Beyond Reason

Knowledge, Religion and Science in The West

David Hopson

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Sample Chapter Only

It's the Thought That Counts

How Descartes (and others) invented a new way of thinking, which led to development of science.

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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.

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It's the Thought That Counts

"It is vanity to imagine that one can introduce a new philosophy by refuting this or that author. It is necessary first to teach the reform of the human mind and to render it capable of distinguishing truth from falsehood."
Galileo[1]

"What Descartes did was a good step ... If I have seen a little further it is by standing on the shoulders of Giants." ***Isaac Newton in a letter to Robert Hooke, 1676***

René Descartes was a French mathematician and philosopher whose name is better known than his achievements. In our everyday lives, the most visible product of Descartes' genius is his invention of the graph [2]. He wrote what is widely seen as the first handbook on the mathematical methods of science. As a mathematician and methodologist Descartes' place in intellectual history is assured, however his impact on philosophy was perhaps even more significant.

Descartes records that his philosophical interests began in earnest at the age of 23 when he was staying in Ulm[3] in Germany. Whilst there, on the night of the Vigil of the Feast of St. Martin of Tours, Sunday, November 10th 1619, Descartes had three dreams that he says were the origin of the project which would occupy him for the rest of his life.

In his dreams he acquires a book (an encyclopaedia and dictionary) which opens at the words, *"Quod vitae sectabor iter?" (What road in life should I take?)*. A stranger then appears and directs him to some verses which begin with the words *"Yes and no" (Est et*

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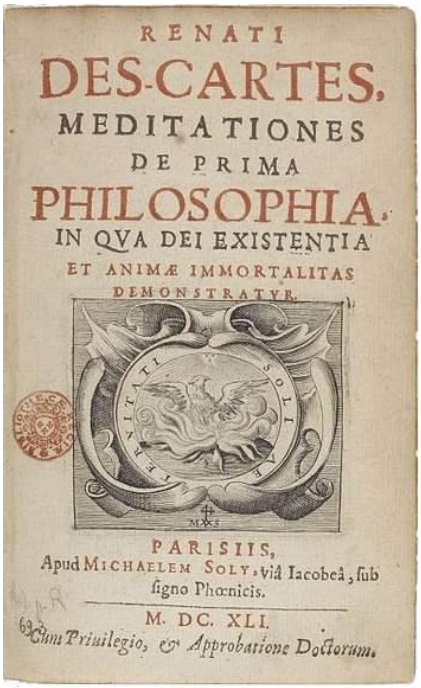
[1] Salviati speaking in, Dialogue Concerning the Two Chief World Systems, Galileo, 1632, p. 57, *Trans. Stillman Drake*, University of California Press, 1970.

[2] Graphs were developed after the publication of Descartes' book in 1637, *Discourse on the Method of Rightly Conducting the Reason, and Seeking Truth in the Sciences* (usually referred to more simply as Discourse on Method). Descartes' insights underpinned the development of the calculus, fifty years later, by Newton and Leibnitz; a mathematical approach that was critical to understanding the force of gravity and the development of classical physics in general.

[3] Ulm is also the birthplace of Albert Einstein. Allegedly there is a local proverb: "*Ulmenses sunt mathematici*" (Ulm people are mathematicians), which the local tourist industry likes to link with both Descartes and Einstein – though in truth neither of them lived there for more than a few months. Descartes was overwintering in Ulm after service in the army of the Prince of Orange, Maurice of Nassau. Maurice created a relatively stable Netherlands, the place in which Descartes would live and do his best-known work, in self-imposed exile from his native France.

non). Descartes interprets all this to mean that he should pursue knowledge through a process of the simplest reasoning. He established that his goal was to create a science which, on sound mathematical and philosophical principles, would bring together all knowledge and cover the entire universe (the scope of the book in his dreams). Descartes was convinced that his dreams were a sign from God, and that they gave him a mandate to carry out his plans.

However, as we saw earlier, this was an extremely dangerous time to be taking a new look at knowledge. It is perhaps not surprising then that Descartes, though Catholic, spent most of his adult life in the protestant Dutch Republic where he was relatively safe from the risk of being tried for heresy if he offended the Church. Descartes spent thirteen years after his dreams researching and writing a book that he modestly titled, *Treatise on the World*, at the centre of which was the Copernican system. In 1633, the year that the Galileo was convicted by the Inquisition for his heretical views on the heliocentric universe, Descartes decided he would not be publishing his book after all. Descartes was forced to go off on a different tack and what he came up with established an entirely new foundation for knowledge


RENATI
DES-CARTES,
MEDITATIONES
DE PRIMA
PHILOSOPHIA,
IN QVA DEI EXISTENTIA
ET ANIMÆ IMMORTALITAS
DEMONSTRATVR.
PARISIIS,
Apud MICHAELEM SOLY, viâ Iacobeâ, sub
signo Phœnicis.
M. DC. XLI.
Cum Priuilegio, & Approbatione Doctorum.

1st edition cover of Descartes' Meditations

The work for which he is best known today is *The Meditations on First Philosophy*[4], published in 1641. It is a description of a retreat in which Descartes spent six days on his own, in his dressing gown, sitting by a fire, in a semi-darkened room, without distractions, and *"undisturbed by any passions."* He was meditating on his discovery that everything he thinks, feels and believes about himself and his world could be an illusion created by an invisible and mischievous arch deceiver. It is an unusual thing to do! The surprise is that the book which told the story proved to be hugely influential, had a major impact on scientific thought, and is still very widely read today. The meditations go something like this:

Descartes is sitting comfortably in front of his fire and he begins, almost chattily, by observing that in the past he has got things wrong; that he has believed things that subsequently turned out to be false, ill-founded and poorly thought through. As a reader this experience of getting things wrong is something that you are familiar with, because we have all made this kind of error. Descartes has hooked you from the get-go. It is a very good beginning.

Next he says that for some time he has been planning to try to work out everything from the ground up; to throw out all his beliefs and start again from first principles. He

[4] The full title was, Meditations of First Philosophy – In Which the Existence of God And the [Real] Distinction between the Human Soul and the Body Are Demonstrated. (though in its first edition it was subtitled, "In which the existence of God and the immortality of the soul are demonstrated".

has adopted a very simple rule, and decided that he will reject all and any knowledge of which he cannot be absolutely certain. This is an extremely powerful approach, although at first sight it appears to be rather extreme, if not slightly bonkers. Descartes knows this full well, and asks how he could possibly be uncertain that he is sitting in his dressing gown, in front of warm fire, with his meditation notes in hand? He contemplates madness.

He observes to himself that he might be deluded, like those people, *"whose brain is so troubled and be-fogged by the black vapours of the bile that they continually affirm that they are kings while they are paupers, that they are clothed in purple while they are naked; or imagine that their head is made of clay, or that they are gourds, or that their body is glass."* He acknowledges madness might be possible, but rejects the idea that it a condition which currently affects him[5].

Having examined the deluding potential of madness, Descartes then wonders if he is asleep, and if what he is experiencing is a dream. He notes that sometimes he has woken up and found he is not sitting in front of a fire as he expected, but rather that he is in bed. He notes that all sorts of weird stuff can happen in dreams and have a reality in his imagination that doesn't correspond to the kind of reality he experiences when he is awake. In the midst of this he doesn't quite say how he can tell whether he is awake or asleep, but as readers we all know that it is possible to make the distinction. Descartes decides that in his meditations he is awake.

Next he wonders if the God that he believes in could have made him so that he has impressions of things which don't exist; and provided him with a mind that is always mistaken, even to the point where he is wrong about simple arithmetic (like 2+3=5) and geometry (like whether squares have four sides). Descartes now takes a very dangerous step for his times and reflects that he should also admit to an uncertainty about the existence of the God that he is minded to believe in. However, despite his scepticism about a supreme spiritual power he allows that even if there is no God there might nonetheless be an evil spirit, *"not less clever and deceitful than powerful who has bent all his efforts to deceiving me... to tricking my credulity ... so that the sky, the air, the earth, colours, figures, sounds, and all external things, are nothing better than the illusions of dreams, by means of which this being has laid snares for my credulity; I will consider myself as without hands, eyes, flesh, blood, or any of the senses, and as falsely believing that I am possessed of these."*

At the end of his first day's meditation, Descartes feels that he can indeed claim there are good reasons to doubt that he knows anything at all that is '*absolutely certain*' about the material, corporeal, mathematical, or geometric world. It is important to emphasise here that the Cartesian test is about *absolute* certainty. Descartes is sometimes represented as doubting whether anything exists at all – which really is nuts. What he is actually asking is whether or not he can be absolutely certain about what he knows

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[5] A 17th century physician might have speculated that the Descartes himself had an excess of black bile; an imbalance in the element of Earth which produces melancholy, depression and paranoia. Descartes has an insight into 'madness' which supports the belief of some of his biographers that he had had one or two breakdowns himself.

about the world. If he can find even a wee dark corner of uncertainty in a piece of knowledge, then it fails this very exacting test.

This is the line along which Descartes seduces his readers; and it works very well. At the end of his first day of meditation he admits that this stuff is pretty hard going; but acknowledges that a certain laziness leads him insensibly back into what he believes are the normal paths of ordinary life; and that it is time for bed.

On the following morning, Descartes wakes up in a pretty dark frame of mind, and says that he feels as if he has, "fallen all of a sudden into very deep water, ... unable either to plant my feet firmly on the bottom or sustain myself by swimming on the surface." It's at the start of his second meditation that he also makes his most overt reference to the burning problem of his time, the possibility of removing Earth from the centre of the universe.

He declares that he is utterly resolved to find out something certain even if that means knowing with certainty that nothing is certain. Then he comments, *"Archimedes, that he might transport the entire globe from the place it occupied to another, demanded only a point that was firm and immovable; so, also, I shall be entitled to entertain the highest expectations, if I am fortunate enough to discover only one thing that is certain and indubitable."* In other words, he reckons that if he can get to some certainty, he too can hope to move the Earth.

Happily, the certainty he is after doesn't elude him for too long. What he figures out is that even if he is being deceived by some evil spirit in every single idea that he has about the world there must be something, himself, that is being deceived. The limitation on the deceiver's power is that for so long as Descartes thinks he is something (anything at all will do), it will be impossible for the beast to persuade Descartes that he is nothing. Accordingly, Descartes declares that whenever he states or thinks, *"I am, I exist,"* it must be true. Another way of putting it is that Descartes concludes that there must be a thinker if thoughts are going on (however phoney or wrong those thoughts may be) and that thinker must be **ME**.

This all takes quite a lot of processing but René is not daunted by the limited reward that his thinking has brought him so far because certainty was what he believed he had to find if, like Archimedes, he could hope to move the world. Having found himself, Descartes' next move was to say, 'OK. *I am;* but what exactly *am I*? His answer, which has got some of the characteristics of the bleeding obvious, is to decide that he is a being who thinks, a thinking being, or *res cogitans* as they say in the Latin. The subtlety in his point is that it isn't the content of thought that defines me, including the possibly false ideas that I have a body and live in a material world. I am defined by the fact that I am having these thoughts at all. This is the basis for Descartes' most famous statement: *"I think, therefore I am" – cogito ergo sum* [6].

So now René knows with absolute certainty not only that he exists, but what kind of thing he is as well and he can head for bed well satisfied at the end of his second day. By this point, in terms of the leverage his ideas will have on culture and cosmology,

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[6] The phrase itself is found in *Discourse on Method*.

Descartes' job is mostly done. The philosophical biggy is about this identification of a mental thing (*res cogitans*) that is separate in substance and nature from matter, from the corporeal world of bodies, flesh, and all that has extension (*res extensa* - 3-D-ness). We will return to this later.

The immediate and most practical relief that Descartes offers to his contemporaries is an insight into how error can arise in thought, perception and knowledge. Through his discipline of rigorous scepticism and doubt, Descartes shows that in every respect it is *possible* for us to be wrong about the world, except in one matter, the certainty of our own existence as thinking beings. The critical political point is that this recognition of possible error does not involve questioning or attacking existing knowledge; it's about admitting the frailty of human intellect and understanding.

In plainer language, Descartes is suggesting that we all screw up; we all get things wrong; make misjudgements; and believe stuff that is phoney or fantastic or even mad. These errors, he claims to have shown, are a consequence of our fundamental separation from the material world. We are observers of the world, but we are not of the world, and in our observations we can make mistakes.

Here it is important to recall that the title of Descartes' first edition was, *"Meditations on First Philosophy in which the existence of God and the immortality of the soul are demonstrated."* For Descartes the 'thinking being' is so fundamentally different from the material corporeal world that it is not vulnerable to the imperfections, change and decay that are inherent in the notion of material reality. The 'thinking being' is of the same substance as the immortal soul, the ground and centre of 'I' and of 'Me.' The essentially perfect nature of the 'substance' of a 'thinking being' poses the obvious problem that if we're so smart, how come we get it wrong? According to Descartes there are two reasons why we make errors in our ideas about the world.

The first is that we don't have the kind of breadth and extent of vision that God has of the universe (we will get to proof that God exists later) – we can only have a limited view of reality. In Descartes' view it follows that although God created us with a perfect ability for understanding, it is impossible for us ever to have a complete overview of things and that is why we fall into error.

In this context, Descartes also makes an understated but critically important inference, using a very similar argument to the one he uses about error. What he infers is that the limited overview that we have of the Creation means it is impossible for anyone to figure out what God's purpose is. The point is made so quietly that it doesn't hit the Church in the eye, but it has profound implications in the revolution of knowledge which is to follow. Science can explain how things happen (and in this strictly limited sense, why), and predict what is likely to happen, but it cannot say anything whatsoever about design or purpose. This repudiation of the possibility of ever knowing the purpose of anything will become a key intellectual principle in science. It represents a major break with the Greek concept of causation.

The second reason why Descartes thinks we get things wrong is because of a conflict between our God-given powers of understanding and will. Descartes' test for certainty in knowledge is that it should be based on clear and distinct ideas formed through the application of understanding. What Descartes says is that sometimes we short-circuit the

difficult process of understanding by exercising the power of the will, taking decisions about what we understand knowing that they are a punt rather than the result of proper thinking. If you indulge in this kind of gambling then errors are inevitable, though sometimes you might get away with them. Descartes' science handbook, *Discourse on the Method of Rightly Conducting the Reason, and Seeking Truth in the Sciences* is essentially about how to think properly in a disciplined way that mitigates the dangers of the will [7] and assures clarity and distinction in ideas.

What Descartes provides in his meditations is a way of explaining and understanding why the long-held knowledge of the Greeks might be wrong; but without actually attacking it. Error is an inevitable part of human knowledge, because we are both limited in our vision and likely to reach impatiently for ill considered conclusions. The radical power of Descartes' view is that it applies to all human beings, including philosophers, sages and saints of old, as well as clergymen and academics.

The psychological power of Descartes' views in a culture where heresy was a deeply serious matter is subtle. What Descartes does is to establish that errors about the world are a natural and inevitable consequence of the gap between the thinking being, AKA the soul, and the quite different substance of the material universe. From this perspective, the individual who holds and defends views that are socially or religiously unacceptable may be doing so because they are too mad, dozy, or incompetent to have come to a proper conclusion. They don't hold their views because they are necessarily morally bad, or under some kind of evil influence, or wilfully flouting authority.

In matters of heresy Descartes provides the accused with an offence-crushing plea in mitigation that error is natural and built into the relationship of souls, of *res cogitans*, with the material world, *res extensa*. The intellectual onus is placed on the authorities and accusers to explain just how and why their views are right and to lead the accused away from error, rather than punish them for it. In the midst of this the accusers, being human too, must constantly be understood to be vulnerable to error too, and cannot simply place reliance on written and scriptural sources. One indicator of the influence of Cartesian thinking may be that executions for heresy came to an end in the century after Descartes' ideas were published and took hold.

At the start of the 17th century it was believed that humankind was somehow wired into knowledge about the world and its creator. There weren't any theories about knowledge. You got born, you saw stuff, you grew up, you agreed an understanding with everyone else about what you all saw and that was kind of it – you were cosmologically done and dusted. In effect what Descartes was saying though was:

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[7] Chapter 1 opens as follows: "Good sense is, of all things among men, the most equally distributed; for every one thinks himself so abundantly provided with it, that even those who are the most difficult to satisfy in everything else, do not usually desire a larger measure of this quality than they already possess ... [however] to be possessed of a vigorous mind is not enough; the prime requisite is rightly to apply it. The greatest minds, as they are capable of the highest excellences, are open likewise to the greatest aberrations; and those who travel very slowly may yet make far greater progress, provided they keep always to the straight road, than those who, while they run, forsake it."

> 'No, no! This is wrong. We've each got to figure this out for ourselves, and the process of doing this is absolutely riddled with error traps. The priority now is to figure out how we can get round these traps and be completely certain about what we think is going on. It is utterly pointless arguing about what we think or know about the world if there is no basis in certainty, or any agreement about how we get to certainty.'

It is difficult to know how anyone could disagree with Descartes' general point. Errors in understanding and perception are the lot of all of us; whether or not you sign up to the Godly bits of the explanation. What Descartes has to do next in his meditations is to address the question of how, as a thinking being, you can get beyond the simple certainties and errors of thought-life to some certainties about the world at large.

Descartes cannot deny, anymore than any of the rest of us can, that somehow a material world seems to press its reality upon us. Even if we can contrive reasons for doubting that it exists in any certain knowable form, it is very difficult, for example, to be persuaded that there was nothing to the swig of coffee that I just took!

Descartes meditates on material reality using a lump of fresh beeswax, which he describes as still smelling and tasting of flowers and honey, as cold and hard, and which makes a noise when tapped. He then melts the wax in front of the fire, and in short order the remaining smell and taste evaporate off, the solid becomes a pool of liquid, the colour changes, and you certainly can't tap it to produce a noise. As the wax cools again, Descartes plays with it, and finds he can mould it into all sorts of shapes.

Descartes question is about how, despite all its changes, he can know that the wax he started with is the wax that he ended up with. It's a mind game and, like all mind games, both dim and sublime at the same time. In terms of the senses (vision, taste, smell, touch, and hearing) the wax after he has heated and played with it produces quite different sensations from the ones that he had when he started. So it is clear that you can't 'trust' your senses.

The thing that enables you to connect 'wax 1' to 'wax 2' is that it is extended, flexible and moveable. In other words it is a substance that has three dimensions, can be moulded into different shapes, and shoved around the place. You might think at this point that Descartes had finally got to his bit of certainty about the material world, but nothing is so simple to a man in thought before a warm and cosy fire.

What Descartes notes is that you still can't say anything definite about the wax itself. It, whatever it is, changes form as you heat it – its 3-Dness isn't of fixed dimension. It can be moulded into an infinite number of shapes, which in itself is unimaginable. It can be put into an infinite number of different locations, which is similarly unimaginable.

The conclusion is a tricky one, but what Descartes ends up saying is that you cannot know anything certain about the wax (and for wax read the entire material world) through either the senses or through imagination. The world of matter can only be grasped through the faculty of understanding which is informed by ideas like extension, flexibility and move-ability. In other words, reality is something that we form in our own heads; it is not something that is laid on us (via the senses) by the world of stuff out there. Descartes will add the ideas of geometry and mathematics to the mix of things that

inform the understanding, and assert that when they are properly applied it is possible to form clear and distinct ideas about the world.

As with so much of this kind of stuff, it can seem a little pointless to go through it all in such detail. Who really cares about what wax does when you heat it; and if you look up the Meditations online, you'll discover that this isn't the half of it. What Descartes is doing though is to address a key problem of Copernican cosmology, and a critical difficulty for emergent science. The problem is that under the new regime, the '*natural*' experience of reality has to be subordinated to a '*conceptual*' experience of reality.

None of us experience ourselves as moving at thousands of miles per hour, whilst standing on ball of rock that is spinning at a speed which should be dizzying; but that's what the 'facts' say is going on, and it's kind of weird getting your head around it. Descartes is addressing Galileo's comment that we must learn, *"to be more circumspect and less confident about that which the senses represent to us at a first impression, for they may easily deceive us."* Descartes' meditations create a bridge from natural to conceptual experience. He affords a most reasonable account of just why you cannot simply rely on your senses or imagination to produce a true 'picture' of the universe. The job is done in a way that is simple and remarkably easy to empathise with even when the detail seems endlessly dull, and the subject matter trivial.

What is rather less obvious is that as you cross Descartes' bridge, the planks are quietly being taken up behind you. If you cross over the chasm with this man, there ain't no going back. You can argue about exactly what the bridge was made of, how it was constructed, and quite why it supported any weight – which is what successive generations of philosophers to the present day have done – but you cannot get back to where you started from.

Descartes changes the way that we look at things. He says that we cannot simply ask questions about what we are looking at; rather we must ask questions about why we see what we see. People call him the father of modern philosophy. Perhaps more accurately he is the father of the philosophical subject epistemology; the theory of knowledge. His theory was that our understanding of the world is not created or driven by our experience of it; it is created by the application of rational thought inside the entity that is a thinking being; a soul; an individual; I; Me; You.[8]

For Descartes, faced by the unreliability of the senses and imagination, certainty lies in the creation of 'clear and distinct ideas,' through methodically applied reason. Within and alongside his philosophical musings, Descartes also provides a lot of written material about how to do proper reasoning which, as we saw earlier, becomes a primer on how to do science.

Once people move on to Descartes' new observational ground, the traditionally and scripturally accepted ideas of the ancient world may legitimately be confronted to see just what clear and distinct ideas they contain; if any. This does not involve challenging the authority of great thinkers from the past, rather it involves an attempt to walk

[8] This is why Descartes is described as a rationalist, as distinct from an empiricist, who believes that understanding is formed by the action of the senses.

alongside them and mimic the processes which they, as earlier thinking beings, must surely have been through to achieve their clarity.

In this we can see a precursor of that most hallowed of principles of Science, repeatability. If I make a series of observations and base statements about the universe on them, then it must surely be possible for any other individual to make the same observations, and draw the same conclusions. This is a critical and necessary test if what I think and say is to be accorded the status of scientific knowledge; though other conditions apply and are endlessly debated[9].

In the wake of Descartes, the views of Copernicus, Brahe, Kepler, Bruno, Galileo, and their fellow travellers have come to prevail because they offer a clearer, simpler and more distinct explanation of why people can see what they see; not because they change what people are actually seeing and experiencing for themselves. When all is said and done, the night sky looks the same whether it goes around you, or you spin underneath it.

The risk to Descartes of his work is that if you try to find God in the world using methods that are appropriate to material corporeal reality you come unstuck. In the religious context of the 17th century it was essential that Descartes found a way to demonstrate the existence of God which he does in a manner that in many ways is rather thin and lame. Briefly and simply Descartes gives two closely related proofs of God's reality, both of which detach Him from an intimate and material involvement in the world. In theological jargon, Descartes radically undermines the idea of an immanent God, a God who is acting within His creation.

The first proof starts with that ancient and well-established notion in the Greek tradition that something cannot come from nothing (expressed in Latin as *ex nihilo nihil fit* – out of nothing, nothing comes). A simplistic example of this principle is that you can't get a quart of milk out of a pint carton. The something from which another thing emerges must have at least as much 'reality' as the thing that has emerged from it.

Descartes says that he has within himself an idea of God which has an infinite and perfect objective reality. Since he, Descartes, is anything but an infinite and perfect being, he cannot be the cause of this idea – because of the premise in the paragraph above. Only an infinite and perfect being could cause this big, big idea and so it follows that God must exist. For good measure, and to meet his principle of required certainty, Descartes also points out that his idea of God is of an absolutely perfect being and therefore God, by the definition of perfection, is bound to be good and benevolent. On this basis God as creator and underwriter of all reality would not permit Descartes to be in error without giving him a method to avoid error; nor would God act deliberately to deceive him. That's the first proof of God..

The second proof is founded on the certainty of Descartes' existence – which we must not forget is as a thinking being, not a material being. Following the earlier argument, Descartes, says that ultimately his existence must have a cause – so what is that cause?

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[9] For example in any statement claiming the status of scientific knowledge arguably it must be possible to discern how it could be falsified.

He rules out a series of possible causes. If he'd produced himself, he'd have made himself perfect, which he isn't. He can't point to his parents, because then he'd have to go on back to his grandparents, and so on ad infinitum; so this leads nowhere. He can't have been caused by something less perfect than the God he thought of earlier, because otherwise the idea of such perfection could not have been planted inside him. So when all is said and done, all that's left to be his cause is God; and so God exists.

Stripping the proofs out like this is unfair to Descartes, whose style and arguments are altogether more subtle and seductive. These proofs of God, and he slips in at least one more, and some say two, have been endlessly argued about in the four hundred years since they were first published. There will hardly be a high-school student doing theology or philosophy 'A' level who hasn't written a 'critical' essay on the subject.

My own feeling is that Descartes himself was never wholly persuaded by his 'proofs,' but they clearly serve a vital political purpose in relation to the church and all the oppressive power that it could bring to bear on those who got out of line[10] . The proofs of God that Descartes offers are considerably less persuasive than those of some of the heavyweight theologians in the Christian tradition like Augustine, Anselm and Thomas Aquinas. However, the really neat consequence of Descartes' Meditations is that he takes God out of the material world.

Descartes by a kind of reverse engineering process gets God from himself rather than the other way round. A core tenet of the Abrahamic, monotheistic religions is that we are made in God's image. Once Descartes has got a reality for himself and his existence as a thinking being, *res cogitans*, he has the imago of God. God maybe be altogether bigger, more perfect, more powerful, and infinite than Descartes is, than all of us are, but God's essence and His substance is that of mind, not matter; because His is the image in which we are made.

In Descartes, God is moved out of the domain of material 3-D reality into the domain of mind. The impact of this is a subtle and unstated lancing of a critical problem with the emerging new world order which arises from a moving earth in an incomprehensibly large universe. After Descartes the ancient Greek spheres can dissolve without leaving a divine *'Where's Wally?'* problem about the location of God's principle domain (aka Heaven), and where He might be found.

In effect, through Descartes the material universe is sterilised of God. He is not to be found here, because he is not of a substance that can or does physically occupy the extended world, *res extensa.* There's a small, but very significant catch in the back of this, which is that if the *"something cannot come out of nothing"* rule applies, how could a non-extended God create an extended world? This is problem which Descartes is clearly aware of, but one on which he has little to say.

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[10] The Meditations begin with a Letter of Dedication to the Dean and Doctors of the Sacred Faculty of Theology of Paris. Descartes makes clear that his purpose is not to upset people who already benefit from the gift of faith that comes from God – and who need no proofs of His existence and of the soul. Descartes' loftier purpose is to find arguments in reason that will persuade the infidels, the unbelievers, of God's existence, and their obligations to Him.

At this remove, it is hard to embrace an understanding of what it was to live in a universe that had an edge, beyond which lived a God who was something like a like a Big You. God's Heaven was a place that had nothing not to like in it, and where you aspired to go after your earthly life was over. Descartes enabled this universe to be dissolved away under the drip-drip-drip of a methodical flow of finely filtered clear and distinct ideas, without any remaining vestige of worry that this was displacing or upsetting God. Descartes' largely unsung, but critical relocation of God, opens the material world to a kind of dissection that is psychologically impossible if you believe that God is somehow to be found or embedded within it. If God is actually in the material world, well you might just slice into Him with your scalpel of reason, or seriously upset Him by looking in places that He intended to be private.

Once God is removed from the extended world, the way is open for a new definition of the universe as being like a clockwork mechanism – the view that Newton came to and promoted. This is the idea that God created the universe as a perfect machine, wound it up, set it running according to the laws of physics, and then went off to have tea and do something more interesting instead. In this environment, for the time that our souls are somehow strangely embodied on earth, it is entirely legitimate, if not a duty, to try to understand God's creation, by applying as honestly as we can the imagination, intuition, and understanding that are characteristics of our created being. In short, the pursuit of scientific investigation, wherever it may lead, becomes a laudable vocation rather than a marginal activity which exists on the edge of the abyss of heresy.

Cartesian dualism, the mind-matter split, was an essential move in creating the intellectual circumstances in which science could emerge and flourish, not just as a practice, but as a culture. Descartes sets people thinking for the first time about what knowledge is, how we get it, and, most importantly, what's so great about it anyway[11] . There can be little doubt that conceptually this mind-matter split has profoundly influenced an entire way of seeing and understanding things, which goes way beyond enabling the exposure and investigation of the material world.

Descartes can justifiably be seen as the philosopher who resolved the conceptual and religious difficulties that the Copernican astronomers, thinkers and wannabe scientists of the 16th and early 17th centuries had run into. What should also be understood is that his thinking, within scientific culture, has come to characterise, and in many ways to define, how we see ourselves as human beings, and the way that we relate to the world. In particular, the notion of '*The Self*' that has emerged from Descartes' work over the past 400 years has had a profound effect.

What is '*The Self*'? It is that 'part' of a human being which constitutes their uniquely individual consciousness – in short the thinking being bit of them, their *res cogitans*, as Descartes would have put it. *The Self* is the 'bit' of the universe that is distinctively YOU and you alone.

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[11] I am indebted to my former tutor, Paul Feyerabend, for this formulation of the problem of knowledge.

This aloneness is one of the defining characteristics of the Cartesian self. You are a distinct 'atom' of consciousness, quite independent of any other atom. This distinctiveness implies a further characteristic which is that in some profound way *The Self* comes into existence with its essential mental attributes pre-formed and ready for thinking action. *The Self* isn't made by the world, *The Self's* challenge is to make something of the world. This, in its turn, establishes another quality of the Cartesian self which is that it is, in its essence, wholly independent of the material world. The world of *The Self* is a mental world, in which it is possible to lead an independent mental life.

In this there remains a problem that was identified as soon as Descartes published his Mediations, which is about how *The Self* connects and interrelates with the material world, including the corporeal embodiment of *Other Selfs*. Descartes' solution, rather bizarrely, was to identify the Pineal Gland as the conduit through which we communicate with material reality – though he might just as well have pointed to the belly button for all the sense that it makes.

At the level of culture the key consequence of Descartes' thinking turns less on his mind-matter dualism, and more on the way in which his thinking disrupts the notion of Human-kind, and breaks us all out into individuals. Descartes famous statement, "*I think therefore I am*", the Cogito (to give it its common nickname), is wholly focussed on the 'I', on *The Self*. Descartes finds his point of certainty, the place from which he will re-build the world, in his own singular identity and existence – the one place where he can find nothing that is clearly or distinctly real and permanent apart from himself. He invites and seduces each of his readers to reach the same conclusion.

The principle issues that arise from Descartes' individuation of humanity are twofold. Firstly there is the problem that if minds are essentially private and separated from each other, how is it possible to explain, know or understand the way that we interact with each other? In short, what is society all about, if anything, in a world that is comprised entirely of individuals? The new disciplines of psychology and sociology will emerge as 'scientific' attempts to address these problems.

In Cartesian terms we can see Psychology as an attempt to understand how T*he Self* formulates clear and distinct ideas about its own identity, and its relationship with other *Selfs*. Sociology is concerned with understanding the formation of *Selfs* into 'entities' like families, communities and societies, and the process by which the clear and distinct ideas of individuals are collectively represented and made concrete. The point is that the way that we have come to understand ourselves, follows from Descartes' view of the clear and distinct separation of each of us from each other. This approach essentially forbids us to think of or represent ourselves as a 'kind', or a 'type', or as having a human nature. As an approach it is, by our own lights, both powerful and insightful. However it is an approach that is clearly not shared by the whole of humanity, and it is different from the understanding of our ancestors.

We may like the words of John Donne's meditation (1624):

> *"No man is an island, entire of itself; every man is a piece of the continent, a part of the main; if a clod be washed away by the sea, Europe is the less, as well as if a promontory were, as well as if a manor of thy friends or of thine own were; any man's*

death diminishes me, because I am involved in mankind; and therefore never send to know for whom the bell tolls; it tolls for thee,"

however in our culture the idea of 'mankind' is a vestigial tail in the Cartesian description of ourselves that has developed in the scientific world. So too is Donne's allegorical sentiment that somehow we belong to and are a part of the earth itself, a manifestation of material reality rather than observers from a parallel mental universe.

The second problem which arises from Descartes separation of mind from matter is about notions of truth, meaning and purpose. The scientific enterprise is limited to describing, through clear and distinct ideas, why people see what they see. What science cannot do is reach any conclusions about what its discoveries mean or signify. The uncomfortable reality is that Descartes' conceptual distinction of mind from matter places the 'responsibility' for value and meaning entirely in the mental and individual arena, for these things cannot be derived from the material world. In science, value and meaning have no objective validity, for there is no way to measure them as material properties like size, shape, temperature, hardness etc.

To assert that meaning and value have any objective reality in the material world you must introduce concepts that from a Cartesian perspective are 'supernatural.' They are 'supernatural' because of their lack of objective validity. The notion of 'supernatural' is offensive to the sensibilities of those people who regard themselves as rational, empirical scientists in the finest Western tradition of the Enlightenment. They see themselves as the legitimate inheritors of the torch of reason so courageously lit by the likes of Copernicus and Galileo and shielded so beautifully by the insight of Descartes from the smothering mists of myth and superstition that poured from the religious authorities.

Within the Cartesian framework, anything about meaning and value ends up in the political domain; the domain where the shared and conflicting views of endless *Self*s are managed into action (or not). The 17th century work of Thomas Hobbes, the famous English political philosopher and Descartes' contemporary, is essentially about how *Self*s have to contract socially with each other to achieve a workable and survivable society. In correspondence with Descartes, Hobbes was clearly not persuaded by the radical distinction which Descartes had drawn between mind and matter, but has no problem at all with the concept of an atomised 'self.'

In conclusion then, Descartes found a way to mount a challenge to the knowledge of the ancient world which was not dependent on first questioning its validity and/or the authority of its proponents. His achievement was to foment an intellectual climate in which new ideas would no longer be judged by whether or not they conformed to existing knowledge, but rather by whether they were clear and distinct. The political consequence of this was that the theological objections of the church to the dismantling of Greek cosmology ceased to have any clout. By the start of the 18th century, the embryonic framework of the new natural philosophy, which we call science, was in place, a framework to which, as a mathematician rather than philosopher, Descartes made a major contribution. It is from this perspective that Descartes can be described as undertaker of the old knowledge and midwife of the new.

Of course Descartes wasn't by any means alone in establishing the foundations of science. In England, for example, where the religious pressures were much less, a more

down to earth empiricism emerged. The English scholar Francis Bacon, 30 years older than Descartes, is acknowledged as the first proponent of the experimental disciplines and methodology which, in combination with the new mathematical methods will become the driver of science and the industrial revolution. This said, it is Descartes' work which really breaks the waters for the birth of the modern European mind.

Descartes demonstrates that knowledge is something that human beings create for themselves as individuals. Understanding the mind, and the nature of the self, become as important a part of *The Enlightenment* as anything to do with material science. Knowledge isn't given by the world, it is something that we make up for ourselves, and because we make it up we can also get it wrong. In short, Descartes tells us that what we see and feel may not be the same as what is real. The Sun may look like it is setting, but the reality is that we are on a turning Earth. Our challenge is to disclose what is hidden, and not simply to report what is seen.

The thing that Descartes could not possibly have imagined is where the pursuit of 'hidden' reality would take us. Today's science, at both micro and macro scales, offers an account of the universe that is not only beyond the ability of any human being to experience directly, it is beyond the vast majority's ability to verify for themselves.

Descartes enabled monotheistic religion to be detached from the ancient Greek view of the universe and for science, the infant progeny of traditional natural philosophy and history, to develop without the drag of faith to stunt its growth. The uncomfortable truth for Jews, Christians, and Muslims is that the God described in so much of scripture and tradition simply cannot exist in the universe which has been disclosed by science. However, in its maturity, science too is faced with an equally uncomfortable truth that it is founded on untestable principles and doctrines which it inherited from monotheism. The challenge in contemporary scientific culture is that it has become clear that the big questions which have been exposed about the origin of the universe, the purpose and meaning of life, and the nature of consciousness, cannot be answered scientifically, though they have long since been the subject of religious investigation.

It is therefore to contemporary science, which was so influenced by Descartes' work 350 years ago, that this essay goes next.

Post Script

Descartes' Meditations were of course a device. He never did sit down for six days on the trot and think things through as he described himself doing, and in truth his book took him many years to complete.

What it is interesting about his choice of a six day structure is that this is the same amount of time, according to Genesis, that God took to create the world. There is a resonance in this which perhaps reflects what Descartes thought he was doing – re-creating the world – as well as being a neat way to engage the unconscious sensitivities of the believing reader. It might also reflect Descartes' rather grandiose estimation of himself and the role that God had given him in his dreams.

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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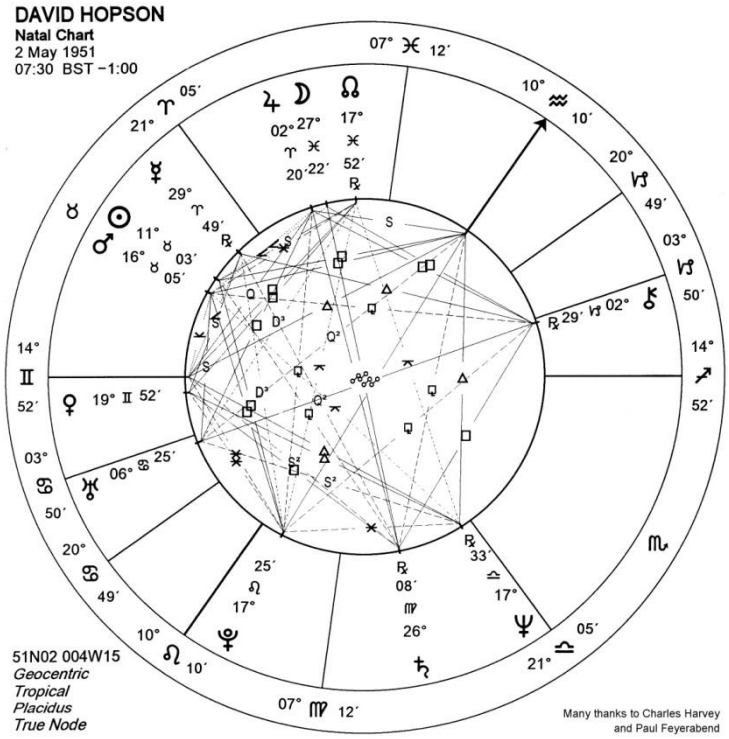
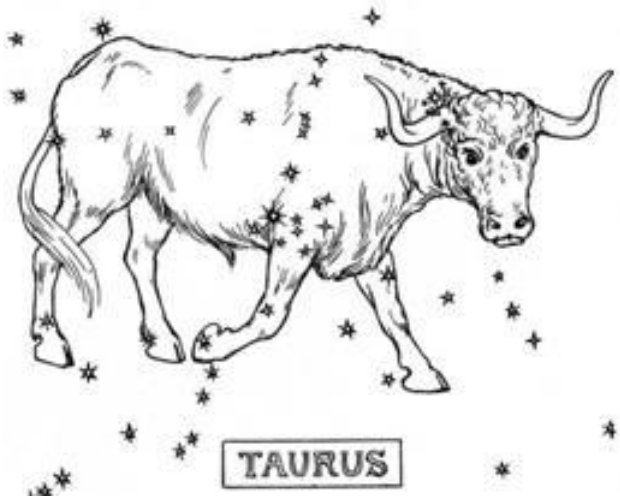


David Hopson read philosophy and social sciences at the University of Sussex, where he was taught by one of the twentieth century's preeminent philosophers of science, Paul Feyerabend, and the noted Aristotelian scholar, Timothy Sprigge. Among other things, David has been a merchant seaman; the tour 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.