Milesians, though he still takes much from Anaximenes. Pythagoras defends the digital perspective. Xenophanes accentuates the radical aspects of Anaximander and initiates the Eleatic school.

THE PEAK

The pivotal generation of Xenophanes and Pythagoras is followed by that of Parmenides and Heraclitus. Both of them were born around 540 B.C. and active around the end of the sixth century. Actually, we have an alternative date for the birth of Parmenides, 515 B.C., but it is far less likely. The reference to the late date is found only in one source, a particularly satirical passage within a notoriously difficult dialogue by Plato. Even though this date is dubious, most modern scholars prefer it. The reason is simply this: the late date props up the standard orthodox interpretation of the movement. Interpreters want to treat Heraclitus as the last of the naïve monists, groping to make progress but still not yet capable of Parmenides' metaphysical 'ontological principle.' They want to split the whole movement into the two halves that are called pre-Parmenidean monists and post-Parmenidean pluralists. I contend that this interpretation is an unfortunate Aristotelian anachronism that damages our understanding of the movement. Heraclitus and Parmenides can best be understood as contemporaries who together make the highest expression of the presocratic problematic. Parmenides stands for the radical left, and Heraclitus the centrist position inherited from Anaximenes.

Parmenides and Heraclitus have much in common. Both of them love paradox, a trait they inherited from Xenophanes who was, if not a direct teacher, then certainly *the* major influence. Both of them cultivate a certain compression and obscurity of expression. Their writing styles demand multiple translations in order to bring out alternative meanings. More than any other philosopher they use deliberate puns and grammatical ambiguities to throw up walls that we must climb. The effort is worth it. It leads to a broad perspective on the whole movement.

I have already outlined Parmenides' amazing take on the One as the All or the Whole. He brings out an aspect of the Musical paradigm that is paradoxically unmusical (timeless, motionless), since the Musical paradigm is naturally ruled by Time and eternal motion. However, even this extraordinary achievement does not do justice to his remarkable poem. He also gives support for the Milesian philosophy of Becoming.

Topics to be found in the surviving fragments of the poem include: the renowned pathway between the One and the All, the gift of the goddess, the contradiction between Being and Not-Being, the relation between Being and Thinking, scattering and gathering, the circle and sphere, the poetic theme of mortals and immortals, sense and reason, signs, need and growth, justice and generation, the All as paradoxically indivisible, the continuous plenum, limits, color and place, the plenum as a sphere, truth and seeming, the opposites as Fire and Night, the assignment of powers, necessity, musical astronomy, the central goddess who steers all, Love and Strife, sun and moon, mind and limbs, medical issues, naming and becoming, and the naming of the Whole.

Needless to say, I cannot do justice to his work within the tight format of this essay. I will just say that his poem concerns the paradoxical relation between truth and seeming.

Heraclitus also achieved fame for his obscurity, but he is easier to fathom than Parmenides because he inhabits a centrist position. In fact, Heraclitus is the ultimate centrist. His eclectic genius syncretizes the essential core of the philosophies of Anaximander, Anaximenes, Pythagoras and Xenophanes. He throws light on all of these figures.

In my estimation Heraclitus wins the prize as the greatest single early Greek philosopher—though I admit that he as strong contenders in Parmenides, Anaxagoras,

Empedocles, Anaximander. Heraclitus wins the prize not because of some new doctrine as such, rather for the powerfully dense expression of the common Musical paradigm. He says more with fewer words than any other philosopher. He writes short oracular prose statements in a unique style demanding multiple translation and long reflection. They are somewhat like Zen koans. In Heraclitus we see an Orphically inspired religious figure expounding some revelation from the Muse. Plato called him 'the Ionian Muse.' Scholars tend to think that he wrote in an ambiguous manner because his doctrine is so obscure that he struggles to express it in words. But his doctrine is *not* some isolated eccentricity. It is the same prevalent Musical paradigm. He just wants to bring out deeper and more paradoxical features of it.

His central position on the spectrum between conservatives like Pythagoras and radicals like Xenophanes appears over and over. As an excellent example, take the issue of the void and the plenum, a litmus test for conservatives and progressives. Most philosophers sit on one side of the fence or the other. But in one of his pronouncements Heraclitus says that 'it' is *both* a void and a plenum. He forces us to think over why this is so. He leads us deeper and deeper into the musical model. And he does this kind of thing repeatedly, a catalyst for further insight.

Some of the topics for his commentary include: the meaning of various religious practices, on human and divine knowledge, truth and seeming, on the scarcity of true revelation, on methods of inquiry, on various senses of ***logos***, on ***harmonia***, on the transmutation of the elements (a complex topic I cannot pursue here), on musical astronomy, on the Great Year, on Fire as the One or MONAD, and on the unity of opposites—perhaps his central theme. He also sheds light on various Orphic issues, such as: motion and change within the soul, the soul as a microcosm, sleep, death, awakening, consciousness, the senses, reincarnation and the judgement of the soul. Then we also see issues relating to ethics, politics and medicine.

In this essay I have purposely refrained from making many quotes from the old philosophers. Yet I have allowed myself several quotes from Heraclitus. They serve to illustrate how illuminating he can be. Over a hundred of his short, gnomic sayings have survived. Throughout history many people have been perplexed and fascinated by them. No one has ever been able to put them into a canonical 'correct' order because they have so many interconnected senses and references to each other. Surely they rank among the greatest treasures of ancient philosophy.

DIALECTIC

Heraclitus and Parmenides prove to be hard acts to follow. In the next generation we find three figures of interest but of lesser importance.

Hippasus was probably born about 520 B.C. and active early in the fifth century. He may have been a direct student of Heraclitus. At any rate their doctrines appear to be quite similar. Fire is the first principle (MONAD) and it transmutes into other elements by condensation and rarefaction according to necessity and the power of Time. Later writers also called Hippasus a Pythagorean, and this interpretation seems plausible since he came from Metapontum in southern Italy—a stronghold of Pythagorean politics. He may have been a link between Heraclitus and Pythagoras, a student of both of them.

But Hippasus was apparently no ordinary Pythagorean. According to later writers he was a rebel, a scapegoat, or even a rival of Pythagoras in the community. The Pythagorean movement quickly split into two camps: the conservative *acusmatici* (hearers) and the progressive *mathematici* (scientists). He headed the progressive faction. According to one late story he was punished for revealing secret doctrines relating to irrationality and incommensurability. In other words, he probably favored irrationals. Other late stories say that he fostered musical research, discovered the musical intervals, and uncovered the classical Means. None of this has much historical credence, but it does show the difficulty in assigning persons to one camp or another. According to the later Sophists the Pythagorean School was an arch-enemy of the Heraclitean School, but when we look below the surface they have much more in common than not.

Our second figure is Alcmaeon of Croton in southern Italy, born about 510 B.C. He was a medical man and provides a window into early medical philosophy. Medicine is *not* a peripheral issue in early Greek philosophy. Most early philosophers had both a theoretical and a practical interest. Indeed, Pythagoras may well have moved to Croton because of its famous medical school. Alcmaeon was most likely a Pythagorean. One can also find medical issues in the surviving fragments of Heraclitus, Parmenides, Anaxagoras and Empedocles.

Alcmaeon wrote a book covering many topics, not just medicine. His astronomy, like that of Pythagoras, is derived from the Milesians. He supports eternal motion, the Orphic cycle of the soul, the ***daimon*** as the immortal aspect of the soul, the self-motion of the soul, and other Orphic matters. He separates truth and seeming, things seen and unseen, human and divine knowledge. He makes commentaries on the senses, explaining them by dissimilars (like meets unlike). He associates different senses with particular elements, though not so clearly as in Indian philosophy. He mentions passages (***poros***) that connect senses to the brain. Many scholars consider him the discoverer of the theory of pores, but it can already be found in Heraclitus and is probably present in the Milesians. He discusses sleep and consciousness. He connects together elements, opposites and reciprocals. He says that health arises out of a balance (***isonomia***) between opposites. Disease comes about through an excess of 'hot and cold.' All of this is consonant with Heraclitus and the Milesians.

Our third figure is of much greater importance because he had a major influence on the development of skeptical Sophism. I refer to Zeno of Elea, a direct pupil of Parmenides and the author of a famous collection of paradoxes. He was born about 515 B.C. Zeno formulated the procedures of *dialectic* or negative logic, the means by which statements can be deconstructed or disproved. The simplest form of the procedure is called the *dichotomy-and-dilemma* structure. A question is first dichotomized into either **A** or not-**A**. Then the dichotomy is turned into a dilemma by disproving both alternatives rather than just one. Zeno provides the additional technique of *infinite regress*, an aid in the disproof of the two links of the dichotomy.

The dichotomy-and-dilemma structure can already be found in a modified form in Parmenides. The proposition (something comes into being) is dichotomized into **A** (it comes from Being) or **B** (it comes from Not-Being). Each limb is then shown to be impossible. Therefore he affirms the counter-thesis (Being is unchangeable). Parmenides is still using it here in a positive sense to prove the counter-thesis. If **A**, then either **B** or **C**. Neither **B** nor **C**, therefore, not **A**. But it could also be used in a negative sense to

destroy any proposition. Parmenides uses it as a 'truth' in paradoxical support of a 'seeming.'

Zeno used his arguments to disprove plurality, motion and time. Take, for example, the 'Dichotomy.' One can never traverse a given finite space, since one would first have to get halfway across it, then halfway across the remaining distance, then halfway across what still remains, and so on ad infinitum. The infinite regress builds upon the assumption that space is infinitely divisible. Note that this paradox still potentially comes out of a monochord context, since it involves the division of a line segment and invokes the old Milesian issue of infinite divisibility. Zeno goes on to prove that space and time must be either continuous or discontinuous (plenum or void). In either case motion is impossible. Moreover, if time is continuous there can be no present, and if time is discontinuous there can only be the present (thus no change). If space is continuous there can be no here, and if space is discontinuous there is only here (thus no motion).

Zeno presented a large number of such arguments (some say forty). He uses them to defend Parmenides, but they could also have been used against him. What makes Zeno so unusual is his refusal to claim any distinctive views of his own. He claims pointedly only to be a defender of Parmenides. Later in the fifth century the skeptical Sophists took such arguments to heart and used them to attack any theory at all. Aristotle eventually pointed out the flaws in their methods. His criticism of their logic led to the formulation of proper logic and what we moderns call the laws of thought. Meanwhile the Sophists used the negative dialectic to utterly destroy the architecture of the old Musical paradigm.

LATE MASTERS

Anaxagoras and Empedocles are near contemporaries. Anaxagoras was born in 500 B.C., Empedocles in 492. Both were active toward the middle of the fifth century. They together hold a special place within the history of early Greek philosophy. For they represent the last generation of greats before the rise of the Sophist movement. Various sophists increasingly dominated the second half of the fifth century.

Moreover, a larger body of fragments has survived for these philosophers in comparison to earlier figures. Within these fragments can be found practically every issue that animates the movement as a whole.

Much of the credit for the relatively good inventory of fragments must go to Simplicius, who made extensive quotes. He was drawn to them because Aristotle focussed mainly on Anaxagoras, Empedocles and Democritus when he discussed early philosophy. Aristotle tended to use these three to represent the movement as a whole. Now Democritus is a special case, being active much later—towards the end of the fifth century. But Anaxagoras and Empedocles do admirably represent the progressive and centrist strains of the movement. They sum up the dominant tendencies.

The progressive Anaxagoras wrote in a lofty direct prose that nevertheless did not shy away from paradox, especially in consideration of the religious ***nous***. The centrist Empedocles wrote in flowery poetry that cultivates an artfully measured ambiguity. Both philosophers must have looked back to Heraclitus for inspiration. Sometimes in Anaxagoras one finds such profound compression in his expression that he rivals Heraclitus. He provides a window into many issues only hinted at in the meager

fragments of the Milesians themselves. Anaxagoras has something to say about many vital topics: infinite divisibility, infinite types, the plenum, the vortex, preponderance or proportionality, opposites and reciprocals, mixture and separation, universal mixture, the importance of ***nous*** as mediator, and more. In Empedocles we also find many of these themes, along with cyclicity, Love and Strife, the nature of the elements, the Orphic pathway and so on. Between them one can find practically every subject of interest in the movement of early Greek philosophy.

These two philosophers share much in common, most notably an affirmation of the plenum. However, they differ in the path to that end. Empedocles poses a handful of Roots with their innumerable compounds, an extension of traditional harmony. He leans somewhat toward the conservative Pythagoreans, though he is best compared to the centrists Heraclitus and Anaximenes. Anaxagoras favors innumerable Seeds and their growths, in other words, n-limit harmony. In addition, Anaxagoras is quite comfortable both in rational and irrational harmony, and he moves effortlessly between them. For rational harmony he uses the term Seeds, the equivalent of Empedocles' Roots. For irrational harmony he uses the term Parts, a term perpetuated by later musical writers, such as Aristoxenus. Anaxagoras shows himself to be very musically astute. He was, after all, the teacher and friend of the great dramatist-musician Euripides.

As an example of the musical proficiency and brilliance of Empedocles, take this statement, which has often been judged his most important scientific pronouncement. He says that Roots and their compounds '*run through each other*' and come to be different things or appearances at different times, depending on where they sit in the mixture; and yet they remain always and continuously the same. Such problematic statements have proven perennially difficult for interpreters, because they try to squeeze them into the context of Aristotelian substances. It just isn't clear how a 'stuff' can be both the same and changing in appearance.

But all of these problems disappear when we put it back into the context of Harmonics. Take our two sample harmonies 3:4:5:6 (C G Eb C) and 4:5:6:8 (C Ab F C). Now look at the number 6, a compound of the prime roots 2 and 3. It is found in both harmonies, so that we can say that it has remained the same. But its function has changed according to where it sits in the mixture. The same numbers can yield differing 'appearances,' in this case the pitches 'C' and 'F.' Empedocles draws out various implications of the musical model.

In the same way, the pronouncements of Anaxagoras pose huge difficulties when interpreted within Aristotle's framework. These problems evaporate by shifting to Harmonics. One can find an excellent example in his commentary on ***nous***, a place where he employs maximum compression and paradox, even contradiction. Of course, he does this in order to accentuate its religious significance.

In one place he says that everything is mixed with everything except ***nous***, which is unmixed, alone, and the controller of everything else. Yet in another place he says that ***nous*** is nevertheless mixed, in contradiction to its being absolutely unmixed. Moreover, he says that ***nous*** is present where everything else is. These statements make no sense from the standpoint of the mixture of material substances. Due to the influence of Aristotle, scholars have interpreted ***nous*** in a crude dualism with matter, either as absolutely immaterial or else as a vague something with vestiges of materiality present. The 'three ways' of early philosophy became the dualism between Mind and Matter.

Anaxagoras is just bringing out the special features of ***nous*** as mediator between Being and Becoming. The DYAD is paradoxically unmixed because it forms the 'mixing bowl,' the place where mixtures are made. In this sense it stands apart from the mixture, as it is the controller of mixture, yet it sits in the same place where everything happens. Anaxagoras has more significant things to say about ***nous***, but I must forego them here. Suffice it to say that his commentaries on ***nous*** constitute one of the highest moments in the whole of ancient philosophy. We must thank Simplicius for taking the trouble to quote them.

Aristotle liked to contrast Anaxagoras and Empedocles, showing Anaxagoras to be the loser in the process. He preferred Empedocles because he wanted a limited number of elements and because it was easier to distort Empedocles into his own system. He had more problems with Anaxagoras, like his problems with Parmenides and Anaximander. They just could not be fit into his mold. Consequently he misrepresented Anaxagoras on occasions. With the earlier philosophers he preferred to sideline them when he could. Once we have an understanding of the various ways that Anaxagoras and Empedocles were abused by Aristotle, then we are on the road to understanding the old school.

DECLINE

The dialectical arguments pioneered by the Eleatics were increasingly employed to refute any and every doctrine. An extreme skepticism took hold, leading to the birth of critical analytical philosophy as we know it. Early philosophy was essentially religious and revelatory. In spite of the differences between conservatives, centrists and progressives, the movement formed a unified response to Orphic sensibilities. After the middle of the fifth century atheistic sophists set the philosophers against each other for the sake of a good argument. At the same time, Orphism went out of fashion, not to be revived until the Hellenistic era.

In the second half of the fifth century we still see philosophers of the old school, but they were increasingly secondary in importance. The old flame diminished.

The most important Sophists are Protagoras (born about 485), Antiphon and Georgias (about 480), Hippias (about 475), Socrates and Critias (about 470), Cratylus and Prodicus (about 465), and Antisthenes (about 455). I could go on but we are leaving the 'presocratic' period behind. The Sophists as a group (not Socrates alone) form the great divide within ancient philosophy. Socrates was himself a Sophist in his methods and his skepticism.

Perhaps the Sophist movement is best epitemized by the remarkable book of Georgias, called *On Nature* or *On Not-Being*. It is the earliest extant example of a total dialectic. He reduces to absurdity the central questions of ontology, epistemology and semantics without positing any counter-thesis. By using the Zenonian method of dichotomy-and-dilemma as well as infinite regress, he proves that: 1—nothing exists, 2—if anything does exist it cannot be known, and 3—if anything could be known, it still could not be communicated to anyone. We cannot discount a certain element of satire here, inherited from Xenophanes and the other Eleatics. This sort of work marks the death of the old school.

Of course, we still find philosophers of the older sort, but they tend to be eclectic figures who act mostly as defenders of the older masters. Archelaus (485?) defends

Anaxagoras. Melissus (about 480) defends Parmenides. Philolaus (about 470) defends Pythagoras. Leucippus (470?) is a shadowy figure best lumped with Democritus (born 460). Diogenes of Apollonia (460) defends Anaximenes, among others. Hippon (460?) is a minor eclectic. Strictly speaking, Diogenes and Democritus are not presocratic, since Socrates was born about 470. When I say that the late philosophers were secondary figures the important exception is Democritus, who is clearly a major writer. But he is not of the old school. In him we see very different issues and sensibilities that have little to do with early philosophy.

Archelaus defends Anaxagoras but he says very little that is new. Our main interest in him derives from the fact that he was a teacher of Socrates. One would therefore expect Socrates to have some sympathy with or at least knowledge of Anaxagoras' work. Yet Socrates claims that he knows little of Anaxagoras, and only second-hand from books. This seems odd because Anaxagoras, Archelaus and Socrates all lived in Athens in overlapping times. This peculiar situation reminds us that the Socrates we know is largely a literary creation of Plato and not necessarily historically accurate. Plato hates Anaxagoras, rarely ever mentioning him in his voluminous writings, and then only in a satirical polemical or demeaning manner. He uses Socrates as a mouthpiece for these attitudes.

Melissus defends Parmenides and is often called a late Eleatic, even though he came from Samos in the east. He wrote in prose rather than verse, made no claims to divine inspiration, and argued his theses more lucidly than Parmenides. Thus he follows the historical trend—more emphasis on logical argument, less on revelation and religious attitudes. Melissus disagrees with Parmenides on two points. Instead of a Timeless present he posits the temporally infinite. Instead of the One being spacially finite in accord with monochord realities, he favors the spacially infinite. Thus he also exhibits the trend away from monochord fundamentals.

Philolaus, the defender of Pythagoras, is a more important figure because he serves as a window into Pythagorean philosophy. I have not said much about Pythagoras in this essay for the simple reason that little can be said with any certainty. But now we have a new problem. How much of Philolaus comes from Pythagoras and how much is original to him? Then we have the controversy over whether he was a Pythagorean *at all*. Perhaps we should best treat him as an autonomous agent. At any rate one finds little in the fragments that could not come from any early Greek philosopher. For example, he defends the Limited and Unlimited. He says that harmony requires both like and unlike entities. He makes some classification of numbers. One also encounters a set of specifically musical fragments that may or may not be authentic. They show him to be musically astute. By far his best fragment says essentially that the 8:9 wholetone can be resolved into nine commas. This statement constitutes the earliest extant reference to the commatic resolution in Greece.

Aristotle made a study of the Pythagoreans and it is likely that he based it mostly on the book of Philolaus. But now we have another problem. How much of what Aristotle reports comes from Philolaus and how much from earlier sources? Aristotle demeans the Pythagoreans and sometimes misrepresents them in order to attack Plato. He attributes to them a peculiar and very unmusical number theory and saddles Philolaus with the eccentric 'counter-earth' cosmology. On a more solid footing he presents the doctrine of the harmony of the spheres (the planetary monochord division), but he doesn't

give the numbers. After much detective work involving all of the ancient references to the division, I have concluded that the most likely division for the planetary harmony employs the 5-limit diatonic ogdoad harmony ruled by the double 72:144. When dealing with Pythagorean materials Aristotle forms his most polemical stance.

Leucippus may have come from Elea or from Miletus, and that sums up very well the uncertainties surrounding him. He may have invented the atomic theory (atoms and the void) that he taught to his illustrious pupil Democritus. However, forms of proto-atomism were probably already in existence, for example among some Pythagorean circles (numbers as atoms and the void). Atomism can even be implicated in Anaximenes because the lack of fragments mean that he may after all have confirmed the void. If this is the case, then Anaximenes may come close to atomism. Like Anaximenes, Democritus preferred the irrational.

Democritus was an extremely prolific writer, but almost everything has been lost. This situation is due mostly to the inordinate power of Plato and his school. For Plato hated Democritus and refused to even mention him in his many writings. In spite of this stance he felt no qualms in stealing a form of atomism for use in his *Timaeus*.

Plato and Democritus present totally opposing ontologies. For Plato, at least in his middle-period dialogues, the phenomenal world is unreal and derivative, a shadow of the noumenal world of Forms that alone is real. Democritus took the opposite route, sometimes called phenomenalism, relativism, or subjectivism. Nothing is accessible to the knowing faculty except subjective experience. Appearance is the only reality. If I say that the room is hot and you say that it is cold, we have no possibility of reconciling the views because there is no accessible objective criterion to consult. Objective truth is unreal, a misunderstanding of the human condition, and not the proper concern of philosophy. Democritus is atheistic, and contends that personality and consciousness, like everything else, are temporary by-products of atomic combinations.

Thus Democritus is a child of the skeptical Sophists. In turn, he influenced what can be called the skeptical-phenomenalist strain of Hellenistic philosophy. It can be seen, for example, in Pyrrhon, and reached its highest expression in Sextus Empiricus.

The last of our philosophers, Diogenes of Apollonia was a contemporary of Democritus. Much of his book concerns medical issues and he was probably a practicing doctor. He wrote against the Sophists and defended Anaximenes, thus showing that, even at this late stage, the Milesians still had considerable influence. Diogenes reaffirms Air as the meta-element that transforms itself into other elements by condensation and rarefaction. He argues that the elements could not blend unless they amount to the same thing below the surface.

Diogenes draws an equivalence between intelligence or thought (***noesis***) and Air or Soul (***psyche***). The term ***noesis*** is closely related to ***nous***. In effect, he cryptically says that the DYAD and the TRIAD are identical. Nor is this confusing statement confined to Diogenes. It can also be found in Anaxagoras and potentially even in Anaximenes. Perhaps the statement is meant to emphasize the fact that the two archetypes are always found together. Air as a super-element tends to take over the characteristics of the other elements. At any rate, this statement and the whole notion of a meta-element supports an irrational perspective on ***harmonia***. In a tempered environment the traditional primes lose their separate status. According to some later writers the eclectic Diogenes took over

concepts not only from Anaximenes and Anaxagoras but also Leucippus. Atomism also tends to support the irrational perspective.

PLATO

Aristotle's revisionist interpretation of early philosophy would have been impossible without the remarkable work of Plato, who was for a long time his teacher. Plato was born in 428 B.C., the same year that Anaxagoras died. Between them lies the continental divide of the Sophist movement.

Plato can be summed up in two ways that are not necessarily incompatible with each other. He is the grand syncretist and also the skeptical satirist.

He made an elaborate synthesis consisting of many themes from early philosophy. Indeed, practically everything in Plato has some reference to the movement. From Heraclitus he took Becoming and the states of the soul. From Parmenides he took Being, truth and seeming, knowledge and opinion. From Pythagoras he took number mysticism, the planetary harmony, Limited-Unlimited. From Empedocles he took elements, opposing Forces, and the cosmic cycle. From Anaximenes he took the World-Soul. From Anaxagoras he took Mind and the Forms. From Thales he took esoteric geometry. From Xenophanes he took the satirical stand. And from Zeno he took corrosive dialectic. He makes numerous references to every major philosopher, yet rarely ever acknowledges their contribution. He rarely ever quotes them, but shows himself to be totally in command of the old literature. Yet at the same time he feels no responsibility in presenting it accurately. Instead he plays with it in a corrosively polemical and satirical manner. He makes it material for an entertaining if inconclusive conversation.

Plato also demeaned Orphism, and yet he also perpetuated various Orphic themes, such as the exiled god, reincarnation, purifications and knowledge as recollection.

As an example of Plato's methods, take the *Cratylus*. The dialogue outwardly concerns the 'correctness of names.' Much of the banter consists of imaginative etymological analyses for a variety of names. However, just below the surface he makes almost constant allusions to the sayings and themes of Heraclitus. The dialogue is like a homage to Heraclitus, but he studiously avoids mentioning his name directly—his name appears only twice in the whole dialogue. Without a background familiarity with the sayings of Heraclitus, one would never suspect that the dialogue has anything to do with Heraclitus. The work also displays an elaborate glossary of musical terms. The etymologies mostly relate to terms about movement, flow and change. Plato must have written this dialogue as an entertainment for an elite audience that understands the veiled references, puns, innuendo and polemic surrounding the old philosopher.

Plato says himself that he likes to mix 'comedy with tragedy,' satire with seriousness. Nor is he bound to be fair to the old philosopher. For on the very last page of the dialogue he names Heraclitus directly and attributes to him the fatal doctrine of universal flux. Thus the *Cratylus* is not a loving or accurate homage to Heraclitus. The dialogue forms a satirical send-up with no clear commitment to Heraclitus. Indeed, he takes great pleasure in doing damage.

It proves quite difficult to find *any* commitment to a clear position in Plato. In one place he defends a doctrine, in another place he demolishes it with caustic dialectic. Even his famous theory of Forms finds defense only in his middle dialogues. In the late

dialogues he undermines it. Plato uses all the tools and sensibilities of the Sophists. Divide and conquer. One of his greatest ruses consists of his claim to be anti-sophist. In actuality he is the very king of the Sophists.

Plato himself said that he doesn't trust the written word. He reserves for oral teaching his true intentions and deepest thoughts. Aristotle gave some details about the unwritten doctrines, and said that some were different from (not only additional to) the written work. Some aspects of these doctrines have also been revealed through the writings of the Academy and the Neoplatonists. This whole issue of the unwritten doctrines underwrites the difficulty in finding out Plato's true stance—if he even has one!

Even when we concentrate on his middle dialogues with their elaborate system of Forms that seems to defend Pythagorean musicality, we cannot trust his take on Pythagoras. The early philosophers consistently defend the One (Being) and the Many (Becoming) as both real and mediated by ***nous***. The antimony lies only between Being and Not-Being. The key to understanding early philosophy lies in a clear awareness of the musical properties of the DYAD (a unity of opposites). Plato deliberately mutates the DYAD away from its musical base and makes it the formless *Other*, the 'indefinite dyad' or *tabla rasa* to be imprinted with Forms. Only the MONAD is real and knowable because only what is unchangeable can have an *essence*. Becoming is now allied with Not-Being as unreal and unknowable.

Plato proceeds to make a *gradational ontology* in which some things exist more than others. At the top of the pyramid sits the One—the only real existent. Then comes the principles of the Ideas—Being, Mind, Sameness and Difference. According to Plotinus we should add to these principles Rest and Motion. These ***archai*** then emanate the hierarchy of Forms: first Pythagorean (harmonic) numbers and their geometrical correlates, then Generic Ideas (such as the Idea of Beauty), then mathematical objects, the World-Soul, the gods, human souls, particulars, reflections of particulars, and finally (the least real) the Dyad or receptacle. Thus he makes a dualism between the Monad and the Dyad—a dualism that allows a vast all-embracing network of metaphysical forces to inhabit the middle ground. Plato includes Harmonics but only among the higher Forms. The physical world of particulars is cast out of the harmony to endure eternal and unknowable 'flux.' This warp of early philosophy is then passed off as 'Pythagorean.'

Plato liked some philosophers and disliked others. Due to his influence the star of Pythagoras rose high, while some other philosophers who are much more significant in the movement (such as Anaximander) were demeaned, ignored and abused. But even his treatment of his favorites, like Pythagoras, is not to be trusted.

Plato thoroughly mixes satire and serious commentary. He puts gems among stones. Unfortunately, he does not say directly when he is serious or not, although he often leaves clues. A large part of the entertainment for his elite audience consists of working out what is what. But even when he is not serious he provides a valuable window into early philosophy. For he displays total fluency in the themes, images, metaphors and controversies of the movement. He manipulates them with virtuosity. Also part of his toolkit is a good comprehension of Harmonics. It forms a major aspect of his unwritten doctrines. Numerous examples can be cited throughout his ouvre. I have already given one spectacular example—his disclosure of the seminal progression of Means. Because he is such a gold mine I want to give one more good example of his musical proficiency.

In his late dialogue the *Sophist* and elsewhere, Plato refers to a mysterious scientific methodology that he calls '*the method of collection and division.*' It forms the esoteric science taught to the guardian-rulers in *Republic*. Plato rarely ever says anything clear or unambiguous about it, but he does mention that it involves divisions and classifications. The subject is surely based upon Harmonics, although he never directly says so. However, in the lead-up to our relevant passage in the *Sophist* he has dropped numerous hints. He has discussed elements as letters and numbers, the issue of blending and not blending, and various Kinds or Forms. He is apparently concerned with what harmonizes with what. The method evidently involves the ability to divide things by kinds and not to think that the same Form is a different one or that a different Form is the same. He goes on to make a series of statements to illustrate the methodology of his mysterious science. Here is a short review of his statements, using as examples our sample harmonies ruled by the doubles 3:6, 4:8 and 12:24.

He says that some Kinds run though all of the Forms and link them together to make them capable of blending. Here he must refer to the octave 1:2 which is present in all divisions and controls generation. Again, he says that there exists a single Form that is connected as a unity throughout many wholes. One of the Greek names for the octave is ***diapason***, which literally means '*running through all the notes.*'

He goes on to say that we can discriminate a single Form spread out through a lot of other Forms. As an example, take the ratio 2:3. It appears in both sequences 3:6 and 4:8 where it is expressed in the numbers 4:6.

Next, he says that we can discriminate Forms that are different from each other but are included within a single Form that is outside them. No problem. Our two harmonies 3:6 and 4:8 are different from each other but both are included within the 'outside' harmony 12:24.

Then he says that we have many Forms that are separate from each other. Two examples: 3:6 and 4:8.

Thus Plato has shown '*how to discriminate by kinds how things can associate and how they can't.*' The orthodox scholarly community has expressed perennial exasperation over such obscure statements. But their difficulties arise only out of an inability or unwillingness to think musically. Instead, they treat the material as intellectual abstractions subject to arbitrary classification. Plato's problematic discourse makes perfect sense when we return to the context of the monochord. Indeed, it works *only* in that context. Thus Plato provides a window into the Musical paradigm, without being responsible to it or divulging his own position concerning it.

SUMMING UP

I conclude with a brief contrast between the orthodox position and the paradigm of Music. The Aristotelian view sees the philosophers as the earliest rational scientists. They discard the mythological narratives of the poets, in favor of naturalistic speculations about the world. They establish increasingly abstract first principles that account for the origins of everything.

Instead one can look at early Greek philosophy as first and foremost an exuberant literary movement, contemporary and akin to the Orphic writers, the lyric poets, etc. Some write in poetry, some in prose, but even the prose writers tend to use colorful

language. The intent is revelatory and oracular. Although it has a sure scientific component, it resembles more an Orphically inspired religious movement. Aristotle wanted atheistic scientists, but even philosophers who were later classed as atheists, such as Anaxagoras, are better seen as religious noncomformists. Atheism came in with the Sophists. Indeed, as late as Roman times three of the philosophers were *still* regarded as religious figures: Heraclitus among Stoics, Pythagoras among Neoplatonists, and Empedocles among alchemists and others.

The early writers don't jettison the mythological narratives, they deepen them by examining underlying first principles and the problematic that arises out of them. Just what is the mysterious relation between the One, the Many, and the All? The love of paradox arises out of a poetic-religious-artistic intent. Only with the Sophists do we find the establishment of proper analytical philosophy. Even in Zeno, who pioneered the methods of reductive dialectic, the Sophist agenda is not yet present. Among the early philosophers no schism or friction exists with the Orphic writers and with such religious institutions as the Mysteries. Some of the philosophers *were*, however, ostracized for religious nonconformity.

Aristotle wanted abstract thinkers who speculate about the natural (physical) world. Consequently, their first principles must concern matter or substance, which then defines the focus and purpose of the movement. No doubt the philosophers *were* interested in the natural world, but it must be put into perspective. They exhibit a very wide field of interests: politics, medicine, astronomy, arithmetic, psychology, ethics, magic, the arts and more. It sits comfortably within the remit of the Muses. Rather than showing a fixation on brute matter they endorse a solidly musical perspective (elements, opposites, limits) that can be widely applied to variable contexts. The first principles (***logos, harmonia, genus***) and their problematic (complexity) are firmly grounded in the culture of musical tuning (Harmonics). We can easily define alternative harmonies, but how do we model the analog All? On the deepest level, how do Being and Becoming relate to each other?

The orthodox perspective divides the philosophers into opposing camps—monist and pluralist. But such divisions first appear with the Sophists and Plato. Then it is no longer One and/or Many; rather it is One either/or Many. The classification into monists and pluralists is quite meaningless, for the whole movement recognized the One, the Many and the All. The notion that every philosopher has an individual 'system' in competition with the others also comes from Sophist revisionism. They set the philosophers against each other. Instead, the movement shows remarkable cohesion for well over a century before it began to lose steam. But it didn't evolve itself out of existence. Rather, it was set aside by skepticism. Plato and Aristotle then recycled it to suit a very different intellectual era in which ecstatic Orphism was quite out of fashion.

The orthodox paradigm assumes some sort of evolution in which naïve monism gives way to a more advanced pluralism. Instead we should recognize that the major issues already appeared early on. Later philosophers made more explicit what is already implicit. Very little evolution is actually evident. Instead, one can see three historical peaks in the movement. The first comes around the middle of the sixth century with the Milesians. Pythagoras and Xenophanes react to it. The next and highest peak comes around the end of the sixth century with Heraclitus and Parmenides. The third peak

comes around the mid-fifth century with the late masters Anaxagoras and Empedocles. After them the flower begins to wilt, but it lived on until the end of the century.

The true continental divide in ancient philosophy occurs with the Sophists, roughly a generation before Socrates. For Socrates and Plato simply further the dialectical deconstructions instigated by various Sophists. Plato uses similar arguments and distortions that he employs in irreverent ways. Although Plato solidly understands Harmonics, he takes delight in sending it 'up the river' for the sake of an engaging conversation. Aristotle, fed up with Plato's ambivalence and esoteric undercurrents, resolved to put philosophy on a new footing. He succeeded with such brilliance that his vision of early philosophy became an unquestioned orthodoxy. He buried early philosophy within his shadow.

A NOTE ON NUMBERS

In this essay I have done my best to minimize the mathematics, in order not to alienate a general readership. I have kept my examples of monochord arithmetic to an easy level. However, the ancients had no qualms in exploring rather large numbers. When Plato said that his 'city' of Magnesia has exactly 5040 'citizens,' most interpreters assume that such numbers are entirely arbitrary. They are not. Because monochord arithmetic is hierarchical, certain numbers stand out and beg for a musical interpretation. Unfortunately, one must have a solid grounding in the arithmetic in order to make any kind of judgement in these matters. In the case of the Magnesia number, it forms a particularly prominent 7-limit division. The philosophical community has never valued a musical perspective and hence has not bothered to take the trouble of gaining expertise. I often see an inexcusable confusion between Numerology and Harmonics, as if they amount to the same thing. Such errors are shocking since they demonstrate not even an elementary understanding of the subject.

Without a firm grounding in the arithmetic of monochords, a lot of the numbers used by various ancient writers become essentially meaningless. One also loses the rich associations that accompany the tunings.

I took a degree in philosophy during the 1960's after which I naturally assumed the orthodox model. However, during the 70's I did extensive research in ancient tuning methods, among other subjects. By the early 1980's I was a monochord 'expert.' I proceeded to formulate the underlying principles of monochord work, and began to notice that I had largely reproduced the conceptual framework of early philosophy! Consequently, I was forced to go back to the old fragments and reconsider them. To my surprise the fragments fit like a comfortable glove within a musical perspective. It made the corpus self consistent and eliminated the various difficulties that cling to the Aristotelian model. Moreover, it enabled me to see Plato in a different light. For these reasons I felt compelled to rewrite the history of early Greek philosophy from the new perspective.

-essay written between April and May, 2014 in Amsterdam.