The Presocratics and the Limits of Knowledge

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I. Introduction

"How do you know?" is the question that separates philosophy from dogma. At its best, philosophy vividly demonstrates the means by which we come to know and subjects those means to critical inquiry by other parties. The presocratics are considered to be the originators of Western philosophy precisely because they began to address this question in a deliberate manner. This essay will explore three very different presocratic conceptions of how we come to have knowledge, and by pointing out commonalities while acknowledging differences between these accounts, it will draw conclusions about the necessary conditions for the possibility of knowledge that are relevant for contemporary philosophy as well. The three explanations to be examined are those of Anaxagoras, Empedocles, and the Pythagoreans. Anaxagoras saw the senses as arising in mind through the destruction of opposites. Seemingly his near opposite, Empedocles thought of the senses as the affinity of effluences of the same type. The Pythagoreans, in turn, viewed knowledge as being received through a means different to either: the eternal harmony of mathematical reason with the physical world. Though these three epistemologies are radically different, if we approach them with the right attitude and

look for the underlying reasons that their proponents endorsed each of them, we will find that all three demonstrate the need for humans to have a certain kind of relationship with the universe. In order to know the world, we must in some ways be like the world. Another way of saying this, all knowledge must begin in anthropomorphism. This insight in turn suggests to us the qualities of the outermost limitations of our reason and our ability to know.

II. Anaxagoras

A. Theory

In order to gain a full appreciation of the usefulness of Anaxagoras' theory of knowledge, it is necessary to understand the way that his cosmology informs it. For Anaxagoras, the universe is such that all things contain a bit of all materials. Simplicius, one of our chief sources of knowledge about Anaxagoras, records him saying that, "In everything there is a portion of everything" (Fr. 11, all quotes from KRS). All material things are composed of infinitely small parts, and these parts in turn, are made of further sub-parts ad infinitum. The infinitesimal parts of matter are called the "seeds" of what is. These seeds come in a variety of types. There are "seeds of all things with all sorts of shapes and colors and tastes" (Fr. 4). Scholars differ on whether Anaxagoras thought the kinds of seeds are just the four opposites, or if there are a relatively large or even infinite number of them. In any case, every object is made up of an infinite number of seeds, which are infinitely small in size and contain further infinitely small seeds. Though the number of each type of seed is the same in all matter (that is, infinity), nevertheless, the individual kinds of matter visible to us and the individual kinds of seeds within matter both differ from kind to kind according to the proportions of sub-seeds that make them up. In general, "each single body is and was most plainly those things of which it contains most" (Fr. 14). Hence if the seeds of water-ness are most prominent in one object, and then object takes on the appearance of water to us, but if later that water becomes steam, then it is because

different seeds, the seeds of steam, have become most apparent, such that nothing truly passes away or comes to be.

The reason that Anaxagoras' cosmology has this seemingly bizarre arrangement of parts within sub-parts ad infinitum is that he was influenced by Parmenidean philosophy, which taught the impossibility of non-being or change. This influence can be seen strongly in, for example, fragment 17:

> The Greeks are wrong to recognize coming into being and perishing; for nothing comes into being or perishes, but is rather compounded or dissolved from things that are. So they would be right to call coming into being composition and perishing dissolution.

In order to accommodate both the apparent flux of the world and the Parmenidean logical argument against change, Anaxagoras conceived of a cosmos that allows for the possibility of change through the reorganization of things but not for the possibility of true creation or destruction of material. This property of Anaxagoras' cosmology will be important to his theory of sensation.

Of course, Anaxagoras' cosmology does not end here as a solely materialist universe of seeds. Every material thing is made up of the infinitesimal seeds of everything else; however, material things are not the only sort of things that exist. As Simplicius continues in fragment 11, "In everything there is a portion of everything *except Mind*; and there are some things in which there is Mind as well" (the emphasis is mine, of course). Thus, Mind has an ontologically distinctive existence, which is present in some parts of the cosmos but not all. Mind is unlike all of the seeds in that,

> nothing is all together separated off nor divided one from the other except Mind. Mind is all alike, both the greater and the smaller quantities of it, while nothing else is like anything else… (Fr. 14)

Hence, Mind has a unique form of existence in Anaxagoras' cosmos in that it alone can form greater or smaller quantities which are alike instead of taking on the appearance of whatever seed predominates it. Though Mind pervades space, it does not mix with the material things of this world, since,

> if it was not by itself, but was mixed with anything else, it would have a share of all if it was mixed with any… (Fr. 14)

Thus, Mind is not only distinctive but also separate from everything else. On top of this, mind possesses "the greatest power" (Fr. 14) by which it "controls all things, both the greater and the smaller that have life" (Fr. 14). Mind is the motive force of the universe, which causes the original and ongoing rotation of the cosmos in which things separated off from the primordial chaos and differentiated themselves. It is through the power of mind that ordinary matter at some times presents the form of one kind of seed, and at another time it presents the form of its supposed opposite. Indeed, all action in which opposites appear to transform into one another is in fact merely the reapportioning of seeds, since, as Anaxagoras reasons, "How could hair come from what is not hair or flesh come from what is not flesh?" (Fr. 10). As Aristotle explains Anaxagoras' thought, since "it is impossible for [it] to arise from what is not… things come into being out of existent things, i.e. out of things already present, but imperceptible to our sense because of the smallness of their bulk" (A4, 187a23). Thus, the dance of opposites is merely the play of Mind over what is unconcealed to us.

Moreover, since Mind controls the apparent change of the cosmos, "all the things that are mingled and separated and divided off, all are known by mind" (Fr. 14). As the controller of things, it is natural that Mind will come to know what is happening. However, the knowledge possessed by the overarching Mind is not the same as what is known by our individual minds. As individual intelligences, we clearly do not possess explicitly knowledge about how the universe itself rotates into being. Such knowledge must be worked out by reasoning. For us as individuals, "Appearances are a glimpse of the obscure" (Fr. 21*a*). That is, as individuals, we cannot get from appearances an accurate portrait of what is, namely, the infinity of seeds and kinds that are contained in all things, since "From the weakness of our senses we cannot judge the truth" (Fr. 21). Our ordinary perceptions do not do full justice to the world that is. It only gives us a hint

of it, in part because of the limitations of its mechanism. As Theophrastus explains, for Anaxagoras, our senses work through the interaction of opposites:

> Anaxagoras thinks perception is by opposites, for like is not affected by like… A thing that is as warm or as cold as we are does not warm or cool us by its approach, nor can we recognize sweetness or bitterness by their like; rather we know cold by warm, fresh by salt and sweet by bitter in proportion to our deficiency in each. For everything, he says, is in us already… (DK 59 A 92)

The result of this interaction of opposites is not the annihilation of the pair of course, since nothing can pass away, but it does have an effect on the individual mind. Again, Theophrastus explains:

> Every perception is accompanied by pain, a consequence that would seem to follow from his hypothesis; for everything unlike produces pain by its contact; and the presence of this pain becomes clear either from too long a duration or from an excess of sensation. (DK 59 A 92)

As Theophrastus rightly notes, this theory of perception follows directly from the other theories of Anaxagoras as its culmination. Mind is what causes the seeming change in the world, which is really just differing manifestations of a preexistent infinity of seeds. When those seeds interact in a certain way, one kind begins to manifest itself, and another becomes indistinct. This change in turn is felt by the individual mind, which perceives the presence of certain kinds of seeds in the world though the covering over of the opposite kind of seed in itself, which produces pain. It is an elegant explanation for the whole cosmos. But what value does such a theory, connected as it is to an outmoded cosmology, have for us today?

B. Critique and analysis

It is valuable to first recognize gaps in our reception of Anaxagoras' thinking. As noted before, it is not clear if the kinds of seeds are infinite in number, large in number, or merely correspond to a handful of opposites, perhaps only the Aristotelian four. Also unclear is whether the motion of matter can ever proceed from self, and hence only secondarily caused by Mind, or must always proceed directly as the result of mental initiative. Further, Anaxagoras never properly addresses the exact relationship between the

Mind of the cosmos and the mind of the individual. Are our minds just a small part of its overall whole? Or are we formally separate from it but made of the same stuff? In addition, how precisely does the individual mind come to have pain? Is the pain caused by the interaction of the opposites? Or, to the contrary, is the very interaction of the opposites caused by the individual mind, which is aware of its own actions as pain?

Nevertheless, as interesting as those question are, they are nothing compared to the one that will be foremost in the mind of any modern reader of Anaxagoras: What use do his theories have for us today? We know now about the existence of touch receptors, optic nerves, and neurotransmitters in the field of perception and about electrons, quarks, and the electromagnetic force in the field of cosmology; what use have we of outmoded speculations?

The answer is that Anaxagoras' "speculations" illustrate for us an important aspect of any conception of human perception, namely, the vital need for a causal connection between the human mind and external world. If human thought is to have any meaningful grasp on what really is, it must be connected to the process of transformations that appears to take place in the world in a manner such that it is capable of taking in information about the state of other objects in that world. In order for these connections to be meaningful, they must be reliable (though not infallible) and material. Our knowledge of the cosmos is dependent on the cosmos having a certain, knowable structure which is revealed through interaction by its affect on our own makeup. If the universe were not a place in which things have reliable interactions which we can gauge then we would be blind at best. Accurate knowledge does not need divine revelation or intuitive connection to reach us if there are causal mechanisms which regulate the material of the person's sense organs in a manner analogous to those causal mechanisms linking the repeated actions of the physical world itself.

This might seem like an obvious necessity, but this is only because it has driven home to us by later philosophers and by the scientific mindset, which is structured around

the assumption of causal uniformity. However, even in modern physics, the message of Anaxagoras can still surprise us when it is brought to our attention. For example, Heisenberg vividly illustrates the way that causal connections must be demonstrated in the physical world with his uncertainty principle. In Anaxagoras' thought, we can learn about the presence of heat only through its masking of the cool in us. So too, in the quantum world, we can learn about the location of an electron only by its interaction with, and thus disturbance of, another electrically charged particle. Without the existence matter of a sort that can affect other matter in a way that affects us, our ability to learn facts about the physical world would be limited to external revelation, and nothing but a miracle would allow us to look out our windows in the morning.

Moreover, from Anaxagoras we must take away a vivid sense of the need that sensation produce a change in our own physical state. If matter is physical, it should be known by a physical means. If it is known by a physical means, then perception must proceed on the basis of sympathetic physical changes. If matter were apprehended by only non-physical means, then there would be no inherent reason for its limitations in epistemic reach. However, as it is, "From the weakness of our senses we cannot judge the truth" (Fr. 21) is attested to by our own failures of understanding. These failures are only comprehensible if they are the product of the mutual physicality of our world and our sense organs.

III. Empedocles

If for Anaxagoras knowledge comes from the interaction of opposites since, "like is not affected by like" (DK59A92), then Empedocles may seem on the surface to be the direct contradiction him, since for Empedocles, "Thinking is of like by like" (DK31A86). To understand where there commonalities and differences lie, it is again necessary to begin with a sketch of the cosmology of the thinker, in order locate the grounds upon which his theory of sensation was built.

A. Theory

The basic premise of Empedocles' cosmos is that there are four elemental constituents of the world (four "roots"), which are brought together by a force called Love and drawn apart by a force called Strife. According to Aristotle, "he was the first to make the material 'elements' four" (DK31 A37). As a post-Parmenidean, he affirmed that, "it is impossible for anything to come to be from what is not, and it cannot be brought about or heard of that what is should be utterly destroyed" (Fr. 12) and explained the seeming coming to be or passing away of things as the mixture of the roots into new forms, which "running through one another … become different things at different time and yet ever and always the same" (Fr. 17b). When ordinary people speak about creation and destruction, "they do not name them as is right, but I myself comply with custom" (Fr. 11). Love and Strife cause these changes of arrangement continuously, so that things in the world are "now through Love all coming together into one, now again each carried apart by the hatred of Strife" (Fr. 17a).

This process not only gave birth to the cosmos, it gives rise to "effluences." All things give off effluences (Fr. 89), and they are vital to the process by which we come to know. In Plato's *Meno*, Socrates asks Meno about the doctrine:

> Do you agree with Empedocles that existing things give off certain effluences?… And that they have certain passages into which and through which the effluences travel? … And of the effluences some fit some of the passages while others are too small or too big? … And there is sight? … color is an effluence of shapes which is commensurate with sight and perceptible. (DK31 A92, Meno's replies omitted for brevity)

As these effluences are emitted and absorbed by various bodies in the world, they interact on the basis of like with like:

> For with earth do we see earth, with water water, with air bright air, with fire consuming fire, with Love do we see Love, Strife with dread Strife. (Fr. 109)

This means that as with Anaxagoras' theory, we must contain within us all of the elemental constituents of the world in order to perceive. On top of that, for Empedocles, we must also have a means of perceiving forces in action.

Not only does Empedocles' theory account for perception, it accounts for the different modes of perception (the five senses) as well. Theophrastus explains,

> perception arises when something fits into the passage of any of the senses. This is why one sense cannot judge the objects of another, since the passages of some are too wide, of others too small and narrow for the object to be perceived, so that some things pass straight through without making contact while others cannot enter it at all. (DK31A86)

Thus, one can hear a particular sound without being able to see its source or smell what cannot be felt and so forth, because of the differences in modes of sensory reception. Without the fitting of the sense organ to effluence, there is no possibility of their interaction, and without their interaction, we can have no perception.

Thought, as mentioned previously, operates in a manner similar to the senses. Aristotle explains,

> Thinking is of like by like, ignorance of unlike by unlike, thought being either identical or closely akin to perception. For having enumerated how we know each things by its equivalent, he added at the end that "out of these things are all things fitted together and constructed, and by these do they think and feel pleasure or pain." So it is especially with the blood that they think; for in the blood above all the elements are blended. (Fr. 109)

Thus, Empedocles' theory accounts not only for our knowledge, but for our ignorance. For human beings, "wit grows according as they encounter what is present" (Fr. 106). However, what is not present is not known, and what is unlike is never known. This gives us a hint of our own mental limitations. As Clement quotes him,

> It is impossible to bring [the divine] near to us within reach of our eyes or to grasp him with the hands—although this is the main road of persuasion entering the minds of men. (Fr. 133, brackets original)

Thus, when Empedocles tells the divine "is mind alone, holy and beyond description, darting through the whole cosmos with with thoughts" (Fr. 134), the basis by which he

can give us this description of what is "beyond description" can be that he has made himself into something like a god. As his work on purifications explains,

> An immortal god, mortal no more, I go about honored by all, as is fitting, crowned with ribbons and fresh garlands… (Fr. 112)

Only after one has completed the process of purification is one qualified to speak about the gods, since one then speaks on the level of a near equal. For the ordinary person, such pronouncements are impossible to make.

B. Critique and analysis

Contrasting Empedocles and Anaxagoras, one may wonder how it can plausible both that one knows by like by like and like by unlike. Both alternatives seem plausible, but when juxtaposed the very fact that both are plausible makes them seem more like idle speculation than truly informed reasoning. To untangle which of the two is correct, we must examine them each carefully. In the previous analysis, we said that Anaxagoras' account seemed reasonable, because it rested on the reliable effect of one element on the other. Empedocles, for his part, introduces the principle of like knowing like on the ground that Love binds like things together.

When we contrast both these theories with modern ones, we see that what they share is their most valuable contribution. According to modern science, when a photon hits a nerve cell in the eye, it excites an electrons in cell, and when enough electrons are so liberated, the nerve cell sends a chemical-electrical message to other nerve cells. The reason that a photon is capable of causing such a change in the eye is that electrons are the sort of particles that have an electromagnetic charge, and photons are nothing other than a quantized wave of electromagnetic energy. Under the proper conditions, the wave can interact with the electron, causing the electron to change its orbit and the wave to cease its forward propagation.

In all three models of sensation, what is important is that the perception receptor is the sort of thing that is capable being changed by what is perceived. Thus, Empedocles is essentially correct that the two sides of the perception event must be alike in their shared ability to respond to the force uniting them. Anaxagoras, on the other hand, can be defended on the basis that any pair of opposites is only a pair of opposites and not just unrelated things if they share the relationship of being opposites. That is, hot is cold's opposite because they both share the relationship of being opposite temperatures. Hot is not the opposite of loud because these two do not share a sufficient basis of commonality. Thus, even to suppose that only opposites can affect opposites is to posit a relationship between what are at core likes. Hence, both philosophers can be said to capture an portion of the truth in their account. With Anaxagoras' account, it is easier to see that what is perceived by us must be the sort of matter that can cause a change in us. With Empedocles' account, it is easier to see that what is perceived by us must share certain commonalities with us.

Another contrast between Empedocles and Anaxagoras is Empedocles' embodiment of the senses. While in all likelihood, Empedocles believed in an immaterial psyche, since he also apparently believed in reincarnation, he nevertheless posited the embodiment of thinking. Whereas for Anaxagoras thinking is apparently entirely disembodied in the cosmic and individual mind, for Empedocles thinking is literally in the blood, since it is in blood that all four elements are present in such a way that they can relate to one another. While Empedocles' speculation about the role of blood in thinking turned out to be incorrect, he was nevertheless correct that—whatever immaterial components may or may not be related to thinking—the process of thinking itself has physical correlates in our bodies. What the theories of both thinkers demonstrate vividly is the need for a connection between thought and the physical world that rests on reliable interactions based on their similarity.

What is perhaps most important about Empedocles' thought specifically is that he contributes a theory of ignorance. His theory that unlike does not know unlike is important on the one hand because it allows him to explain the differences between the kinds of senses, but on the other hand, it is even more valuable because it suggests to us our own limitations. In the case that we try to theorize about realms or beings that are totally unlike us, the deepening of our own ignorance is the only possible result. Whereas Anaxagoras' theory of knowing held that we do not realize innately the composition of the universe by seeds because the expression of certain seeds masks the perceptibility of others, Empedocles holds that our ignorance stems from insufficient congruity between the inquirer and the object. Again, these accounts may seem conflicting on the surface, but what unites them shows the insight of both. In both cases, failure to perceive rests with the lack of correlation between viewer's material composition and the world. Where we cannot build up a causal connection, whether because the connection is drown out by competing connections or due to the dissimilarity of the materials, then ignorance is sure to follow. This recognition of the preconditions for ignorance is even more interesting when contrasted with the views of the final presocratic school that we will consider.

IV. Pythagoreans

According to Porphyrius, Empedocles says concerning Pythagoras, "whenever he reached out with all his understanding, easily he saw each of all the things that are, in ten and even twenty generations of men" (Empedocles fr. 129). This is high praise, no doubt, but unfortunately for us, true knowledge of the exact grounds on which Pythagoras himself staked his claims about the world, other than his reaching out of understanding, are lost to time. As Porphyrius also records, "What he said to his associates, nobody can say for certain; for silence with them was of no ordinary kind" (DK14, 8*a*). For our purposes then, we will speak not of Pythagoras, but the Pythagoreans who followed in his footsteps, and we will presume that their beliefs reflect something of those of their

patriarch's, since they contain thought which is original and useful enough to serve as the basis for our own philosophical reflections.

A. Theory

Iamblichus writes of those who followed Pythagoras,

> There are two varieties of the Italian philosophy which is called Pythagorean. For those who practiced it were also of two sorts, the *acusmatici* and the *mathematici*. (KRS 234)

The *acusmatici* were those who preserved the oral teachings of the Pythagorean school or *acusmata* ("things heard"). The *mathematici*, as their name implies, were those who attempted to expand the mathematical insights of Pythagoras. While the Pythagoreans themselves had questions about whether the *acusmatici* or *mathematici* were more faithful to Pythagoras' teachings, whatever the case may be, both groups certainly inherited a distinct numerological lens by which to look at the world. For example, from the *acusmata* we learn that the wisest thing is, "Number; but second, the man who assigned names to things" (DK58C4). Similarly, the Oracle of Delphi is, "The *tetractys*: which is the *harmonia* in which the Sirens sing" (DK58C4). *Harmonia*, in turn, is "the finest" of the things in our power. The most powerful thing in our power is "knowledge" and so forth. All of these *acusmata* show an underlying concern for the harmony of nature which is presented by mathematics.

The Pythagoreans also had many teachings concerning the afterlife and general rules for living; however, since these teachings are not well enough known, we will not attempt to precisely piece together a unified version of their cosmology as we did for Anaxagoras and Empedocles. Instead, we will only remark on the general theme which seems to inform their composition. For the Pythagoreans, *acusmatici* and *mathematici* alike, what is important in gathering knowledge is to draw connections between the mathematical, the cosmological, and the moral. While we can only speculate about what attracted the Pythagoreans to mathematics, it seems reasonable to assume that the claim

of mathematics to possess what appears to be rigorously demonstrable "eternal truth" was a deciding factor. That is, mathematics is capable of giving a hint of facts that, like moral laws, give guidance in a range of seemingly disparate situations. By merely reasoning about shapes and numbers, one can discover surprising and novel "facts" about the mathematical "world," which can be proven to others with perfect clarity and the applied to the physical world. For example, though the Pythagorean theorem almost certainly pre-dates Pythagoras, it must nevertheless have been a source of inspiration to his followers that its truth could not only be physically demonstrated by the measuring of any well drawn right triangle no matter what its particular size or other angles, but also logically demonstrated through a well-reasoned proof. Thus, through the rise of the proof, mathematics seemingly promises to open our minds to an unbounded world of surprising but certain knowledge.

Of course, mathematics would not be the discipline that it is if it did not marry the eternality of its proofs with the practicality of its applications, forming one body of knowledge. Hence, perhaps the most interesting aspect of math for the Pythagoreans is that it seems to provide a bridge between ideas and the fleeting physical world. The reflection of one realm in another may be termed a "cosmological correspondence," if the relations of objects in one realm mirrors the relations of objects in the other. If our own universe possesses a cosmological correspondence between the mathematic idea and its physical facts, then rather than having to discover properties of the physical world through individual observation, we can merely do mathematical inquiry and in so doing reveal necessary properties of our own world. Realizing this prospect was clearly the focus of all learning for both the *acusmatici* and *mathematici*.

B. Critique and Analysis

There are two sides to the contemporary view of the Pythagoreans. On the one side, numerology of the sort commonly practiced by the Pythagoreans has generally fallen out

of favor in the modern world. The *tetractys*, for example, is no longer seen as a symbol of divine mysteries but rather as a geometrical curiosity. On the other side, post-Newtonian science has experienced an explosion of mathematization. In ordinary thought today, being scientific is synonymous with proposing an experimentally verifiable mathematical relation. Indeed, it is by no means unheard of to believe that universe is nothing other than the working out of some fundamental equation, a proposal that would have been shocking without the precedent of the Pythagoreans. Thus, the Pythagoreans have both been repudiated and vindicated by modern science and modern thinking. What is important for us is to seize on the root from which the most positive contributions have sprung up. Clearly, that root can be nothing other than the demonstrable utility of mathematics for understanding the world around us, that is, its cosmological correspondence with the world.

Another serious difficulty for Pythagorean thought, and one that was faced by the ancient Pythagoreans in their own time, is the existence of irrational numbers. Though their dogma holds that all numbers are proportionate to one another, an indisputable proof was produced that the diagonal of a square cannot be expressed as a fixed proportion of the sides. Legends have it that Hippasus was murdered for his role in the discovery. Whatever the case may be, what this points to is the fact that mathematical reasoning can lead to highly unexpected or even unwelcome results. What seems to be a matter of common sense may be refuted by hard proof, and what seems dubious may flow undeniably from what is axiomatic. This gives us yet another view of the limitedness of our ordinary thoughts, but it leaves open the hope that perhaps through such reasoning we can identify and eliminate all such errors in our thinking. Alas, however, the work of Kurt Gödel rules out this possibility. Any mathematical system of sufficient complexity will always have gaps in its reasoning that cannot be filled without creating new gaps. Thus, it seems that the dream of the Pythagoreans is dead, if that dream is taken to be the collation of all knowledge into a unified, mathematical system. However,

if we see the contribution of the Pythagoreans as mathematical thinking itself and its analogical application to the real world, then their contribution is not dimmed even if we can see more clearly now its limitations. Hence, while the goal of understanding all mathematical truths may need to be abandoned after Gödel, significant contributions by the Pythagoreans remain in place—specifically, that our world can be understood through the application of mathematical models. However, if we return to the conclusions drawn from the philosophies of Anaxagoras and Empedocles, we may be able to draw a surprising connection between the means by which knowledge is arrived at in their systems, and the kind of knowledge which is achieved in a Pythagorean system.

V. Synthesis

In previous sections, we suggested that what the cosmologies of Anaxagoras and Empedocles demonstrate is the need for our knowledge to always be grounded by connections between our minds, our physical sensory organs, and the world. These connections must be both causal and of a similar make up in order for us to utilize them properly. If these connections hold in the case of our knowledge of the physical world, then it stands to reason that they must hold in the case of our knowledge of the mathematical world as well. For the Pythagoreans, knowledge of the mathematical is the surest means of apprehending the world. It is now generally recognized that there must be some connection between the world and the mathematical which allows the mathematical to describe the world adequately, if not necessarily completely. However, it is rarely acknowledged that there must be a connection between us and the mathematical that allows us to understand it. That is, if to have knowledge in Anaxagoras' world, we must be made of seeds, and to have knowledge in Empedocles' world, our blood must contain all the roots; then to have knowledge in the Pythagoreans' world, we must be made of mathematics, so to speak, as must the world.

Thus, if we accept the mathematization of the world as a useful method of reasoning, then we must also accept the reciprocal mathematization of the mind—our minds must be somehow mathematical in their character in order for us to obtain mathematical knowledge. But mathematizing the mind is the same as "mind-izing" mathematics and the world. That is, if we suppose that the mind has a real connection to mathematics by virtue of some causally linked common substance then we are obliged to think it is reciprocal, that mathematics shares a common basis with our minds at least in part, much as we were obliged to think that there is, at least in part, a physical basis for the mind which allows it to interact with the physical world. Indeed, when we examine the process by which humans do mathematics, we find that humans themselves never enter directly into the world of mathematics in itself, just as we never enter into the physical world in itself. Rather, just as we only understand the physical world by relating it to our own composition, we enter into mathematics only phenomenologically as we observe the ways that our human minds work through the implications of the proposed rules of mathematics and then we reify these observations into a picture of a frozen mathematical world. That is, our interaction with mathematics takes its relevance from our ability to correlate it with the mental, just as is the case with the physical world. However, for this reason, math is never grasped directly as math alone, but always indirectly as our mental computations, which are composited partly of our own selves. The "noumenal essence" of math alone, math without mind, remains forever just outside of our grasp, at least in non-mystical experience.

Hence, the insight of these three presocratic schools have lead us to the edge of knowledge—the horizon to which we can point but beyond which we cannot cross. As Empedocles points out, it is impossible for mortals to grasp the nature of the divine unless we share something in common with it. Thus, we are obliged to posit both that mathematics as we know it shares something in common with us and that there may nevertheless be characteristics that mathematics does not share with us about which

we can know nothing due to their extreme otherness. Just as for Anaxagoras ignorance comes from the covering over of the seeds by other seeds, for us our ignorance of mathematics is covered over by what reveals itself to us in normal mathematics. If, as the Pythagoreans assert, the most powerful thing is knowledge, then we must recognize the finitude of our power. It is clear then why not only is number the wisest thing, but also why the second wisest is, "the man who assigned names to things" (DK58C4), for man is the connection between the world of numbers and the physical world, a bridge anchored on both sides of the ontological divide.

VI. Conclusion

In this paper, we have shown that the work of the presocratic philosophers is still relevant to us as a means of taking up a different perspective on the cosmos and trying out a new way of understanding our place in the world, and that this is still a valuable activity even if the cosmology behind those perspectives is no longer in favor with contemporary, scientific understanding of the physical world. From Anaxagoras, we learn the importance of possessing a reliable connection to the physical world in the form of a causal connection between the materiality of the self and the world at large. From Empedocles, we learn the importance of similarity of substance between the world and the embodied mind, and the concordant limits of our understanding. From the Pythagoreans, we learn the importance of recognizing the utility and timelessness of a mathematical understanding of the world. What we learn by combining all of their insights is that mankind must be a microcosmic encapsulation of both the mathematical and the physical. We must have one foot planted firmly in each world, and in so doing bring the two, seemingly disparate worlds into a great whole. At the same time, however, we learn that mankind is also fundamentally limited in its understanding, and what is utterly other to us can be gestured at, but never unconcealed except by either its becoming like us or by our becoming like it, since without a foothold, we are unable

to find the ground upon which to base our assertions. Instead, we find only the sinking sand of dogmas, in which we would remain forever trapped, were it not for the question, "How do you know?"

VII. Work cited

Kirk, G.S., J.E. Raven, and M. Schofield. *The Presocratic Philosophers*. Second edition. Cambridge University Press, 1983.