

PART I

Physics and Cosmogony

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CHAPTER 1

The Creation and Destruction of the World

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1. Introduction

The creation and destruction of the world were much discussed in antiquity, and the Presocratics, Plato, Aristotle, and Hellenistic thinkers all made distinctive contributions. The term “creation” could in some ways be a little misleading. None of the ancient Greeks believed anything to be created out of nothing, *ex nihilo*; instead, the world we know was generated from some prior, less organized state of the universe. Nor should “creation” here be taken necessarily to imply a creator, or even some entity which organizes. The Greek notion of *cosmos* is also important. A *cosmos* was not only a well ordered place, it was often also thought of as aesthetically and/or morally good. I will use “universe” for all that there is and “*cosmos*” for a well-ordered world within the universe. In general, a *cosmos* consisted of earth, sun, moon, five planets, and some surrounding stars. In some views, one *cosmos* exhausted the universe, in others there were many *cosmoi* (plural of *cosmos*) within a universe, with variations on earth, sun, moon, and five planets. In some views, there was one *cosmos*, eternal once generated; in others, *cosmoi* were subject to destruction and replacement. One can classify Greek ideas on the creation and destruction of the world into four broad types:

- 1) A single *cosmos* is generated, which then exists permanently, with no destruction.
- 2) There are a succession of *cosmoi*. Only one exists at a time, but when one is destroyed another is generated in its place.
- 3) There are multiple *cosmoi* which co-exist. These undergo destruction, but other *cosmoi* are generated which replace them.
- 4) There is no generation or destruction of the *cosmos*. It has always been here and will always be here.

A different way of classifying theories of the creation and destruction of the world is in terms of whether *cosmoi* are generated by chance, with a multiplicity of accidents, or by design. The order of our *cosmos* might be explained by chance, with an infinite array of other accidental *cosmoi* of which our *cosmos* is one. Alternatively, someone or something may have guided the generation of our *cosmos* such that it has order. An interesting question is, then, whether all those who postulate chance have many different *cosmoi*, either co-existent or successive, and all those who postulate design have a unique *cosmos*. No ancient thinker held that a unique *cosmos* had come about by chance.

Two more questions relate to the sophistication of ancient thinking on the creation and destruction of the world. To what extent are ideas of space and time (finite, unlimited, infinite) coordinated with ideas on the creation and destruction of the world? Second, to what extent are parallel discussions of the origins of life coordinated with ideas on the creation and destruction of the world? On these questions hangs the answer to whether ancient discussions of the creation and destruction of the world were a loose collection of entertaining tales or a serious and coordinated philosophical investigation.

In terms of sources, from Plato onward, we have good evidence for what individuals and schools believed, both in relation to original texts and works by the commentators. In later antiquity, Neoplatonists and early Christians also theorized about the creation and destruction of the world. With the Presocratics, little original material has survived, and problematic are accounts preserved with the doxographers, who tend in some cases to assimilate differing views and elsewhere to see precursors to Christian views. Plato, as ever, has his own specific interpretive difficulties. His *Timaeus* gives a wonderful account of the generation of the world, but commentators have been split since antiquity on whether this is a literal or a metaphorical account.

2. Myth and Hesiod

Prior to the first philosophical accounts of the creation and destruction of the world, mythological and poetical explanations were given. Egyptian and Babylonian mythologies employed many gods to explain the origins of the world, and often the idea that land forms after water dries out, a notion probably derived from the seasonal flooding of the Nile, Tigris, and Euphrates rivers. Typical of these is this Babylonian account:

When above the heavens had not yet been named
 And below the earth had not been called by a name
 When only Apsu primeval, their begetter existed
 And mother Ti'amat, who gave birth to them all
 When their water still mixed together
 And no dry land had been formed and not even a marsh could be seen
 When none of the gods had yet been brought into being
 When they had not yet been called by their names, and
 their destinies had not yet been fixed
 Then were the Gods created in the midst of them.

(trans. Heidel 1942, 8)

Early Greek mythologies too, such as those of the Orphics, mixed creation in terms of the sexual couplings of the gods with idea of growth from a primeval egg. One issue here, on which there are a diverse range of positions, is how great the difference is (if any) between mythology and any philosophical account of the creation of the world. Some would say that there is no difference in structure, others that there is no difference in their function within society. One can argue for significant differences on the grounds that philosophical accounts are either parsimonious, invariantly reject the supernatural in contrast with myths, or are some combination of these premises. One can also argue that the key difference is process: philosophical theories need to be based on evidence and argument, and they need to be capable of justification relative to other theories in ways in which myths are not. Attempts to differentiate between myths and Greek philosophical theories of creation on the basis of the involvement of gods will not be successful, as many Greek theories invoke some form of god, though there are interesting comparisons to be made about the role of gods. A different approach is to differentiate between creation tales and cosmogony, where the end product of a cosmogony has the characteristics of a Greek *cosmos* but a creation tale does not.

Hesiod is often seen as an important bridge between creation myth and cosmogony.¹ His account in the *Theogony* gives a logical sequence of events leading to the world as we know it, and, in contrast to many myths, there is a strict and well-organized genealogy of the gods described in the *Theogony*:

First a chasm was generated, then broad-breasted Gaia (earth), a safe seat for all forever. ...
From the chasm, Erebus and black night were generated. From night, aether and day were generated, who she bore after sex with Erebus. (116–125)

Hesiod is the first to make explicit that the world, once generated, will last forever. How sharp a division exists between Hesiod and the first philosophical accounts of the creation and destruction of the world is controversial. One view, championed by Cornford, Stokes, and West, argues that there is little difference, while others hold that philosophical cosmogony proper begins with the Milesians and that this is a different type of discourse from the myths of Hesiod. Most recently, Gregory (2013) suggests that Anaximander (*TEGP* 30), giving natural explanations for thunder, lightning, thunderbolts, whirlwinds, and typhoons, is a direct allusion to Hesiod's *Theogony* 845–846, in particular, where these phenomena are explained in terms of the actions and wills of the gods.

3. The Milesians

There is a general principle for the Milesian thinkers, Thales, Anaximander, and Anaximenes, that what we see around us is generated from some basic element (water, the unlimited, and air, respectively) and will ultimately be destroyed back into that basic element. Aristotle tells us:

Most of the first philosophers thought of matter as the only principle of all things. That from which all things are, that from which a thing first comes to be, and into which it is ultimately destroyed, the substance persisting but changing in its qualities. This they say is the element and beginning of the things that are and because of this they say there is no absolute coming-to-be or destruction, but nature is always preserved. (*Metaphysics* 983b18–27)

We know little of Thales' ideas on the formation of the world, but we are somewhat better informed about Anaximander and Anaximenes, although there remains controversy about their views. Anaximander supposed there to be an *apeiron*, probably best translated as "unlimited," something without spatial or temporal limits or any distinction between its parts:

He says this is not water, nor any of the other so-called elements, but some other unlimited nature, from which are generated all the heavens and the *cosmos* in them. The source of generation for extant things is that into which destruction occurs, **according to what is proper. They pay penalty and retribution to each other for injustices according to the order of time**, as he says in a poetic fashion. (TEGP 9)

The words in bold here are generally accepted as Anaximander's own (KRS 105–106, 117–121). We also hear:

Anaximander says that which is productive out of the eternal hot and cold was separated at the genesis of this *cosmos*, and that a sphere of flame was formed around the air around the earth like the bark around a tree. When this was broken off and enclosed in certain circles, the sun, moon, and stars were formed. (TEGP 19)

So first the opposites of hot and cold are produced from the *apeiron*, followed by a process which generates the earth. Aristotle tells us something very interesting:

The unlimited has no beginning ... However, this seems to be the beginning of all other things, and it surrounds and steers (*kybernan*) all, as with all those who do not suppose other explanations, such as mind or love, beyond the unlimited. This is divine, for it is immortal and indestructible, as Anaximander and most of the physiologi say. (TEGP 16)

Thus it would seem that the unlimited has some power to steer and may help to guide the *cosmos* into existence (*kybernan*: to steer, as in a boat, or more metaphorically, to guide or govern; Guthrie 1962–1981, 1.88 note 2). The latter may be important in suggesting some form of intelligent guidance. To what extent Anaximander considered the *apeiron* to be divine is not clear.

The controversy with Anaximander's view concerns how many worlds he believed in and what became of them. There are three positions here, that he believed in

- 1) an infinite number of co-existent worlds which were destroyed but then formed new worlds,
- 2) a single *cosmos* which was destroyed but then formed another *cosmos*, the cycle continuing in perpetuity, or
- 3) a single *cosmos* which did not undergo destruction.

The basic substance for Anaximenes was air:

All things are generated by a certain condensation of air, and again by its rarefaction. Motion has existed for all time. He says that when the air felts, firstly the earth is generated, entirely flat, and because of this, it rides on the air. So too sun, moon, and the other stars have their origins in generation from earth. (TEGP 11)

We also hear:

Anaximenes declared air to be the beginning of existing things. From it all things come to be and into it all things are dissolved. He says as **our soul, being air, holds us in order** (*syngkratei*), so wind and air envelop the whole *cosmos*. (TEGP 8)

There is debate about whether the words in bold are Anaximenes' own, but the sense is clear enough and should be compared with Anaximander's *kybernan* (steering). With Anaximenes there is a similar debate about the number of *cosmoi* and their fate. Possible interpretations include multiple co-existent *cosmoi*, a single recurring *cosmos*, and a unique everlasting *cosmos*.

4. Heraclitus

Interestingly, Heraclitus rejected cosmogony and destruction for the world:

This *cosmos*, the same for all, was not made by Gods or men, but has always existed and will always exist. It is an ever living fire, kindling in measures and going out in measures. (TEGP 47)

If we take this at face value, then there is no creation and destruction of the world for Heraclitus. Some doxographers, perhaps influenced by the importance of fire in Heraclitus, assimilated him to the Stoics, who believed in successive *cosmoi*: the death of one *cosmos* in a fiery conflagration leading to the birth of the next. On the evidence we have, there is no reason to suppose Heraclitus believed in successive *cosmoi*. The doxographic tradition could be misleading and even simply wrong. Relative to the Milesians, there are two interesting points. First, there is also a sense of cosmic justice and fair exchange. Second, it is interesting to note that even though Heraclitus does not have a generation for the *cosmos*, he nevertheless believes there is steering. So TEGP 40 says that "all things are steered through all" (cf. TEGP 56: "The thunderbolt steers all things.")

5. The Hippocratics

The Presocratic medical writers too were interested in the origins and fate of the world, especially where they wished to place their account of the nature of human beings and how they should be treated medically in a broader philosophical context. The Hippocratic *On Regimen* 1.10 (circa 400 BCE) describes the body, how the parts are suitable for their functions, and the synergy of those parts according to a fiery triptych responding to the physical properties of dry, moist, cold, and hot:

In this fire made for itself three circuits bounded by each other internally and externally. Those towards the hold of the moist have the power of the moon, while those towards the outer circuits, towards the surrounding mass, have the power of the stars and those in the middle are bound internally and externally. The hottest and strongest fire, which controls all things, manages everything according to nature, it is imperceptible to sight or touch. In this are soul, mind, understanding, growth, change, diminution, separation, sleep, waking. This steers all things though all both here and there and is never still.

Again we have the steering motif as part of the formation and control of the *cosmos*. Important here, too, is the correspondence of microcosm and macrocosm, the way in which the human body has structural similarities to the way in which the whole *cosmos* is put together.

6. Eleatics

Also significant is Parmenides' thinking on the creation and destruction of the world:

It never was nor will be, as it is now, all alike,
 one and continuous. What birth will you seek for it?
 In what way, from what source did it grow? I will not allow you
 to think or say from not being, for it is not to be thought or said
 that it is not; and what warrant might have driven it
 later rather than sooner, beginning from nothing, to grow?
 (TEGP 17.5–10)

While the passage is quite general about any change whatsoever, it was also seen as denying creation *ex nihilo*. Whether this is original to Parmenides, or whether it codified something that was held generally, we do not find any other Greek thinker proposing that something comes from nothing. All Greek thinking on creation of the world involves organization from a previous, less organized state.

7. Empedocles

Empedocles' cosmic cycle has been the subject of much debate. I give the orthodox or "symmetrical" view of this cycle, though there are many variations, and more radical interpretations are possible. For Empedocles, there are four elements, earth, water, air, and fire, and two principles, Love and Strife. I am careful not to call Love and Strife "forces" as they do not act in a manner recognizable as any modern description of a force. Love is a principle of association, whereby all the elements are mixed together, while Strife is a principle of dissociation whereby all the elements are separated. On the orthodox view, there are two extremes to Empedocles' cosmic cycle. There is a state of complete association of the elements, where they are perfectly mixed together, under the dominance of Love. And there is a state of complete dissociation, where the elements form four disjoint groups, under the dominance of Strife.

On the orthodox view, there are two periods of world formation. When Love begins to associate the elements after the time of Strife's complete dominance, a world is formed. However, as Love moves the elements further toward complete association, there will be a destruction of our world as well. As Strife begins to dissociate the elements after the period of Love's complete dominance, a world is formed. Again though, as Strife moves the elements further toward complete dissociation, there will be a destruction of our world. So there is a cycle of the generation of a single world and its destruction in perpetuity. Aristotle comments:

At the same time he says that the *cosmos* is in a similar condition now under the influence of strife to that which it was in under the influence of love. (TEGP 54)

Empedocles himself says:

I will give a double account. At one time, they grew together to be one alone out of many, at another time they grew apart to become many out of one. In two ways are mortal things generated, and in two ways do they fail. They are born and perish through the coming together of all things, and they are nourished and vanish as they are drawn away once again. These things never cease their continual interchange. At one time all things were brought together through Love, at another each being drawn apart by Strife's hatred. In that they have learned to grow into one from many, and the one is again drawn apart into many. In this way they are generated and themselves have no stable life, in that they never cease their continual interchange, they are forever unchanged in the cycle. (TEGP 41.1–13)

What is remarkable here is that a *cosmos* is not seen as an end state of a process, but a by-product of the all-encompassing cosmic cycle. Two issues which are controversial in Empedocles' cosmogony are the role of chance and how different successive cycles are. Aristotle comments:

Empedocles says that air is not always separated out upward but according to chance—He says in his cosmogony “Thus at one time it ran by chance, but many times it was otherwise”—and he says that the parts of animals are for the most part generated by chance. (TEGP 97)

One must always be cautious with Aristotle regarding chance, as he will call events chance in the absence of teleology, even if those events are determined. Here he seems to attribute genuine chance events in cosmogony to Empedocles. This would suggest that various cycles are quite different from each other, unlike the Stoic theory of universal recurrence (§13, below), yet this is contested. We also find chance in Empedocles' zoogony, where Aristotle describes the nightmare scenario whereby parts of animals wander freely until they join together by chance to make viable living creatures:

On the earth there burst forth many faces without necks, arms wandered bare bereft of shoulders, and eyes wandered needing foreheads. (TEGP 118)

Many sprang up two-faced and two-breasted, man-faced ox progeny, and conversely ox-headed man progeny. (TEGP 121)

Whether Empedocles envisaged any teleology on this process is again controversial. Some say yes, others say that the descriptions of the eye on which this view rests are simply descriptions of the structure and function of the eye without teleology. Studies of Empedocles are currently in a state of flux, with the relatively recent discovery of new material in the Strasbourg papyrus and radical reassessments of the relationship between science and religion in Empedocles in light of recent advances in historiography.

8. Anaxagoras

Anaxagoras was the first Presocratic to give a cosmic intelligence, *Nous*, an independent existence and a role in cosmogony, in contrast with the pantheism of Anaximander and Anaximenes. From an initial state of mixture, *Nous*—pure, unlimited, and

unmixed—controls a vortex which separates out the mixture and leads to the formation of the *cosmos*:

Nous is the finest and purest of all things, it has all knowledge concerning everything and it has the greatest power. *Nous* controls all things that have life, both the greater and the smaller. *Nous* controlled the revolution of the whole, such that it revolved in the beginning. At first it revolved in a small region, but now it revolves in a greater, and will revolve in a greater still. The things which are mixed and separated and divided are all known by *Nous*. *Nous* ordered them all, this revolution in which the stars and the sun and the moon and the air and the aether which are being separated off. This revolution produced the separation. The dense is separated from the rare, and the hot from the cold, the bright from the dark and the dry from the moist. There are many parts of many things. Nothing is entirely separated or divided from anything else except *Nous*. *Nous* is entirely alike, both the greater and smaller parts of it. Nothing else is like anything else, but what is most in each single entity is most clearly what it is and was. (TEGP 31)

Anaxagoras also says:

As these things rotated in this way they were separated out by the force and speed. It is the speed which generates the force. The speed is unlike any speed which now exists among mankind, being in every way many times more rapid. (TEGP 17)

More specifically:

The dense, the moist, the cold and the dark came together here, where the earth now is, while the rare, the hot, the dry and the bright went out into the further reaches of the aether. (TEGP 35)

The general outline of an initial mixture, followed by a vortex initiated and controlled by *Nous* resulting in the *cosmos* we now know, is clear enough. There is no indication in any of the ancient evidence that Anaxagoras gave any role to chance in this. It is an interesting development in Greek thought that while *Nous* has many of the attributes of a deity (immortality, intelligence, etc.), at no point is it referred to as divine.

Sometimes Anaxagoras is credited with the first teleological account of the creation of the world. Whether that is accepted depends on what is thought of the earlier “steering” principle and also on what one makes of Plato’s criticisms in the *Phaedo*, effectively that this is not a full teleological account. While there is nothing about the destruction of the *cosmos* or successive worlds in Anaxagoras, there has been debate about the possibility of co-existent worlds:

If this is so, it is right to believe that there are many things of all types in all that has been separated, seeds of all things and all sorts of shapes, colors and tastes and men have been formed and animals have souls, and that men have lived in cities and established farms, as with us, and have sun and moon and the others as with us, and the earth grows for them a great amount of many sorts of things, of which they harvest the useful and take into their houses to consume. This then I have said concerning separation, that separation would occur not only with us, but elsewhere too. (DK 59B9)

There are ways of accommodating this passage within a one-*cosmos* framework, or this can be thought to suppose many *cosmoi* separated in space, as with the atomists (§9, below), or with variations of the idea that smaller *cosmoi* are embedded in larger *cosmoi*.

9. Leucippus and Democritus

Leucippus and Democritus (in common with many, I make no attempt to separate their views) held that there was an infinite void populated with an infinite number of atoms. There was no beginning to this infinite universe. Within this universe were an infinite number of co-existent *cosmoi*, coming into existence after the formation of a vortex in the void and then destroyed. The residual matter was then used in further vortices and *cosmoi*:

Leucippus holds that the whole is infinite ... part of it is full, and part void ... from these innumerable *cosmoi* come to be and are dissolved into these again. The *cosmoi* are generated in this manner. By “cutting off from the infinite” many bodies of all shapes move into a great void, where they are crowded together and produce a single vortex, where colliding with each other and circulating in all manner of ways, they separate out like to like. When, because of their great number they are no longer capable of moving around in equilibrium, those that are fine spread out into the outside void, as if sifted, while the rest “hold together” and becoming entangled, they unite their motions and create the first spherical structure. This stands apart like a membrane, containing in itself all kinds of bodies. As they whirl around, due to the resistance of the middle, the surrounding membrane becomes thin, and the close packed atoms flow together due to touching the vortex. In this way the earth came into being, the atoms which had been borne in to the middle remaining there together. Again the surrounding membrane itself is increased, due to the influx of external bodies. As it moves around in the vortex, it takes in whatever it touches. Some of the bodies which become entangled form a structure which is firstly moist and muddy, but which dries out as it revolves with the vortex of the whole, and then ignites to produce the constitution of the stars. (TEGP 47)

These *cosmoi* are all different from one another. They grow, reach a peak, and then decline and are destroyed:

In some of these (*cosmoi*) there is no sun or moon, in some they are larger than ours and in some more numerous. The spaces between *cosmoi* are not equal, in places there are more and in others less, some are growing, some are in their prime, some declining, some are coming to be and others failing. They are destroyed by falling into each other. There are *cosmoi* bereft of animals and vegetation and all moisture. In our *cosmos* the earth was generated prior to the stars, and the moon is the lowest, followed by the sun and then the stars. A *cosmos* is at its height until it can no longer accrete external material. (TEGP 53)

How original and radical Leucippus and Democritus are in their views here depends on what we attribute to Anaximander—did he (or anyone else) believe in an infinite number of co-existent *cosmoi* prior to Leucippus and Democritus? If not, then this is a radical departure. In any event, there are important differences in that Leucippus and Democritus attribute a significant role to chance and deny any form of intelligence, design, or purpose for the universe. Contentious issues are whether this can properly be

described as a fully mechanical view (biological analogues such as membranes are used, and the explanation of the like-to-like principle is biological and agricultural rather than mechanical), and whether this is in fact or in intention an atheist view (Leucippus and Democritus do have things to say about the gods).

10. Plato

Plato's *Timaeus* gives an extended account of the generation of the best possible *cosmos* by a craftsman god from a primordial chaos. This account was highly influential in antiquity. Opinion is still divided on whether this is a literal or metaphorical account, what actually happened or what the world would be like in the absence of a caring god. What is clear is Plato's thoroughgoing teleological intent. Early in the *Timaeus* (30a), we are told that:

God desired that all things should be good, and nothing paltry as far as was possible, he took over all that was visible, which was not at rest but in discordant and disorderly motion, and led it into order out of disorder, judging the former to be entirely better than the latter.

This applies to the large-scale *cosmos*, and also the small-scale *cosmos*, the basic entities that constitute the *cosmos*, and the living entities which populate the *cosmos*:

This we hypothesize as the principle of fire and of the other bodies ... but the principles of these which are higher are known only to God and whoever is friendly to him. It is necessary to give an account of the nature of the four best bodies, different to each other, with some able to be produced out of the others by dissolution ... We must be eager then to bring together the best four types of body, and to state that we have adequately grasped the nature of these bodies. Of the two triangles the isosceles has one nature, the scalene an unlimited number. Of this unlimited number we must select the best if we intend to begin in the proper manner. If someone has singled out anything better for the construction of these bodies, his victory will be that of a friend rather than an enemy. We shall pass over the many and postulate the best triangles. (*Timaeus* 53d4–54a6)

It is notable that, in contrast to Leucippus and Democritus, Plato has a non-progressive conception of the primordial state. So while for Leucippus and Democritus *cosmoi* will form without any intervention in the primordial state, Plato is specific in arguing they will not. It is often thought that Plato's objection to Leucippus and Democritus is theological, but the following passage from the *Laws* (889b; cf. Vlastos 1975, 29) indicates there may be other more subtle objections as well:

Let me put it more clearly. Fire, water, earth, and air all exist due to nature and chance, they say, and none to skill, and the bodies which come after these, earth, sun, moon, and stars, came into being because of these entirely soulless entities. Each being moved by chance, according to the power each has, they somehow fell together in a fitting and harmonious manner, hot with cold or dry with moist or hard with soft, all of the forced blendings happening by the mixing of opposites according to chance. In this way and by these means the heavens and all that pertains to them have come into being and all of the animals and plants, all of the seasons having been created from these things, not by intelligence, they say, nor by some god nor some skill, but, as we say, through nature and chance.

This poses a key question for ancient cosmogony; is it plausible to suppose that our *cosmos* came about by chance? Plato is clear on the fate of the *cosmos*. The Demiurge says that:

I am the craftsman and father of these works, and they are indissoluble except by my will. Although all that is bound can be dissolved, to will to dissolve that which has been beautifully and well constructed would be bad. (*Timaeus* 41a)

This is important in itself and may also be significant in the literal/metaphorical debate. In *On the Heavens* 1.12 (§12, below), Aristotle produced some highly influential arguments to show that something generated could not be eternal. Early attempts at a metaphorical interpretation may well have been motivated by a desire not to be susceptible to Aristotle's critique. The modern metaphorical view holds that if we take the cosmogony literally, there are too many evident inconsistencies in the account. The literal view argues that the inconsistencies are not so many or so problematic and, while not denying that there are inconsistencies, argues that these fall within the early warning in the *Timaeus* not to expect a fully consistent account.

11. Aristotle

Aristotle's position on the creation and destruction of the world is in essence very simple. The world is neither created nor destroyed but eternal. It always has existed and always will exist:

The whole heaven is not generated nor can it be destroyed, as some have said, but is unique and eternal, not having beginning or end to its lifetime, having and embracing unlimited time in itself. (*On the Heavens* 283b26–29)

Aristotle has a complementary position on the origin of life and species. Life has always existed, and the species we see now have always existed. Aristotle has some interesting arguments for the eternity of the *cosmos*. One quite modern contention concerns the possibility of generation *ex nihilo*:

In conclusion then, the basic principle is clear. There is always a ratio between changes, for they are in time, and between two determinate time periods there is always a ratio, but there is no ratio between fullness and the void. (*Physics* 216a8–11)

So if something were to be created from nothing, that would then involve us in infinities as nothing cannot be in ratio with something. In *On the Heavens* 1.12, Aristotle argues for the following conclusions:

- 1) Everything which always exists is absolutely ungenerable and indestructible.
- 2) Everything which is absolutely ungenerable and indestructible always exists.

Along with this goes the following assumption:

Nothing can be indestructible or ungenerable through chance. Chance and luck are contrary to that which always or mostly happens. That which exists for an unlimited time, absolutely or from a certain time, exists either absolutely or for the most part. (*On the Heavens* 283a32)

So a *cosmos* which exists forever is incapable of not existing. Indeed, anything which exists forever exists of necessity. The precise nature of Aristotle's argument is controversial, and to the modern eye something has gone wrong here (see Judson 1983 for the nature of the supposed error). Whatever Aristotle's reason for holding this view, his target is clear enough. He wishes to oppose the Platonic view that the *cosmos* came into existence and will subsequently exist for all time. *On the Heavens* (283b17-21) concludes as follows:

It is impossible for what was previously eternal to perish later, or what was previously not eternal to be eternal later. All generable and destructible things are subject to change. They change by means of contraries, and that from which natural things are constructed is the same as those by which they are destroyed.

Aristotle's influential view was one of the issues that later caused difficulties for the Christian church, which consequently had to rethink Aristotle's views in the generation of scholasticism, the fusion of Christian theology with Aristotelian thought.

12. Epicurus and Lucretius

The views of Epicurus and Lucretius are a development of the earlier atomism of Leucippus and Democritus. Epicurus says that

There are an infinite number of *cosmoi* both like and unlike this one. As has already been demonstrated, there are an infinity of atoms, and they are carried far away. The atoms which are such that a *cosmos* could be generated or made from them, are not exhausted in the completion of one *cosmos* or many, nor all those that are alike or those that are unlike. (*Letter to Herodotus* 45.3–9; cf. Lucretius 1.232–233)

An important factor in cosmogony for Epicurus and Lucretius is the atomic swerve. Atoms are thought to fall in straight lines. Unless there is lateral motion, atoms would never interact. So atoms have the ability to move sideways on occasions, in an unpredictable manner. Epicurus describes the origins of *cosmoi*:

Cosmos formation occurs when the appropriate seeds flow in from one *cosmos* or an inter-*cosmos* or from many. Gradually, by additions and joinings and migrations to another place, as may occur, and appropriate irrigations of this matter, a state of completion and permanence is reached, which lasts while the underlying foundations are capable of being added to. (*Letter to Pythocles*, 89.6–11)

Lucretius gives us some more specific details:

Firstly, all of the pieces of earth, because of their weight and entanglement, gathered in the center and took the lowest place. The more tightly they became united and entangled, the more they expelled that which would form the sea, stars, sun, moon and the walls of the great world. The constituents of these bodies are smoother, rounder and of significantly smaller size than the elements of the earth. Firstly, fiery aether immediately passed through the loose interstices of earth and being light, elevated itself carrying with it much fire ... light and aether then formed a coherent body curved in all places which spread widely in all directions to enclose all things in a greedy embrace. (5.449–471)

Behind this there is an important principle of cosmology:

So many primordial particles, in a multitude of ways, have been propelled by their own weight and impacts for an infinite amount of time, and they have made trial of all things their union could produce. It is hardly surprising if they have come into arrangements and patterns of motion like those repeated by this world. (5.186–194)

This should be compared with the views of Leucippus and Democritus and contrasted with the views of Plato and the Stoics.

13. Stoics

The Stoics were believers in a process known as *ekpurōsis*, whereby a world was created out of a cosmic conflagration and later destroyed into a cosmic conflagration. So the beginning and the end of the world was in fire. There is only a single world at any one time, but the process of the generation and subsequent destruction goes on for eternity:

The *cosmos* is generated when the substance is converted from fire through air into moisture. The thicker parts of this then condense to become earth, while the finer are thoroughly rarefied, and when they have been thinned a great deal, they become fire. After this, from mixture come plants, animals and other sorts of things. (SVF 1.102)

We are also told:

Only matter and god survive *ekpurōsis*. (SVF 2.1047)

A key part of the Stoic view is that god guides the generation of the *cosmos* and that the *cosmos* has a providential ordering. An important Stoic argument against any non-teleological, non-providential *cosmos* is given by Cicero, through his speaker Balbus in *On the Nature of the Gods*:

Should I not be amazed here that anyone might persuade themselves that certain solid and indivisible pieces of matter are carried by their own weight and from the fortunate combination of these bodies a world of the greatest splendor and beauty is generated? I fail to see why someone who thinks this can occur does not also believe that if innumerable copies of the twenty one letters, made of gold or anything else, were thrown together in some vessel then shaken out onto the ground, it is possible that they would form a readable *Annals* of Ennius. I doubt whether Fortune would give us even a single verse! (2.37)

And, according to those who believe in atomism:

From bodies without any heat, or with any quality or any sense the world has emerged complete by chance, or rather innumerable worlds, some being born and some perishing at each moment. But if the coming together of atoms can produce a world, why can it not produce a colonnade, a temple, a dwelling, which are much less difficult things to produce? (2.37)

This should be contrasted with the views of the atomists and, in particular, that of Lucretius at the end of the previous section. One key issue for the Stoics, a subject of much debate, was whether the successive worlds would be identical or not:

The *cosmos* is re-established in its original condition. The stars move again in a similar fashion, and each thing which happened in the first period is completed without any change. There will be again a Socrates and Plato and each of humanity with the same friends and citizens. They will suffer and meet the same things, and deal with the same things, and every city, village and field will similarly be reconstituted. This reconstitution of everything happens not once but many times, or rather, this reconstitution is accomplished an unlimited number of times. Those gods who are not subject to destruction, due to their knowledge of this one period, know from it all that will happen in future periods. There will be nothing foreign to what has happened previously, but all will be utterly without change of even the smallest detail. (*SVF* 2.625)

Simplicius discerned a problem:

In saying that the same I is generated in the regeneration the Stoics rightly enquire whether the I now and the I at some other time are one in number, through being the same in substance, or are torn apart through being placed in different cosmogonies. (*SVF* 2.627)

Origen tells us:

Those who were ashamed of this doctrine said there were few and very insignificant changes of things occurring in one period when compared to the preceding period. (*SVF* 2.626)

Here we learn more detail on what sort of changes we might expect from one cycle to another:

The Stoics believe that after *ekpurōsis*, all things happen again in the *cosmos* according to number, such that the same idiosyncrasies in nature that existed before will occur again in this *cosmos*, as Chrysippus says in *On the Cosmos* ... They say that the only discernible changes between later and prior idiosyncrasies of nature are due to certain external accidents, and these changes, for the same Dion continuing and living, do not alter him. He does not become someone else if formerly he had spots on his face, but subsequently he does not. Such changes, they say, do happen between the idiosyncrasies of nature in one *cosmos* and another. (*SVF* 2624)

This view on the relation of successive worlds should be contrasted with that of Empedocles.

14. Early Christians

With the rise of Christianity, we find the idea of creation *ex nihilo* being taken seriously and adopted for the first time. Creation *ex nihilo* cannot be found in any thinker prior to the rise of Christianity. Sorabji (1983, 246 note 65) lists some possible exceptions, but in each case the balance of evidence is against an *ex nihilo* view. There is no

definite position of creation *ex nihilo* outside the Greek and early Christian traditions. In the Jewish tradition, there are some inconclusive passages in the Syriac *Apocalypse of Baruch*:

You who at the beginning of world called forth what previously was not. (21.4)

By a word you called into life what was not there. (48.4)

One might possibly interpret these passages as entailing creation *ex nihilo*, but more plausible alternatives are available. For the first passage, it might be the organization of the world called forth into existence from chaotic pre-existing matter; in the second, life is called into existence from non-animate pre-existing matter. Some early Christians then, though not unanimously, perhaps as a way of demarcating themselves from the Greek philosophical tradition, originate serious contemplation of creation *ex nihilo*. There was a considerable divergence of opinion in response to a battery of arguments concerning creation in general and Christian creation in particular. I do not see any clear cut evidence for creation *ex nihilo* in the Bible. This may surprise some, but that is the view of many scholars. I would add, in symmetry, that I do not find clear-cut evidence in favor of creation from pre-existing matter either. It may well be that for the original authors of the Bible this was not a key question. So:

- 1) There are passages which refer to God's act of creation without referring to pre-existing matter, but none which state there was no pre-existing matter.
- 2) There are passages which refer to God ordering a *cosmos* out of pre-existing matter, but none which state that this matter has always existed and has not been earlier created *ex nihilo*.

What we do not find is the kind of explicit formulation that Augustine gives:

All formed things were generated from matter, and this matter itself was made from absolutely nothing. (*On "Genesis" against the Manicheans* 1.6)

I would agree with Winston (1971–1972, 191; cf. May 1994, xi–xiii; Grant 1980, 137):

The first explicit formulation of creation *ex nihilo* appeared in second-century Christian literature.

This only became an issue around the end of the first century CE in debates between Christian theologians and Neoplatonist philosophers. On balance, most passages lean towards creation from pre-existing matter without excluding creation *ex nihilo*.

15. Conclusion

There was much discussion of the creation and destruction of the world and much original and sophisticated thought on the topic. Ideas about the creation and destruction of the world were tied not only to theological beliefs, but also to views on the nature of explanation as well as space and time, and to views on the origins of humans and life in

general. In these ancient discussions, we can see the genesis of many modern debates on the origins of the universe and how we should go about explaining the order of the universe.

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FURTHER READING

For ancient theories of creation, see especially David Sedley (*Creationism and Its Critiques in Antiquity*. Berkeley: University of California Press, 2007), and Andrew Gregory (*Ancient Greek Cosmogony*. London: Duckworth, 2007).

NOTES

- 1 For considerable similarities between Hesiod and the Hittite account found on the Kumarbi stone (Gurney 1952, 194; KRS 45–46). Pherecydes (circa 550 BCE) is an interesting character, but Aristotle puts him in a different tradition from the philosophical thought of the Milesians (KRS 50–71). Alkman (circa 600 BCE) is possibly a bridge between myth and philosophy, but what little we know of him is badly corrupted by later commentators. See West 1971, 1–77, 206–208; KRS 47–49; Aristotle *Metaphysics* 1091b; Penwill 1974; West 1963, 154–156; West 1971; Vernant 1965.