# 2. Classical Natural Philosophy

For many generations the scholars of the Fertile Crescent had studied things. They looked at the stars and the world around them and made measurements and predictions. They also did accounting, for example, working in the Temple of Babylon in 1800 b.c.e., you might have had to keep records of who'd paid what, who owed what, and what were the equivalent values of things. There are numerous fragments from this period showing knowledge of astronomy, medicine and accounting.

Finding mathematical consistencies is routine in these things. The very oldest evidence of Babylonian scholarship are mathematical tables from this time. It is quite likely that people saw the potential of mathematics to reveal deeper truths about the world. The Rhind Mathematical Papyrus, from Egypt, dated to 1550 b.c.e., begins with a claim to give “accurate reckoning for enquiring into things, and the knowledge of all things, mysteries... secrets.”

When some people discover just how long into the past this kind of knowledge goes they are amazed. They marvel and the genius of ancient people. To me this is seeing the world the wrong way up. Ancient people had exactly the same mental hardware as we do. If anything, the fact that such knowledge stretches so far into the past, shows how surprisingly long it took for humanity to get around to the next step.

Eventually, the next step came. A new kind of society brought with it a new way of thinking. It is worth mentioning the possibility that this new way of thinking was not new at all, but appears at the oldest time from which records have survived. This is possible, although these earliest records really do coincide with significant changes in society. It seems likely that these changes caused or accelerated the evolution of ideas.

The main thing that distinguishes this new kind of society is money. It allows for profession of independent teachers. It also freed people from fixed social obligations so they could more easily travel. Many of the teachers of the new ideas are thought to have travelled along established trade routes, into Egypt and on the Phoenician coast, and perhaps into Mesopotamia, from where they brought back the best of ancient wisdom.

From around 800 b.c.e., around the Aegean and East Mediterranean sea, a number of Greek-speaking city states emerged. By 600 b.c.e., they contained enough people who could study, read, write and spread ideas around, to mark a turning point. Threads of thought were laid down that would weave through the rest of history. At the very beginning was the search for natural, rather than supernatural, explanations.

**Cosmology**

By tradition, Thales is regarded as the first Western philosopher. He was from the Greek city of Miletus and lived from around 620-546 b.c.e.. We know very little about him and none of his writings, if he ever wrote anything, have survived. Everything we know of his contribution to philosophy comes from ideas attributed to him by later writers. Modern scholars have pulled all these fragments together to reconstruct how he might have thought.

Thales was not interested in mythical or divine explanations. There were already enough stories of Godly adventures to account for all manner of natural phenomena. The fact that in all of Thales' explanations the Gods play no part, suggests that he held to a materialist discipline, that is to say, he wanted to find natural causes for natural effects.

Thales probably devoted a lot of his time to astronomy, measurement and mathematics. He is also

thought to have travelled, gathering ideas from the nearby ancient civilisations. It is believed for example, that geometry was invented in Egypt for purely practical reasons, first for the redividing of land after floods and then for the building of monuments. Thales visited Egypt, and returned to teach geometry back in Miletus.

A school of thought developed amongst the Milesian, but there is some evidence that it was not dogmatic. Thales' students did not just repeat his ideas but had their own. Anaximander and Anaximenes for example, developed distinct ideas about nature. It seems that along with the school's materialist discipline and search for natural explanations, it had a relatively open and critical approach to ideas.

As a demonstration of the power of natural explanations, Thales' predicted a solar eclipse. It was not particularly precise by modern standards. He is reported to have said it would occur in 585 b.c.e., which it did. Modern scholars are not sure how he could have made this prediction with the information available at the time. Most likely it was a guess based on the probability of a solar eclipse following a lunar eclipse. When the eclipse came it is said to have stopped a battle and lead to a peace accord. It must have significantly enhanced Thales' reputation.

We can't know this for sure, but the nature of his ideas suggest one kind of reflective thinking. He seems to have moved from simply “how does the world work?” to “what is a proper explanation?”. He may have observed that explanations take the form of attributing causes to effects. But then causes are the effects of other causes, and so on. You can follow the chain beyond the reach of the senses, leading to the metaphysical question of ultimate causes and fundamental substances.

Evidence for this kind of thinking can be found in Thales' most well-known theory. Starting from the idea that we live in a world of substances: wood, stone, metal, soil, sand, blood, oil, etc., we can observe that they change and interact. Wood can become ash, for example, stone can melt and separate into metals, soil can dry into sand or moisten into mud and clay, etc.. Perhaps, at some invisible level, we can think of them all as one substance in different forms.

Looking at how water changes from ice, to its liquid form and into steam, and how it is so common and vital for life, Thales concluded that the fundamental substance is water. When plants and animals grow they are turning water into their bodies. When islands form at the mouths of rivers, this is water changing into land. The earth itself may have formed in the same way. Thales said that it was spherical and rested on water. It is ripples in this water that cause earthquakes.

What about ultimate causes? It is often reported that Thales believed that the Gods were behind all motion and causation, but it is only writers who lived long after him who say this. People writing not long after his life use the word “soul”. Thales and his contemporaries thought the soul was mysterious, but not divine. He may have thought of the soul as an energy that fills the universe, as a natural rather than a supernatural force.

**Monism**

Several decades after Thales, perhaps a little after 500 b.c.e., in the Greek city of Elea, lived a man called Parmenides. He is said to have written his philosophy in a poem of a few thousand lines, 150 of which have survived. His ideas have been reconstructed by later scholars, especially by the prolific writers from a century or so later, Plato and Aristotle. They seem to have been inspired by Parmenides, even if the actual connections are hard to pin down.

While Thales and the Milesians talked about fundamental substances, Parmenides took the idea one step further. Nothing he said, can come from nothing, and no thing can turn into nothing. Therefore, nothing can be created or destroyed. As there can never be nothing, there can't be anything

separating one thing from another. Therefore, there is only one thing. This idea is called “monism”.

Parmenides believed that there is not only one fundamental substance as the Milesian believed, but there is only one being and one time. As nothing can change there can't be any past or future. We all exist in one moment, in one substance, eternal and unchanging.

It may not surprise you to learn that Parmenides writings have divine and mystical elements. The first part of his poem is the report of a visit to a Goddess who speaks the “way of truth”. It is in this revelation that we find this ultimate truth of the oneness of being and time. In the second part of his poem he moves on to the “way of opinion” which is where humans get involved, and we stray from the way of truth. Parmenides is happy to give some of his own opinions, but points out that they are only how the world appears to him.

Although this strange idea has divine and mystical elements, it is worth philosophical consideration. It is the beginning to new questions about the relationship between thought and experience. Parmenides is saying that reason shows that there *must* be only one thing. If you see various things, which I assume you do, it is an effect of having human senses in this world. We often see different things and have different opinions. This is because our senses are partial and flawed. If there is a conflict between “sensible” and “intelligible” reality, that is to say, between what experience tells you and what reason tells you, Parmenides says you should trust reason.

At roughly the same time as Permenides, some 1000km away, in the city of Ephesus, a man called Heraclitus was teaching monism, but of a radically different kind. Writing his philosophy in the form of obscure aphorisms, with subtle wordplay, Heraclitus left enough fragments to keep the scholars busy, but not enough to provide a clear picture of his philosophy. He was frequently cited and claimed as an influence by others who lived soon after, which suggests that he must have been reasonably clear and convincing at the time.

The key idea attributed to him is “flux”. His most famous aphorism has been translated as “you cannot step into the same river twice”. By this he succinctly points out that a river is continuously flowing and changing, every moment is different from the last. Every time you cross the Yellow river it is different, yet it is still the Yellow river. It both is, and isn't, the same river.

A river, which is visibly moving, is only an illustration of something Heraclitus believed was true of all things. Things take different forms however, because they are in different states of transition. In short, there is only one thing and it is in flux. He thought that this had something to do with different dynamic tensions within things. Another one of Heraclitus' aphorisms speaks of a bow, which you draw back to propel an arrow forward. You are simultaneously moving in both directions.

Like the other philosophers of his time, Heraclitus seemed to relish his own cleverness and obscurity. I think that at this time, in this culture, it helped to be esoteric and elitist. It encouraged a following of eager, young, fee-paying enthusiasts, who enjoyed decipherment and a sense of glorious superiority. Although this is a perversion of philosophy, it generates ideas that philosophy can work on.

Parmenides and Heraclitus loved reason. Our senses are partial and flawed, but reason can reveal fundamental truths which are beyond them. Once these ancient thinkers surrendered to reason, with a kind of absolute faith, they went wherever it took them. It took them, in good faith, to the same idea, that the universe has a fundamental unity. Then, in good faith, to radically different ideas. To one, it revealed one moment and one substance, eternal and unchanging. To the other, it revealed flux, the state of being in constant change as the norm and identity of everything.

**Atomism**

Both the idea of eternal, unchanging, oneness and the idea of unending flux, have an intuitive appeal. Out of their contradiction came a new idea. In the absence of first hand evidence we don't know how much direct influence they had on the philosopher who came next, but we do have Aristotle, writing 100 or so years later, who believed there was a connection.

Think back to Thales and the Milesians, and the idea of a fundamental substance. They seem to have intuitively supposed that it would have a pure form that we could see in the world around us. Thales identified water, which happens to be abundant and observable. It is possible however, to imagine a fundamental substance that has no pure form we can actually experience. It exists but only at the level of the invisibly small.

Democritus, who was born in Abdera in 460 b.c.e., and is known to have travelled extensively around the city-states, is the earliest uncontested advocate of an idea called “atomism”. It supposes that the fundamental substance lies beyond experience, in objects too small to see. Everything we actually see, and all the substance of the universe we experience, is made of these objects.

The word “atom”, still used today to refer to a particular kind of material particle, comes from the Greek meaning “indivisible”. It is important not to confuse the fact that modern scientists have divided the atom, with the theoretical idea of an indivisible particle. Modern scientists today who talk about a “singularity” imagine that when we break up particles, and break up the pieces, and so on and so on, we will eventually reach something that cannot be divided. This is the modern form of atomism.

The ancient atomists imagined that the one universal substance took the form of invisibly small pieces, of different sizes and shapes. This variation is why things behave differently and produce the world of variance we actually experience. Whether movement and change is fundamental, as it was for Heraclitus, or a kind of illusion, as it was for Parmenides, it still needs to be explained. The best explanation is that atoms move and bump into each other.

Parmenides denied that “void”, that is to say, a place of true nothingness, could ever exist. Democritus, on the other hand, had to concede a space for moving atoms to move into. In that sense atomism, has to have a sense of the space between the atoms, a place were there are no atoms. It is sometimes said therefore that Democritus and the atomists allowed there to be two things: atoms and void.

This however, is merely a trick of language. The void is no thing. So I would argue that Democritus' idea qualifies as a kind of monism. It requires the idea of a single, universal substance, but develops it a little further. The idea of moving atoms of various shapes and sizes allows us to grasp how nature can be both one thing and the multitude of things we actually experience.

**Numerology**

The name of Pythagoras has been transmitted down the ages thanks to a well-known mathematical theorem. Pythagoras is credited with discovering the fact that a square made with the hypotenuse of a Right-angled triangle (that's the longest side facing the 90 degree angle) will always be equal in size to the sum of the sizes of squares made by the other sides.

This is a useful fact for highlighting the moment when the role of mathematics changed in western philosophy. While for Thales, in all likelihood, mathematics was a practical skill for measuring and comparing things in the world, for Pythagoras, and for many philosophers since, it became the key to finding the underlying essence of reality.

Nothing at all of what Pythagoras wrote has survived. There are only ideas attributed to him by a later group in Rome, some 200 years later, who called themselves Pythagoreans. There is no corroborating evidence that he was a real person, but biography is not our problem. Pythagoras represents an important point in the evolution of natural philosophy in the Western tradition.

The 4th century Roman Pythagoreans were a mystical, religious cult. They mythologised Pythagoras as a travelling Holy man who could talk to animals, remember past lives and predict earthquakes. They believed in keeping his sacred wisdom a secret, so they didn't publish anything. What we know of them, even their association with their founding father, comes from other people's reports.

As a secretive cult, by the way, we know only by reputation that they didn't (or rarely) washed, ate a lot of beans, took their shoes off right foot first and washed their feet left foot first. They also believed in the transmutation of souls, that is to say, the notion that souls live on after death and move into other bodies.

Their most important idea (attributed directly to Pythagoras) is that the physical world can be studied and understood only because it reflects, in some mysterious way, the eternal truths of mathematics. Pythagoras for example, is said to have discovered the mathematical properties of musical harmonies, demonstrating that such pure, rational relationships fill the universe.

If you use your imagination you can find all kinds of connections by treating numbers as if they were categories. For instance, if there are seven notes on a musical scale, and seven planets in the sky, does this not show that there is some kind of harmony in the solar system? Of course, this is mere coincidence of quantities. Seven of one thing and seven of another have nothing except their quantity in common. But this is fertile ground for the imagination, and its in this respect that I distinguish between mathematics, the study of quantitative relationships and “numerology”, the kind of thing the Pythagoreans did.

Numerology recurs in the history of thought as the wild side of some of the great mathematicians. It is the price the human imagination pays for some illuminating pure mathematics. Johannes Kepler, the 17th century astronomer, who made the first accurate elliptical model of the solar system for example, was influenced directly by the Pythagoreans. Isaac Newton, who gave the world laws of motion and gravity, also left behind reams of numerological speculations.

**Platonism**

By around 400 b.c.e., philosophers are beginning to routinely write and preserve their thoughts. Important in this is the founding of schools with a clear sense of tradition and continuity. Some cities, Athens in particular, had grown rich and powerful. At this time it is believed to have had over 300,000 people, which is enough to sustain a lively culture of independent schools and teachers.

The most important schools for the story of classical natural philosophy, were those founded in Athens by Plato around 387 b.c.e., and by his former pupil Aristotle in 334 b.c.e. They not only looked for natural explanations for natural phenomena, but tried to deduce the fundamental nature of reality, beyond experience. They gave us two distinct schools of “metaphysics”.

Plato said that beyond the world of experience is a world of “forms”, which is real in a way that the world of experience isn't. For instance, I can see a beautiful landscape and a beautiful person, but what actually is beauty? For Plato, beauty is a form. It exists independently of the landscape and the person. In fact, the landscape and the person are always inferior manifestations of the form. The form is eternal, perfect and above all, real.

Plato's stress on the reality of forms has lead to his idea being called “realism”. This often causes confusion for two reasons: Firstly, elsewhere in English “realism” is used to mean down-to-earth, common sense thinking, which Plato's certainly wasn't. Secondly, it is contrasted with “idealism”, which is the belief that forms are *only* ideas. This is a very strange distinction, in my opinion. I will explain why.

In front of me I can see a cup (it could be a picture or a hallucination). Forget about whether or not this cup physically exists. Think instead about the idea. Does the idea of the cup exist only in my mind, or does it exist outside and independent of my mind (in “reality” as some people might say)? For an “idealist” it exists only in my mind and is not independent of my mind. For Plato it exists in reality and *is* independent of my mind.

In one sense, idealism and Platonic realism have different metaphysics, in another sense, they are the same. They both think that ideas, or forms, are non-physical and must be, in some way, generated spontaneously without physical causes. They differ only in whether this occurs inside or outside the human skull.

To me, separating Plato from the idealists because he is realist is like replacing the distinction between dogs and cats with the distinction between monochrome and multichrome domestic carnivores. It is not only unnecessary, but confusing because it straddles a more important distinction than the one it makes. I mention it only because it is useful to note that some people describe Plato's metaphysics as “realism”. I won't.

Plato said that we are like people living in a cave who never leave. The sunlight casts shadows on the cave wall. We see them dance like images on a screen, telling a story, reflecting reality, but in a partial and imperfect form. They move and die. Only when a man leaves the cave and sees reality in the sunlight does he really know things. This act is the equivalent of the philosopher engaging in reason. It goes beyond our sensations and opinions, to the knowledge of perfect forms.

You can see how this idea brings together two ideas. It follows Parmenides, who believed that the senses produce illusions and reason reveals reality. It also follows Pythagoras, who believed that the consistency and certainty of mathematics reveals the perfect truths of reality, which are independent of the physical world.

Much later in Rome, in the 3rd century c.e., these ideas climaxed in the work of Plotinus, whose school would later become known as “Neo-platonism”. They used the power of reason to reveal levels of reality beyond the physical world. First there are souls, which have a greater unity than bodies. Then there is intellect, which has greater unity still and can know the “intelligible” world of forms. Ultimately there is the oneness of everything.

The idea that by reason alone a trained mind can know hidden layers of reality lends itself to a cult. 3rd century Rome was the springtime of the cults, which liked to incorporate communal rituals and comforting beliefs and miracles, into their systems. It is easy to see how the philosophical thread that leads from Parmenides to Plato to Plotinus, could develop this way. After all, if humans are imprisoned in the physical realm, perhaps divine powers could be called on to free them.

**Materialism**

Remember the cup in front of me that I mentioned earlier. For the Platonists the physical reality of the cup is irrelevant, the idea of a cup is real. The sensation of seeing the cup is a mere reflection of its reality (and an unreliable one). The reality of the idea exists independently and reasoning minds (perhaps with divine help) can know it.

Aristotle, who studied under Plato, rejected this and developed his own distinct ideas and school. For Aristotle, a cup is one form that physical matter can take. By calling it a cup, we are referring to the things we imagine it has in common with other cups. Only these physical objects are real, in the sense of having an independent existence. Our minds observe and label general characteristics, but the real world itself contains only particular examples.

I can imagine Aristotle trying to bring Plato's school back down to earth, as its students were self-indulgently revelling in their knowledge of a reality they alone could see. Aristotle pulled philosophy back toward the cosmology of the Milesians. He wanted natural explanations of natural phenomena and he built a substantial model of the cosmos.

At the centre of his great mechanical cosmic wheel is the earth (although you must imagine this wheel as spherical) there are 47-55 crystalline spheres around the earth, moving at their own constant speed. They are all made of aether, whereas everything down here is made of the four elements, two earth and water, which are heavy and tend to fall down, and two air and fire, which are light and tend to rise.

This may sound like wild speculation, but Aristotle justified each part of his elaborate system with observations. For example, the Greeks were aware of the phenomenon of parallax and knew that if you were on something that was moving the positions of the things you could see would change in relation to each other. Aristotle said that as the stars never change their position in relations to each other, the earth must be still.

In addition to the grand cosmology, Aristotle classified and explained the form and behaviour of living things and justified everything with observations. He described plants, animals and humans according to the nature of their soul. Plants have a vegetative soul, which allows growth and reproduction. Animals have this, but also a sensible soul, which allows them to move and sense things. Humans have both, plus a rational soul, which allows thought and reason.

Aristotle wrote extensively on politics, ethics, poetry and the arts. In all cases there is the strong sense that opinions must be justified with reason. What he called “theoretical science” (in his time, science simply meant a subject of study) included both the metaphysics of materialism, and physics, which included geology, optics, medicine and the system building astronomy and biology I've just mentioned. In all cases, Aristotle makes observations and builds on them with reason.

Over the centuries of the classical world, from the peak of Greek power in the 4$^{th}$ century b.c.e., to the height of Rome in the 2$^{th}$ century c.e., followers of Aristotle applied his method, extended its reach and taught his systems. Plague, invasions and climate change hit the Western Roman Empire from the 3$^{rd}$ century on. The money system collapsed and the schools closed.

From around the 6$^{th}$ to the 12$^{th}$ centuries, there was a gap in the history of western philosophy. Perhaps because of social disintegration and the psychology of fear, the focus of attention turned to other needs. The bulk of writing from this period comes from Christian monks, and what they wrote was almost always the Bible, or comments on it. To the question “how does the world work?” the answer could be found in the Judeo-Christian stories. This is the metaphysics of revelation. From the beginning, the world was God's creation and it reflected his will.

**Conclusion**

Thales looked for natural rather than supernatural explanations. He looked for ultimate causes and the fundamental substance from which everything is made. Parmenides said that reality was an unchanging, eternal unity, while the world of difference and change we experience is a kind of illusion. For Heraclitus change is no illusion, but the opposite. Things seem to be stable but are in

fact moving and changing. This flux is the key to reality.

Democritus reconciled these ideas by supposing that the universal substance does not manifest itself in a pure form. It takes the form of invisibly small atoms of different shapes and sizes. They move through the void between them, scattering and bumping into each other. There is, therefore, a unity of all things, yet also the movement and change we see around us.

Pythagoras saw that behind the world of particular things we experience, there are deeper mathematical truths. This lead him down the path of numerology, with mystical diversions. The path was followed to some extent by Plato, whose later followers, the Neo-Platonists, turned the contemplation of oneness and the power of mathematics into a magical cult.

While studying under Plato, Aristotle must have despaired at his mystical tendencies. In his own work, Aristotle wanted to bring philosophy back to reality, which is physical and observable. He wanted to know how it really works. From observation he constructed an elaborate model of the cosmos, which would later find its way back into the mainstream of Western philosophy through the new Universities of medieval Europe. Along with atomism, it would become the foundation of modern natural philosophy.

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