Beyond Reason

Knowledge, Religion and Science in The West

David Hopson

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Sample Chapter Only

Going Greek

What the ancient Greeks thought about the universe and how their thinking still resonates today.

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Publishing and Copyright Information

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Introduction

This is an essay about knowledge – what knowledge is; where it comes from; and what's so great about it anyway. At the outset I argue that whatever you know, it begins in what you learnt at your mother's breast; through your native language and from the culture in which you were raised. This is knowledge that you can't un-know, and which feels so certain and true that it is impossible to understand (let alone believe) that the world can truly be different for others.

In The West, amongst the peoples of the Mediterranean, the Jews, the Christians and the Muslims in all their many dispersions, varieties and descendants, the roots of the knowledge we learn as children goes back 3,000 years to the ancient Greeks, and beyond. In the second chapter I describe how the Greeks understood the universe, and how their knowledge still resonates through our thoughts and feelings today. For example, in a Greek manner we still think the Sun is *going down* at the end of the day; although for hundreds of years now, we have known that it is *earth-turn* which puts out the light.

In chapter three I move on to show how the traditional Mediterranean understanding of God was wrapped around the Greek description of the universe, producing a scriptural and cultural account of God's role in creating and sustaining the world, the meaning of His creation, and the place of humanity in the scheme of things. This religious understanding remained stable and meaning-full until the 16th century when the natural philosophers (later to become known as scientists) started to question whether the Sun goes round the Earth; and suggested it was easier to understand the night sky by 'hypothesising' that the Earth spins and is in orbit around the Sun.

The collapse of Greek knowledge which followed from this hypothesis is covered in chapter four. This collapse posed a fundamental threat to the long-held religious beliefs of Judaism, Christianity and Islam about God and His creation. The greatest challenge was to the authority and power of the Roman Catholic church which, in a trial that has become emblematic of the conflict between religion and science, found the Italian thinker Galileo '*vehemently suspect of heresy*' for his opinion that the Sun rather than the Earth was at the centre of the universe.

The fifth chapter describes the method by which René Descartes, a French mathematician and philosopher, found a way of re-shaping our knowledge of reality without insulting the traditional scriptural understanding of God and His universe; or exposing himself to the risk of a trial for heresy. After Descartes it became clear that knowledge was not simply about describing our experience of the world, it was about explaining why we see what we see. It is certain that we experience the sun moving below the horizon at the end of the day, but the challenge is to explain why we see it like this, and to tie this explanation in with the movements we see in all the other stars and planets.

After Descartes and other 17th century thinkers had done their stuff, science leapt ahead. Chapter six offers an overview of how, in less than three hundred years, science has completely redefined the Mediterranean cultures' understanding of the nature and

laws of the material universe; an intellectual success that was exemplified by the astonishing power of the technology which arose from it. Chapter seven gives an account of the similarly dramatic changes in the life sciences, where the most startling development was Darwin's theory about the evolution of species by natural selection.

By the beginning of the 20th century, the traditional account of God and His Creation had been comprehensively undermined. In The West, as the century progressed, a large proportion of the population, especially those with roots in Northern Europe, came to the conclusion that "*God is dead*."

The challenge for science was that as 'The Enlightenment' of the 17th and 18th century progressed and as science matured it became clear that some of the most fundamental assumptions about the nature of the universe could not be scientifically 'proved' and, worse perhaps, were directly inherited from the religions whose God had been undone. In chapter eight we see that the philosophical difficulties that this gave rise to were not just matters of intellectual navel-gazing; the uncertainties inherent in the assumptions of science, found a parallel in the material discoveries of science in quantum mechanics and the Big Bang.

The conundrum we face as we move into the 21st century is that if God is dead and reality is founded on uncertainty, how can we truly claim to know anything at all? Bluntly, the answer is that we cannot. In the final chapter I argue that the only way forward from this uncomfortable conclusion is to move beyond reason and seek a compelling and widespread cultural understanding about what the discoveries of science mean. In the absence of such an understanding, the vacuum of meaning at the heart of our culture is all too easily filled by religious and scientific fundamentalists who exhaust their passionate certainties in a divisive spectrum of responses which range from the simply vitriolic to the appallingly violent.

Covering 3,000 years of thought from Aristotle through Copernicus, Galileo, Descartes, Kant, Darwin and Einstein (and many others), this essay provides an informative historical context for those who are studying philosophy, science and religion. It will also be of interest to the general reader who wants to understand more about the important role that religion has played in the development of Western science and contemporary knowledge.

Preface

At the simplest level, knowledge is made up of the answers to the questions we asked when we were children about what things are and why things happen. As adults we come to realise that the knowledge we acquired in childhood is hugely dependent on when and where we were born, and whoever brought us up. Other people from different times, cultures and places don't (or didn't) think like we think, or know what we know.

The realisation that other people's knowledge of the world is different from our own gives rise to a difficult question: "*Who is right – them or us?*" It is immediately clear that there is no simple way to answer to this question. If what *I know* fundamentally conflicts with what *you know*, then there is no common ground on which we can thrash out our differences. The question of how to decide whether or not knowledge is right has been at the core of Mediterranean culture and philosophy for the better part of 500 years now. It is a quest that is generally said to have begun in 1543, when Copernicus made the radical suggestion that the Sun rather than the Earth was at the centre of the universe.

Science emerged from the efforts of thinkers like Galileo and Descartes to demonstrate that the Copernican view was correct, even though this big idea overturned what had been 'known' about the universe for thousands of years, and conflicted with the everyday evidence of the senses. These early 'scientists' established that the aim of this new way of thinking was to develop clear and distinct ideas about the world, based on universally accessible and repeatable evidence. Scientific methodology evolved as a mixture of rigorous (often mathematical) thinking, detailed observation, and careful experimentation.

The unparalleled practical success of science is the basis for a widely held view that scientific knowledge alone represents an understanding of the world which can claim to be true. According to this view the consequence of scientific success is that through its methodology a bar has been established which any proposition about the world must get over if it is to be considered as real knowledge and a candidate for the accolade of Truth.

Culturally, the most important proposition to fall at this bar is the idea that there is a God. The God of tradition, as described in the scriptures of Judaism, Christianity and Islam, began to dissolve as the universe was re-ordered in the wake of Copernicus' insight, and evaporated completely under the light of contemporary physics and evolutionary biology. By the beginning of the 20th century, from a strictly scientific perspective, it seemed inevitable that this loss of God should sound the death knell of religion (along with myth, superstition, magic and fairy tales), but it hasn't quite worked out like that. In fact there has been a resurgence of traditional religion, and amongst the fundamentalists of all three Mediterranean faiths (see note below) the failure of science to validate the existence of God is seen as a sign of scientific weakness and error, rather than casting doubt on the truths of the God who is found in Holy Scripture.

The differences between those who believe in the absolute truths of science and those who believe in the immutable teachings of religion are turning out to be far more influential than might have been expected. For example, in the origin of life debate about

whether creationism and intelligent design should be taught in schools alongside evolution and natural selection, it has become clear that the competing views are fundamentally irreconcilable. Here there are passionately debated issues with social and political implications which at one end of the spectrum influence how people vote, and at the other end form part of the rhetoric which serves to justify such horrifying events as 911 and the war in Afghanistan.

I have to own that I have become increasingly despondent about the debate and conflict between what I call the scientistas and the religionists. Both sides seem to have become pointlessly aggressive and abusive in their positions. This would be fine if they could confine their conflict to a private row between consenting adults, but they can't, and the backwash increasingly affects all of us. In good part this essay is my attempt to make sense of the relationship and conflict between religion and science, and to understand how we got into such an *unholy* mess. I have approached the subject by looking at the history of knowledge from the Greeks right through to our own time in quantum mechanics, evolution, and the idea of the Big Bang. This work has been informed by my background as a marine engineer and classically educated philosophy graduate, and by my great good fortune in having had some inspiring teachers.

What emerges in this essay is that the distinction between religion and science is far less clear cut than it is generally represented to be in the heat of partisan debate, and in fact they turn out to be very closely related to each other; and always have been. Most importantly it is clear that science is based on a key belief of all the Mediterranean monotheist religions, that the universe is a singular whole and subject to natural laws which are true throughout time and space. The monotheists inject God into this, arguing that the reason why the universe has this nature is because it was created by a single Creator with definite purposes. However you don't need the God of monotheist scripture to believe that the universe has a singular nature.

The challenge for science is that this most fundamental belief about the nature of the universe is quite impossible to demonstrate objectively within the framework of scientific methodology – it falls at the same bar as God does. You cannot prove that the nature of the universe is singular by either evidence or logic. How can we know that the laws of physics are exactly the same here as they are on the other side of the universe? What is the basis for our belief that the future will be like the past? We believe in the consistency of the universe across time and space, but only because we make an underlying assumption that nature is uniform – and as the famous philosopher David Hume so coherently demonstrated in the middle of the 18th century, this proposition is empirically 'unprovable'.

In fact, since the beginning of the 17th century, the central concern of philosophy has been to try to explain the uncomfortable truth that the intellectual foundations of science (and monotheism) cannot themselves be 'proved' scientifically. There is a broad consensus, which has been expressed in a multitude of different ways, that somehow the reality we know is created in and through the acts of perception and observation; in short that our knowledge of reality has its origins in our minds every bit much as it does in the world of material 'stuff.' The implication of this is that the nature of reality-in-itself is beyond our ken. This would be a lot more airy-fairy were it not for the fact that at the leading edge of physics, in quantum mechanics, in Big Bang theory, and in the

'discovery' of Dark Matter and Energy, it turns out that fundamental reality is impossible to grasp within the rules of space-time perception that we use to make sense of the world in our daily lives. The impossible truth seems to be that at the most basic level of matter the ruling principle is one of uncertainty and an infinite range of possible futures, albeit that the probability of most of them happening is vanishingly small.

The intellectual conundrum we face as we move into the 21st century is that if God is dead and reality is founded on uncertainty, how can we truly claim to know anything at all? Bluntly, the answer is that we cannot. It is manifestly ironic that after 500 years in pursuit of 'facts' science has led us to an understanding that the nature of reality and our role in its 'creation' makes it impossible to achieve complete and certain knowledge. This may seem like a disappointing conclusion, but it is only a disappointment because for two hundred years or so, those of us who live in the scientific cultures have believed our own propaganda about the factual quality and certainty of the kind of knowledge that science was capable of delivering. For most of our history it was understood that whilst we could be sure of God's existence and enormous powers, *"He moves in a mysterious way, His wonders to perform,"* (as the 18th century English Poet, William Cowper, put it).

All this said, it is abundantly clear that the knowledge which science has created is enormously stable, and offers a compellingly practical description of the universe and the way it works. The challenge is about how to reconcile the enormous success of science with the truth that the beliefs which underpin it are 'untestable', and that its own investigations reveal a profound degree of uncertainty and incompleteness in the nature of the reality it describes.

The approach that I suggest here is to ask about the meaning of science. This is a quest that is in essence religious, although I am anxious to be clear that this essay is not an attempt to revive the God of Mediterranean scriptures. I call this quest religious because, as I show in the historical sections of this essay, the function of religion has precisely been to wrap meaning around the description of the universe given by natural philosophers (aka scientists).

It may seem odd to ask, for example, what the Big Bang means. However when it is pursued it becomes clear that there is a close analogy between this event and the logical need for a Prime Mover in the traditional Greek account of the universe; an account which remained unchanged for the better part of 3,000 years. This is not to equate the Big Bang with Divine action. What the Big Bang means is that there was indeed some founding action, some initial impulse in our universe, and that all things flow from it, including life on Earth, us and our consciousness. Does this mean that it is in the nature of the universe to become, in some manner and degree, self-aware? This is a question that cannot be answered scientifically, and can only be addressed religiously. The validity of religious answers is determined by the assent of people and not by the assent of evidence.

We are moving into a post-rational age, where we have to re-establish the idea that it is meaning which determines the validity and quality of knowledge; not simply whether it is logically and experimentally correct. Knowledge has a moral and political dimension which we ignore at our peril. This is nowhere more true than in the advanced scientific cultures of the Western Mediterranean cultures.

Religion is not about the God-bothering rival factions of megalomaniac control-freaks. It is about trying to understand bigger truths about our relationship with reality than can be established at the particulate level of individual human beings and science. I have no axe to grind about what conclusions should be drawn about the meaning of science. I simply believe that if we learn from our past about how religion wrapped meaning around natural philosophy (or science) to produce knowledge we are more likely to make progress than we are if we persist in condemning each other for stupidity and blasphemy, and all too often blowing each other up on this account.

The beginning of this understanding is to remind ourselves of the importance of what we learn at our mother's breast, and how that determines everything we know and can ever know.

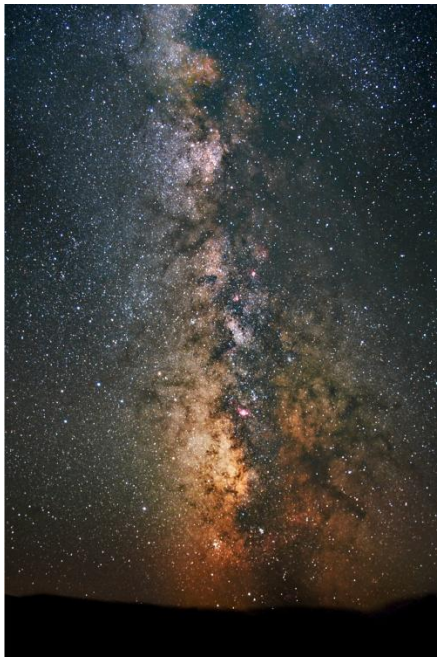
NOTE:

I've used the term Mediterranean cultures to refer to the cultures of those 'nations' which originally existed within about 1,800 miles of the Mediterranean shoreline – two months travel by foot, horse and boat. Roughly speaking that takes in the whole Jewish, Christian, and Muslim sphere of influence, before the 'discovery' of the Americas and Australasia, and the age of colonialism. Click or tap here to see a map.

2

Going Greek

"In the beginning God created the heaven and the earth ... And God said, Let there be light: and there was light. / And God saw the light, that it was good: and God divided the light from the darkness. / And God called the light Day, and the darkness he called Night. And the evening and the morning were the first day." ***Genesis 1: 3 5***



The Milky Way - 200,000,000,000+ stars

In the nations of the Western scientific cultures it has been several generations since we have been able to see the night sky as most of the rest of humanity has seen it. We now have a term for the phenomenon which has changed our view – light pollution. Our street light, the light that spills from lamp posts, shops, vehicles, and past our curtains, overwhelms all but the brightest of objects in the night sky. Just occasionally we find ourselves in places which are properly dark, where we can see the night sky in all its star-filled glory. It is such an exciting spectacle, that in places where there is no light pollution, entrepreneurs are now creating 'Dark Parks' as tourist attractions, places where you can go and see, for example, that the Milky Way really is like a huge milky splash across the sky. Looked at through binoculars, this 'milk' resolves itself as hundreds of thousands of twinkly stars.

In our history, it was the ancient Greeks who first asked serious questions about the night sky, though you don't need to be in place that is free of light pollution to align yourself with a Greek frame of mind. Ideally wait for a warm and beautiful evening, with clear skies. Find somewhere with as big a view of the western sky and horizon as possible. Watch the sun go down, and then allow yourself a long evening of star-gazing.

These are the things to think about and the questions to answer. Firstly, as day gives way to night, is the sun going down or are you spinning away from it? Is it the sun moving or is it you? Does the Earth seem to you to be stable and fixed? Secondly, as the night wears on you will notice that the positions of the stars relative to you are changing. If there is a moon you will see that it is moving too. Are all the lights in the sky revolving about you, or are you turning underneath them?

I have never met anyone who claims to have a personal, felt experience of being on a moving, revolving earth unless they were under the influence or in the throes of love. If, as a star gazer, your earthly viewpoint is manifestly still, then it is eminently reasonable to argue that if you aren't moving then the things up there are; and they look like they are travelling in a circular arc.

Another thing to notice in the night sky is that although there are some differences in colour and size between the stars, there is actually not a lot to choose between them. They are pinpricks of light in a large dark canvas, and so far as one can see they just twinkle away forever. The stars are so numerous that unless you have a guide you almost certainly won't spot a planet on a one night stand. The dynamism of the sky only becomes apparent through long familiarity of the kind you might get sitting around, chewing the fat with friends and family night after night on balmy Greek islands, or standing summer watch over livestock up in the mountain pastures.

If you do become familiar with the stars you discover that every night the sky 'starts' in a position that is slightly different from the night before. Eventually it also becomes apparent that amidst the squillions of dots of light which you can see, there are five stars which seem to wander around the sky as if they are disconnected from everything else up there. The Greek word for wanderer is '*planetes*'. Once you spot the planets you can see that they move around quite a lot; that they are slightly bigger and brighter than other stars; and in some cases have a distinct colour. Mars is an obvious reddish colour, and Venus is distinctly yellowy. Today, when you see images of the solar system, the planets are all great big things with distinct features, like craters, mountains, clouds, moons and rings, but until we got decent telescopes, photos and spacecraft, nobody ever knew them like that.

Somewhere along the line a consensus was reached by our ancestors that there are seven wanderers in the sky: Mercury, Venus, Mars, Jupiter and Saturn, along with the Moon and the Sun. All the other stars were deemed to be fixed. The fixed stars are so called because they sit in an unchanging position in relation to each other. There is evidence from the very earliest times that patterns (constellations) were identified in the fixed stars. The ancient Greeks identified and named 48 of them (the definitive catalogue was set down by the astronomer Ptolemy in the 2nd century AD). Today the official count from the International Astronomical Union is 88. Twelve of these constellations constitute the signs of the Zodiac, parts of the sky through which the Sun cycles every year, and they provide key reference points in astrology.

A few particularly bright or interestingly positioned fixed stars got their own names, for example, The North Star, or Polaris. This star, by a quirk of rotational geometry (though this was not known by the Greeks) appears to sit permanently in the same static position over the North Pole, and can therefore be used as an aid to navigation.

The phenomenon of the planets and the fixed arrangements of the other stars have of course become obvious to all human cultures. There is nothing unique about the Greeks' observations. The important feature of Greek thought is the questions they asked about what they saw, and how they answered them. Of equal importance, though less obvious, is an underlying belief that it was possible to find satisfactory answers to the kind of questions they wanted to ask. Here we can see in play the principle that the universe is a consistent, stable, material whole. It is a remarkable act of imagination to think that we can interpret what is going on so far beyond our physical reach, in terms of what we experience here on earth. If this seems no more than common sense, that is because we live within a culture that is rooted in the intellectual achievements of the ancient Greeks. No other cultures have made this move in the way that our ancestors did. It is one of the

keystones of science, and indirectly therefore one of the reasons why our culture has become so dominant.

The movements of the night sky reveal a huge and dynamic system which is manifestly beyond our physical reach, but of which we are clearly some kind of part. The questions which emerged for our ancestors are natural and obvious. *What is going on out there? What are all those stars? What makes them move? Why do a handful of them move independently of the others? How come we're not moving? How exactly do the Sun and the Moon fit in? What powers are in play? What influence do those powers have on us? How does all this the link to our seasons? Where did it all come from?*

The answers which the Greeks came up with and set down in writing about 2,500 years ago, survived largely unchanged and unquestioned in the Mediterranean[1] cultures until the 16th century. These answers informed and became deeply embedded in all the religions and cultures that evolved around the Mediterranean – Pagan, Jewish, Christian and Islamic.

The interpretation of what could be seen in the sky was that the Sun, the Moon, each of the planets and the whole collection of fixed stars were contained within their own individual rotating spheres, which were nested and centred on the still core of the Earth. The material of the spheres themselves was the fifth element, quintessence or Aether, which was conveniently transparent (see the other four elements below). There were centuries of discussion and dispute about how many celestial spheres there were, and in what order they were found. In the third century BC, an eccentric called Aristarchus, from the island of Samos, made the bizarre suggestion that the Sun rather than the Earth was at the centre of the spheres; but it wasn't a popular view and did not get any intellectual traction for nearly 2,000 years.

The notion that the universe is made up of nested spheres is a sophisticated and reasonable interpretation of the evidence. It isn't a casual myth or superstition, and it is soundly based on objective and detailed observation. The ancient Greek view offered a workable explanation of what could be seen in the heavens; workable in that it accounted for experience and could be used to predict what paths the planets and the stars would follow through the sky in the future.

Early in the first millennium, a definitive version of the system of spheres was produced in a book called the Almagest. The author was the astronomer mentioned earlier, Ptolemy[2], who was an Egyptian by birth, a Roman citizen by status, but wrote in Greek – an indication of how cosmopolitan the Mediterranean world became in antiquity. The diagram sets out the Ptolemaic view of the universe as it was understood in the 16th century, in its mature final form before the scientific revolution began to

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[1] I've used the term Mediterranean cultures to refer to the cultures of those 'nations' which have existed within about 1,800 miles of the Mediterranean shoreline – two months travel by foot and horse. Roughly speaking that takes in the whole of Jewish, Christian, and Muslim sphere of influence, before the 'discovery' of the Americas and Australasia, and the age of colonialism. Click or tap here to see a map.

[2] In full: Claudius Ptolemaeus

undermine it. For something like two and half thousand years this understanding was at the heart of cosmology for the Mediterranean cultures and it has left a legacy which remains firmly in place today.

Ptolemy's earth-centred model of the universe

In the Ptolemaic drawing, a cut away section across the spheres, you can see the Earth lies at the centre of the universe, followed by the spheres for the Moon, Mercury, Venus, the Sun, Mars, Jupiter, Saturn, and finally the fixed stars. The sphere of the fixed stars has sub-divisions which correspond to the astrological zodiac and other beliefs about the nature of the outermost domain.

What this diagram also shows is the area beyond the final sphere of the universe, which it describes as "*The Empyrean heavens, the dwelling place of God and all the Elect,*" though in Latin - *"Coelum empireum habitaculum dei et omnium electorum."* Here we can see implied an explanation of how and why this universe is believed to exist – it is down to God. Here too is an explanation of why it is that when you ask people where Heaven is, they point vertically upwards. If you are on Earth, at the very centre of this system, then Heaven, the dwelling place of God, is always straight up.

Whatever you feel about the introduction of God to the universe, there is a logic working here. When you define a boundary you divide an area or space into two parts – the part that is inside the boundary and the part that is outside. In asserting that the universe is spherical, the ancient Greek view necessarily implied that it is embedded within some larger 'space,' although a space with unknown dimensions and impenetrable properties. The question of how the universe came to be in this space (whether it was placed there or created in situ) is surely unanswerable. What matters is the sense that the universe is included within something that must be bigger and implicitly more powerful than it is itself. Within this logic, the idea that there is a 'parental' space and perhaps therefore, a parent (a God) is an easy and natural conclusion.

This conclusion is strengthened by the experienced-based sense that everything has a beginning, and all beginnings are the result of some action or event. How did the world begin? Surely there must have been a creator inside the parent/God space, who used 'its' material resources to create the universe. This is the God of "*The Empyrean heavens.*" Whether you like God or not, He, She or It emerges unbidden, if ill-defined, from a model of the universe which has a boundary, for such a model can only be conceived as a participant subject of a bigger whole.

If the fundamental topology of the universe, the shape and arrangement of its parts is understood, the most compelling follow-on questions are about its substance and nature. On the basis of what you can see very clearly in the night sky, it seems obvious that the universe is sub-divided into two different realms.

There is an upper realm, the realm of the spheres, where nothing changes. All those gazillions of stars just twinkle away night after night, following their unvarying and wholly predictable paths through the heavens exactly as they have always done. The constellations and the zodiac are forever there. New stars are never born, existing stars never die. Even those wandering stars, The Sun, the Moon, and the planets follow utterly predictable if rather peculiar paths.

Here on Earth, in the lower realm, things are very different. Everything changes or is susceptible to change. Birth and life lead invariably to death and decay. Everything made and unmade is subject to the effects of weather, tide, eruptions and earthquakes. More simply, everything wears out or, as Gautama Buddha famously put it in another cultural tradition, '*All conditioned things are impermanent.*'

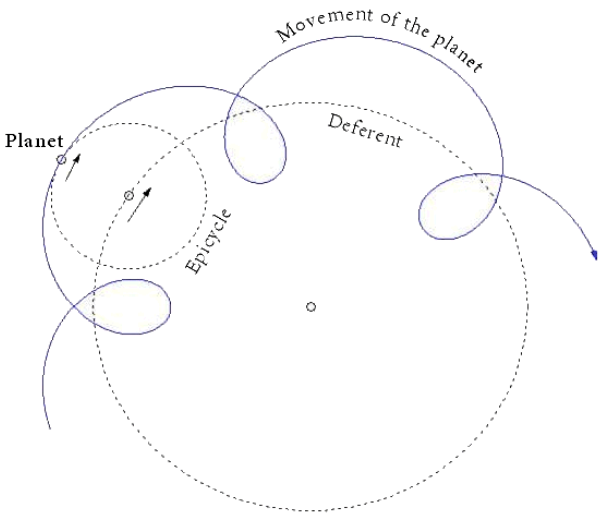
In short then, the evidence is that the Heavens are perfect and incorruptible unlike the Earth which is a place of imperfection and corruption – corruption in the sense that things fall apart. This is not in any sense a moral judgement, it is just observed as a matter of empirical fact.

Inevitably there were some anomalies in the evidence. Comets were a rare but spectacular problem, since they were novel and largely unpredictable phenomena that looked like they might be happening in the supposedly unchanging and incorruptible upper realm. In the fourth century BC, The Greek philosopher Aristotle resolved this matter by declaring that in fact comets were hot, dry exhalations which gathered in the Earth's atmosphere and occasionally caught fire. That put comets firmly back in the lower realm of corruption.

The planets posed a bit more of a problem because their paths lacked the elegant simplicity of movement that they ought to have as heavenly bodies. The planets seem to head in one direction, and then go in the reverse direction, before turning back once again towards their original course. They didn't seem to have the smooth and pure movement you'd expect in the upper realm of incorruptible perfection. The Greek solution to this problem (attributed to Apollonius of Perga c. 200 BC) was also set out by Ptolemy in the Almagest, and introduced epicycles into planetary orbits.

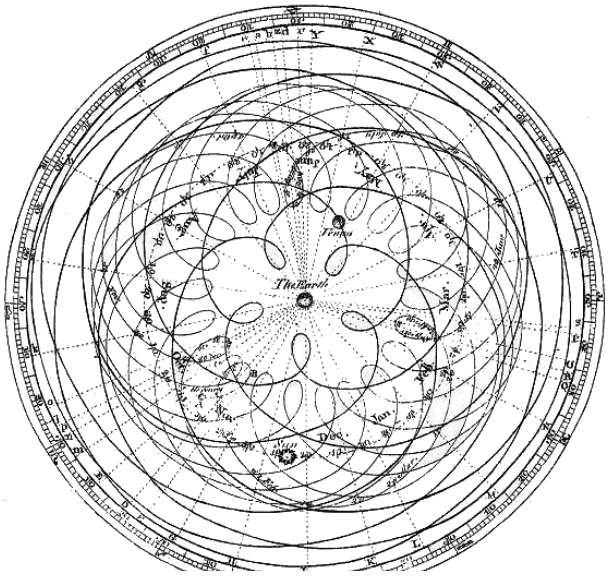
Epicycles are like dancing whirls on a planet's underlying circular path. Epicycles are the images that you get from a Spirograph, the children's toy that draws mathematical patterns. From the perspective of a still Earth, planets moving in epicycles will appear to move backwards and forwards in the sky, as they track along their paths. The obvious problem with them is that when you actually start to plot paths for all the planets, a seriously complex picture emerges. The difficulties posed by this complexity will become one of the drivers of the scientific revolution in the 16th century. The lower illustration shows the epicyclic track of just two planets, Venus and Mercury – imagine laying five more on top.

Epicycles may have looked rather complex but they helped with another question concerning the consistency of the spheres. Were the spheres solid or fluid? Were the planets fixed in their spheres like jewels on a ring or did they move around within them? Clearly if the planets could make epicycles they had to be able to move so it followed that the spheres they occupied were fluid; but what about the sphere of the fixed stars?



If the Earth is taken to be still, planets appear to follow an epicyclic path

There was much discussion about such things, and some argued that since the heavens had all to be of the same fluid substance the planets might even travel between spheres to achieve their epicyclic movement. It seems reasonable to imagine that such matters were as opaque to most people then as discussions about the true characteristics of the Higgs Boson are to most of us today.



Apparent epicyclic motion of Mercury and Venus from Earth

The point to emphasise about all this is that even though things got very complicated, the ancient Greeks built their knowledge on the basis of evidence; on real experience and observation. It is when the question moves on from, *"What is happening?"* to, *"Why is it happening?"* that things start to become a little more speculative and controversial. A rather large and obvious question is about why all this heavenly movement takes place. In the Greek view there are only two kinds of motion: natural motion and 'violent' or induced motion (i.e. motion caused by some external cause). Natural motion was a quality of material objects, reflecting their elemental make up (of which more below). All other motion was 'driven' by someone or something.

A circular path is eternal; you can go round and round it forever, and in this sense it is perfect. The motions of the heavenly bodies were constrained within spheres, and were believed to move in perfect circular paths consistent with their eternal and unchanging nature. The difficult question was about where the motion came from. The motion had to be started and sustained by something, and here God, or rather Gods came in to the picture. Aristotle proposed that each sphere, and its planetary or stellar payload, was moved by a God, a divine unmoved mover, and that the 'force' through which this motion was effected was love (and you thought hippies were a phenomenon of the 1960s). In the multi-God (polytheistic) culture of the Greeks, this idea worked well, and each of the heavenly spheres had its own God in the driving seat. The Romans, who

inherited their understanding of the universe from the Greeks, went for this idea too. It is the Roman names of the driver Gods that we use for the planets today (Greek names in brackets):

- Mercury - God of commerce, travel and thievery (Hermes)
- Venus - Goddess of love and beauty (Aphrodite)
- Mars - God of war (Ares)
- Jupiter - King of the Gods (Zeus)
- Saturn - God of agriculture (Kronos)

The Greek deity, Gaia, the Goddess of Earth, is enjoying a bit of a revival in James Lovelock's idea that our planet is a kind of living organism.

Apart from thinking that love was the motive force for stellar motion, Aristotle also thought there was a hierarchy amongst the unmoved movers which ultimately went up to a 'Prime Mover' at the very top. When polytheism (the belief in a multitude of Gods) was replaced by monotheism (the single God theology of Judaism, Christianity and Islam) Aristotle's idea came into its own. In monotheistic culture the lower Gods were dispensed with and replaced with a single Prime Mover driving the outermost sphere, inducing a motion that was transmitted to every other sphere in the universe. Not surprisingly the Prime Mover of antiquity and the monotheists' single God were seen as identical. In this way, the Greek heavens, with a bit of juggling on the God and Prime Mover front, were sorted into a cosmological system that underpinned the religious cultures of the Mediterranean peoples, and continues to have a significant though generally unrecognised influence on our understanding today.

Complementing their account of the Heavens, the Greeks also developed a detailed understanding of Earth, the heart and centre of their universe; where imperfection, change and corruption are the defining environmental characteristics. Here it can be more difficult to get your head around Greek knowledge because we use some of the same ideas that they had, but in a quite different way. For the Greeks, the motion they saw in the heavens was 'violent' – it was driven by the energy in the love of their Gods. Earth however was the domain of natural motion.

In the Greek view everything at Earthly level is made up of four elements – Earth, Water, Air and Fire. These aren't elements of the kind that we mean by Hydrogen, Oxygen, Iron, Uranium etc. The Greek elements are about the nature of matter, about its qualities, the way that it behaves, and the way that we experience it. An element in the Greek sense is not, as we would think of it, about identifying a wholly distinct type of matter with uniquely defining properties.

The Greek elements are arranged in a hierarchy. The base element is Earth, above that is Water, then there is Air, and finally there is Fire. By nature, each element is impelled from 'within' to locate itself in the right place in this hierarchy, which gives each of them a 'natural motion'. In extremely simple terms we can think of the Greek elements as solid, liquid, gas and heat; which from our perspective can help to make it easier to understand why the elements seek their place in the hierarchy. So for example, if you throw a stone into a pond, it will be impelled by its 'earthiness' to move down through the air and then through the water until it reaches the pond bottom.

Things that are principally comprised of the element Earth always try to make their way to the very centre of the universe, to the centre of the globe on which we live – which is why we call our home The Earth. This produces an answer to the question, *'Why is The Earth a globe?'*: because it is clear that if vast quantities of Earth stuff try to move towards the very centre of creation, a spherical ball is going to be formed as all that stuff jostles for position.

Here too is an explanation of geographical features like the mountains, the land and the sea. Things don't always work out perfectly in the corruptible part of the universe, so 'Earth' can get trapped and clumped up and make no further progress towards the centre – and thus landscapes are formed. Later, religious thinkers will suggest that this 'clumping' was done by God when he was creating the planet, and needed some land to populate with plants and animals.

If the planet was smooth, then it would be wholly covered with 'Water', because water always 'wants' to be the next skin out from earth. Now it only fills the sea basins and valleys but if there were enough of it, it would cover the Earth. However, some water, somehow, is locked up in the clouds, in a kind of balancing act with air. Religious thinkers argued that God could influence this too, and once did so by emptying the clouds in an almighty flood, which did indeed drown the whole Earth. Air, to the limit of its quantity, fills all the space above the Earth and Water, up to the sphere of the Moon. Fire always heads upwards and away from the other elements, towards the Sun, and thence to the outermost spheres of the universe where it meets the fifth element, quintessence, mentioned above.

Although from today's perspective this is a strange way of looking at things, it does hang together, and can be tied in convincingly with experience. You can produce perfectly good explanations of what happens in the world (and will happen), which in most respects are quite as satisfying to the mind and heart as anything we have today. So if you ask Newton's supposed question, '*Why do apples fall?*', an ancient Greek answer might be, '*Because when they ripen their growing elemental earthiness finally overcomes the impediment to their natural motion that is the stalk. At this point they drop and roll as close to the centre of the Earth as they can get.*'

Here is another example: *'Why is iron heavier than copper?'* 'Because in its elemental composition it embodies more Earth, and so has a greater desire than Copper to get to the centre of the universe'. We experience this desire as weight. It is a perfectly understandable notion, though it has the unfortunate consequence of implying that iron will fall faster than copper, which diligent observers have long known to be false, even in antiquity.

An important aspect of the Greek system of elements is that it reflects a fundamental concern with proportion and balance as well as with order and place. There are no pure elements; everything is a composition of elements. It is the composition that determines the characteristics and properties of material substances – which makes them, in our terminology, elements. Imperfections in composition affect the quality of a substance. The possibility of producing a radical shift in composition opens the tantalising prospect of transforming one substance into another, and in this we have the roots of alchemy – that mystical search for the Philosopher's Stone which, amongst its other powers, will

turn base metal Lead in to noble metal Gold. This understanding of the elements, their nature, structure, order and balance became deeply rooted in the cosmology of antiquity in all sorts of ways, and there are powerful echoes of it in our thinking today.

For example, medicine was based on the idea that the human body was constituted of four humours (literally, 'juices'), in the same kind of way that objects in the material world were constituted of the four elements. The humours can be thought of as the elements of life, and conceptually were closely linked to the four elements of the inanimate material world. The humours with their elemental linkages were as follows:

- Black bile: Earth (autumn; cold/dry; melancholic; spleen)
- Phlegm: Water (winter; cold/wet; phlegmatic; brain/lungs)
- Blood: Air (spring; warm/wet; sanguine; liver)
- Yellow bile: Fire (summer; warm/dry; choleric; gall bladder)

Character reflected subtle differences between the mix of humours in different individuals, and could be observed working at both a social and individual level. Illness was seen as being caused by an imbalance of the humours.

Within the Greek framework, the job of the physician was to identify the nature of the imbalance in the humours and to restore it using a range of medicinal and physical therapies. So in simplistic terms, if it was determined, for example, that a patient had excess of blood, you could bleed them to let some out. Other therapies included getting patients to throw up and clear their bowels using emetics and purgatives; though most treatment involved less dramatic interventions. People's diet and exercise were seen as very important considerations in achieving a balance of the humours.

You can also see from the list above that in determining the health of a patient a form of elemental psychology was also in play. The humours were connected with character traits, like melancholy, which the doctors took into account when diagnosing what kind of imbalance the patient was suffering from. The words and concepts that they used remain part of our psychological and emotional vocabulary today, for example, melancholy and phlegmatic.

Put in our terms, illness for the Greeks was seen as a manifestation of physical, environmental, and psychological disorder. In this sense their view of health was fundamentally holistic. Their understanding resulted in a medical tradition and practice that survived more or less intact in the Mediterranean cultures of the West until the 19th century, and is still highly influential today. Much of what we call complementary medicine has its roots in ancient Greek practice.

Although mainstream medical practitioners in the contemporary Western tradition tend to deride what is left of the ancient ways, and believe that humourism has long since been disproved, all doctors nonetheless subscribe to the Hippocratic Oath. Hippocrates, who lived around 400 BC, was from the Greek island of Kos and apart from pulling together what is considered to be the first encyclopaedia of medicine, also wrote the first ethical code for doctors; his famous oath.

The Rod of Asclepius

In its original form doctors swore their oath by the names of Apollo, Asclepius (the god of medicine) and his daughters Hygieia and Panacea. From Asclepius we get the snake-wrapped staff that is the traditional symbol of medicine, and of surgery in particular.

The legacy of his daughters is in the words hygiene and panacea. Hygieia's role in balancing 'the humours' was based on cleanliness and sanitation. The understanding of hygiene has been at least as important as medicine in improving health and extending life. Panacea had a potion (sometimes used as a poultice) which she used as a remedy to heal the sick. The influence on our lives of Greek ideas about health is unquestionable, and remains significant today.

Having looked at what the ancient Greeks knew about the heavens and the earth, it remains to say something of what they thought about the origins and nature of life. The ancient Greek views on the origin of life get pretty bogged down in a lot of Gods and myths. The gist of the Greek view is as follows:

There was a void into which, amongst other things, was placed the Earth. The Earth aka Gaia (who ends up female) spontaneously produces the Heavens aka Uranus (male). Gaia is then fertilised by Uranus, and produces the Titans – six males and six females – and some other offspring who included Cyclops and some pretty impressive giants, the Hecatonchires. The Titans, presumably for the want of any other options, got into incest and started producing children.

One of their children is Zeus. The myths are scrambled, but the thread of it is that Zeus' son (Zagreus aka Dionysus) is killed by the Titans (i.e. grandparents killing grandchildren!). Zeus gets into a battle with the Titans, and reduces them to ashes, which are mixed up with the ashes of his murdered son. From the mix of these ashes humanity is born. Humans have a divine and immortal soul which comes from the ashes of Zeus' son, Dionysus, and a mortal body which comes from the ashes of the Titans and imprisons the soul, preventing it from realising its divine nature. The soul escapes from the body (through death) but it is trapped in an endless and inescapable cycle of re-birth. The poor humans find themselves constantly getting into sticky relationships with their far more powerful and straightforwardly immortal Godly relations; and life is not easy.

This will probably conclusively compound my many offences in the eyes of classical scholars, but Greek mythology about the origin of life and humanity is of far less consequence than their views about the universe, the stars, the planets, the earth, and the way it all holds together. Perhaps the most important aspect of their stories about the creation of life is the idea that humans have an eternal and immortal soul (a heavenly attribute), and an impermanent mortal body (an earthly attribute). This view became a part of all the Mediterranean religions and is still widely held today.

The legacy and enduring value of Greek mythology about the goings on in the sex lives, relationships and fates of the ancient Gods, is that they are the earliest stories we

have of the challenges and dilemmas that we face in being human. They became important cultural illustrations of ideas about morality and justice that emerged in the civilisations which followed; providing examples of how and why some ways of living are good and others are bad.

The triumph of Greek thought was that it produced a coherent account of the reality and nature of the universe, which was founded upon and consistent with the objective evidence of experience. This knowledge, along with the invention and understanding of mathematics and geometry was also thoroughly practical; which is testified to in the technology and magnificent architecture of the classical period.

Before ending this chapter, I should add something about the famous bearded Greek philosophers, notably Socrates, Plato and Aristotle. What I've written here is a highly condensed distillation of centuries of Greek and later thought, to which many thinkers and scholars contributed. The three philosophers that I have mentioned, and the ones that are best known[3], were in at the founding stage of Greek thought. Socrates, about 450 BC, taught Plato, and Plato then taught Aristotle. Our understanding of ancient Greek knowledge stands upon the foundations that these thinkers established. The 20th century English philosopher, A.N. Whitehead, drily observed that, "*Western philosophy is just a series of footnotes to Plato.*"

Today we think of Philosophy as one subject amongst many, but until about 500 years ago, it was a love of wisdom covering all subjects. To be a philosopher of note in antiquity was to be a polymath, with knowledge of the sciences, social sciences and the arts. It simply isn't possible here (nor relevant) to try to cover the astonishing wealth of subjects that were addressed in antiquity, and the myriad ways that they determined the development of our culture, and continue to have an influence upon us. For example, the manner in which US President Obama speaks in public is an object lesson in rhetoric, the Greek art of discourse and persuasion, which was a central part of education from ancient times until about 100 years ago.

For all their knowledge and understanding though, the questions that Greek and classical culture failed to satisfactorily address are about why we are here, whether we have any purpose and, if we have *A Creator*, why He, She or It put the universe together. It was the monotheistic religions that emerged from the Mediterranean cultures which provided elaborate and satisfying answers to these questions. These answers were deeply infused and entangled with the Greek understanding of the universe, and became highly sophisticated. It is this combination of Greek and monotheistic religious thought which lies at the intellectual centre of our culture.

The next step in this investigation is to look in more detail at how the monotheistic religions wrapped themselves around the Greek view of the universe.

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[3] Other Greek names also remain very well-known. For example Pythagoras and his famous truth about right-angled triangles; and Archimedes whose cry of Eureka when he made an important discovery that is remembered a lot more than the discovery he made (that if you put a golden crown in water, the volume of water displaced is equal to the volume of the crown; which is cool because it then allows you to work out if the crown is solid gold or an alloy)

Appendix 1
Genesis – Chapters 1-3

The book of Genesis tells the story of the creation of the universe, the origin of life, and provides a 'social history' and family tree of the first humans. Genesis forms the opening part of the Judaeo-Christian scriptures. Many elements of Genesis can be found, or are assumed within the Qur'an, which was written much later.

Chapter 1

1 In the beginning God created the heavens and the earth. 2 The earth was without form, and void; and darkness was on the face of the deep. And the Spirit of God was hovering over the face of the waters.

3 Then God said, "Let there be light"; and there was light. 4 And God saw the light, that it was good; and God divided the light from the darkness. 5 God called the light Day, and the darkness He called Night. So the evening and the morning were the first day.

6 Then God said, "Let there be a firmament in the midst of the waters, and let it divide the waters from the waters." 7 Thus God made the firmament, and divided the waters which were under the firmament from the waters which were above the firmament; and it was so. 8 And God called the firmament Heaven. So the evening and the morning were the second day.

9 Then God said, "Let the waters under the heavens be gathered together into one place, and let the dry land appear"; and it was so. 10 And God called the dry land Earth, and the gathering together of the waters He called Seas. And God saw that it was good.

11 Then God said, "Let the earth bring forth grass, the herb that yields seed, and the fruit tree that yields fruit according to its kind, whose seed is in itself, on the earth"; and it was so. 12 And the earth brought forth grass, the herb that yields seed according to its kind, and the tree that yields fruit, whose seed is in itself according to its kind. And God saw that it was good. 13 So the evening and the morning were the third day.

14 Then God said, "Let there be lights in the firmament of the heavens to divide the day from the night; and let them be for signs and seasons, and for days and years; 15 and let them be for lights in the firmament of the heavens to give light on the earth"; and it was so. 16 Then God made two great lights: the greater light to rule the day, and the lesser light to rule the night. He made the stars also. 17 God set them in the firmament of the heavens to give light on the earth, 18 and to rule over the day and over the night, and to divide the light from the darkness. And God saw that it was good. 19 So the evening and the morning were the fourth day.

20 Then God said, "Let the waters abound with an abundance of living creatures, and let birds fly above the earth across the face of the firmament of the heavens." 21 So God created great sea

creatures and every living thing that moves, with which the waters abounded, according to their kind, and every winged bird according to its kind. And God saw that it was good. 22 And God blessed them, saying, "Be fruitful and multiply, and fill the waters in the seas, and let birds multiply on the earth." 23 So the evening and the morning were the fifth day.

24 Then God said, "Let the earth bring forth the living creature according to its kind: cattle and creeping thing and beast of the earth, each according to its kind"; and it was so. 25 And God made the beast of the earth according to its kind, cattle according to its kind, and everything that creeps on the earth according to its kind. And God saw that it was good.

26 Then God said, "Let Us make man in Our image, according to Our likeness; let them have dominion over the fish of the sea, over the birds of the air, and over the cattle, over all the earth and over every creeping thing that creeps on the earth." 27 So God created man in His own image; in the image of God He created him; male and female He created them. 28 Then God blessed them, and God said to them, "Be fruitful and multiply; fill the earth and subdue it; have dominion over the fish of the sea, over the birds of the air, and over every living thing that moves on the earth."

29 And God said, "See, I have given you every herb that yields seed which is on the face of all the earth, and every tree whose fruit yields seed; to you it shall be for food. 30 Also, to every beast of the earth, to every bird of the air, and to everything that creeps on the earth, in which there is life, I have given every green herb for food"; and it was so. 31 Then God saw everything that He had made, and indeed it was very good. So the evening and the morning were the sixth day.

Chapter 2

1 Thus the heavens and the earth, and all the host of them, were finished. 2 And on the seventh day God ended His work which He had done, and He rested on the seventh day from all His work which He had done. 3 Then God blessed the seventh day and sanctified it, because in it He rested from all His work which God had created and made.

4 This is the history of the heavens and the earth when they were created, in the day that the Lord God made the earth and the heavens, 5 before any plant of the field was in the earth and before any herb of the field had grown. For the Lord God had not caused it to rain on the earth, and there was no man to till the ground; 6 but a mist went up from the earth and watered the whole face of the ground.

7 And the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living being.

8 The Lord God planted a garden eastward in Eden, and there He put the man whom He had formed. 9 And out of the ground the Lord God made every tree grow that is pleasant to the sight and good for food. The tree of life was also in the midst of the garden, and the tree of the knowledge of good and evil.

10 Now a river went out of Eden to water the garden, and from there it parted and became four riverheads. 11 The name of the first is Pishon; it is the one which skirts the whole land of Havilah, where there is gold. 12 And the gold of that land is good. Bdellium and the onyx stone are there. 13 The name of the second river is Gihon; it is the one which goes around

the whole land of Cush. 14 The name of the third river is Hiddekel; it is the one which goes toward the east of Assyria. The fourth river is the Euphrates.

15 Then the Lord God took the man and put him in the garden of Eden to tend and keep it. 16 And the Lord God commanded the man, saying, "Of every tree of the garden you may freely eat; 17 but of the tree of the knowledge of good and evil you shall not eat, for in the day that you eat of it you shall surely die."

18 And the Lord God said, "It is not good that man should be alone; I will make him a helper comparable to him." 19 Out of the ground the Lord God formed every beast of the field and every bird of the air, and brought them to Adam to see what he would call them. And whatever Adam called each living creature, that was its name. 20 So Adam gave names to all cattle, to the birds of the air, and to every beast of the field. But for Adam there was not found a helper comparable to him.

21 And the Lord God caused a deep sleep to fall on Adam, and he slept; and He took one of his ribs, and closed up the flesh in its place. 22 Then the rib which the Lord God had taken from man He made into a woman, and He brought her to the man.

23 And Adam said:

"This is now bone of my bones
And flesh of my flesh;
She shall be called Woman,
Because she was taken out of Man."

24 Therefore a man shall leave his father and mother and be joined to his wife, and they shall become one flesh.

25 And they were both naked, the man and his wife, and were not ashamed.

Chapter 3

3 Now the serpent was more cunning than any beast of the field which the Lord God had made. And he said to the woman, "Has God indeed said, 'You shall not eat of every tree of the garden'?"

2 And the woman said to the serpent, "We may eat the fruit of the trees of the garden; 3 but of the fruit of the tree which is in the midst of the garden, God has said, 'You shall not eat it, nor shall you touch it, lest you die.'"

4 Then the serpent said to the woman, "You will not surely die. 5 For God knows that in the day you eat of it your eyes will be opened, and you will be like God, knowing good and evil."

6 So when the woman saw that the tree was good for food, that it was pleasant to the eyes, and a tree desirable to make one wise, she took of its fruit and ate. She also gave to her husband with her, and he ate. 7 Then the eyes of both of them were opened, and they knew that they were naked; and they sewed fig leaves together and made themselves coverings.

8 And they heard the sound of the Lord God walking in the garden in the cool of the day, and Adam and his wife hid themselves from the presence of the Lord God among the trees of the garden.

9 Then the Lord God called to Adam and said to him, "Where are you?"

10 So he said, "I heard Your voice in the garden, and I was afraid because I was naked; and I hid myself."

11 And He said, "Who told you that you were naked? Have you eaten from the tree of which I commanded you that you should not eat?"

12 Then the man said, "The woman whom You gave to be with me, she gave me of the tree, and I ate."

13 And the Lord God said to the woman,
"What is this you have done?"

The woman said, "The serpent deceived me, and I ate."

14 So the Lord God said to the serpent:
"Because you have done this,
You are cursed more than all cattle,
And more than every beast of the field;
On your belly you shall go,
And you shall eat dust
All the days of your life.

15 And I will put enmity
Between you and the woman,
And between your seed and her Seed;
He shall bruise your head,
And you shall bruise His heel."

16 To the woman He said:
"I will greatly multiply your sorrow and your conception;
In pain you shall bring forth children;
Your desire shall be for your husband,
And he shall rule over you."

17 Then to Adam He said, "Because you have heeded the voice of your wife, and have eaten from the tree of which I commanded you, saying, 'You shall not eat of it':
"Cursed is the ground for your sake;
In toil you shall eat of it
All the days of your life.

18 Both thorns and thistles it shall bring forth for you,
And you shall eat the herb of the field.

19 In the sweat of your face you shall eat bread
Till you return to the ground,
For out of it you were taken;
For dust you are,
And to dust you shall return."

20 And Adam called his wife's name Eve, because she was the mother of all living.

21 Also for Adam and his wife the Lord God made tunics of skin, and clothed them.

22 Then the Lord God said, "Behold, the man has become like one of Us, to know good and evil. And now, lest he put out his hand and take also of the tree of life, and eat, and live forever" — 23 therefore the Lord God sent him out of the garden of Eden to till the ground from which he was taken. 24 So He drove out the man; and He placed cherubim at the east of the garden of Eden, and a flaming sword which turned every way, to guard the way to the tree of life.

Appendix 2
Further Reading

People are surprisingly snotty about Wikipedia. Sometimes a Wikipedia entry turns out to be a bit wobbly, but mostly what you find is good basic fare and (here is the important bit) it is backed up by references which take you to primary sources and/or high quality academic work. So Google what you are interested in, go to the relevant Wikipedia pages, and at the bottom of each you will find reading lists that will be much better than anything I can list here.

For the philosophical stuff I also highly recommend the Stanford Encyclopedia of Philosophy.

This said I can highly recommend taking a look at the following (free texts available from my website at www.beyond-reason.info). Some of them can get a bit heavy-going, but these books aren't like novels where if you don't read everything it is impossible to get the plot. The truth is that from Aristotle onwards, much of what you will find here is already deeply embedded within you anyway!

- Aristotle's Organon (on logic) and On the Heavens (on astronomy)
- Galileo Galilei (trans. Stillman Drake) (1970). Dialogue Concerning the Two Chief World Systems. 2nd ed. USA: University of California Press. (Sorry can't do this one for free – go to Amazon)
- René Descartes' Meditations on First Philosophy and Discourse On the Method
- David Hume's An Enquiry Concerning Human Understanding
- Immanuel Kant's Prolegomena {to Any Future Metaphysics That Will Be Able to Present Itself as a Science}
- Charles Darwin's On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life

A free .pdf version of this essay is available to purchasers who wish to copy or print from this text for their personal use only – go to www.beyond-reason.info/freepdf/

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There are so many people who, in so many different ways, have influenced, helped and encouraged me in this essay, that I hardly know how to acknowledge them properly.

In my education, I was introduced to philosophy and intellectual history at Sussex University in 1972 by Brian Easlea, Derek Burns, and Roy Edgley. Timothy Sprigge then made it clear that philosophy was more than just messing with words. It was astonishing good fortune to have Paul Feyerabend as a tutor, who was inspirationally sceptical about all forms of received wisdom, and in particular about the rational reliability of science and its method.

That was the easy bit. Beyond Sussex it is more chaotic, but it is enough to say that through AI for Society and Kingston University I was able to remain engaged with thought about knowledge and how you get it in the digital age. My friend, Richard Ennals, has been the most important influence, but Maggie Boden, and Karamjit Gill must get a mention too for the opportunities that they afforded me.

There are friends to thank who I must pick out for special attention. Jan Skajarowski is a reader of the finest kind, and longer than anyone else has quietly and consistently asked the most challenging of questions. Titus Alexander keeps me wired into the politics of community, culture and religion. Charles Harvey, Astrologer Royal (well he should have been), enabled me to understand Greek cosmology and causation in a way that eluded me first time round. Readers Fanny Scott, Christoph Wyld and Margaret Shepherd, in their quite different ways, convinced me that I was getting to the tone and level I wanted to achieve. Tim 'TV' Smith was another excellent reader, and has also inspired with the uncompromising decades-long pursuit of his own muse. James Abbot, coal miner and nurse has done much to ensure that I keep it real. Vicky Pile made sure this was finished by her dry observation (three years in) that 95% of success is about finishing – though the last 5% seemed to take as long as the rest of it. I can't acknowledge by name everyone who has given me time and thought, but you know who you are: thank you too.

I must give a whole paragraph to my old friend Desmond Ryan, historian and anthropologist, who acted as my academic supervisor throughout this project. Desmond has been endlessly patient in pointing out the unacceptable errors and exaggerations in the sweeping generalisations that are the leitmotif of this essay (though I'm responsible for all that are left). I can't thank him enough.

Last, but manifestly not least, there is my family. Daisy and Wil inspired me to write this through their decision to do a philosophy 'A' level - which had a curriculum that seemed to me to be devoid of historical context. This essay started life as a context filler in the wake of greatly stimulating discussions with them! Finn, in his trenchant manner, ensured that I didn't slip over into any religious bollox! The death of much loved son and brother Mike underlined everything that really mattered. Josie Melia (mother of Finn and Mike) has been a most generous listener, pointed questioner and reader. And at the alpha and omega points is Sal, my wife of now a silver number of years. Sal is sine qua non; and any words I might add to that would be flimflam. I am deeply grateful to her for indulging this work, and for all her support intellectual and practical throughout it.

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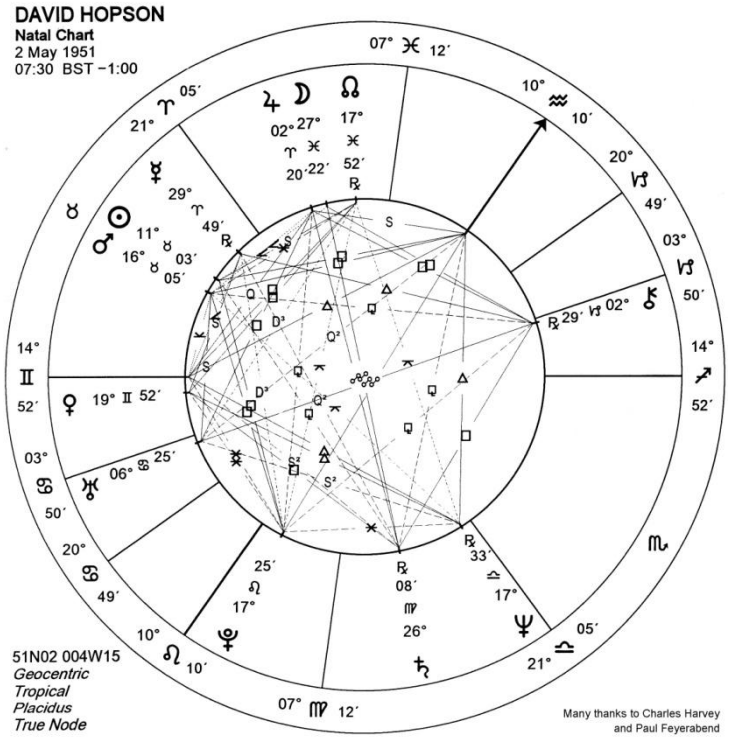
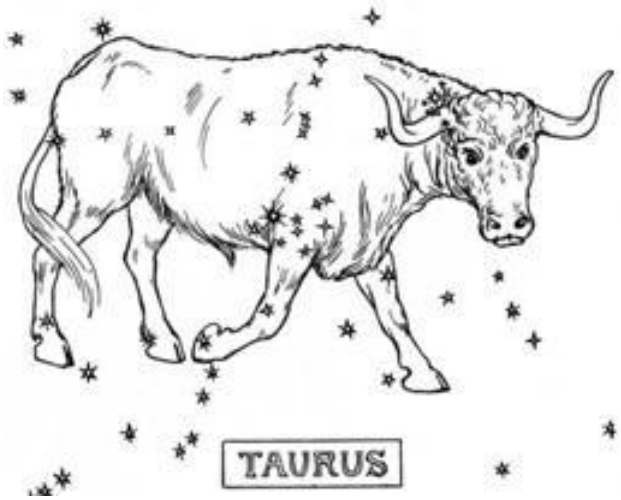
David Hopson



David Hopson read philosophy and social sciences at the University of Sussex, where he was taught by one of the twentieth century's preeminent philosophers of science, Paul Feyerabend, and the noted Aristotelian scholar, Timothy Sprigge. Among other things, David has been a merchant seaman; the tour manager of a punk band, *The Adverts*; and a voluntary sector IT consultant. He is currently a visiting fellow at Kingston University. He has maintained a close interest and involvement in discourse about religion and science for over forty years. His two youngest children studied philosophy at school, which prompted him to write this essay.



Cover Notes

Beyond Reason – Knowledge, Religion and Science in the West

If 'God is dead' and the uncertainty principle lies at the heart of science, on what grounds can we know anything for sure? This sweeping history of Western thought, from the Greeks to the geeks, reveals that knowledge in the West has always been a double-act in which science describes how the world works and religion gives meaning to that description.

David Hopson shows how this intellectual partnership has broken down as developments in science have invalidated many traditional religious understandings of the universe, and the place of life and humanity within it. This breakdown has created a vacuum of meaning at the heart of our culture which is all too easily filled by religious and scientific fundamentalists who express their passionate certainties in vitriolic argument and violence. David argues that it is essential to develop a new understanding of the meaning of science if we are to restore broad-based, democratic confidence in both the practical and spiritual value of Western knowledge.

This illuminating essay will be of interest to anyone who wants to understand the interplay of religion and science in the development of Western thinking. 3,000 years of thought from Aristotle through Copernicus, Galileo, Descartes, Kant, Darwin, Einstein, and many others, are put into context by this highly readable text. Those who are studying philosophy, science or religion will welcome the everyday language in which key philosophical, scientific, and religious ideas are presented here.