Galileo and the Conflict Between Religion and Science

Gregory W. Dawes
To Kitty
This is a small episode in an unending argument between those who know they are right and therefore claim the mandate of heaven, and those who suspect that the human race has nothing but the poor candle of reason by which to light its way.

Christopher Hitchens
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Figure 2: A Copernican explanation of the apparent retrograde motion of the planets, John Wilkins, *A Discourse Concerning a New Planet* (1684).

Figure 3: A 1573 representation of Martianus Capella’s geoheliocentric system, which was followed by Tycho Brahe.
On 22 June 1633, Galileo Galilei was summoned to appear for the last time before a special tribunal of the Roman Inquisition. For more than two months he had appeared regularly before his ecclesiastical judges, charged with having disobeyed an injunction given to him seventeen years earlier. That injunction, delivered personally by no less a figure than Cardinal Robert Bellarmine, had instructed Galileo not to ‘hold, teach, or defend’ the Copernican view of the cosmos, the idea that ‘the sun stands still at the center of the world and the earth moves’. In what his Inquisitors judged to be a defiance of that prohibition, Galileo had published a work on the Copernican view, his *Dialogue Concerning the Two Chief World Systems*. While it claimed merely to discuss the Ptolemaic and Copernican systems of astronomy, it was clear to every reader just where Galileo’s sympathies lay. To make matters worse, the work had been written, not in a learned Latin accessible only to fellow scholars, but in a lively Italian that could be read by all Galileo’s fellow countrymen.

Galileo was by then seventy years of age, and not a well man. His condition had surely been made worse by the ordeal of the trial. He might have expected to avoid the fate of his fellow Copernican, Giordano Bruno, burned alive by the Inquisition only thirty-three years before, although one of the judges at Bruno’s trial had been the very same Cardinal Bellarmine who had delivered the injunction to Galileo in 1616. By 1633 Galileo had incurred the hostility of the Vatican authorities, as well as some leading Jesuit astronomers. But he continued to have friends and supporters in the Church hierarchy. Galileo’s suspected heresy was also less serious than those that found in the works of Bruno. More importantly, Bruno remained defiant until the end, reportedly averting his face from a crucifix even while being led out to meet his appalling death. Galileo, on the other hand, submitted, with at least apparent piety, to the authority of the Church. Galileo might be remembered as a martyr for science, but he himself had no desire for martyrdom.

His submission surely provoked sighs of relief among his judges. Galileo’s trial did nothing for the reputation of the Catholic Church, but even the Roman authorities must have realized that to put him to death would

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be a step too far. Galileo was a well-known figure among the intellectual élite of Europe. His trial merely contributed to his reputation. No less a figure than John Milton would later speak of meeting ‘the famous Galileo, grown old a prisoner of the Inquisition’. Galileo’s formal abjuration of his opinions must have seemed to his judges a much happier solution.

It was not, however, a happy solution for Galileo. Although he had reason to hope for a relatively mild verdict, his abjuration was elicited under formal threat of torture. For victims of the Inquisition, the threat of torture was terrifying enough. The first step was generally to show a suspect the instruments of torture, in the hope that this would suffice. Even leaving aside the possibility of torture, the outcome of the trial must have seemed a humiliating end to a scientific career. Galileo was being forced to disown an opinion he had vigorously defended, with arguments both theological and scientific, and supported by means of the first published telescopic observations of the heavens. He had not submitted after being convinced of the wrongness of his scientific views. Nor did his Inquisitors put forward any theological arguments that he had not already considered. Galileo was submitting because he had no choice, or, more precisely, because the only alternative was one that few of us would have the courage to face.

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4 On what might have happened to Galileo, had he defied Church authority, see R. J. Blackwell, *Behind the Scenes at Galileo’s Trial, Including the First English Translation of Melchior Inchofer’s Tractatus syllepticus* (Notre Dame, IN: University of Notre Dame Press, 2006), p. 23.
As it happens, his trial did not mark the end of his career as a scientist, a fact for which we can all be grateful. Sentenced to house arrest in his villa at Arcetri, near Florence, Galileo would go on to produce what was, in many respects, a still more important work for the history of science, his *Two New Sciences*.\(^1\) That work would help revolutionize the study of mechanics and of motion, a revolution that would be brought to its conclusion with the work of Sir Isaac Newton. Moreover, rather than diminishing his reputation, Galileo’s forced submission would make him even more famous. For several hundred years, the trial of Galileo would appear as a symbol of a supposed conflict between religion and science.

### 1. The Old Conflict Thesis

The idea of a conflict between religion and science is often attributed to two nineteenth-century writers, John William Draper and Andrew Dickson White. Their works are generally conflated and seen to be representative of a single thesis: the ‘Draper-White’ or ‘warfare’ thesis. But although both Draper and White believed there had been conflicts between religion and science, they had quite different ideas about the nature of those conflicts and their cause.

#### 1.1 John William Draper

Let me start by considering Draper’s work, a *History of the Conflict between Religion and Science*. There is, first of all, no doubt that about the book’s immediate target. It is not religion, as such, but the Roman Catholic Church. Indeed many of Draper’s arguments are strikingly traditional, being drawn from centuries of Protestant Christian polemic. (This may, of course, reflect his background as the son of a Methodist minister.) Draper does not merely accuse the Catholic Church, in the form of its Roman authorities, of an unbridled lust for power and a desire to dominate all forms of human life. He also regards it as having compromised its

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Christian origins by accepting pagan ideas, a decline that began with the conversion of the emperor Constantine. The doctrine of the trinitarian nature of God, for instance, Draper sees as Egyptian in origin. The veneration of the Blessed Virgin Mary he sees as ‘the adoration of Isis under a new name’. The rituals of the Roman Church he sees as nothing more than the adoption of ‘heathen rites’, which led over the centuries to an extraordinary ‘depth of intellectual degradation’.

Draper admits that opposition to science is sometimes to be found within Protestant Christianity. But he is more sympathetic to Protestantism, regarding the Protestant Reformation as the beginning of the process by which human thought freed itself from dogmatic shackles. While he regards Roman Christianity and science as ‘absolutely incompatible’, he claims that a reconciliation between Protestant Christianity and science is possible, if only Protestants would remain faithful to their original principles, leaving individuals free to interpret not only Scripture but also ‘the book of Nature’.

So despite the title of Draper’s book, it would be wrong to see its thesis as one of a simple opposition between religion and science. Not all forms of religion, he suggests, are equally opposed to scientific progress. Indeed one striking feature of Draper’s book is its sympathy towards Islam, which he regards as having resisted the temptation to revert to pagan idolatry. Draper highlights the development of science within the Muslim world and is sympathetic to the doctrines of the Muslim philosopher, Ibn Rushd (1126–1198), known in the West as Averroes. While Draper recognizes that there have been occasional outbreaks of what he calls ‘fanatical hatred against learning’ in the Muslim world, he does not dwell on these, presenting them as exceptions to a general rule.

This seems surprising. One might think that Draper would be equally opposed to any religion that looks back to an alleged divine revelation. After all, he holds that there is a necessary tension between the idea of a

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divine revelation and the open-ended inquiry that is characteristic of sci-
ence.¹ A divine revelation, he argues, must be regarded as inerrant, 
while science makes no such claims. It has what I shall later call a ‘fal-
libilist’ view of knowledge.²

It is important to emphasize this contrast, for James Moore suggests 
that Draper claimed for ‘the church-militant scientific’ a degree of infallib-
ility ‘no less ... than that which he denied the pope’.³ This is quite unfair. 
Draper is clear that scientific claims are open to revision, that science 
would give up even the theory of gravitation, if it were found to be in con-
tradiction with the facts.⁴ So the clash between religion and science, as 
Draper understands it, is a clash between two conceptions of knowledge. 
Science stands opposed to the authority of tradition and holds that all 
claims can be tested.⁵ So why is Draper so focused on the Roman Catholic 
Church? It seems to be because of its political power. Belief in a divine 
revelation is really dangerous only when it is coupled with political power, 
for then religious authorities can take action to suppress scientific re-
search.

Draper’s history has been rightly criticized, for its sweeping generaliza-
tion, oversimplifications, and outright errors. Among the last we might 
note his repeated assertion that the Roman Catholic Church ‘had irrevoc-
ably committed itself to the doctrine of a flat earth’.⁶ This is simply false. 
While a few Church Fathers did hold such a view, and others seem simply 
confused,⁷ the idea that the earth was a globe was a commonplace of later 
medieval thought. Similarly even a passing familiarity with Roman Cath-

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¹ Draper, History of the Conflict between Religion and Science, p. vi.
² See chap. 6, ‘The Criticism of Myths’.
³ J. R. Moore, The Post-Darwinian Controversies: A Study of the Protestant 
Struggle to Come to Terms with Darwin in Great Britain and America 
⁵ Draper, History of the Conflict between Religion and Science, p. 303.
⁷ W. H. Stahl, Roman Science: Origins, Development, and Influence to the 
218.
olic theology would have saved Draper from repeatedly making the claim that ‘infallibility means omniscience’. So I have no intention of defending the details of Draper’s history.

I do, however, want to insist that his book be read in its historical context. This is something that Draper’s recent critics (although themselves historians) seem reluctant to do. The book first appeared in 1874, only ten years after Pope Pius IX issued his notorious *Syllabus of Errors*. Among those alleged errors were that individuals should be free to follow their conscience in religious matters, that educational institutions were exempt from the authority of the church, that there ought to be a separation of Church and State, and that where Catholicism is the official state religion it should tolerate other religions in its territories. (Remember these were condemned views.) As if that were not bad enough, only four years before the publication of Draper’s book the Pope had summoned the first Vatican Council, which had declared the Pope to be infallible in matters of faith and morals, reaffirmed the Church’s right to reject scientific conclusions, and condemned those who defended the right of scientists to hold doctrines that had been rejected by the church. This was, in other words, a period when the highest Roman Catholic authority, feeling politically as well as intellectually under siege, was adopting a particularly uncompromising stance. If Draper saw that Church as a threat to human freedom, he had, at that time, some reason to do so. After all, even moderate Catholics, such as John Henry Newman, were alarmed.  

1.2 Andrew Dickson White

What about our second representative of the so-called ‘warfare’ thesis, Andrew Dickson White? His two-volume book, *A History of the Warfare of Science with Theology in Christendom*, is a much more careful and detailed study. While tendentious at times, overly reliant on secondary


2 J. H. Newman, *A Letter Addressed to his Grace the Duke of Norfolk* (New York: Catholic Publication Society, 1875), § 7 (pp. 101–23). I cannot, therefore, agree with James Moore (The Post-Darwinian Controversies, pp. 25–29), who draws attention to the historical context only to argue that Draper had no reason to be anxious about papal power.
sources, and containing some factual errors (as is inevitable in a work of this scope), it does make an effort to be even-handed. In the course of the work, White sets out a series of topics on which theology and science have been in conflict. His discussion of each has a set form. White begins with what he regards as the foolish and wrong-headed pronouncements of the theologians. But he then notes that there have existed, in every age, thinkers who preserved the scientific spirit and refused to allow their religious beliefs to stand in the way of scientific progress. Such thinkers are the heroes of his history, insofar as they initiated the process of reinterpreting the Bible so as to avoid conflict with science.¹

If opposition to nineteenth-century Roman Catholicism was the motivating force behind Draper’s work, what was motivating White’s book? It seems to have been his own experience as the co-founder (with Ezra Cornell) of Cornell University. Central to his vision of this new institution was the idea that it would be strictly non-sectarian. As a young faculty member at the University of Michigan, White had witnessed the struggle of its chancellor, Henry P. Tappan, against denominational control of academic posts.² White shared Tappan’s view of these matters, holding that a university should be ‘under the control of no political party and of no single religious sect’.³ This does not mean that religion was to be excluded from the newly established university. But it does mean that no one Christian denomination was to exercise a dominant role. As it happens, even this apparently moderate proposal met with religious opposition, a fact that only hardened White’s resolve to keep his institution free from sectarian influence.

When it comes to religion and science, White does not hold that there exists an inevitable conflict between the two. Indeed he admits that the

Christian churches have often fostered scientific inquiry.¹ Nor does he write in an anti-religious spirit. On the contrary, he claims to be writing in defence of religion, in order to preserve it from the ignominious defeats that it faces when it sets itself in opposition to science. White’s target is not religion, as such, but what he calls ‘dogmatic theology’. The phrase is not particularly illuminating, but the theological tendency to which White is opposed is clear. It is that of using the authority of Sacred Scripture to make pronouncements on matters that fall within the scope of science. It is, he argues, in the interests of neither science nor religion when theologians take it upon themselves to speak on scientific matters.²

We should probably take at face value White’s claim to defending religion. The idea is certainly consistent with what he said in his inaugural address as President of Cornell.

We shall not discard the idea of worship. This has never been dreamed of in our plans. The first plan of buildings and the last embraces the university chapel. ... From yonder chapel shall daily ascend prayer and praise. Day after day it shall recognize in man not only mental and moral, but religious want. We will labor to make this a Christian institution; a sectarian institution may it never be.³

It is consistent, too, with what we know of White’s own religious practice, for he attended Episcopalian church services and professed a commitment to religion, broadly conceived.⁴

The key phrase here, however, is ‘broadly conceived’. What kind of religion was White defending? While he rarely makes positive affirmations about God, White does speak about a ‘Divine Spirit’ that operates in human history.⁵ But in common with other nineteenth-century liberal Protestants,⁶ White thinks of this Divine Spirit as an immanent power. It operates in and through the natural causes that bring about the evolution of

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⁴ Marsden, The Soul of the American University, p. 116.
culture. The evolution of culture may give rise to ‘inspired’ individuals, whose lives and teachings can be thought of as ‘revelatory’. But neither of those terms – ‘inspiration’ and ‘revelation’ – refer to anything other than a human capacity to grasp some fact about the world. As one critic of liberal theology wrote, ‘what is called revelation from one point of view, may be called human discovery from another.’\(^1\)

Even if one identifies divine revelation with a certain kind of human knowledge, this does not make religion identical with science. After all, religion could involve non-scientific forms of knowing. The idea that the only legitimate form of knowledge is scientific knowledge is sometimes known as ‘scientism’.\(^2\) I have found no evidence that White held to such a view. Nor, incidentally, do I. There may be facts about the world that we understand without employing anything like a scientific method. Think, for example, of the ways in which we understand other people: their gestures, their expressions, the intended meanings of their words. Think, too, of the way in which we grasp the meaning of a poem.\(^3\) Those who recognize such differences hold to a broad conception of human reason. William James, for instance, speaks of four ‘dimensions’ of reason – the intellectual, the aes-

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thetic, the moral, and the practical\(^1\) – and there is no reason to regard his list as exhaustive.

What is clear, however, is that these are all forms of *human* reason: they involve natural human capacities. Liberal religious thinkers such as White believe that these capacities were developed under divine guidance. But this is a very different claim from that traditionally made by religions such as Judaism, Christianity, and Islam. Such religions have traditionally laid claim to a *supernatural* divine revelation, which comes to us ‘from without’ (as it were), and which can inform us of matters that lie beyond the capacity of human reason.\(^2\) White’s view of religion was never going to be acceptable to those who embrace a theology of this kind. Indeed the idea that ‘all truths of religion are derived from the native force of human reason’ had already been condemned by Pope Pius IX, in the same *Syllabus of Errors* that had caused Draper such concern.\(^3\)

### 1.3 Rejection of the Draper-White Thesis

I noted a moment ago that Draper and White are generally understood as leading representatives of a ‘warfare’ thesis, one that holds that there is some kind of inevitable conflict between religion and science. It should by now be clear that neither holds to such a view. We may disagree with Draper’s anti-Catholicism and lament his misrepresentations of history. We may regard White’s liberal theology as hopelessly vague, an attempt ‘to defend some shadowy ghost of Christianity by yielding up all that has hitherto been thought its substance’.\(^4\) But both Draper and White believe

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4. The words are those of Bishop Samuel Wilberforce (1805–73), in his (anonymous) review of the work entitled *Essays and Reviews* (1860); see the *Quarterly Review* 109 (1861), pp. 248–305, on p. 251.
there are forms of religion that can avoid conflict with science. White vigorously advocates a religion of this kind.

Whatever Draper and White may have intended, the understanding of religion and science that is attributed to them – the so-called ‘warfare’ or ‘conflict’ thesis – has become deeply unfashionable. A plethora of books and articles have appeared arguing that it is badly mistaken. An unambiguous statement of this view is provided by the theologian Alister McGrath.

The idea that science and religion are in perpetual conflict is no longer taken seriously by any major historian of science, despite its popularity in the late nineteenth century. One of the last remaining bastions of atheism survives only at the popular level – namely, the myth that an atheistic, fact-based science is permanently at war with a faith-based religion. Not only is this caricature clearly untrue in the present day, but historical scholarship has now determined it to be misleading and inaccurate in the past. Yet the myth still lives on in popular atheist writings, undisturbed by the findings of scholars.¹

When it comes to the trial of Galileo, for instance, such authors claim that it was merely a tragic mistake, the result of theological misunderstandings on the part of the Church and, on the part of Galileo, the pride of a scientist who refused to admit that his conclusions were not as certain as he claimed.

Representative of this view is an essay by historians David Lindberg and Ronald Numbers. ‘The trouble in which Galileo eventually found himself’, they write,

resulted not from clear scientific evidence running afoul of biblical claims to the contrary (as White tells the story), but from ambiguous scientific evidence provoking an intra-mural dispute within Catholicism over the proper principles of scriptural interpretations dispute won by the conservatives at Galileo’s expense. Galileo never questioned the authority of scripture, merely the principles by which it was to be interpreted.²

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As Lindberg and Numbers tell the story, the trial of Galileo was not so much a dispute between religion and science as a dispute within the Catholic community regarding the interpretation of the Bible.

This re-reading of the history has been encouraged by the fact that Galileo, unlike his predecessor Giordano Bruno, has been rehabilitated by the Church.¹ In a statement issued in 1992, Pope John Paul II noted that a key issue in this debate had to do with the interpretation of the Bible. He went on to endorse what he presented as Galileo’s view on these matters.

Paradoxically, Galileo, a sincere believer, showed himself to be more perceptive in this regard than the theologians who opposed him. ‘If Scripture cannot err’, he wrote to Benedetto Castelli, ‘certain of its interpreters and commentators can and do so in many ways’. We also know of his letter to Christine de Lorraine (1615) which is like a short treatise on biblical hermeneutics.²

The Pope also took the opportunity to repeat a view he had expressed in 1979, when he spoke about the ‘deep harmony which unites the truths of science with the truths of faith’. On that occasion, too, he spoke highly of Galileo, noting that ‘he who is rightly called the founder of modern physics, declared explicitly that the two truths, of faith and of science, can never contradict each other’.³ As John Heilbron has recently suggested, with tongue firmly in cheek, perhaps Galileo is on his way to being canon-
is. In four hundred years’ time, will we be celebrating the feast of St Galilei Galilei?¹

I suspect not. The disagreement between Galileo and his ecclesiastical opponents was deeper than the Pope imagines. Galileo may have been a more or less conventionally devout, seventeenth-century Catholic.² As such, he would freely have agreed that the truths of faith and those of science cannot be in conflict. But this was not the question at issue. The question at issue was how one was to identify both sets of truths and what was to be done when they appear to be in conflict. On these matters Galileo and the Church authorities were at loggerheads. More importantly, the attitudes that brought them into conflict are still alive and well. Despite the Pope’s attempts to rehabilitate Galileo, little has changed.

2. The Relation of Religion and Science

But this is to jump ahead. As the debates regarding the work of Draper and White show, there are different ways of characterising the relation between religion and science. So before entering into an examination of the ‘Galileo affair’, as it is often known, I shall step back for a moment and examine the competing views. If the reader is impatient to know which of these I will be defending, she could skip immediately to Section Three of this chapter.

2.1 Ian Barbour’s Fourfold Typology

A popular way of classifying views regarding the relation of religion and science was that put forward, some decades ago, by Ian Barbour.³ I shall argue shortly that any simple classification of this kind – a ‘typology’ as it is often known – is ultimately unsatisfactory. But Barbour’s will make a useful starting point.

The first view of the religion and science relation discussed by Barbour is that often attributed to Draper and White, the so-called ‘conflict’ or ‘warfare’ thesis. Barbour notes that there are two groups likely to hold to

¹ Heilbron, Galileo, p. 365.
² Heilbron, Galileo, p. 105.
such a view: scientific materialists and biblical literalists. Scientific materialists do so because they believe that only science represents a reliable way of forming beliefs (an epistemological position) or because they believe that science shows that no non-material entities exist (a metaphysical view). The latter is sometimes linked with the view that any other entities of which we may speak are ultimately explicable in terms of physics (a kind of reductionism). But at the other end of the spectrum are biblical literalists, who see a conflict between science and religion because of their particular way of interpreting Sacred Scripture.

It is necessary to qualify Barbour’s comment about these so-called ‘biblical literalists’. Such people cannot consistently believe that there is an actual conflict between religion and science. After all, the ‘two books’ – that of nature and that of Sacred Scripture – cannot ultimately contradict each other, since God is the author of both.\(^1\) Any conflict must be merely apparent. It follows that such people will not, strictly speaking, claim that there is a conflict between religion and science. They will claim that there is something faulty with the science, since it leads to conclusions that apparently contradict the Bible. The ‘science’ in question is (as they often say) ‘science, falsely so-called’.\(^2\) A better form of science, they argue, would resolve this apparent conflict.

A second view, as outlined by Barbour, is an ‘independence’ view. This tries simply to isolate religion and science, to keep each safely quarantined, with distinct domains over which they have authority and distinctive methods of inquiry. Again, this position can be defended by both believers and non-believers. Evolutionary biologist Stephen Jay Gould, for example, defends a strong version of this independence view. He speaks of the ‘non-overlapping magisteria’ (NOMA) of religion and science, the term magis-

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2 The phrase is a biblical one, from 1 Tim 6:20, in the King James Version.
terium being a traditional Roman Catholic one for ‘teaching authority’. But a similar view is defended by what Barbour calls Protestant neo-orthodoxy, which makes a sharp distinction between the domain of divine revelation and that of history and science. A similar distinction is made by those who appeal to the later work of Ludwig Wittgenstein, arguing that religion and science represent distinct language games, rooted in differing forms of life.

A third position is what Barbour calls a ‘dialogue’ view. This accepts that religion and science answer different kinds of questions and have distinct methods of inquiry, but holds that there is room for dialogue between the two. It might be argued, for instance, that religion lends support to the presuppositions of scientific work, such as the assumption that the natural world is intelligible, or that it answers ‘limit questions’ that go beyond the results of scientific inquiry. Those who hold to this view may also argue that there are methodological parallels between religion and science, science not being as objective and value free as it is sometimes portrayed. A rather different version of this ‘dialogue’ view sees the natural world – the world as described by science – as itself sacred. This is sometimes described as a ‘religious naturalism’, which bases itself on those religious feelings that can be elicited by a scientific view of the world.

A final position described by Barbour is what he calls the ‘integration’ view. This sets out to integrate religious beliefs and scientific knowledge into an inclusive vision of reality. There are three ways in which this can be done. Firstly, the old tradition of ‘natural theology’ seeks evidence in the creation for the existence and nature of God. Arguments from design, such as the modern ‘intelligent design’ theory, are of this kind. Secondly,
what Barbour calls a ‘theology of nature’ seeks to reformulate traditional religious doctrines in the light of scientific knowledge. (One might, for instance, reformulate the Christian doctrine of original sin in the light of what we now know of human origins.) Finally, one can attempt to create a new metaphysics – a comprehensive view of the kinds of entities that exist in the light of both scientific knowledge and religious belief. Barbour’s example of this trend is what has become known as ‘process theology’, which draws on the work of both Alfred North Whitehead and Charles Hartshorne to develop a new vision of both the natural world and divinity.

2.2 Mikael Stenmark’s Analysis

There are other, more recent analyses of this kind, such as that of John Haught, whose fourfold typology – conflict, contrast, contact, or confirmation – resembles that offered by Barbour. But perhaps the most sophisticated recent scheme is that of Mikael Stenmark. Stenmark notes that there are ‘restrictive’ and ‘expansionist’ views of science, offering differing conceptions of the scope of the scientific enterprise. A scientific expansionist believes that science can (or will eventually be able to) fulfil many of the functions now performed by religion. He may hold, for example, that an ‘evolutionary epic’, drawn from biology, is able to offer us ethical guidance. But on the other side there are ‘expansionist’ views of religious authority, which broaden its scope. As we shall see, Galileo’s ecclesiastical opponents held such a view of biblical authority, being reluctant to narrow the range of matters to which it applied. They were not alone in this respect. Indeed to describe this view as ‘expansionist’ is questionable, since it is widely held by religious thinkers.

In any case, this analysis leads Stenmark to distinguish five different ways of relating science and religion. Three of these are closely related to Barbour’s typology. The first sees religion and science as independent,

2 See chap. 9, ‘Grand Narratives and Dodgy Metaphors’.
4 See chap. 4, ‘The Scope of Biblical Authority’.

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having no overlapping domain. On this view, for example, religion might deal with purely ethical claims, about how we should live, while science deals with factual claims, about the way the world is. (This is, of course, Stephen Jay Gould’s ‘NOMA’ view.) This stands in stark contrast with a second, ‘monist’ view, which holds that religion and science deal with the same kinds of problems. On the monist view, religion and science either offer contrasting answers to those questions (the ‘conflict’ version of the monist view) or complementary answers (the ‘harmony’ version of the monist view). Finally, there is an ‘overlap’ or ‘contact’ view, which posits an intersection between the concerns of religion and those of science.¹ But Stenmark adds two more categories, which he calls, firstly, the ‘complete scientific expansionist’ view and, secondly, the ‘complete religious expansionist’ view.² These would retain the functions of religion and science, but subsume one under the other. Either religion would become part of science or science would become part of religion.

Mikael Stenmark’s contribution goes beyond that of drawing up a simple typology. He also offers what he calls a ‘multidimensional’ analysis. The religion and science relation, he argues, can be analysed along at least three different dimensions. The first of these is a social dimension, since both religion and science are sets of social practices (an idea that will be central to the present study). But religion and science can also be compared by reference to (a) the goals that each pursues (a ‘teleological’ dimension), (b) the methods employed to reach those goals (a ‘methodological’ dimension), and (c) the content of the beliefs and theories to which each gives rise (a ‘theoretical’ dimension).³

3. What We Mean by ‘Religion’ and ‘Science’

It is this last aspect of Stenmark’s work that comes closest to the analysis I am about to offer. But I shall approach the question a little differently. What I am investigating is whether there is a conflict between science and religion. One could answer this question, as Stenmark does, by thinking about the ‘dimensions’ of both religion and science. But my own preference

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¹ Stenmark, How to Relate Science and Religion, p. 9.
3. What We Mean by ‘Religion’ and ‘Science’

It is to think about the different ways in which the terms ‘religion’ and ‘science’ can be defined.

3.1 Defining Religion and Science

Both terms, of course, have fuzzy boundaries. What one counts as a religion and as a science will vary from context to context. For the sake of this study, I am happy to understand ‘science’ very broadly, as embracing all those fields customarily known as physical and social sciences. My historical case study will deal with a form of inquiry that was, until quite recently, known as ‘natural philosophy’. Late medieval thinkers did use the Latin term *scientia*, from which our modern word ‘science’ derives, but the Latin term had a much broader scope. When medieval scholars wanted to narrow its meaning to something akin to our modern one, they would use a phrase such as *scientia naturalis*. I admit that it might seem anachronistic to use the term ‘science’ when referring to medieval *scientia naturalis*. But I do so unashamedly. Although very different from modern science, it, too, was a form of inquiry that attempted to explain natural phenomena by reference to principles derived from observation and experience.

The scope of the term ‘religion’ is even more vigorously contested, since the diversity of the movements to which this word is applied seems baffling. The point is strikingly made by a ‘Peanuts’ cartoon printed at the beginning of a recent sociology of religion textbook. Lucy is saying to Charlie Brown, ‘All religions are basically alike... You know, love your neighbour. They're all alike. Just name any two, and you'll see’. Charlie Brown replies, ‘Melanesian frog worship and Christian science?’ As far as we know, frog worship has never been a characteristic of Melanesian religion, although it may have been practised in Nepal. But the point remains well made. It is difficult to find any feature that all religions have in common.

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3.1 Defining Religion and Science

My interest in this study, however, is in a very particular class of religions. These do have something in common. They are all scripturally based religions, tracing themselves back to an alleged divine revelation. This revelation, received by faith, represents a source of knowledge that is not identical with human reason. The present discussion will focus on the history of Christian thought, since Christianity is the scripturally based religion that I know best. But much of what I have to say will also be applicable to Judaism and Islam. To what extent it will apply to other religions is a question I must leave to others. I am inclined to follow Émile Durkheim in holding that all religions have certain texts, institutions, practices, or persons that they consider ‘sacred’ and therefore unquestionable. But I cannot defend that broader claim here.

3.2 Locating the Conflict

I hope it is now clear how I shall be using the terms ‘religion’ and ‘science’. But there is still a problem with the idea of a conflict between religion and science. When people speak about such a conflict (even to deny it exists), it is difficult to know what they are talking about. What kind of conflict are they referring to? Where exactly is it to be located? Let me outline four options and indicate which of these I consider most promising.

(a) Bodies of Doctrine

We might, first of all, think of the conflict in question as one between bodies of doctrine: religious dogmas, on the one hand, and the theories of science on the other. This seems, at first sight, a promising approach, since there certainly have been conflicts of this kind, involving competing claims about the world. Often-cited examples are the Church’s condemnation of the Copernican hypothesis in the seventeenth century – the focus of the present study – and the rejection by many Christians of Charles Darwin’s theory of evolution by natural selection.

1 É. Durkheim, *The Elementary Forms of the Religious Life* (1912), tr. J. W. Swain (London: George Allen & Unwin, 1915), p. 37; see chap. 6, ‘The Authority of Myths’. I am encouraged in this belief by the fact that a fellow citizen of mine, Philip Blackwood, is currently in a Burmese prison for a perceived insult to Buddhism. (His offence was to post images of the Buddha wearing headphones, in order to advertise a bar.)
3.2 Locating the Conflict

There are, however, two problems with this approach. The first is that a conflict on the level of doctrine would hardly be conflict between religion, as such, and science. As I have already suggested, if we focus on doctrines, we could argue that there is no ‘religion, as such,’ since there are few, if any, doctrines that religions have in common. Even a ‘belief in supernatural beings’, which the early anthropologist E. B. Tylor regarded as the mark of the religious,\(^1\) is not universally shared. Take, for example, Theravada Buddhism. Most Buddhists believe in gods, but it can be argued that you do not need to believe in gods to be a Buddhist.\(^2\) Even what I am calling scripturally based religions differ significantly in the kinds of doctrinal claims they make.

A similar remark may be made about science. The word ‘science’ is an ‘umbrella term’, covering a very diverse range of disciplines. Not only do these have differing subject matters, but even when they have the same subject matter, they frequently offer competing theories about it. On some matters, it is true, we can talk about a scientific consensus, so it may be that the sciences have more in common that religions do. But even if we concede this, the most we could claim is a conflict between particular religions doctrines and particular scientific theories.

Such conflicts surely occur. But the second problem with this approach is that they do not seem to be inevitable; indeed in many cases they are eventually resolved. We have already seen that from the believer’s point of view a conflict between religion and science must be merely apparent. It is the theologian’s task to resolve the apparent conflict, either by rejecting the science (as somehow faulty) or amending the relevant religious beliefs. Believers have often taken the latter course, as the Catholic Church’s eventual acceptance of the Copernican opinion reminds us. They have altered their understanding of their faith to accommodate the science. Even in the seventeenth century, there were many Catholics who believed the Copernican view to be compatible with a nuanced reading of Sacred Scripture. So while one can think of Galileo affair as a conflict between re-


3.2 Locating the Conflict

religion and science, one can also think of it as a dispute about the meaning of Scripture, as Lindberg and Numbers remind us. Similar remarks may be made about Christian debates in our own day regarding evolution and the doctrine of creation.

(b) Distinct Communities

There is, however, a second option, which thinks of a conflict between religion and science as a clash between two communities. Remarkably, this seems to be a common view among historians, who repeatedly argue that religion and science cannot be in conflict because many scientists are themselves religious or because religious communities have often been supportive of science. There is, of course, some truth in this argument. Religious communities have not always been in favour of science, and the Galileo affair is a reminder that institutional conflicts can, and do, occur. It may be, too, that atheism is a more common position among scientists than it is in the population at large, and that scientists as a body are becoming steadily less religious. But it remains the case that many scientists have been, and continue to be, religious. So whatever conflict there may be, it is a not a simple conflict between two groups of people.

This observation, however, does not tell us very much. The problem here is that a lack of conflict on the communal or institutional level may hide real conflicts in other respects. A believing scientist may think, for instance, that her religious beliefs are compatible with her science and yet be mistaken. After all, in complex matters people can hold inconsistent beliefs without aware of the inconsistency. It is at least conceivable, for instance, that a Darwinian account of human origins cannot be reconciled

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1 Lindberg and Numbers, ‘Beyond War and Peace’, p. 346.
with the Christian doctrine of original sin. If this is the case, then it does not matter how many Christians attempt to bring the two into harmony. The conflict would remain.

Such a conflict would be on the level of doctrine. But there could also exist conflicts on other levels, conflicts of which individuals might be equally unaware. Religion and science may represent differing modes of thought which the same individual may embrace, on different occasions: a religious of thought employed in church and a scientific mode employed in the laboratory. Alternatively religious and scientific communities may employ contrasting norms when dealing with knowledge claims, religious beliefs being treated quite differently from scientific theories. So the observation that many believers are themselves scientists, or that religious communities are supportive of science, does not take us very far.

(c) Modes of Thought

Here’s a third option, at which I have just hinted. It may be that religion and science represent differing ways of thinking. If there is a conflict between religion and science, it would have to do with what an earlier generation would have described as differing (and perhaps irreconcilable) modes of thought or, to use the French term, mentalités.

The idea that different groups might employ differing modes of thought was first proposed by an early twentieth-century thinker, Lucien Lévy-Bruhl. In his early work, Lévy-Bruhl spoke about what he called the ‘prelogical’ mentality of tribal societies,¹ while his later work made a contrast between ‘causal’ and ‘participatory’ orientations to the world.² The causal orientation, he argued, is characteristic of science, while the parti-

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3 There is an extensive body of philosophical literature on this topic. But even those who argue that we cannot have self-contradictory beliefs accept that we can have inconsistent beliefs. See, for example, R. Foley, ‘Is it Possible to have Contradictory Beliefs?’, Midwest Studies in Philosophy, 10 (1986), pp. 327–55, on p. 328.
3.2 Locating the Conflict

cipatory orientation characterizes religion and magic. Note that the phrase ‘modes of thought’, like its French equivalent *mentalités*, can be misleading. It can suggest too individualistic a conception of where the differences are to be found. Lévy-Bruhl was clear that these ways of thinking about the world were collective representations.\(^1\) They are inherited from one’s society. He also came to recognize, in his later work, that the two forms of thought – causal and participatory – exist in all societies and at all times.\(^2\)

Lévy-Bruhl’s early work met with severe criticism and widespread rejection.\(^3\) But his later views have been more widely accepted, having been adopted by a number of recent scholars of religion.\(^4\) Noteworthy in this context is the work of Donald Wiebe, who contrasts religion with science by describing religious thought as ‘mythopoeic.’\(^5\) Wiebe not only regards these two modes of thought as very different, he also argues that they are ultimately incompatible.\(^6\) If true, this would represent a real conflict between religion and science.

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A less polemical view has recently been defended by Michael Barnes, using ideas drawn from the psychology of Jean Piaget. On Barnes’s account, religious thought most commonly employs what Piaget calls ‘concrete operational’ thinking, a ‘commonsense’ attitude to the world that collects and categorizes, but in a way that makes use of concrete images and narratives rather than abstract ideas. Scientific thinking, by way of contrast, is a type of ‘formal operational’ thought. It relies on ideas of ‘fit’, making general claims about the world that it tries to make consistent both with the relevant evidence and with each other. Such thinking is critical thinking, in the sense that it gives you a ‘place to stand intellectually’ in order to judge inherited traditions. An advantage of Barnes’s work is that it recognizes that forms of religious thought are not always the same. They change over time. The ‘formal operational’ thought characteristic of philosophy and modern science can influence religious thinkers, giving rise to critical and reflexive forms of theology. We might call such forms of theology ‘scientific’, in a broad sense.

The most discussed recent contribution to this ‘modes of thought’ literature is that of Robert Bellah, whose Religion in Human Evolution makes use of Merlin Donald’s distinction between mimetic, mythic, and theoretic cultures. Donald argues that the earliest form of distinctively human culture was mimetic. Mimetic actions are deliberate attempts to represent some event or fact about the world, but in ways that do not (yet) involve language. A clear example is that of the Australian aboriginal dance that acts out the actions of a totemic animal. A second mode of thought and culture is mythic. A myth is a ‘collectively held system of explanatory and

2 Barnes, Stages of Thought, p. 21.
3 Barnes, Stages of Thought, p. 95.
4 In chap. 7 (‘Religion without Faith’) I shall discuss the difficulties facing a theology of this kind.
3.2 Locating the Conflict

regulatory metaphors'.

Myths do not merely bestow significance of the lives of individuals and the tribe; they also aim at causal explanation, prediction, and control. While mimetic actions represent particular events or facts, myths model much larger states of affairs. A third form of thought and culture is theoretic. This also predicts and explains, but does so by means of ‘argument, discovery, and proof’. Its distinctive ways of operating include ‘systematic taxonomies, induction, deduction, verification, differentiation, quantification, idealization, and formal methods of measurement’.

There is one aspect of Donald’s work that is of particular relevance to the present discussion. It is his observation that any new application of theoretic thought is inevitably ‘antimythic’: it opposes the old, mythical view. As Donald writes, ‘things and events must be stripped of their previous mythic significances before they can be subjected to what we call “objective” theoretic analysis’. This process of ‘demythologization’ is often strongly resisted. Robert Bellah touches on this idea, but also makes use of Donald’s insights to argue that tribal religions employ mimetic and mythic modes of thought. Even when religions develop a theoretical dimension, he argues, mimetic and mythic forms of thought remain influential.

(d) Epistemic Norms

The ‘modes of thought’ tradition looks promising. It may well be that religion and science can be distinguished in terms of their dominant ways of thinking. This might also account for the conflicts that occur between them, as science ‘demythologizes’ areas of the world that previously had mythic significance. I shall draw on some insights arising from this tradition, when I examine the relations that exist between religious myths and

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3.2 Locating the Conflict

the critical thinking characteristic of theoretic cultures.¹ My focus, however, will be a different one. What I shall focus on are the *epistemic norms* – the norms relating to knowledge – that are dominant within religious and scientific communities.

A norm is an ideal to which members of a community subscribe, and to which they are expected to subscribe as a condition of membership. It is, however, an ideal: it describes how members *ought* to behave, which may or may not be how they *actually* behave. So what I am referring to here are two differing sets of communal expectations regarding behaviour. My central argument will be that religious and scientific communities have different ways in which they believe knowledge claims ought to be handled. These differing norms are rooted in differing *epistemological* views, epistemology being the theory of knowledge. The key point here is that religious communities lay claim to a second source of knowledge alongside human reason. It is at this level – that of epistemology and epistemic norms – that there seems to be an ineradicable conflict between science and religion.

In making this suggestion, I am cautiously endorsing a version of Victor Stenger’s recent proposal, for he also claims that religion and science represent ‘opposed epistemologies’.² But I am locating this opposition on the level of institutional norms: collective values and procedures. It is important to note that while individuals often act in conformity with the collective norms of a group to which they belong, they need not do so. Norms, like *mentalités*, are not “prisons” from which individuals cannot escape³. In a modern, liberal society religious communities are rarely, if ever, co-extensive with the societies in which they are found. Because of this, individuals have choices regarding which group norms they will follow, even in matters of religion. A particular person may, for instance, choose to apply scientific norms to her religious beliefs, as do (for example) religiously-

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¹ See chap. 6, ‘Religion and Criticism’.


committed sociologists of religion, when acting in their professional capacity.

As this example suggests, communal norms are often associated with particular social roles. In modern societies, individuals not only belong to different communities, with their own norms, but they also have a diversity of roles. As sociologists have noted, these can involve very different, even conflicting expectations. But because the roles are different, being exercised on different occasions with different communities, individuals may not notice the conflict. Take, for instance, a devout Christian lay preacher who is also a scientist. There could be a real conflict between the epistemic norms governing such a person’s scientific work and those governing her preparation of a sermon. But the individual may never notice the difference, since the two activities are exercised on different occasions and in very different contexts. From that person’s point of view, the two activities may seem quite compatible. We can see, once again, why the observation that individual scientists are also believers is of little significance. It says nothing about the epistemic norms governing religious and scientific communities or about the modes of thought that characterize each set of practices.

4. Goals and Means

My aim in writing this book is to revive the old conflict thesis, in a somewhat more nuanced form, or at least to convince you it was not entirely mistaken. There is a deep divide between the world of science and that of faith, a fact that is illustrated by the clash between Galileo and his ecclesiastical opponents. That divide is not bridged by focusing on the doctrines of religion and science and observing that the pronouncements of religious authorities and scientists sometimes agree. The conflict between Galileo and the Church was not resolved when the Church accepted Copernican astronomy, any more than it had been resolved by Galileo’s apparent acceptance of the Church’s decree. Nor is the divide bridged by the observa-

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tion that scientific and religious communities overlap. Yes, there are, and have always been, scientists who are themselves religious. But so what? The real divide is to be found on the level of epistemic norms: expectations regarding claims to knowledge.

A distinction made by the sociologist Robert Merton may be helpful in this context. Merton begins his essay on social structure and anomie by discussing two of the elements that make up a social structure. The first consists of what he calls the ‘culturally defined goals, purposes and interests’, which are ‘held out as legitimate objectives’ for the members of a particular society. The second has to do with ‘the acceptable modes of reaching out for these goals’.¹ For the purposes of this essay I shall assume that religious and scientific communities form identifiable subgroups within the wider society. I shall also assume that they have both distinctive goals and recognized means of attaining those goals. My argument will be that while religious and scientific communities have at least one epistemic goal in common, they differ radically in their view of how that goal may legitimately be attained.

Let me begin with the common epistemic goal. The goals of religious and scientific communities are by no means identical, but they do overlap. One goal they have in common is that of attaining knowledge. If science makes progress, it is by extending our knowledge of the world.² Religious communities may not think of themselves as ‘making progress’ – an interesting difference in itself – but they do regard themselves as imparting knowledge. To use categories derived from the ‘speech act’ theory developed by John Searle,³ some utterances within the fields of both religion and science function as assertives. They purport to be stating facts. In the case of religious utterances, the facts they purport to state are not necessarily facts about supernatural beings. A statement about the life of the Buddha, for example, is a statement of fact, even if it is not understood as

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referring to a divine being. The statement that Jesus was put to death under Pontius Pilate, the Roman governor of Judaea, is contained in the creed established at the Council of Nicaea (AD 325). But if true, it refers to a simple fact of history.

Religious utterances have, of course, other functions, in addition to their assertive role. Take, for instance, the Muslim shahāda, the profession of faith:

I bear witness that there is no God but God, and Muhammad is the messenger of God.

When a convert to Islam pronounces this formula, he is not only stating what he believes to be a fact (making an assertion). He is also uttering a commissive, committing himself to a certain way of life. Indeed when pronounced formally before witnesses, it can also be what Searle calls a declaration, bringing about a new state of affairs, for it is the act by which one becomes a Muslim, with all the rights and duties this entails. (One is now entitled, for instance, to make the hajj, the pilgrimage to Mecca.) But the fact that religious utterances serve more than one function does not undermine the claim that they are assertives. Insofar as they are assertives, they have something in common with the statements of scientists. They claim to be expressing and imparting knowledge.

Not only do religious and scientific communities have a common epistemic goal, but their claims to knowledge sometimes overlap. Using a familiar philosophical distinction, we can say that some religious and scientific utterances would (if true) have a common referent, even when that referent is described very differently. In saying this, I am rejecting the strong version of the independence view I mentioned earlier: that defended by Stephen Jay Gould. Gould, you may recall, holds that religion and science have ‘non-overlapping magisteria’ (NOMA). Religious and scientific claims, on this view, have quite distinct referents. ‘The net of science’, Gould writes, ‘covers the empirical universe: what is it made of (fact) and why does it work this way (theory)’, while ‘the net of religion extends over questions of moral meaning and value’.

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4. Goals and Means

It is true that religious doctrines sometimes speak of a distinct, spiritual realm, with regard to which scientists claim no expertise. Religions also make moral claims of a kind that scientists generally avoid. But on other occasions religious doctrines make this-worldly claims, about realities that also fall within the domain of science. An alleged miracle, for instance, will be an event for which scientists could attempt to offer a natural explanation. Similarly, a claim about a certain historical event (such as the death of Jesus) will relate to facts with which secular historians may also deal. The idea that religion and science have non-overlapping magisteria is a popular one, with a venerable history. It dates back at least as far as Cardinal Baronius’s quip, cited by Galileo, that the intention of Scripture was ‘to teach us how one goes to heaven and not how heaven goes’.¹ But such separation of powers was not acceptable to the Church in the seventeenth century, nor is it acceptable today.²

What is important to note here is that while two communities may share a common epistemic goal, they may disagree about how that goal is to be attained. One might think that communities having a common goal would, over time, converge on the most efficient way of attaining it. But even if there is a most efficient way of attaining knowledge, such as some form of scientific method, a particular community may refuse to adopt it. It may be considered unacceptable for reasons related to what Merton calls a community’s ‘value-laden sentiments’.³ It may be, for instance, that a critical attitude towards historical records is best way of attaining knowledge of the past. But a religious community may refuse to allow such an attitude towards its Sacred Scripture. In other words, while technical efficiency may play some role in the choice of a means, so will the institutional norms of the group in question.

³ Merton, Social Theory and Social Structure, p. 187.
4. Goals and Means

My argument will focus on one set of institutional norms, which have to do with knowledge. These norms find expression in both the attitudes of individuals and the collective procedures of the groups in question. My examination of the Galileo affair in the opening chapters of this work will reveal these collective procedures at work. The later chapters will uncover the normative attitudes characteristic of each field through a study of the writings of theologians, philosophers, and scientists. What I shall show is that while religious and scientific communities may come into occasional conflict on the level of particular doctrines, they are always at odds when it comes to their differing epistemic norms.

It will not be enough, however, to show the existence of these differing norms. We also need to understand what lies behind them. These differences, I shall argue, are rooted in a particular belief, shared by all scripturally based religions. It is the belief that the faithful have access to a source of knowledge distinct from, and more reliable than, human reason. The epistemic norms of scientific communities, by way of contrast, assume that all we have is fallible human reason. What does this mean? It means that religion and science represent two very different ways of thinking about how we attain knowledge of ourselves and our world. These differences have led the religious and scientific communities into substantive conflicts in the past, and they are likely to lead to more conflicts in the future.

I expect this claim to meet with resistance. It will meet with resistance from those fellow academics who have spent more than thirty years combating what they see as Draper and White’s ‘warfare’ thesis. But it will also meet with resistance from a wider audience, who both admire the modern sciences and have a certain respect for religion. Not all these readers will consider themselves religious, but they may suspect religion is, on the whole, a good thing, at least for other people. Such readers will want religion and science to be in harmony. They will resist the idea that religion and science represent irreconcilable attitudes to knowledge, whose peaceful coexistence can never be guaranteed.

I understand this view, since I once held it myself. I was quite confident that there was no conflict between religion and science, or at least no conflict that could not be eliminated, with a bit of goodwill on both sides. Sadly, however, merely wanting something to be true does not make it
true. The evidence I am about to present eventually convinced me I was wrong. Will the same evidence convince you? It remains to be seen. But I hope it will at least give pause for thought to those who so confidently reject the conflict thesis.

5. The Way Ahead

How, then, shall I argue my case? I shall begin by examining the view of the universe that dominated medieval European thought. This cosmology was, in its origins, pagan: it was developed by Greek thinkers before the rise of Christianity. Despite an initial period of hostility towards Greek philosophy, medieval Christians eventually came to incorporate this cosmology into their Christian faith. They achieved what appears (at first sight) to be a remarkable marriage between religion and science. But it was an uneasy marriage. By the late medieval period, natural philosophers – as scientists were then called – were operating in ways that were at least partly independent of Church authority. In response to this, religious authorities insisted that the claims of natural philosophy must be subservient to those of theology. This led to a series of conflicts in the thirteenth century, centred on the University of Paris, which hinted at the difficulties to come.

In the sixteenth century this uneasy marriage began to fall apart. The critical event here was the emergence of a new cosmology, that of Nicolaus Copernicus (1473–1543), whose astronomical system involved a central sun and a moving earth. This proposal met with resistance from Copernicus’s contemporaries. Only some of this opposition was religious, for there were, on the face of it, good scientific reasons to reject the Copernican view. But it also met with religious opposition, the most famous instance of which was the trial of Galileo.

The Church’s objections to Copernicus’s theory centred on the interpretation of the Bible, since there were a number of biblical passages that seemed irreconcilable with the idea of a stationary sun and a moving earth. This gave rise to two questions. First, what is the scope of biblical

authority: does it cover scientific as well as religious questions? Second, what is to be done in the case of such apparent conflicts? With regard to apparent conflicts, there was one principle everyone accepted. It was that if the scientific theory in question had been conclusively demonstrated, then it was permissible to reinterpret the Bible. If, on the other hand, the scientific theory remained uncertain, then the literal sense of the Bible should prevail.

There is, however, a problem with this view. If it comes to a competition between the certainties of faith and the fallible theories of science, it is not hard to see which is going to win. Galileo tried to find the demonstrative proof of the Copernican view that the Church demanded, but seems to have realized that it was, for the moment, unobtainable. Scientists today do not even hope for demonstrative proof for their theories. Leading religious thinkers, on the other hand, continue to claim the same degree of certainty for their beliefs that was claimed by Galileo’s opponents in the sixteenth century.

These contrasting attitudes towards knowledge have real-world consequences. The most important has to do with the role of critical thought in religion and science. Religions are bound to what I shall call their ‘foundational myths’ in a way that finds no parallel in the world of the sciences. Some religious believers do think critically about these narratives, which are embodied in Sacred Scripture, but they are not permitted to challenge their authority. In the world of the sciences, by way of contrast, there are no beliefs that are sacrosanct: even the most fundamental principles of science are open to criticism and revision. Indeed the sciences operate on the assumption that our most well-established theories may one day be overthrown.

What lies behind these contrasting attitudes? It is, I shall argue, the believer’s claim to be in a possession of a source of knowledge that is distinct from human reason. The beliefs drawn from this source are accepted by an act of faith rather than on the basis of evidence and arguments. Since they are thought to be of divine origin, they are regarded as having a greater degree of certainty than any ‘merely human’ claim to knowledge. To illustrate this idea, I shall outline a traditional Christian conception of religious faith, as found in the work of the late medieval philosopher and theologian, St Thomas Aquinas.
A critical reader will already be raising objections to this line of argument. But at least some of these objections will be addressed. There are two, in particular, that I shall consider. The first objection is that religious faith is not unique in this respect. There are many beliefs, it could be argued, that we hold in an equally uncritical manner. These are sometimes described as ‘hinge beliefs’, since they are the basic assumptions upon which our lives turn. Is religious belief really so different from these? More seriously, do scientists not also make acts of faith, different in content but comparable in form to those made by religious believers?

The second objection is that my view of science is naïve, that it embodies a false ideal of scientific openness and objectivity. Firstly, the scientific community seems to have its own orthodoxy. It, too, one might argue, is intolerant of heretics, having beliefs that members are not permitted to question. Secondly, scientists often go beyond making simple factual claims. They present their theories as grand narratives, which ought to shape our view of what it means to be human. Science, in other words, often functions as a religion. But if this is true, then religion and science are much closer than I am suggesting.

These are serious objections to my view, and addressing them will involve some philosophical reflection. But as we shall see, they do not undermine my case. It remains true that religious and scientific communities exhibit differing epistemic norms. Do these differences amount to a conflict? Yes, they do, but it is a very particular kind of conflict. The teachings of science and those of religion can often be reconciled. Nor is there any necessary conflict between religious and scientific communities. Even today, scientists and believers can achieve a modus vivendi. But the scientific community operates on the assumption that we have no source of knowledge other than human reason. Reason may be a dim candle, but it is all we have to light our way. Scripturally based religions, on the other hand, claim a source of knowledge that is distinct from and superior to human reason. When the knowledge derived from faith comes into conflict with science, it is science that must give way.

This leads me to my conclusion: that scripturally based religions not only claim a source of knowledge that is independent of human reason, but regard that knowledge very differently. In particular, they are bound by tradition, insist upon the certainty of their claims, and are resistant to
criticism in ways that the sciences are not. It is this attitude that leads to conflict between religion and science. There is no sign that these religious attitudes are altering. Indeed what we see around us are increasingly vigorous reaffirmations of traditional religious claims to authority and certainty. While these traditional norms remain in force, new conflicts between religion and science could arise at any time.
1. BEFORE COPERNICUS

Let me begin with a picture, a snapshot, as it were. It is taken about a hundred years before the publication of the theory that would prompt the trial of Galileo, that of Nicolaus Copernicus. The content of the snapshot is late medieval cosmology: the view of the universe that was commonly accepted among European Christians by the fifteenth century. What the snapshot reveals is a remarkable marriage of pagan cosmology and Christian faith. This marriage took a long time to achieve and the relationship had not always been a happy one. Yet by the mid-fifteenth century the partners had found a way of living together, more or less in harmony.

1.1 Ptolemy and his Medieval Followers

The general outline of the late medieval view of the universe goes back at least as far as the ancient Greek philosopher Aristotle (384–22 BC). It was first worked out in detail by the astronomer Hipparchus of Nicaea (190–120 BC). But it was given canonical expression in the second-century work known as the Almagest, written by the astronomer Claudius Ptolemaeus (AD 90–168). Ptolemy, as he is known, wrote this work under the title Mathematical Treatise, an entirely appropriate title given its use of sophisticated geometrical arguments. At a later date, the book seems to have become known as the Great Treatise: in Greek, megistē syntaxis. This, in turn, gave rise to its Arabic title al-kitāb al-majastī, where the phrase al-kitāb means simply ‘the book’. It is from this Arabic title that we have the Westernized form Almagest.\(^1\)

It would be wrong, however, to think that most late medieval Europeans were familiar with Ptolemy’s great work. Like many scientific ideas today, his conception of the universe was widely known only at second hand. Even a highly educated thinker like the Florentine poet Dante Alighieri (1265–1321) had probably never read Ptolemy’s work for

himself.\textsuperscript{1} Even if he had access to it,\textsuperscript{2} he would probably not have understood its technical details, which were beyond the comprehension of those lacking a specialised mathematical training. Neither Copernicus nor Galileo lacked mathematical skill and it is the more complex version of Ptolemaic cosmology to which they were responding. But it is the simpler version of the Ptolemaic vision that was influential in the wider culture.

\subsection*{1.1.1 Popular Cosmology}

There were a number of popular works that transmitted the basics of Ptolemaic astronomy to a wider audience. So even if few people had read Ptolemy himself, we should not underestimate how widespread this knowledge was. Mary Orr, for instance, writes that while ‘the average educated man’ of Dante’s time would have had little of the technical details of astronomy, there are many things he would have been aware of. These include the idea

that the earth is a globe, motionless at the centre of the universe, and smaller than any of the stars; he would know the names of the seven planets (including among these the sun and the moon), and probably also their colours, their periods, and their astrological significance; the zodiacal constellations would be familiar, especially as they were often used decoratively; and he would believe that stars and planets are set in crystalline transparent spheres.\textsuperscript{3}

We should remember, too, that pre-modern Europeans had neither street lighting nor easily accessible timepieces. As a result, they were more aware than we are of the appearance of the night sky, the phases of the moon, and the daily and seasonal movements of the sun.

Among the popular works that transmitted Ptolemy’s theory to the wider culture was a book entitled \textit{Tractate on the Sphere} by Giovanni di Sacrobosco. This was first published about 1230, and became a standard textbook in the late medieval and early modern universities. It continued to be printed and widely used even in the seventeenth century, well after

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the development of Copernican astronomy.¹ The *De sphaera* (as it was known) was an influential work, but it was hardly a sophisticated one. One scholar describes it as a ‘slavish copy’ of ‘an elementary Arabic treatise’.² But it also contains practically all the cosmological information ‘that ever became common knowledge among nonastronomers’.³

The *De sphaera* begins with an overall description of the cosmos, which it describes as consisting of nine spheres. (The precise number of spheres varies, even in different editions of the work.) The outer sphere is that of the *primum mobile*, or the first mover. The next, as we move inwards, is that of the fixed stars. Beneath this outermost sphere there are the spheres of the seven planets, the largest being that of Saturn, followed (in decreasing order of size) by Jupiter, Mars, the Sun, Venus, Mercury, and the Moon. These spheres constitute the heavenly world, which is immutable, free from all change. At the centre of the cosmos is the earth, situated ‘in the middle of everything’. Surrounding the earth is a circle of water, above which is a circle of air, and, above that, a circle of pure, undisturbed fire reaching to the orbit of the Moon. Outside the nine spheres lay... Well, we shall come to that in due course, since it was natural philosophy and theology, not astronomy, that shed light on what lay beyond the observable universe.

### 1.1.2 The Universe of the Astronomers

Sacrobosco’s *De sphaera* offers a simplified view of the Ptolemaic vision of the cosmos and we should not judge pre-Copernican astronomy by its standards. To do so would be like forming an assessment of twenty-first century physics by reading a popular introductory text. But even the *De sphaera* contains some hint of the more complex mechanisms employed by Ptolemaic astronomers.

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Ptolemy was no fool. His view of the cosmos may have been mistaken, but it rested on careful observation and sophisticated calculations. Hipparchus seems to have been the first to match a cosmological model with numerical data regarding the movement of the heavens, and Ptolemy followed in his footsteps. The systems to which his work gave birth could become very complicated. But all I want to note here are three of the devices that Ptolemy and his followers employed to reconcile this model of the universe with observations.

Ptolemy and his followers had inherited from Plato and Aristotle the belief that the movements of the heavenly bodies ought to be both circular and uniform. The devices we are about to examine were ways of reconciling these traditional assumptions with the observed movements of the planets and stars. The devices seem awkward and we might wonder why no one questioned the assumptions on which they were based. But in fact no astronomer rejected the idea of uniform circular motion until the work of Johannes Kepler, who was a contemporary of Galileo. (Kepler, of course, discovered that the planetary orbits were elliptical.) Copernicus continued to take the traditional view for granted and even Galileo did not abandon it. Ptolemy and his followers certainly insisted on it. Ptolemy himself

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wrote that ‘uniform circular motions’ are the only motions that are ‘proper to the nature of divine beings’,¹ the heavens themselves being regarded here as in some sense divine.

The first of the devices used by Ptolemy and his followers to reconcile theory with observation – to ‘save the appearances’ (as they put it) – is the eccentric orbit. The orbits of the planets were thought of as forming circles that were ‘off-centre’, as it were, when seen in relation to the universe as a whole. More precisely, they were circles that included the centre of the universe but whose centre did not coincide with that of the universe.² Applied to the sun, for instance, the idea that its orbit was eccentric could account for the fact that the seasons do not have equal length. In the northern hemisphere, the sun takes approximately eight days longer to travel through the summer half of the year (from the spring to the autumnal equinox) than through the winter half of the year (from the autumnal to the spring equinox). The proposed eccentric orbit meant that for part of the year the sun was farther from the earth. Since it was assumed that it travelled at constant speed, this could account for the differences in the seasons.

Figure 1: Planet-Deferent & Epicycle (De Sphaera 1543) Caption: ‘An illustration of a planet (here resembling a star) moving on an epicycle, whose deferent is an eccentric orbit, from a 1543 edition of Sacrobosco’s De Sphaera.’

The second of the devices designed to reconcile theory with observation is the epicycle. This is most simply thought of a circle upon a circle: as a smaller orbit whose centre lies on a fixed point on the larger orbit, the centre of which is (approximately) the earth. These epicycles were useful in accounting for the apparent retrograde movement of the planets: the fact that the planets occasionally stop their forward movement and reverse direction for a time before continuing their movement forward. But minor epicycles were also used to account for other observed aspects of planetary motion, including that of the sun and moon.

¹ Ptolemy, Almagest, IX 2 (Ptolemy’s Almagest, p. 420).
1.1.2 The Universe of the Astronomers

The final and most radical amendment – one to which Copernicus would take exception as a matter of principle – was the *equant*. This device was used to preserve the assumption that the speed at which the heavenly bodies revolved was uniform. The problem is that their speed is often not uniform, when measured from the centre of their orbits. But it can be seen as uniform with respect to an ‘equant point’, which is itself off-centre. The equant is, therefore, a point in empty space, whose sole purpose is that of preserving the principle of uniform motion. It is this device, in particular, that pushes at the limits of the received Aristotelian cosmology. While it preserves the Aristotelian assumptions, it looks like a desperate expedient.\(^1\)

1.2 The Marriage of Ptolemy and Christ

Once Ptolemy and his followers combined these various devices, their astronomical systems could become exceedingly complex. Fortunately, the complexity of their calculations need not detain us. At least until I come to deal with Copernicus, it will suffice to keep in mind the simpler vision of the Ptolemaic cosmos that we find expressed in works such as the *De sphaera*. As I noted a moment ago, such introductory works were the means by which the Ptolemaic vision of the cosmos was introduced to the wider culture, and an important part of that culture was religious.

The Aristotelian and Ptolemaic conceptions of the cosmos were not developed by Christian thinkers, but late medieval Christian thinkers readily adopted them. Indeed what is striking is how easily they found it to reconcile pagan cosmology with Christian thought. In order to bring about the marriage of Ptolemy and Christ, all they needed was a little exegetical skill. This, of course, is something that theologians have never lacked.

1.2.1 Ptolemy and Genesis

Their exegetical skill was applied, above all, to the creation account found in the first chapter of the biblical book of Genesis. Late medieval interpreters for the most part felt bound to a literal interpretation of the Gen-

\(^1\) Kuhn, *The Copernican Revolution*, p. 71.

esis story. But even when insisting, wherever possible, on the literal sense of the text, commentators found ways of bringing the Bible and natural philosophy into some sort of harmony.

Genesis 1, for example, speaks of a ‘heaven’ created on the first day. Some interpreters regarded this as the immobile ‘empyrean’ heaven. This was thought to lie beyond the sphere of the fixed stars and, therefore, outside the bounds of the observable universe. Other commentators regarded the heaven created on the first day as the entirety of the heavenly spheres, down to and including that of the moon. Similarly, Genesis speaks of a ‘firmament’, which was established by God on the second of the six days of creation. Medieval interpreters could understand this as either the outermost mobile sphere – the sphere of the fixed stars, as it was known – or as ‘that part of the air in which clouds condense’.

A little more exegetical skill was required to deal with the biblical ‘waters above the firmament’ (Gen 1:7). Most late medieval commentators, following St Augustine, believed that this reference must be understood literally. If the firmament is that part of the air in which clouds condense, there is not too much difficulty. The waters above the firmament could be the very same waters that condense and come down as rain. But if the firmament is the sphere of the fixed stars, then it is a little more difficult to explain why there are waters in that place or what kind of waters they are. Here medieval commentators were divided. Some held that these wa-

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4 Grant, Planets, Stars, and Orbs, p. 103. An exception here was William of Conches, who argued that the existence of such waters was physically impossible (Lemay, ‘Science and Theology at Chartres’, pp. 231–32).
ters, although perhaps unlike terrestrial water, were nonetheless fluid.\(^1\) Others held that they were crystallized, existing in a form similar to ice,\(^2\) an idea that gave rise to belief in an extra ‘crystalline sphere’.\(^3\) This, then, was a theologically motivated addition to the Ptolemaic scheme.

The other theologically motivated addition to Ptolemy was one I have already mentioned: the empyrean heaven. It was an addition in the sense that whatever the number \((n)\) of mobile orbs, ‘the empyrean orb was always numbered \(n+1\).\(^4\) But it was an addition in the sense that, while adding to the pagan cosmology of Ptolemy, was not inconsistent with it. The other addition I mentioned – the empyrean heaven – became particularly important for Christian belief. Many commentators regarded this as ‘the dwelling of God and of all the elect’,\(^5\) although it was often thought of as a dwelling-place for angels as well. (The angels were often regarded as having another cosmological role, that of moving the heavenly spheres,\(^6\) so they were not confined to heaven.) It follows that the addition of the empyrean heaven gave the Christian God what was quite literally a home within the Ptolemaic system.

But it is not just the structure of the ancient cosmos that could be understood in Christian terms. A theological interpretation could also be offered of celestial dynamics. In his *Metaphysics*, Aristotle had already suggested that the outermost sphere, that of the fixed stars, was moved by a mover who was himself unmoved.\(^7\) But this created a new puzzle: how could something move the outermost sphere, if it were not moving itself? Aristotle’s answer is to note that objects of desire move us in this precisely

\(^1\) Grant, *Planets, Stars, and Orbs*, p. 333.
\(^3\) Grant, *Planets, Stars, and Orbs*, p. 332.
\(^6\) Grant, *Planets, Stars, and Orbs*, p. 527.
\(^7\) This was not the only ‘Aristotelian’ view. In *On the Heavens*, book 1, chaps 2–3 (De caelo 268b-270b) Aristotle adopts a different conception of heavenly movements, seeing these as ‘natural’. See R. C. Dales, ‘The DeAnimation of the Heavens in the Middle Ages’, *Journal of the History of Ideas*, 41 (1980), pp. 531–50, on pp. 531–32.
way, without being moved themselves. They move us by being both good and beautiful: it is for this reason that we love them and seek to move towards them. It follows, then, that the prime mover is a ‘final cause’, one for the sake of which movement occurs, even though it does not itself move. As Aristotle himself puts it, ‘the final cause... produces motion by being loved’. This means, of course, that the spheres must either themselves be thought of as living beings, having a soul, or they must be associated with personal movers of their own, who can be attracted to the beautiful and the good. Some combination of these two views was also possible.

In any case, it was a relatively small step to identify Aristotle’s prime mover with the Christian God. It is true that while Aristotle’s prime mover was divine, he was a self-absorbed divinity, interested only in the contemplation of his own perfection. This deity had little concern for human beings, a fact that distinguished him from the Christian God. (One of the Aristotelian propositions condemned by Church authorities in 1277 was the idea that ‘God knows nothing other than himself’.) But this was no insuperable obstacle to the Christian appropriation of Aristotelian cosmology. God could not merely be loved by his creatures; he could (with a little metaphysical sleight of hand) also be said to love them. It was convenient, too, that Aristotle had located his prime mover on the circumference of the cosmos, where he could move the outermost sphere. This could now become the dwelling-place of the Christian deity, in the immobile empyrean heaven.

4 Proposition 3; see ‘The Debates regarding Aristotle’, below.
5 I say ‘with a little metaphysical sleight of hand’ because theologians influenced by Aristotle continued to deny that God was actually affected by his creatures. A common view, which is reflected in Aquinas’s *Summa contra Gentiles* (book 2, chap. 12), was that while the creature has a real relation (relatio realis) to God, God’s relation to his creatures can be only conceptual (relatio rationis). I can still recall how shocked I was, as a student of theology, to discover this doctrine.
1.2.2 The Christian Cosmos of Dante Alighieri

The apparent harmony between Christian belief and medieval cosmology is beautifully illustrated in the work of Dante Alighieri. In his autobiographical work, *Vita nuova*, Dante refers to the existence of the nine heavenly spheres that we find described Sacrobosco’s *De sphaera*. Revealingly, he cites as evidence for their existence not merely Ptolemy but also Christian belief, as if the existence of these nine spheres were itself an article of faith.¹ ‘According to Ptolemy and according to the truth of Christianity’, he writes, ‘nine are the heavens that move’.² But the marriage between pagan cosmology and Christian belief is particularly evident in Dante’s epic poem, the *Divine Comedy*. Here Dante is taken first by the Roman poet Virgil and then – since Virgil is a pagan and cannot enter heaven – by his former love, Beatrice, on a tour of the late medieval cosmos.

They descend, first of all, into hell (*l’inferno*), which is located in the centre of the earth. As they approach the centre, the home of the devil, the force of gravity increases as Aristotelian physics predicts.³ They emerge from this journey through the earth in the Antipodes, where Dante (with poetic licence) has placed purgatory (*il purgatorio*) on an island in the southern sea, which was created by the dry land that fled from Satan as he fell from heaven.⁴ On that island there is a mountain reaching into the upper regions of the sublunary sphere. At the top of this mountain is the location of the Garden of Eden, raised above the disturbances of the lower atmosphere so that Adam and Eve (before the Fall) might not be disturbed. On the summit of that mountain Dante can feel a constant and gentle breeze coming from the east. That breeze, it turns out, is caused by the movement of the air being drawn around by the celestial spheres.⁵ A more vivid depiction of the workings of the Ptolemaic cosmos could hardly be imagined. Dante and Beatrice then proceed one by one through the heavenly spheres, where they encounter the various grades of the blessed.

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¹ Orr, *Dante and the Early Astronomers*, p. 432.
² Dante, *Vita nuova*, chap. 24 (30).
³ Orr, *Dante and the Early Astronomers*, p. 481.
⁴ Dante, *La divina commedia*, Inferno, canto 34, lines 121–24.
It is not merely the structure of the Ptolemaic universe that is reflected in Dante’s writings; one can glimpse, too, features of its celestial dynamics. Dante believes, like many of his contemporaries, that the heavenly spheres are moved by angels. In another work, the *Convivio*, Dante argues that the ‘nine orders of spiritual creatures’ corresponds to the number of the number of heavenly spheres. As he writes,

> it is reasonable to believe that the movers of the heaven of the Moon are of the order of the Angels, and those of Mercury are the Archangels, and those of Venus are the Thrones; all of whom, receiving their nature from the love of the Holy Spirit, perform their operation, which is which is connatural to them, that is to say, the movement of that heaven, full of love.¹

Even if he had never read Ptolemy’s *Almagest*, Dante had more than a cursory knowledge of Ptolemaic astronomy, probably derived from the writings of Alfraganus (al-Farghani), a ninth-century Persian astronomer.² We see this in his descriptions of Venus, where Dante assigns an individual angel to each of the three movements of the planet.³ One angel took care of the planet’s deferent (its circuit of the earth), another its epicycle (the path it traces around a point on the deferent), and a third its ‘precession’ (the very gradual shift in its orbital path).⁴

Ultimately, of course, these celestial dynamics require a prime mover, who moves without himself being moved. When he reaches heaven (*il paradiso*), Dante is moved to make a profession of faith, which begins

> I believe in one God,  
unique and eternal,  
who moves the entire heaven,  
being unmoved himself,  
with love and with desire.⁵

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¹ Dante, *Convivio*, treatise 2, chap. 6 (translation my own).
³ Dante, *Convivio*, treatise 2, chap. 6.
⁴ Orr, *Dante and the Early Astronomers*, p. 483.
⁵ Dante, *La divina commedia*, Paradiso, canto 24, lines 130–32.
He is then privileged with a vision of the divine essence, which he describes (memorably) as ‘the love that moves the sun and other stars’.¹ It is true that the term ‘love’ here apparently refers to God’s love for his creation, whereas in a pure Aristotelian physics it would refer to the love of creatures for God. But these lines are not merely metaphorical: ‘the sun and other stars’ are quite literally ‘moved’ by the love of God. It is difficult to imagine a more striking expression of the marriage between religion and science in late medieval Europe.

1.3 Between Athens and Jerusalem

This snapshot will be attractive to those who oppose the conflict thesis, for it suggests that religion and science can live in harmony. But the history of their relationship shows that the marriage had not always been so happy and that the modus vivendi was achieved at a price. A marriage, of course, requires two partners. In this case the two partners represent two sources of knowledge: Christian faith and natural philosophy. But the partners in any marriage must negotiate their relationship. So the question facing medieval Christians had been: is this marriage to be an equal partnership? Or is one partner to be the dominant one, whose word will be decisive in any dispute? This question became increasingly urgent in the twelfth and thirteenth centuries. The answer given left no room for doubt: if it came to a conflict, natural philosophy must give way to faith.

1.3.1 The Need for a Marriage

In the first few centuries of Christian history, it was far from clear that any modus vivendi would be achieved. Christianity emerged in a society in which non-scientific modes of thought were becoming increasingly influential. It could be argued that this was one of the secrets of its success.² The age in which Christianity appeared was, as one author remarks, ‘an age of anxiety’,³ in which the confidence and optimism of the classical and Hel-

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¹ Dante, *La divina commedia*, Paradiso, canto 33, line 145.
³ E. R. Dodds, *Pagan and Christian in an Age of Anxiety: Some Aspects of Religious Experience from Marcus Aurelius to Constantine* (Cambridge:
lenistic ages had been replaced by darker moods. The author of the Hippocratic treatise *On the Sacred Disease* (ca. 400 BC) had described the material world as 'both divine and human'. But that same world now came to be seen as dominated by evil powers. The self, too, was increasingly seen in a negative light. Human beings were no longer 'the measure of all things', a view Plato attributes to Protagoras of Abdera, but were felt to be in need of liberation or redemption. As E. R. Dodds writes, in the world of late antiquity, people were increasingly preoccupied with techniques of individual salvation, some relying on holy books alleged dictated in Eastern temples or dictated by the voice of God to some inspired prophet, others seeking a personal revelation by oracle, dream, or waking vision; others again looking for security in ritual, whether by initiation in one or more of the now numerous 'mystery' or by employing the services of a private magician.

This mood did not affect everyone and there was some first-rate science done during these centuries. It was, after all, the age in which Ptolemy produced his masterpiece. But it was also an age whose dominant mood was, at best, ambivalent about scientific knowledge. It is hardly surprising if the Church Fathers shared this ambivalence.

At times early Christian writers expressed hostility to philosophical inquiry (including natural philosophy) and suggested Christians should avoid it. The most extreme expression of this attitude is found in the writings of Tertullian (A.D. 160–225), for whom 'Athens' represents philosophy and 'Jerusalem' the Christian faith.

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1 Dodds, *The Greeks and the Irrational*, p. 68.
3 Protagoras, DK 80B1 (Plato, *Theaetetus*, 151e). 'DK' references are those found in H. Diels and W. Kranz (eds), *Die Fragmente der Vorsokratiker*.
1.3.1 The Need for a Marriage

What, therefore, has Athens to do with Jerusalem? What agreement is there between the Academy and the Church? ... We want no curious disputation after Christ Jesus, no questioning after enjoying the gospel. Having believed, we desire no further belief.¹

But less extreme versions of this view are to be found in the works of many Church Fathers.² Basil the Great (AD 329–79) regards ancient cosmological writings as ‘idle chatter’, and is happy to leave the natural philosophers to ‘refute one another’.³ Ambrose of Milan (AD 340–97) describes natural philosophy as vain, ‘perishable knowledge’, which ‘deceives and deludes us in our attempts to explain the unexplainable’.⁴ In a similar way, St Augustine regards all pagan knowledge as of little value when compared to that found in Sacred Scripture. Indeed he even suggests that Christians could dispense with such learning, since Sacred Scripture contains all that we need. ‘What a person learns independently of scripture’, he writes, ‘is condemned if it is harmful, but found there if it is useful’.⁵

Other writers, however, and even the same writers at different times, could express a more positive attitude, holding that Christians could make cautious use of pagan learning. This attitude is found even in the New Testament, in Luke’s depiction of St Paul’s visit to Athens. In this account, the apostle meets with some Stoic and Epicurean philosophers and, seeing an altar dedicated to an unknown God, proclaims, ‘What you worship as

¹ Tertullian, Liber de praescriptione haereticorum, book 8, chap. 9 (translation my own).
1.3.1 The Need for a Marriage

unknown, this I proclaim to you’ (Acts 17:23). But it is more clearly expressed in the words of Origen (AD 185–254), who urges his convert Gregory Thaumaturgus to accept

such parts even of Greek philosophy as may serve for the ordinary elementary instruction of our schools, and be a kind of preparation for Christianity: also those portions of geometry and astronomy likely to be of use in the interpretation of the sacred Scriptures, so that, what the pupils of the philosophers say about geometry and music, grammar, rhetoric, and astronomy, viz. that they are the handmaidens of philosophy, we may say of philosophy itself in relation to Christianity.¹

This is an early mention of an idea that would become widespread: that philosophy should be nothing more than a handmaid to theology.² Gregory, writes Origen, should make us of this learning for the sake of interpreting Sacred Scripture.

Along with the handmaiden metaphor, Origen employs another image that would become commonplace: that of despoiling the Egyptians. Just as the Hebrews, when leaving Egypt, took with them gold and silver that they had appropriated from their former masters (Exodus 11:2, 12:35–36), so Christians can appropriate the best of pagan learning. We find this image in St Augustine, in the very same work in which he speaks disparagingly of pagan philosophy.

Any statements by those who are called philosophers, especially the Platonists, which happen to be true and consistent with our faith should not cause alarm, but be claimed for our own use, as it were from owners

² The Latin phrase dates back at least as far as St Peter Damian (1007–72), who (in his De divina omnipotentia) wrote that secular knowledge should act as a handmaiden (ancilla dominae), although the idea is much older (as Origen’s comments remind us) and can also be found in the writings of Clement of Alexandria (AD 150–215). See P. Jaroszyński, Science in Culture, Gilson Studies, Value Inquiry Books 185 (Amsterdam: Editions Rodopi, 2006), p. 80.
1.3.1 The Need for a Marriage

who have no right to them. Like the treasures of the ancient Egyptians, who possessed not only idols and heavy burdens, which the people of Israel hated and shunned, but also vessels and ornaments of silver and gold, and clothes, which on leaving Egypt, the people of Israel ... surreptitiously claimed for themselves ... – similarly all the branches of pagan philosophy contain not only false and superstitious fantasies and burdensome studies that involve unnecessary effort, ... but also studies for liberated minds which are more appropriate for the service of the truth.¹

The suggestion that pagan philosophers ‘have no right’ to this knowledge is ominous. It reminds us of the law promulgated by the emperor Justinian in AD 529, which mandated that only orthodox Christians could hold publicly funded teaching positions. This resulted in the dissolution of the remaining philosophical schools in Athens.²

Why might pagan philosophy be useful? Well, even the most hostile Christian thinkers needed to study philosophy in order ‘to know their religious enemies’.³ They could not fight against a paganism influenced by philosophical ideas without being familiar with pagan thought. Christians also needed philosophy in order to settle their own doctrinal disputes. Those disputes required philosophical distinctions and categories, such as ‘nature’, ‘substance’, and ‘person’. (When the Council of Nicaea says that Jesus is ‘of one substance’ with the Father, what does this mean?) But natural philosophy was also required in order to interpret Sacred Scripture, for it dealt with matters that were also mentioned in the Bible, particularly in the opening chapters of Genesis. St Augustine, for instance, grapples with philosophical ideas when writing his commentary ‘on the literal meaning of Genesis’. So many Christian thinkers recognized the need to come to terms with pagan philosophy. Some kind of a relationship was required.

1.3.2 Negotiating a Relationship

For almost a thousand years, however, there was little need to spell out the terms of this relationship. The Romans themselves had made little contribution to science.\footnote{A. C. Crombie, *Augustine to Galileo: The History of Science A.D. 400–1650* (Cambridge, MA: Harvard University Press, 1953), p. 2.} With the collapse of the Roman Empire in the West, the tradition of scientific learning quickly passed to the East, to those countries that in the seventh century came under Muslim rule. In Western Europe, little remained but fragments of classical knowledge, carefully collected by writers such as Isidore of Seville and the Venerable Bede. Such writers were aware of the possibility of something called ‘natural philosophy’. The sixth-century writer, Boethius (best known for his work *The Consolation of Philosophy*), had passed on to early medieval thinkers a tripartite division of philosophy. There was *natural* philosophy (also known as ‘physics’), which deals with matter and motion, *mathematical* philosophy, which deals with forms abstracted from matter, and *theological* philosophy, which deals with forms that have no material embodiment.\footnote{J. A. Weisheipl o.p., ‘Classification of the Sciences in Medieval Thought’, *Mediaeval Studies*, 27 (1965), pp. 54–90, on pp. 60–61.} But while the term ‘natural philosophy’ survived, there was no longer a living tradition of scientific inquiry.

Given the context in which they were writing, the work of the scholars of this period is admirable. Isidore of Seville, for instance, compiled a book entitled *De natura rerum* (‘On the Nature of Things’), the title of which echoes that of a work by the Roman poet Lucretius (99–55 BC). Isidore’s book is at least in part a response to recent lunar and solar eclipses. It aimed to counter apocalyptic fears provoked by these striking events by showing that such phenomena have what we would regard as ‘natural’ causes.\footnote{S. C. McCluskey, *Astronomies and Cultures in Early Medieval Europe* (Cambridge: Cambridge University Press, 1998), p. 124.} But while admirable in its own way, Isidore’s work contains no original scientific thought. Nor does it present a coherent, overall picture of the cosmos. Its scope is more limited.

In this respect, it is not alone. Writers such as Isidore and Bede passed on a portion of the learning of antiquity. But they did so in the form of ‘en-
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cyclopedias’, summaries of that learning intended for a general audience. The most influential example of such works was Isidore’s masterpiece, the *Etymologies*. This uses the meanings of terms as way of presenting information on a bewildering variety of topics. Some of these are apparently trivial, such as the entry on snakes.

‘Serpent’ (*anguis*) is the term for the family of all snakes, because they can bend and twist; and thus it is *anguis* because it is ‘turned at angles’ (*angulus*) and never straight.

Others are more profound, such as that on arithmetic, which refers to the dependence of other disciplines on mathematics.

Arithmetic (*arithmetica*) is the study of numbers, for the Greeks call numbers (*numerus*) ἀριθμός. The writers of secular literature would have this discipline be the first among the mathematical disciplines, as this discipline relies on no other for its existence. However, music, geometry, and astronomy, which follow arithmetic, require its support in order to exist and hold their place.¹

While such works deal with natural-philosophical topics, they do so in summary form. They no longer represent an active tradition of research. What they present are snippets drawn from a few ancient authorities, collected by people who sometimes barely understood what they were transmitting. Not only was there no active scientific tradition, but the transmission of scientific knowledge was generally motivated by religious concerns. Bede’s cosmological writings, for instance, are related to the need for calendar reform, the particular problem here being the date of Easter.²

In this situation, there was no need to define the appropriate relationship of religion and science. It was never in doubt.

This situation began to change in the twelfth century. What happened at that time did not immediately give rise to a tradition of natural philosophy. Even in the early cathedral schools, the secular knowledge taught

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consisted of little more than the seven liberal arts: those of the *trivium* (grammar, rhetoric, and logic) and *quadrivium* (arithmetic, music, geometry, and astronomy).\(^1\) But what we see in the twelfth century is a revival of interest in the natural world, one that is often described as a ‘discovery of nature’.\(^2\) It is, perhaps, better described as a *rediscovery* of nature, analogous to that which occurred (as we shall see) among the earliest Greek philosophers.\(^3\) This involved a view of the natural world as an ‘ordered collection of creatures’,\(^4\) which enjoyed some degree of autonomy. No one doubted that the created order was ultimately dependent on God, as its primary cause. But some twelfth-century thinkers came to see it as a network of ‘secondary causes’,\(^5\) whose structure and function-

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3. See chap. 6, ‘The Criticism of Myths’. I say ‘analogous to’ because the late medieval view of the natural order was not identical with the ancient one. For the medievals nature was ‘a regular system of behaviors, but unlike the ancient Greek view it was not made up of self-regulating quasi-divine forces. It was created out of nothing and given its characteristics by its Creator’; see R. C. Dales, ‘A Twelfth-Century Concept of the Natural Order’, *Viator*, 9 (1978), pp. 179–92, on p. 191.


5. As Aquinas writes (*De veritate* qu. 11 art. 1, Reply), ‘the First Cause, out of the abundance of his goodness, has granted to other things not only that they should exist, but that they should be causes’. The idea of a secondary causes seems to have come from the widely read *Book of Causes* (*Liber de causis*), which was at first attributed to Aristotle. See A.
ing could be understood without immediate reference to its creator. On this view, phenomena should be attributed to divine action only when no natural cause can be found.

A striking feature of this twelfth-century renaissance was the emergence of a critical attitude to traditional authorities. Adelard of Bath, for instance, warns against simple reliance on authority, which he compares to being led blindly, like an animal on a leash. In a dialogue addressed to a nephew, who has been studying philosophy in Paris, he cites the Arab philosophers as examples of a critical approach to knowledge, which he contrasts with the reliance on authority in the West.

I learned one thing from my Arab masters, with reason as guide; you, however, have learned another; taken captive by the pretensions of authority, you are led by a bridle. For what else should authority be called but a bridle? Just as brute animals are led around by any bridle at all, not knowing where or why they are being taken and plodding after the rope that holds them, so many of you, reduced and bound by an animal's credulity, are being led into peril by the authority of things you read.

Exhibiting this same critical spirit, William of Conches disagreed with the Church fathers in his interpretations of Genesis. When criticised for doing so, he responded that

in those things which concern the Catholic faith or morals it is not permissible to contradict Bede or any of the Church fathers... But in mat-

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3 Adelard of Bath, Quaestiones naturales, chap. 6 (p. 98); the translation is that found in Chenu, ‘Nature and Man’, p. 13, n. 26.
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ters of philosophy, if they commit any error, it is permissible to affirm
the contrary. For if they were greater than us, they were nevertheless
men.¹

Other thinkers in this newly emerging tradition begin interpreting the
Bible in the light of how the natural world normally operates. Thierry
(Theodoric) of Chartres set out to show how God created the heavens and
the earth ‘in accordance with physical reason’,² creating the initial condi-
tions from which creatures could develop by way of natural causes.³ In a
similar way, William of Conches declares that the biblical claim that Eve
was made from the rib of Adam is ‘not to be believed literally’.⁴ He goes on
the say that if we attribute the creation of the human body to ‘the opera-
tion of nature’,⁵ this takes nothing away from God’s power. After all, God
is the creator of the world with its various causal powers. The reader will
not be surprised to know that William was bitterly attacked by another
William, the Abbot of St Thierry,⁶ which led him to renounce his bolder
opinions. But even his later work shows a desire to defend the autonomy
of natural philosophy.⁷

¹ William of Conches, Dragmaticon, cited in Lemay, ‘Science and Theology
at Chartres’, p. 232.

² Thierry of Chartres, Tractatus de sex dierum operibus, cited in T. Stiefel,
The Intellectual Revolution in Twelfth-Century Europe (London: Croom

³ For a summary of Thierry’s account of creation, see É. Gilson, History of
Christian Philosophy in the Middle Ages (London: Sheed and Ward,
1955), pp. 145–47.

⁴ William of Conches, De philosophia mundi, cited in Stiefel, The Intellec-

⁵ Stiefel’s translation (see previous note) is a little misleading, so I have re-
translated this phrase from the Latin text she cites.

⁶ Lemay, ‘Science and Theology at Chartres’, p. 231.

⁷ I. Ronca, ‘Reason and Faith in the Dragmaticon: The Problematic Rela-
tion between philosophica ratio and diuina pagina’, in S. Knuuttila, R.
Työrinoja, and S. Ebbesen (eds), Knowledge and the Sciences in Medieval
Philosophy: Proceedings of the Eighth International Congress of Medieval
Philosophy, vol 2, Publications of Luther-Agricola Society B 19 (Helsinki:
1.3.3 The Debates regarding Aristotle

So already in the twelfth century we have two of the conditions needed for a scientific revival. We have a new interest in the natural world, understood on its own terms, and a critical attitude to authority. But the emergence of a new discipline, variously known as *scientia naturalis*, *philosophia naturalis*, or *scientia de naturalibus*, could occur only with the rediscovery and translation of the those parts of the Greek inheritance that had been lost. Twelfth century scholars began this work: Adelard of Bath, for instance, travelled to Sicily and Syria (and perhaps Palestine and even Spain) in order to learn Arabic and collect works for translation. It was at this time, too, that Ptolemy’s *Almagest* was first translated from Greek to Latin, preparing the way for the late medieval synthesis that found its expression in the work of Dante. For the development of natural philosophy more generally, the key event was the translation of those works of Aristotle that deal with the natural world: his *libri naturales*. These translations enabled the revival of a living tradition of scientific research. With his revival, the question of the proper relationship of faith and natural philosophy became unavoidable.

The threat posed by Aristotle’s work was clear. As Edward Grant writes, ‘for the first time in the history of Latin Christendom, a conceptually rich and methodologically powerful body of secular learning posed a threat to theology and its traditional interpretations’.


that the world could only be considered eternal, that there was but one intellect for all men ... , that men had no individual, immortal souls, that God acted merely as an indirect mover, and that in place of his providence were the celestial spheres acting directly on all creatures.¹

It is not clear how many thirteenth-century thinkers actually advocated such broadly ‘Aristotelian’ beliefs, but they were certainly being discussed. It is hardly surprising that the Church’s initial reception was hostile.

The history of this conflict was played out first of all at the University of Paris, where the Faculty of Theology led a campaign to have the teaching of Aristotle’s *libri naturales* banned.² At first it looked as though it might be successful. In 1210, the teaching of Aristotle’s metaphysical and scientific works was prohibited, under pain of excommunication. This prohibition was renewed in 1215 and then reinforced by a papal decree in 1231, which allowed some study of these works, but only after they had been censored and purged of their errors. But the censorship was never completed and by 1255 most of the books causing concern had found a place in the curriculum of the Faculty of Arts.³

What religious authorities seem to have found particularly worrying was the ‘Averroist’ view of the relation of philosophy to theology. The twelfth-century philosopher and legal scholar Averroes (Ibn Rushd) had held that philosophy and theology were of equal status: reason and revelation stood side by side as sources of knowledge. In practice, however, he gave philosophers a privileged position in the interpretation of scriptural texts, for they were, he claimed, the people ‘confirmed in knowledge’ mentioned by the Qur’an (3:5).⁴ The late medieval European thinkers described as Averroist shared the master’s esteem for philosophy. They

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wanted to be able to pursue philosophical inquiries in ways that were not immediately constrained by theological considerations. The philosopher, they held, should be free to treat of any matter whatsoever, letting human reason run its course and come to its own conclusions.

We find this attitude exemplified in the work of Boethius of Dacia, who wrote that ‘the philosopher investigates all being – natural, mathematical, and divine. Therefore it belongs to the philosopher to determine every question which can be disputed by rational arguments’.\(^1\) Note the inclusion of ‘divine’ matters in this assertion: these, too, fall within the scope of philosophy. Boethius insisted that this exercise posed no threat to the authority of the faith, which went beyond what philosophy could demonstrate. He and his fellow Averroists professed themselves ready to accept revealed truth, on account of its more authoritative source. But their insistence on the relative autonomy of philosophy went too far for the religious authorities. The view put forward by Boethius was among the 219 Aristotelian propositions condemned by Étienne Tempier, the Archbishop of Paris, in 1277.\(^2\)

The subordination of philosophical inquiry to theology had already been made clear in a statute passed by the University in 1272. This states that no master or bachelor of [the faculty of arts] should presume to determine or even dispute [discuss] any purely theological question, as concerning the Trinity and incarnation and similar matters, since this would be trangressing the limits assigned him.\(^3\)

If a philosopher deals with any philosophical question that touches on theological issues, he may never settle the question ‘contrary to the faith’. If he happens to come across an argument that appears to undermine the faith, he may not simply present it as a philosophical argument, but must


refute it. Indeed he should refrain from continuing to discuss arguments of this kind.

We have seen that when it came to cosmology the late medieval period did achieve a marriage between religion and natural philosophy. But the disputes of the thirteenth century made it clear that this was not a union of two equal partners. The proper role of philosophy was to be nothing more than the servant of theology. As the Dominican theologian Roland of Cremona wrote in about 1234,

philosophy is the handmaid [ancilla] of theology; theology is the ruler and queen of the sciences which must wait upon it as servants. ... Theology is the science of sciences which is raised above all philosophical speculation and surpasses all others in dignity.

This did not mean that theologians dictated what philosophers were to say. But it did mean that when it came to an apparent conflict, philosophy must give way. Revealed truth had 'absolute epistemic priority'. It was on those terms that Aristotelian philosophy was eventually incorporated into Christian thought, the pioneering figure here being Thomas Aquinas. Dante would later refer to Aristotle as il maestro di color che sanno, 'the master of those who know'. But his philosophy could be accepted into the world of Christian thought only by accepting its subordinate status.

These events are important for our story insofar as they set the scene for the conflict that occurred in the time of Galileo. The debates of the thirteenth century had made it clear that the authority of divine revelation could and should take priority over the conclusions of natural philosophy.

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4 Dante, La divina commedia, Inferno, canto 4, line 131.
By the seventeenth century, this idea was coupled with an uncompromising view of the scope of biblical authority and a strong sense of the certainty offered by faith. These three factors, operating in tandem, made it impossible for Galileo to persuade the Church of the need to accept the Copernican view. Indeed it made the condemnation of the Copernican theory all but inevitable. It is to those events that we must now turn.
2. THE COPERNICAN REVOLUTION

In 1543, a Polish mathematician, astronomer, and physician, Nicolaus Copernicus, published a book that would initiate a revolution in human thought. The book’s title — *On the Revolutions of the Heavenly Spheres* — called to mind the traditional cosmology of Ptolemy, in which the heavenly bodies circled the earth on more or less solid orbs. But the *De revolutionibus* (as the book is known) would eventually overturn that view. By the end of the following century, European thinkers would no longer regard the earth as the central feature of a vast but not immeasurable universe. Rather, they would regard it much as we do today: as merely one planet among many, orbiting an apparently undistinguished star, in a universe that was, as far as anyone knew, endless in extent.

Everyone knows this was a contested revolution, the trial of Galileo being the most notorious expression of the contest. But it has often been assumed that while Copernicus stood for the cause of truth, those who opposed him were motivated by nothing more than blind allegiance to religious dogma. The actual situation was rather different. There were apparently good scientific reasons for rejecting Copernicus’s view. But in correcting the oversimplified views of the past, we must not be like Martin Luther’s drunken peasant, who, ‘when you lift him up into the saddle on one side, tumbles off on the other’. Religious dogma did play an important role in the opposition to Copernicus. This is particularly the case in the trial of Galileo, which was motivated by concerns about biblical authority. But before I discuss the religious objections, it will be useful to examine Copernicus’s achievement and to set out the non-theological reasons that led so many of his contemporaries to reject it.

2.1 The Copernican Theory

Copernicus’s starting point is made clear in the introduction to the *De revolutionibus*, dedicated (it should be noted) to Pope Paul III. Here he argues that the old Ptolemaic system, centred on a stationary earth, was beyond repair. In particular, it was unable to deal economically with the movement of the seven planets, which in Copernicus’s day were thought to

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include the sun and the moon. The Ptolemaic system could be brought into harmony with planetary observations only by adding an unwieldy array of epicycles, eccentrics, and equants. Worse still, Copernicus argued, there was no single agreed way of doing this. Astronomers had merely come up with a series of incompatible proposals, using quite different expedients to deal with the same observations. It follows that the Ptolemaic system had failed to offer that which it had promised: a single, consistent picture of the structure of the cosmos. It is, Copernicus writes, as though a painter were to create a portrait composed of

hands, feet, head, and other limbs from different places, well painted indeed, but not modelled from the same body, and not in the least matching each other, so that a monster would be produced from them rather than a man.¹

Faced with this 'monstrous' but ancient cosmology, Copernicus turned to a solution that also had ancient authority on its side, going back to the Pythagorean philosophers of the fifth century BC.² It had been picked up by Heraclides of Pontus (390–310 BC) and developed by Aristarchus of Samos (310–230 BC).³ It begins with the idea that the movement of the fixed stars is a merely apparent movement, being actually due to the rotation of the earth, which turns on its axis approximately every twenty-four hours. Given this assumption, we can understand the fixed stars to be truly fixed, that is to say, motionless.⁴ It is the earth that is turning.

So far, so good. We can follow Copernicus and assume that the earth revolves on its axis daily. But the observed daily motion of the heavenly bodies still seems to require that the earth remain in its traditional place, at the centre of the universe. After all, only then would the stars even appear to circling the earth. So the most plausible theory so far would seem to be a simple two-sphere theory, corresponding in outline to that of Ptolemy,

² Copernicus, De revolutionibus, book 1, chap. 5.
⁴ Copernicus, De revolutionibus, book 1, chap. 10.
but one in which it is the inner sphere (the earth) that revolves, rather than the outer sphere (that of the fixed stars). Yet Copernicus wishes to go further and to attribute to the earth a second circular motion, in order to account for the observed movements of the ‘wandering’ stars, i.e. the planets. This second motion is the earth’s orbital motion around a new centre of the universe, namely the sun.

This immediately creates a problem. If the earth is orbiting the sun, then one would expect the relative positions of the heavenly bodies to vary during the year, as the earth changes its position in the course of its orbit. (There is a familiar analogy for this, namely the apparent movement of fingers held in a straight line in front of the eyes, as you close one eye and open the other.) But no such variation can be observed, at least with the naked eye, or even with the telescopes that became available in the seventeenth century. This came to be known as the problem of ‘stellar parallax’. How can this problem be resolved? It would be resolved if the earth is so close to the centre of the universe that its orbital motion around the sun has no observable impact on the relative positions of the heavenly bodies.

It follows that Copernicus is forced to posit a much larger universe than even the medievals had considered. Contrary to a widespread modern perception, the universe of Ptolemy and his followers had not been small. (Contemporary depictions of that universe are misleading, since no attempt was made to draw them to scale.) A common medieval estimate of its radius – the distance from the earth to the sphere of the outermost planet (Saturn) – was 73 million miles. Copernicus, however, posited a greatly enlarged universe. One estimate, based on his figures, suggests that the distance from the earth to the fixed stars was 154 billion miles. Within that vast universe, the distance between the sun and the planets was relatively small. In the Copernican cosmos, Saturn (the outermost

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2 Note that Copernicus’s solution to the problem of stellar parallax was not a new one. Already in the third century BC, Aristarchus seems to have been aware of the problem and to have adopted a similar solution (Lloyd, *Greek Science after Aristotle*, p. 57).
2.1 The Copernican Theory

planet) was no more than 39 million miles from the sun.\(^1\) So although Copernicus gives no precise figure for the distance of the earth from the sun, it is easy to see that it is insignificant in comparison with the size of the cosmos as a whole.

Copernicus’s scheme is considerably more complex than this simple presentation suggests. He attributes, for instance, a third motion to the earth, that of its axis,\(^2\) which means that a line extending from either the north or south terrestrial poles would carve out a conical shape over the course of a year. Copernicus (mistakenly) believed that he needed this third movement to account for the progression of the seasons.\(^3\) It also helped him offer an explanation for the puzzling ‘precession of the equinoxes’, as it is called: the fact that the celestial pole around which the stars appear to move very slowly shifts its position, tracing out a circle every 26,000 years. Copernicus could offer an explanation of this phenomenon by making the period of this third movement ‘very, very slightly less than a year’.\(^4\) But for our purposes we can ignore these further complications.

If the Ptolemaic system was, as Copernicus argues, unable to deliver on its promises, did Copernicus’s model do any better? We think of our current model of what we call the solar system as Copernican, and insofar as it is heliocentric (‘sun-centred’), it does follow Copernicus. Furthermore, we know that our current model is enormously successful. Not only does it explain the movements of the heavenly bodies, as observed from the earth; it has also allowed for interplanetary space flight. What more could one ask? But our model of the solar system has been transformed by the later work of Kepler and Newton, so it is not identical with Copernicus’s view.\(^5\) Were there good reasons to prefer the Copernican hypothesis at the time it was first proposed?

\(^1\) Grant, Planets, Stars, and Orbs, p. 442.
\(^2\) Copernicus, De revolutionibus, book 1, chap. 11
\(^4\) Kuhn, The Copernican Revolution, p. 270 note.
\(^5\) Kuhn, The Copernican Revolution, p. 212.
2.2 Arguments in Favour of Copernicus

It is important to note that Copernicus had no new observational evidence with which to support his proposal.¹ In the decades following the publication of his work, the Danish astronomer Tycho Brahe would gather a large body of new and more accurate data. But not only were these unavailable to Copernicus; they did not necessarily support the Copernican theory. (Tycho himself was to reject it.) Even after the invention of the telescope in the first decade of the seventeenth century, the evidence remained ambiguous.² The Copernican scheme was not the only one that could explain the observable movements of the heavenly bodies.

Nor did the Copernican system, as first proposed, succeed in eliminating the old Ptolemaic devices of epicycles and eccentrics. The problem here was Copernicus’s (false) assumption that planetary orbits must be circular. This meant that although Copernicus could get rid of the major epicycles, he still needed minor epicycles (epicycles,³ if you like) and eccentric orbits. To deal with the observed movements of the moon, for instance,

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² Empirical confirmation of the Copernican view came only with the observation of stellar parallax in 1838. One could choose James Bradley’s discovery of stellar aberration in 1728, since this was a fact inconsistent with Tycho’s hypothesis but consistent with the Copernican view. But as Bradley himself noted, even at that time the absence of observable stellar parallax remained a problem. See J. Bradley, ‘A Letter from the Reverend Mr. James Bradley Savilian Professor of Astronomy at Oxford, and F.R.S. to Dr. Edmond Halley Astronom. Reg. &c. Giving an Account of a New Discovered Motion of the Fix’d Stars’, *Philosophical Transactions of the Royal Society (1683–1775)*, 35 (1727–28), pp. 637–61, on p. 660.

Copernicus required not just one but three circles,¹ which in this particular case was a more complex mechanism than that posited by Ptolemy.

What Copernicus could do, however, was to provide an account of the movements of the heavenly bodies that was both simpler, overall, and more coherent than its predecessor.² Its first advantage was that it posited what we might call ‘fewer moving parts’,³ the daily apparent motion of all the heavenly bodies being explained by a single motion of the earth. Secondly, Copernicus’s system offered a more coherent cosmology. It could explain, for example, the relationship between the size of a planet’s orbit and the time it took to revolve around the sun: roughly speaking, the bigger the orbit, the longer the time. Thirdly and most importantly, Copernicus’s system offered a unified account of phenomena that could previously be explained only by positing unrelated mechanisms. The clearest example of this is the Copernican account of the retrograde motion of the planets: the fact that they apparently stop their forward movement and reverse direction for a time before continuing. While Ptolemaic astronomer could explain this only by positing a series of epicycles, the Copernican could explain the apparent retrograde motion of the planets as a natural consequence of the fact that all the planets, including the earth, are orbiting a central sun.⁴

Figure 2: **Retrograde Motion-Copernicus (J Wilkins 1684)** Caption: ‘A Copernican explanation of apparent retrograde motion, the upper-case letters representing the earth’s orbit and the corresponding lower-case letters the orbit of Jupiter, seen against the sphere of the fixed stars (n–z), from John Wilkins, *A Discourse Concerning a New Planet (1684)*’

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² M. A. Finocchiaro, *Defending Copernicus and Galileo: Critical Reasoning in the Two Affairs*, Boston Studies in the Philosophy of Science 280 (Dordrecht: Springer, 2010), P. 22. My discussion of the arguments in favour of the Copernican view are drawn largely from this work.

³ Finocchiaro, *Defending Copernicus and Galileo*, p. 22.

⁴ Copernicus, *De revolutionibus*, book 5, chap. 35.
2.3 Arguments against Copernicus

It follows that Copernicus’s theory did have considerable advantages, even at the time it was proposed. But it was not the case, as popular writers sometimes suggest, that Copernicus ‘incontestably established the heliocentric theory’. There were good arguments in favour of Copernicus’s geokinetic (‘moving earth’) and heliocentric theory. But those arguments were far from decisive and his theory faced weighty objections.

If we are inclined to overlook how serious those objections were, Galileo is at least partly to blame, for in his Dialogue he places them on the lips of a character named Simplicio. The name is not necessarily disparaging: it is apparently an allusion to Simplicius of Cilicia, a sixth-century commentator on Aristotle. But the Simplicio of Galileo’s Dialogue is the least sophisticated thinker of the three characters involved. This is quite unfair, for the opponents of the Copernican hypothesis were often very sophisticated thinkers, who had what seemed to them good reasons for their opposition. Some of those reasons were religious, but not all were. There were arguments against Copernicus that were drawn from both astronomical observations and the best natural philosophy (or physics, as we would call it) of the day.

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1 Draper, History of the Conflict between Religion and Science, p. 168.
2 Galilei, Dialogue Concerning the Two Chief World Systems, p. 7. As it happens, the historical Simplicius was already aware of the difficulties facing Aristotelian doctrine, for he reported the opinions of those ancient astronomers who saw in the non-Aristotelian expedients of Ptolemaic astronomy (such as eccentrics and equants) an argument against Aristotelian physics (Dijksterhuis, The Mechanization of the World Picture, p. 65).
3 Simplicio’s thinking has become a little more sophisticated by the time of Galileo’s Two New Sciences (1638).
4 These are conveniently summarised by Finocchiaro in the introduction to The Galileo Affair, which my discussion largely follows, as well as in the same author’s Defending Copernicus and Galileo, pp. 24–34.

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2.3.1 Astronomical Arguments

A first astronomical argument against the Copernican view was the objection that stemmed from the apparent differences between earth and heaven. If Copernicus is correct, the argument goes, then the earth is simply another planet, and its features should resemble those of the other heavenly bodies. But so far as one could tell, before the invention of the telescope, the features of the heavenly bodies are very different from those of earth. Given the observable differences between heaven and earth, the idea that the earth was just another heavenly body seemed deeply implausible.

In Galileo’s Dialogue, Simplicio puts forward precisely this argument, noting that on earth there exists continual change, with generation of new entities and the corruption of old ones. But nothing like this, he continues, has ever been observed in the heavens. Similarly, the heavenly bodies are luminous, giving light, while the earth is dark and without light. For such reasons we must assume that the heavens are the earth are essentially different, being made of different materials and governed by different laws.

A second astronomical argument against the Copernican theory is based on the appearance of the planet Venus. Since, on the Copernican theory, the earth and Venus have different periods of revolution around the sun, their relative positions would alter continuously. This means that Venus should exhibit a full range of phases, like those of the Moon, as different aspects of the planet, illuminated by the sun’s rays, become visible from earth. When it is on the far side of the sun, it should appear full, like the full moon. When it comes between the earth and the sun, none of the illuminated surface would be visible. At intermediate positions, it would vary from nearly full to a narrow crescent. But before the invention of the telescope, no such phases could be observed.

A third astronomical argument against Copernicus comes from observations of both Mars and Venus. On the Copernican view both planets are, of

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2 Aristotle, On the Heavens, book 1, chap. 3 (De caelo 270b).
3 Galilei, Dialogue Concerning the Two Chief World Systems, p. 47.
course, also orbiting the sun, but at a different speed from that of the earth. It follows that sometimes they will be relatively close to one another, and sometimes much further apart. One would, therefore, expect to see a significant variation in their observed size and brightness. In the case of Mars the variation would be by a factor of about eight and in that of Venus by a factor of about six. But naked eye observation yields a much smaller difference: in the case of Mars the size varies by a factor of two, while in the case of Venus the difference is negligible.\textsuperscript{1} Galileo also records this objection and tries to answer it.\textsuperscript{2} As he suggests, telescopic observations resolve this difficulty, but they were not available until more than 50 years after Copernicus.

A fourth argument was one I have already mentioned, namely the argument from the absence of an observable stellar parallax.\textsuperscript{3} If, as Copernicus suggests, the earth were orbiting the sun, then we would be viewing what were regarded as the fixed stars from very different positions over the course of the year. It follows that each star should change its apparent position, when viewed from earth, in a way that is regularly predictable, on an annual cycle. But no such changes are observed. As the figure of Simplicio in Galileo’s \textit{Dialogue} writes, on the Copernican view

the earth’s orbit would necessarily cause changes and variations in the stellar sphere similar to the observable changes produced by the earth’s radius in regard to the sun. No such changes, or even smaller ones, being observed among the fixed stars, it appears to me that by this fact the annual movement of the earth is rendered untenable and overthrown.\textsuperscript{4}

This remained a serious objection long after Copernicus and Galileo had attempted to answer it, for the traditional Copernican response – that the fixed stars were much further away than was previously believed\textsuperscript{5} – seemed suspiciously \textit{ad hoc}, introduced for no other reason than to answer

\begin{enumerate}
\item Galilei, \textit{Dialogue Concerning the Two Chief World Systems}, p. 334.
\item Finocchiaro, ‘Introduction’, pp. 18–19.
\end{enumerate}
the objection. In any case, the existence of an actual stellar parallax was not detected until 1838.¹

2.3.2 Physical Arguments

What about the natural-philosophical or (as we would say) ‘physical’ arguments against the Copernican view? Copernicus’s initial insight was not a new one. Ancient and medieval thinkers were already well aware of the possibility of the earth’s rotation. They realized that the apparent movement of the stars could be explained either by the actual movement of a heavenly sphere or by the movement of the earth. But almost universally they rejected the idea that the earth moved. Arguments in support of this view are already to be found in Aristotle.² But the key arguments – those repeated in medieval times and to which Galileo would respond – date from the time of Ptolemy, being found in his second-century Almagest.

Ptolemy notes that there are those who hold that it is the earth that is turning, rather than the heavens, making one revolution each day. He readily concedes that the apparent movement of the heavens could be accounted for in this way. It would be precisely that: an apparent movement. But the decisive evidence against this opinion relates to what would happen on earth, if it were true. If the earth were revolving, Ptolemy writes, this would involve ‘the most violent of all motions’. It would mean, for instance, that any object not actually attached to the earth would be left behind by the earth’s movement.

Neither clouds nor any other flying or thrown objects would ever be seen moving towards the east, since the earth’s motion towards the east would always outrun and overtake them, so that all other objects would seem to move in the direction of the west and the rear.³

One might respond to this that the air is also carried around with the earth, being in a certain sense attached to it. But then objects in the air would still be left behind. If, on the other hand, such objects are thought to be fixed in the air, then it would follow that they would never be seen to

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⁵ Grant, Planets, Stars, and Orbs, pp. 442.
³ Ptolemy, Almagest, I.7 (Ptolemy’s Almagest, 45).
move at all. What is Ptolemy’s conclusion? It is that the idea of the movement of the earth is ‘quite ridiculous’.

Late medieval thinkers were also aware that there was an alternative to the Ptolemaic, geocentric view. In the fourteenth century, for instance, Nicole Oresme offered a number of apparently persuasive arguments in favour of the rotation of the earth. Oresme’s discussion is particularly interesting, since it offers a way of reinterpreting the relevant Biblical passages: those that suggest the earth is at rest and the heavens move. He suggests that the passages in question could be understood as conforming ‘to the customary usage of popular speech’, as in the case of those biblical texts that speak of God ‘repenting’ or ‘becoming angry’. (God, of course, cannot have such emotions or change his mind.) Oresme also cites Psalm 147:8, which said that ‘God covers the heavens with clouds’. This, too, cannot be understood literally, since the heavens are above the clouds. But after casting doubt on the capacity of human reason to settle the question, Oresme backs away from such reinterpretations and opts for the traditional view.

Oresme’s teacher, John Buridan, had also examined the idea that the earth, rather than the heavens, might be rotating. He, too, notes the arguments in its favour, remarking (for example) that the rotation of the earth seems more plausible than that of the heavens. After all, the relatively small earth could be moved more easily than the heavens. It also requires a much slower rate of rotation. Remember that even the medievals thought the universe was very large, so that on the Ptolemaic view the speed of the outermost sphere would have been truly ‘astronomical’. Despite such arguments, Buridan also opts for the traditional view of a sta-


3 Grant, Planets, Stars, and Orbs, p. 438.
tionary earth. He notes, for instance, that although a rotating earth would move more slowly than the heavens, this is of little significance, since the heavens are more easily moved than the earth, being made of a quite different material. In support of this conclusion Buridan cites the arguments put forward by Ptolemy, but he adds an argument drawn from his own theory of ‘impetus’.

It is a fundamental principle of Aristotelian physics that ‘everything that is in motion must be moved by something’. But this immediately raises a question. If every object in motion must be moved by something else, then what keeps a projectile (such as a javelin) in motion once it has left the arm of the thrower? There were two ways of understanding Aristotle’s rather obscure answer to this question. According to the first view, it is the force of the displaced air that moves the projectile. According to the second, it is the force of the air alongside the projectile that moves it. Buridan rejects both of these views, which he regards as contrary to experience.

What solution does he offer? His solution resembles that of John Philoponus, who already in the sixth century had suggested that ‘a projectile moves on account of a kinetic force which is impressed on it by the mover and which exhausts itself in the course of the movement’. In a similar way, Buridan argues that the force imparted by the original mover somehow remains at work in the projectile. As he writes,

in the stone or other projectile there is impressed something which is the motive force (virtus motiva) of that projectile ... But that impetus is continually decreased by the resisting air and by the gravity [heaviness] of the stone... Thus the movement of the stone continually becomes slower, and finally that impetus is so diminished or corrupted that the gravity of the stone wins out over it and moves the stone down to its natural place.

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Elsewhere Buridan takes this idea further by arguing that the movement of a projectile would be ‘of infinite duration were it not diminished and corrupted by a contrary force resisting it’.¹

How does Buridan use this impetus theory to argue against the idea of a moving earth? He makes reference to a variant of Ptolemy’s argument, which holds that if the earth were rotating an arrow shot directly upwards would not fall to the same spot, but would fall to the west of the point at which it was launched. One could argue, Buridan continues, that the air being carried along with the rotating earth also carries along the arrow. But, he responds, the impetus impressed into the arrow would enable it to resist the motion of the air, so that it would still fall to the west. Since arrows do not act in this way, it follows that the earth does not rotate.²

This might seem a puzzling argument, particularly to those of us brought up with the modern conception of inertia. We are inclined to think that Buridan’s idea would allow him to overcome the very objection that he himself raises. He could have argued that the arrow, once it had received an impetus from the rotation of the earth, would continue to be carried along by that impetus. In the course of defending Copernicus, Giordano Bruno would later take this step.³ But Buridan had not yet, it seems, broken with the Aristotelian view that bodies have ‘a spontaneous tendency to rest’.⁴ He continues to believe, with Aristotle, that ‘everything that is in motion must be moved by something’. He has not yet arrived at the

⁴ Clavelin, The Natural Philosophy of Galileo, p. 95.
idea that a body set in motion will simply continue to move, unless it is impeded. It is only with Galileo that physics takes its decisive step towards the modern view of motion.

### 2.3.3 A Philosophical Argument

A final argument against the Copernican system is more philosophical than empirical. More precisely, it is an *epistemological* argument, one that draws on a theory of knowledge. It can be described as the objection from the deception of the senses. This takes the form of a *reductio ad absurdum*: an argument that discredits a position by showing that it has unacceptable consequences. The argument runs like this. Our senses tell us that we, and the earth on which we stand, are stationary: we have no feeling of movement. Although perceptual illusions are common – a straight stick partly immersed in water appears bent, for example – if the Copernican hypothesis were true, this feeling of being stationary would be ‘a gigantic and radical deception’.\(^1\) If we allowed that our perceptions could be so radically deceived, then all our claims to knowledge would be called into question. But since we are convinced we do know many things, we should not accept that the earth is turning.

While a philosophical rather than a scientific argument, this view is also reported in Galileo’s *Dialogue*. Once again, it is placed in the mouth of Simplicio, who argues that if the Copernican theory were true, then what hope can we have of knowing anything at all. If Copernicanism is true, then

we must necessarily suspect our own senses as wholly fallible or stupid in judging sensible things which are very close at hand. Then what truth can we hope for, if it derives its origin from so deceptive a faculty?\(^2\)

This may not have been a decisive argument, but even Galileo recognized it as having a certain force.

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2 Galilei, *Dialogue Concerning the Two Chief World Systems*, pp. 255–56; see also p. 248.
2.4 Tycho Brahe’s Compromise

There were, then, apparently good non-religious reasons for rejecting Copernicus’s view, at least in the decades before the invention of the telescope. If Copernicus’s theory had been clearly supported by astronomical observations even before 1610, we might expect it to have been embraced by the man who was the greatest astronomical observer of the age, Tycho Brahe. Tycho was a Danish nobleman turned astronomer, who belonged to a breed of scientist of which, alas! there are few surviving specimens. Sporting a prosthetic nose to cover an injury sustained in a duel, Tycho was a lavish entertainer, whose meals were legendary for the quantity of alcohol consumed as well as for the food. He also kept a pet elk, which is said to have died after climbing the steps to the room where a banquet was in progress and drinking too much beer.¹

It is not, however, Tycho’s personal life that concerns us here, but his reaction to Copernicus. Tycho was impressed by Copernicus’s mathematical achievements and very sympathetic to his attempts to get rid of the embarrassing Ptolemaic equant.² Yet Tycho refused to accept Copernicus’s theory, for reasons that were astronomical and physical as well as theological. From the point of view of astronomy, Tycho was particularly dissatisfied with the Copernican attempts to account for the absence of stellar parallax.³ While he appreciated the mathematics that lay behind Copernicus’s account, he also seems to have regarded the idea of a moving earth as physically absurd.⁴ As he wrote, the Copernican hypothesis

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expertly and completely circumvents all that is superfluous or discordant in the system of Ptolemy. On no point does it offend the principles of mathematics. Yet it ascribes to the Earth, that hulking, lazy body, unfit for motion, a motion as fast as the aetherial torches, and a triple motion at that.¹

Theological objections may also have played in role in Tycho’s rejection of Copernicus’s solution,² although these probably played a lesser role than the physical arguments.³ In any case, he had what seemed to him good reasons to try to find an alternative view, which would enjoy the mathematical advantages of the Copernican theory without suffering from what he saw as its physical defects.

Figure 3: Geoheliocentrism—Martianus Capella (1573) Caption: ‘A 1573 representation of Martianus Capella’s geoheliocentric system, which was followed by Tycho Brahe.’

So what was Tycho’s alternative? His starting point may well have been a brief statement in the work of the fifth-century Roman writer Martianus Capella. This writer makes reference to the view that ‘the stars of Mercury and Venus ... do not go around the earth at all, but around the sun in freer motion’.⁴ Copernicus himself singles out this work for praise.⁵ Tycho, however, not only admires it; he develops it into an alternative cosmology. His cosmology can be described as geoheliocentric. It is ‘geocentric’ (earth-centred) insofar as the central position was held by a stationary earth, around which revolve both the moon and the sun. But it was also ‘heliocentric’ insofar as the remaining planets – Mercury, Venus, Mars, Jupiter, and Saturn – orbited the sun rather than circling the earth.

The major objections to this scheme were not astronomical but physical. Tycho’s proposal entailed that the orbit of Mars intersected with that of the sun.\footnote{In fact, the same was true of the orbits of Mercury and Venus, but this did not seem to be so obvious a problem (Thoren, *The Lord of Uraniborg*, p. 254).} This seemed a fatal objection to those who believed that the heavenly bodies were carried around on solid (in the sense of impenetrable) orbs. As it happens, medieval authors were far from clear on this question, which does not seem to have been a live issue before the fourteenth century.\footnote{Grant, *Planets, Stars, and Orbs*, p. 342.} But Tycho had still to face the objection that intersecting orbs were in some sense a physical impossibility and therefore no less ‘absurd’ than the Copernican idea of a moving earth.

It seems that this objection led Tycho initially to doubt his own proposal. As he wrote to a friend in 1588,\footnote{As my remarks suggest, Brahe may be overstating his predecessors’ commitment to solid (i.e. impenetrable) orbs (Rosen, ‘The Dissolution of the Solid Celestial Spheres’, p. 22). But it would have been for precisely that reason that he saw this as an objection to his proposal.}

> I was still steeped in the opinion, approved and long accepted by almost all,\footnote{Cited in Westman, ‘Three Responses to the Copernican Theory’, p. 329.} that the heavens were composed of certain solid orbs which carried around the planets, and ... I could not bring myself to allow this ridiculous penetration of the orbs; thus it happened that for some time this, my own discovery, was suspect to me.\footnote{Grant, *Planets, Stars, and Orbs*, pp. 343–44; Aristotle, *Meteorology*, book 1, chap. 7 (*Meteorologica* 344a).}

What led Tycho to overcome these scruples was the new information that had become available regarding comets, particularly the one observed in 1577. Aristotle had held that comets were phenomena in the upper atmosphere, that is to say, below the orbit of the moon.\footnote{Rosen, ‘The Dissolution of the Solid Celestial Spheres’, p. 23.} Not all later astronomers agreed,\footnote{Grant, *Planets, Stars, and Orbs*, pp. 343–44; Aristotle, *Meteorology*, book 1, chap. 7 (*Meteorologica* 344a).} but many did. But Tycho’s measurements of the location and movement of the comet of 1577 suggested not merely that it was a ce-
Tycho Brahe’s Compromise

Celestial phenomenon, but that it had passed ‘right through ... the Ptolemaic spheres of Mercury and Venus’. It followed that if there were heavenly spheres, they were certainly not impenetrable.

Tycho may not have been the first to realize this, but he quickly embraced the idea of fluid heavens, whose fine ‘aetherial’ substance would pose no obstacle to his intersecting orbits. (The ‘aether’ was thought to be the fine, fluid-like substance, composed of a fifth essence — the ‘quint-essence’ — quite unlike any substance known on earth.) This was a view later embraced by Galileo’s opponent, Cardinal Bellarmine, who wrote that the heavenly bodies move through the aether ‘like birds in the air and fish in the sea’. While this rendered the fixed orbits of the heavenly bodies puzzling — if they were not restrained by solid spheres, why did they not wander all over the place? — it seemed required to explain the movement of comets.

The major disadvantage of Tycho’s scheme emerges when it is compared to that of Copernicus. The Copernican theory offered a unified account of phenomena, in which apparently complex motions (such as those of the planets) which could be explained relatively simply. Tycho’s system, on the other hand, involved a whole series of complex, interacting motions. (This was one of Kepler’s objections to Tycho’s idea.) After 1616 it would be a useful refuge for Roman Catholic thinkers who had long rejected the Ptolemaic view, but who were forbidden to defend the Copernican

1 Thoren, *The Lord of Uraniborg*, p. 257.
3 Grant, *Planets, Stars, and Orbs*, p. 348. While words are those of Bellarmine, the analogy goes back to Ptolemy himself (Rosen, ‘The Dissolution of the Solid Celestial Spheres’, p. 18), who seems to have been less attached to the idea of solid spheres than some of his later followers.
4 Grant, *Planets, Stars, and Orbs*, p. 349 n.76, p. 369; Rosen, ‘The Dissolution of the Solid Celestial Spheres’, p. 24. Keep in mind that before Newton’s formulation of a law of universal gravitation, no one knew what caused the planets to maintain their orbits around the sun.
6 Margolis, ‘Tycho’s System and Galileo’s Dialogue’, p. 271
alternative.\(^1\) But it is hard to imagine that they would have preferred Tycho’s scheme if they had not been under pressure from Church authorities to reject the Copernican one.

But this is to jump ahead. At least in the late sixteenth century it was by no means clear that the Copernican view would prevail. Between the publication of Copernicus’s *De revolutionibus* and the telescopic observations of Galileo, there was no clear answer to the question of which cosmology a rational observer ought to embrace. While the Ptolemaic system may have seemed unsatisfactory, for the reasons Copernicus gave, there were good reasons for being cautious about the Copernican alternative. Even when Galileo finally observed the phases of Venus, with his newly-invented telescope, in 1610, this did not prove the Copernican system to be correct. It did show the Ptolemaic system to be false, but Galileo’s observations were compatible with Tycho’s geocentric alternative, as at least one of his contemporaries reminded him.\(^2\) So at what point did Galileo come to embrace the Copernican view and how did the Church react to his doing so?

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3. THE GALILEO AFFAIR

There are two aspects of what has come to be known as ‘the Galileo affair’. The first has to do with Galileo’s embrace of the Copernican hypothesis. When did he become a Copernican and how did he defend this view? The second has to do with the Church’s reaction to his position. How did this well-known mathematician and natural philosopher, who never ceased to consider himself a loyal Catholic, come to be suspected of heresy?

3.1 Galileo and Copernicus

During his years teaching mathematics at the universities of Pisa (1589–92) and Padua (1592–1610), Galileo gave lectures on astronomy as part of his regular duties. During his time at Pisa, he apparently defended the traditional, Ptolemaic view of the cosmos, repeating the traditional arguments against the idea of a heliocentric, geokinetic cosmology.¹ We do not know for certain when he embraced the Copernican view. Indeed, he may have done so only gradually, so that it would be misleading to assign a single date to the event. In a letter to Johannes Kepler in 1597, he claimed to have accepted the Copernican theory ‘many years ago’, but it is difficult to know exactly what this means.² In that same letter he notes that he was initially reluctant to express this view publicly, for fear of ridicule. It may be for this reason that it did not feature in his teaching.

Interestingly, it does not seem to have been ecclesiastical opposition that worried Galileo at that time; it was more the general scepticism of his contemporaries. As he wrote,

I adopted Copernicus’s opinion many years ago, and deduced from it the cause of many natural effects doubtless inexplicable on the ordinary hypothesis. I’ve written out many reasons for it and many responses to reasons against it, which I have not dared to publish as I’ve been deterred by the fate of our master Copernicus. For although he has gained

² It may mean, as Drake suggests (‘Galileo’s Steps to Full Copernicanism, and Back’, p. 105), that he first adopted the Copernican view as a mere mathematical instrument, and only gradually became convinced of its physical reality.
immortal fame among a few, he has been ridiculed and derided by countless others (for such is the number of fools). I would venture to disclose my thoughts if there were more like you; but as there are not, I will forbear.

The reasoning here is also interesting. What seems to have persuaded Galileo was the explanatory power of the Copernican hypothesis, the fact that it allowed one to account for phenomena that would otherwise remain mysterious. Even at this early date, Galileo may have been believed that the theory would explain the movements of the tides. In fact, it was an inadequate explanation of tidal motions, as Kepler soon realized. But Galileo found the argument irresistible and it later featured prominently in his *Dialogue*.

What other evidence do we have of Galileo's conversion to Copernican astronomy? In lectures given before the University of Padua in 1604, Galileo addressed the question of the *nova*, the new star, which had recently appeared in the heavens. He argued that the *nova* existed beyond the orbit of the moon, an assertion that already challenged the traditional, Aristotelian cosmology. This held that the heavens were made of a fifth element, which unlike the earthly elements (earth, air, fire, and water) was thought to be unalterable. But if the *nova* was indeed beyond the orbit of the moon, then it formed part of the heavens, and since the *nova* had just appeared it showed that the heavens were not, in fact, unchanging. This was an important observation. Yet even if it suggested that the traditional cosmology was false, it offered no direct support to the Copernican theory.

Galileo's support for the Copernican view only became public knowledge with the work entitled the *Starry Messenger*, which appeared in 1610. The aim of this work was to report Galileo's observations with his newly invented telescope. Those observations included the irregular surface of the moon, so closely resembling that of earth, the vastly increased

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1 Galileo to Kepler, 4 August 1597, in Heilbron, *Galileo*, pp. 112–13.
4 Galileo coupled this observation with a false theory of the nature of the *nova* itself, which he did not regard as a star (Heilbron, *Galileo*, p. 120), but this fact need not detain us here.
number of stars that were revealed by means of the telescope, and (per-
mhaps most importantly), four of the moons of Jupiter.

Once again, none of these observations proved that the Copernican view
was correct. But the discovery of the Jupiter’s moons did remove one objec-
tion to it: that our moon would be left behind if the earth moved. In point-
ing this out, Galileo indicates his own support for Copernicus.

Here we have a fine and elegant argument for quieting the doubts of
those who, while accepting with tranquil mind the revolutions of the
planets about the sun in the Copernican system, are mightily disturbed
to have the moon alone revolve around the earth ... But now we have
not just one planet rotating around another while both run through a
great orbit around the sun; our own eyes show us four stars which
wander around Jupiter, as does the moon around the earth, while all to-
gether trace out a grand revolution about the sun.¹

The people whose doubts he is trying to quiet here would seem to be fol-
lowers of Tycho Brahe, since no Ptolemaic astronomer would ‘accept with
a quiet mind the revolutions of the planets about the sun’.² There is an-
other place in the same work in which Galileo indicates his support for Co-
pernicus, promising that he will one day prove the earth itself to be a
‘wandering body’, that is to say, a planet.³

Galileo’s History and Demonstrations Concerning Sunspots, published
in 1613, also reports observations consistent with the Copernican view.
These include the phases of Venus and the evidence, from sunspot obser-
vations, that the sun itself revolves. Galileo is puzzled by the appearance
of Saturn, which he at first takes to be an ‘aggregate of three stars’,⁴ not
having understood the nature of Saturn’s rings. But he suggests that
whatever the explanation turns out to be, it too will harmonize admirably

21–58, on p. 57.
⁴ G. Galilei, ‘History and Demonstration concerning Sunspots and their
Phenomena’ (1613), tr. S. Drake, in S. Drake (ed.), Discoveries and Opin-
3.1 Galileo and Copernicus

with ‘the great Copernican system’.¹ Even if this turned out to be true, however, ‘harmonize with’ is not the same as ‘prove’. The same can be said of Galileo’s observations of the phases of Venus. These constitute evidence against the Ptolemaic system and are consistent with that of Copernicus. But since they were also consistent with Tycho Brahe’s cosmological scheme, they did not yet prove the Copernican view.

The threat to the Copernican view posed by Tycho’s alternative may partly account for the Discourse on Comets,² which Galileo’s follower, Mario Guiducci, published in 1619. As the preface to the work suggests, the work may be attributed to Guiducci but the ideas are those of Galileo.³ Just as Galileo’s work on sunspots had been directed against one Jesuit astronomer, Christopher Scheiner, so the apparent target of this work was another Jesuit astronomer, Horatio Grassi. Its other target, however, was the work of the Danish astronomer. By this time, Galileo had been forbidden to defend the Copernican theory, which only three years earlier had been condemned by the Church. But while he cannot defend Copernicus, he can make assumptions that are inconsistent with the Ptolemaic view,⁴ while also indicating his distaste for Tycho’s alternative. These moves constitute implicit support for Copernicanism.

This work was followed by a vigorous response by Grassi and a further response by Galileo, The Assayer, published in 1623. The awkward position in which he now found himself is very evident in this work. He makes reference to the Copernican theory to point out the importance of his own telescopic observations,⁵ to remind readers that he had refuted an objec-

¹ Galilei, ‘History and Demonstration concerning Sunspots and their Phenomena’, p. 144.
⁴ Heilbron, Galileo, p. 238.
tion to that theory, and to point out its explanatory power in relation to comets. But on two of these occasions he feels obliged to refer to the Church’s position, and to claim that ‘as a pious and Catholic person’ he considers the Copernican theory ‘most false and vain’. It is difficult to take this statement at face value. But while neither this work nor the Discourse on Comets played an important role in the defence of the Copernican theory, they did play an important role in alienating the Jesuits of the Collegio Romano, who had previously been sympathetic to Galileo and had confirmed some of his telescopic observations.

The clearest defence of Copernicanism is to be found Galileo’s Dialogue Concerning the Two Chief World Systems, which remains the best known of Galileo’s writings. Published in 1632, this is the work that would provoke Galileo’s final conflict with the Church authorities. Once again, Galileo must keep up the pretence of merely discussing and not defending the Copernican theory. What allowed him to do this in so lengthy a work was the dialogue style, in which the different participants could present arguments for and against the Copernican view. The choice is presented as one between two world systems, the Copernican and the Ptolemaic, which is odd. Firstly, it practically ignores Tycho’s theory, the strengths and weaknesses of which are never directly addressed. Secondly, it as-

6 In a work published in 1625, Kepler complained about Galileo’s neglect of Tycho’s hypothesis. It is not that Kepler was himself a follower of Tycho in this respect. He had a close, although sometimes difficult, relationship with Tycho, but was himself a convinced Copernican. See J. Kepler, ‘Appendix’ to The Shieldbearer to Tycho Brahe the Dane (1625), in S. Drake and C. D. O’Malley (eds), The Controversy on the Comets of 1618, pp. 339–55 (§§ 3–8).
assumes that the Ptolemaic view is still a live option, when in fact it was already widely regarded as discredited.¹

It is possible that the reason for this also lies in the pressures being exerted by the Church authorities.² We have no direct evidence of this, but Galileo may have been initially permitted to publish this work on the understanding that it would leave Tycho’s system as a viable alternative. This seems a plausible suggestion, for Tycho’s work was already being used by Catholic thinkers.³ In any case, while the Dialogue presents itself as merely a discussion of the Copernican view, it was widely seen as a defence of that opinion. This is certainly how it was understood by the Church authorities.

3.2 The Church’s Response

There are several stages in the Church’s response to Galileo’s defence of the Copernican theory. An initial reaction containing a veiled warning was followed by a decision against the theory and an injunction to Galileo not to defend it. It was these events that led, in due course, to Galileo’s famous trial.

3.2.1 An Initial Reaction

The attitude of the Church authorities towards the Copernican view first became clear in 1615. The key document was a letter written by Cardinal Robert Bellarmine, a Jesuit theologian who was also a member of the Roman Inquisition, the body responsible for ensuring doctrinal orthodoxy. (It still exists, today called the ‘Congregation for the Doctrine of the Faith’.) Bellarmine wrote his letter to the Carmelite priest Paolo Foscarini. Foscarini had written a work whose content is clearly summarized in its wonderfully descriptive title:

*Letter on the Pythagorean and Copernican opinion of the earth’s motion and the sun’s rest and on the new Pythagorean world system, in which*

³ By 1620 Tycho’s system was being taught even in the introductory Jesuit astronomy text (Margolis, ‘Tycho’s System and Galileo’s Dialogue’, p. 274).
are harmonized and reconciled those passages of the Holy Scripture and those theological propositions that could ever be adduced against this opinion.\footnote{Cited in Finocchiaro (ed.), \textit{The Galileo Affair}, p. 333 n.44.}

Apparently confident he could convince Bellarmine of his views, Foscarini had sent him a copy. Galileo had also been forwarded a copy. But Bellarmine’s reply left no doubt that Foscarini’s attempts at persuasion had failed.

Since Bellarmine’s letter to Foscarini also mentions Galileo, it can be seen as a veiled warning to both thinkers. It makes three main points. The first is that the Copernican view is acceptable if taught ‘suppositionally’ (or ‘hypothetically’), but would be unacceptable if it were taught as a matter of fact. I shall come back to this idea in a moment. Bellarmine’s second point is that it would not be enough to show the Copernican view to be consistent with Scripture; one must, as a Catholic, show the Copernican view to be reconcilable with Scripture as interpreted by ‘the common consensus of the Holy Fathers’.\footnote{R. Bellarmine, ‘Letter to Foscarini’ (1615), in Finocchiaro (ed.), \textit{The Galileo Affair}, pp. 67–69, on p. 67.} This was consistent with the principle laid down, not long before, by the Council of Trent (1545–63). The target of the Council’s decree had been Protestant claim that individual Christians were entitled to interpret Scripture for themselves.\footnote{Council of Trent, Session 4, ‘Decree on the Vulgate Edition of the Bible and on the Manner of Interpreting Sacred Scripture’, in Denzinger and Schönmetzer, \textit{Enchiridion symbolorum definitionum et declarationum de rebus fidei et morum}, § 1507.} Catholics, the Council insists, are not permitted to do this, but must interpret Scripture in ways that are consistent with the teaching of the Church. What this entails is also a question to which I shall return.\footnote{See chap. 4, ‘The Scope of Biblical Authority’.}

Bellarmine’s third point is an important admission. He admits that ‘if there were a true demonstration’ of the Copernican view, then we would have to hesitate before invoking the authority of Scripture against it. In these circumstances, Bellarmine notes, it would be better to concede that we do not know the true meaning of Scripture than to invoke Scripture...
against Copernicus. This, too, is an issue with which I shall deal later,\(^1\) since it spells out the condition that Galileo had to meet to make the Copernican view acceptable. He was obliged to show it had been conclusively demonstrated. Bellarmine clearly believed that Galileo could not offer a demonstration of this kind, but it is not clear that Galileo thought he could either.

Let me come back for a moment to Bellarmine’s first point: that the Copernican view would be acceptable if taught ‘suppositionally’ (or ‘hypothetically’). To understand what this means, we need to examine the circumstances surrounding the publication of Copernicus’s work in 1543. Copernicus had been encouraged to publish his *De revolutionibus* by Georg Joachim Rheticus, from Wittenberg. But at the last minute, the oversight of its publication was left to a Lutheran theologian Andreas Osiander. Osiander inserted an anonymous preface, stating that the view of the universe put forward in the book need not be considered as true, or even probably true, but as merely a useful instrument for calculating heavenly movements. This almost certainly misrepresented Copernicus’s intentions, as Galileo would later argue.\(^2\) But what Bellarmine was suggesting was that if the Copernican theory were interpreted in this way, it would be entirely acceptable.

To appreciate what Bellarmine was suggesting, it might be useful to take a modern example. Works on celestial navigation – navigating by reference to the sun and stars – customarily begin by asking the reader to assume something like the Ptolemaic view of the universe. The stars are to be imagined as fixed to a celestial sphere, revolving around the earth. The same books will immediately note that this is not, of course, the way the universe is really structured. But the task of navigating by the stars will be made easier if we *pretend* that it is while we are doing our calculations. This closely parallels the ‘instrumentalist’ interpretation of Copernican theory that Bellarmine was endorsing: the Copernican theory was to be regarded as merely an instrument for calculation rather than a reflection of the way the world is.

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1 See chap. 4, ‘Dealing with Apparent Conflict’.
3.2.2 The Verdict on Copernicus

It is customary to speak about ‘the trial of Galileo’, but there is a sense in which the Galileo affair involved two trials.¹ The first was a trial of the Copernican theory itself, to decide if it was compatible with the Christian faith. Bellarmine had already indicated that it was not, but his 1615 letter was merely an informal response by an influential individual. It was not yet a formal verdict on the basis of which disciplinary action could be taken. The first formal verdict on the Copernican theory arose from a report presented on 24 February 1616 by the consultants of the Holy Office. The consultants condemned two propositions. The first had to do with the position and immobility of the sun. It held that

(1) the sun is the center of the world, and is completely devoid of local motion.

The consultants rejected this view as ‘foolish and absurd in philosophy’ and ‘formally heretical’, since it explicitly contradicts in many places the sense of Holy Scripture, according to the literal meaning of the words and according to the common interpretation and understanding of the Holy Fathers and doctors of theology.

The second condemned proposition had to do with the position and motion of the earth. It held that

(2) the earth is not the center of the world, nor motionless, but it moves as a whole and with diurnal motion.

The consultants describe this view as ‘absurd in philosophy’, but as far as its theological status is concerned, it receives the lesser censure of being ‘at least erroneous in faith’.²


² Cited in Finocchiaro (ed.), *The Galileo Affair*, p. 146.
3.2.2 The Verdict on Copernicus

Based on this report, on 6 March 1616 the Vatican’s Congregation of the Index prohibited the continued or future publication of any book that taught these two propositions. Their decree demanded that Copernicus’s work be emended before being republished and condemns the pro-Copernican work of Foscarini. Galileo’s work was not explicitly mentioned, but he had been formally notified of the condemnation of the Copernican theory in a meeting with Bellarmine on 26 February. What we might think of as the second trial – that of Galileo himself in 1633 – was focused on whether he had obeyed the instructions given him on that occasion.

The wording of these decisions makes it very clear what was at stake. We have seen that there were apparently good arguments against the Copernican view drawn from natural philosophy. But the key issue identified in these documents is that of biblical authority. The differences between Galileo and his opponents were religious, or, more precisely, theological differences. Galileo and his supporters believed that the Copernican view was both supported by the evidence and compatible with Scripture and Catholic tradition. His opponents disagreed, believing that whatever support it enjoyed was insufficient to warrant a reinterpretation of the plain sense of the Bible. In addition to this, Catholics were obliged to maintain the interpretation of Scripture that was established by the teaching of the Church or the consensus of the Church Fathers. As the consultants’ report makes clear, the problem with the Copernican view was not merely that it was contrary to the literal sense of Scripture. It was also that this literal sense of Scripture was backed up by Church tradition: it was in accord with ‘the common interpretation and understanding of the Holy Fathers and doctors of theology’.

3.2.3 The Trial of Galileo

The second of these historic events, the trial of Galileo himself, arose from the publication of his *Dialogue Concerning the Two Chief World Systems*. In 1630 Galileo had travelled to Rome to obtain the *imprimatur* for the book, the official statement that would allow it to be printed. He had obtained what he understood to be approval for publication, subject to some minor amendments.¹ But almost immediately following its publication in 1632, questions were raised in Rome regarding its content. The Pope

(Urban VIII) prohibited the further distribution of the book and appointed a commission to investigate it. In September, that commission reported back and the Pope decided, as a result, to refer the matter to the Inquisition. They, in turn, summoned Galileo to Rome for examination, where he arrived on 13 February 1633.

The key issue in the trial that followed was whether Galileo had obeyed the terms of the injunction given to him by Cardinal Bellarmine in 1616. There was some uncertainty as to just what that injunction had demanded. Bellarmine had died in the meantime, so could not be consulted. At the time, however, Galileo had asked Bellarmine for a letter summarizing their meeting. That letter seemed a little less severe than the account found in the minutes of the Holy Office. But whatever the details, it was clear that he had been prohibited from defending the Copernican theory. The key question was: had he defended it?

In the course of the trial, Galileo denied that he had; the work was, after all, a dialogue, in which various points of view were presented. More importantly, it ended with an argument which the Pope himself favoured. Put in slightly more modern terms, the argument ran this way. It is true that the Copernican theory seems the best available explanation of the astronomical phenomena. But to insist that it is the only possible explanation is to limit the power of God. God may, in fact, have chosen to bring about the same phenomena by other means, unknown to us. As we shall see, this is a difficult argument to answer, if what one is looking for is demonstrative proof of a scientific theory.

In any case, the Roman tribunal was not convinced, holding that Galileo’s denials were disingenuous, if not outright dishonest. As they wrote in their judgement,

the said book was diligently examined and found to violate explicitly the above-mentioned injunction given to you; for in the same book you have defended the said opinion already condemned..., although ... you try by means of various subterfuges to give the impression of leaving it unde-

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2 See chap. 5, ‘Galileo’s Quest for Certainty’.  

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3.2.3 The Trial of Galileo

cided and labeled as probable; this is still a very serious error since there is no way an opinion declared and defined contrary to Holy Scripture may be probable.¹

Note the final argument here. If a view has been defined by the Church as contrary to Sacred Scripture, then one may not hold it to be true. But nor may one hold it to be even probably true. If it contradicts the authority of Scripture, it can only be described as false.

This verdict led to the tribunal’s sentence against Galileo, which contained a dire threat, but also offered him a way out.

Consequently you have incurred all the censures and penalties imposed and promulgated by the sacred canons and all particular and general laws against such delinquents. We are willing to absolve you from them provided that first, with a sincere heart and unfeigned faith, in front of us you abjure, curse, and detest the above-mentioned errors and heresies.

He could, in other words, escape the penalties imposed on heretics by renouncing the views attributed to him. He would still be imprisoned for an indefinite period as a punishment for his crime, a sentence that was later commuted to house arrest.

Since Galileo had no wish for martyrdom, he had little choice but to undergo this humiliating procedure. ‘The ailing old man knelt down painfully before his judges and twenty witnesses and read out, lighted candle in hand, the statement prepared for him’.²

With a sincere heart and unfeigned faith I abjure, curse, and detest the above-mentioned errors and heresies and in general each and every other error, heresy, and sect contrary to the Holy Church; and I swear that in the future I will never again say or assert, orally or in writing, anything that might cause a similar suspicion against me; on the contrary, if I should come to know any heretic or anyone suspected of heresy, I will denounce him to this Holy Office.³

The story that as he rose from his knees he muttered the words *eppur si muove* (‘and yet it moves’) is surely a myth. But it contains an element of truth. Galileo had not been convinced by scientific evidence or theological arguments. He had been forced to submit his judgement to the authority of the Church, behind which was the authority of Sacred Scripture, which was regarded as the voice of God himself.

Were the Church authorities wrong to do what they did? Given the logic of their beliefs, there is a sense in which they were not justified. When considering the Copernican view, they may have made a wrong judgement about the interpretation of Sacred Scripture, as Pope John Paul II would suggest in 1992. But they had made a judgement and issued an order. Given their assumptions regarding the authority of the Bible and the role of the Church in interpreting it, they had every right to expect obedience. On these grounds, their condemnation of Galileo seems entirely appropriate.

One might argue that their case against Galileo should not have mentioned heresy. After all, the Church had not formally condemned the Copernican view, but ‘merely’ prohibited its teaching or defence. But in a Roman Catholic context, heresy is *defined* as a departure from what the Church holds and teaches. So the question of heresy is inseparable from that of obedience. The wording of the charge on which Galileo was convicted – that of ‘vehement suspicion of heresy’ – does not imply that the case against Galileo was thought to be unproven. Far from it. ‘Suspicion of heresy’ was itself a crime, less serious, admittedly, than formal heresy,

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1 William Wallace argues that Galileo, as a loyal son of the Church, may have agreed with his judges that he should reject the Copernican view, since he did not yet have the demonstrative proofs that would warrant a reinterpretation of Scripture. But this implies that Galileo sincerely believed the Copernican view to be mistaken (on the basis of his faith) while also sincerely believing that it was true (and would one day be demonstrated). I cannot believe that this represents his state of mind at the end of the trial. See W. A. Wallace, ‘Galileo’s Science and the Trial of 1633’, *The Wilson Quarterly*, 7:3 (Summer 1983), pp. 154–64, on p. 164.

2 Finocchiaro, *Defending Copernicus and Galileo*, p. 302.
but more serious than some other religious offences.\textsuperscript{3} It may be that defiance of the injunction not to teach or defend the Copernican view would have been sufficient to attract this charge.\textsuperscript{4} The Inquisitors apparently thought that it was.

Those are the facts of the Galileo affair, at least in broad outline. It is time now to look behind the facts at the issues that were involved, to see what light they shed on the relation of religion and science. Underlying the immediate disagreement between Galileo and his accusers were deeper disagreements, regarding both the scope of biblical authority and what was to be done when secular knowledge comes into conflict with the Bible. It is to these deeper disagreements that we must now turn.

\begin{itemize}
\item \textsuperscript{3} Finocchiaro, \textit{Retrying Galileo}, p. 12.
\item \textsuperscript{4} Heilbron, \textit{Galileo}, pp. 322–23.
\end{itemize}
4. THE QUESTION OF AUTHORITY

When Copernicus first proposed his revolutionary theory, there were apparently good scientific reasons – arguments drawn from both astronomy and natural philosophy – to reject it. It seemed, as the Vatican’s consultants put it, ‘absurd in philosophy’. Nonetheless, the conflict between Galileo and his ecclesiastical opponents was primarily a theological one. The Church authorities were persuaded by the scientific arguments, but it was the authority of the Bible they invoked in order to condemn the Copernican view.

No one in this debate rejected the authority of the Bible, as a divinely inspired text. The Galileo affair was certainly not a clash between atheism and religion. The disagreements had to do with two questions. The first had to do with the scope of biblical authority. On what kinds of questions should the Bible be understood to speak reliably? The second had to do with how to deal with apparent conflicts. Under what circumstances was a Catholic permitted to reinterpret the Bible so as to bring its teachings into conformity with science?

4.1 The Scope of Biblical Authority

We know Galileo’s view of the scope of biblical authority, for it is set out in a work that he wrote in 1615 as a letter to the Grand Duchess Christina of Lorraine. The Grand Duchess was the mother of Galileo’s patron Cosimo II de’ Medici, who ruled over the lands of Tuscany between 1609 and 1621. I shall not attempt an exegesis of the entire letter, a task that has been undertaken by others. All I wish to do is to highlight one of Galileo’s hermeneutical principles, the principles he thought should be employed in interpreting Scripture.

The principle Galileo is attempting to defend is sometimes called a ‘principle of limitation’, since it sets limits on the scope of biblical authority. Only once does he set this out in an explicit manner, but elsewhere it seems to be the position he would like to endorse. If we were to set it out more openly, it would read as follows.

1 See chap. 2, ‘Arguments against Copernicus’.
Principle of Limitation: Since the primary concern of Scripture is with human salvation, texts of Scripture should not be taken to have a bearing on questions of natural science.¹

Galileo seems to have believed that this principle has behind it the authority of St Augustine. I think he was mistaken in this respect,² but I shall not pursue that question here. Galileo does, however, begin with a point that both St Augustine and Bellarmine would have accepted, namely that it was not the primary intention of the writers of Scripture to teach natural philosophy. As Galileo writes in his letter,

it is the opinion of the holiest and most learned Fathers that the writers of Holy Scripture not only did not pretend to teach us about the structure and motions of the heavens and the stars, and their shape, size, and distance, but that they deliberately refrained from doing so, even though they knew all these things very well.³

And again, in the same context, he writes:

The Holy Spirit did not want to teach us whether heaven moves or stands still, nor whether its shape is spherical or like a discus or extended along a plane, nor whether the earth is located at its center or on one side.⁴

This claim – that the purpose of Sacred Scripture is different from that of the natural sciences – is relatively uncontroversial. But Galileo goes on to draw a conclusion which Bellarmine and the consultants of the Holy Office were unable to accept. He suggests that the authority of the Bible is limited to matters with which the natural sciences cannot deal.

In his letter to the Grand Duchess, Galileo at first does this only obliquely, merely hinting at his principle of limitation.

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¹ McMullin, ‘Galileo on Science and Scripture’, p. 298. I have adapted McMullin’s wording here, in the light of what I argue elsewhere (see the following note).
4.1 The Scope of Biblical Authority

I would say that the authority of Holy Scripture aims chiefly \textit{[principalmente]} at persuading men about those articles and propositions which, surpassing all human reason, could not be discovered by scientific research or by any other means than through the mouth of the Holy Spirit.¹

It becomes more explicit later in the letter, where Galileo makes reference to the Council of Trent’s teaching. The Council had insisted that in matters of faith and morals no one should interpret the Bible in a way that is contrary to the teaching of the Church or to the consensus of the Church Fathers.² In paraphrasing this passage Galileo makes a significant addition: the ruling applies, he writes, to ‘those passages \textit{alone} which are matters of faith or of morals’.³

For a more explicit statement of Galileo’s principle of limitation, we need to turn to a letter he wrote to the Benedictine priest Benedetto Castelli, ‘The authority of the Holy Writ’, Galileo insists,

has merely \textit{[solamente]} the aim of persuading men of those articles and propositions which are necessary for their salvation and surpass all human reason, and so could not become credible through some other science or any other means except through the mouth of the Holy Spirit itself.⁴

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³ Emphasis mine. This is not so evident in Finocchiaro’s translation (‘Letter to the Grand Duchess Christina’, p. 109), but it is clearer in Drake’s version; see Drake (ed.), \textit{Discoveries and Opinions of Galileo}, p. 203.
4.1 The Scope of Biblical Authority

The implication is that if some truth is not necessary for salvation and is attainable by human reason, it does not fall under the authority of Scripture.

It is precisely such a ‘principle of limitation’ that Galileo’s opponents were unable to accept. Indeed it is expressly rejected in Bellarmine’s letter of 1615 to Foscarini. Bellarmine first reminds Foscarini of the Council of Trent’s decree and then rejects the very restriction for which Galileo argued.

Nor can one answer that this is not a matter of faith, since if it is not a matter of faith ‘as regards the topic’ [ex parte objecti], it is a matter of faith ‘as regards the speaker’ [ex parte dicentis]; and so it would be heretical to say that Abraham did not have two children and Jacob twelve, as well as to say that Christ was not born of a virgin, because both are said by the Holy Spirit through the mouths of the prophets and the apostles.¹

Richard Blackwell refers to this as the de dicto (‘by virtue of being said’) doctrine of biblical authority: something is covered by biblical authority simply by virtue of being recorded by the inspired authors.² This seems to interpret the Council’s decree in such a way that it imposes no limits at all on the scope of biblical authority, as Galileo quickly realized.³

It is clear that this is what Bellarmine intended, for he had already endorsed this view of biblical authority in his earlier work, the De controversiis, written between 1586 and 1593. We find in that work the following statement.

In Scripture there are many things which of themselves do not pertain to the faith, that is, which were not written because it is necessary [for salvation] to believe them. But it is necessary to believe them because they were written.⁴

¹ Bellarmine, ‘Letter to Foscarini’, p. 68.
³ Galilei, ‘Considerations on the Copernican Opinion’, 84; Blackwell, Galileo, Bellarmine, and the Bible, p. 108.
⁴ Bellarmine, Disputationes de controversiis, controversy 1, book 1, chap. 4, cited in Blackwell, Galileo, Bellarmine, and the Bible, p. 32.
4.1 The Scope of Biblical Authority

In a word, whatever is written in Scripture is to be believed. It does not matter how apparently trivial a fact it is or whether it seems to bear any relation to our salvation. As Galileo pointed out, it would mean that Catholics are obliged to believe that Tobias had a dog,¹ because it is mentioned in the book of Tobit (11:4).² This means that ‘whatever the piece of information is, and whatever God’s purpose may have been in including it, the very fact that something is written in Scripture determines that it is true’.³ It follows that if the Bible speaks of a miracle in which the sun stands still (Joshua 10), Christians are obliged to believe that the sun normally moves, and this is inconsistent with Copernicus’s theory.

It is worth noting the similarity of this view to that held by modern evangelical Christians.⁴ Protestant Christians do not, of course, consider themselves bound to the Council of Trent, or even a consensus of the Church Fathers. Nor do they reject Copernican cosmology. But like Bellarmine, many reject the idea that biblical authority is to be limited to expressly theological matters. This is certainly true of the more than 300 evangelical theologians who drafted the Chicago Statement on Biblical Inerrancy in 1978.

Being wholly and verbally God-given, Scripture is without error or fault in all its teaching, no less in what it states about God’s acts in creation, about the events of world history, and about its own literary origins under God, than in its witness to God’s saving grace in individual lives.⁵

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¹ Galilei, ‘Considerations on the Copernican Opinion’, p. 84
² For Catholics, but not Protestants, this forms part of the biblical canon.
⁴ It is interesting to note that Joseph Smith, the nineteenth-century founder of Mormonism (the Church of Jesus Christ of Latter-day Saints), avoided this problem, for the new Scriptures he produced revised the biblical cosmology. Referring to Joshua’s miracle, the Book of Mormon states: ‘Yea, if he say unto the earth – Thou shalt go back, that it lengthen out the day for many hours – it is done; And thus according to his word the earth goeth back, and it appeareth unto man that the sun standeth still; yea, and behold, this is so; for surely it is the earth that moveth and not the sun’ (Helaman 12:14–15).

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4.1 The Scope of Biblical Authority

Just in case the significance of that statement was not evident, the authors added a clarification, which suggests that this view of biblical authority supports young-earth creationism.

We deny that Biblical infallibility and inerrancy are limited to spiritual, religious, or redemptive themes, exclusive of assertions in the fields of history and science. We further deny that scientific hypotheses about earth history may properly be used to overturn the teaching of Scripture on creation and the flood.¹

Here, too, we find a vigorous rejection of a principle of limitation, of the kind that Galileo had sought to defend. Mikael Stenmark would call this view of biblical authority ‘expansionist’.² But as I noted earlier, it is odd to describe it in this way when it so widely shared by Christian thinkers.

4.2 Dealing with Apparent Conflict

So the first question that lay behind Galileo’s conflict with the Church authorities had to do with the scope of biblical authority. The second question had to do with apparent conflicts between science and the Bible. How should the Christian respond if the best natural philosophy of the day appears inconsistent with something that Scripture seems to teach? This was a question to which there was a well-established answer, already to be found in the writings of St Augustine.³ After examining this ‘Au-

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² Chicago Statement on Biblical Inerrancy, Article XII (Sproul, Can I Trust the Bible?, p. xix)
⁴ Note that such principles are not unique to Christianity: they seem to have been shared, for instance, by the medieval Jewish philosopher Moses Maimonides; see E. McMullin, ‘How Should Cosmology Relate to Theology?’, in A. R. Peacocke (ed.), The Sciences and Theology in the Twentieth Century (Stocksfield, Northumberland: Oriel Press, 1981), pp. 17–57, on p. 29 and M. Maimonides, The Guide for the Perplexed (ca.
4.2 Dealing with Apparent Conflict

gustinian solution’, I shall outline a modification of it that has emerged in more recent times, which broadens its scope.

4.2.1 The Augustinian Solution

The Augustinian solution to an apparent conflict between religion and science took the form of two principles. The first is what Ernan McMullin calls a ‘principle of priority of demonstration’.

**Principle of the Priority of Demonstration:** When there is conflict between a proven truth about nature and a particular reading of Scripture, an alternative reading of Scripture must be sought.¹

The key phrase here is ‘a proven truth about nature’, since if something is indisputably true, then it cannot be the case that Scripture would teach otherwise. After all, God is the author of both the book of nature and the book of Scripture and they cannot disagree. Bellarmine had already acknowledged this principle in his letter to Foscarini, where he had noted that a decisive proof of Copernicanism might lead to a reinterpretation of the relevant biblical passages.²

There is, however, another principle that forms part of this tradition. It holds that in the absence of a proven truth about nature that apparently contradicts Scripture, the literal sense of the biblical text ought to be accepted. This is a ‘principle of the priority of Scripture’.

**Principle of the Priority of Scripture:** Where there is an apparent conflict between a Scripture passage and an assertion about the natural world grounded on sense or reason, the literal reading of the Scripture

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¹ McMullin, ‘Galileo on Science and Scripture’, p. 294.
² These debates are not unique to Christianity. Ibn Rushd (better known as Averroes; 1126–98) applies exactly the same principle to the interpretation of the Qur’an. As he writes, ‘whenever the conclusion of a demonstration is in conflict with the apparent meaning of Scripture, that apparent meaning admits of allegorical interpretation’ (cited in Brożek, The Double Truth Controversy, part 1.1).

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4.2.1 The Augustinian Solution

passage should prevail as long as the latter assertion lacks demonstration.¹

Oddly enough, Galileo does not reject these principles; indeed he appears to accept them. One might expect him to support the principle of the priority of demonstration, which would urge the reinterpretation of Scripture given sufficient scientific evidence. But Galileo seems to support even the principle of the priority of Scripture, which urges the priority of Scripture when such reasons are lacking. As he writes in the letter to the Grand Duchess,

even with regard to those propositions which are not articles of faith, the authority of the same Holy Writ should have priority over the authority of any human writings containing pure narration or even probable reasons but no demonstrable proofs. This principle should be considered appropriate and necessary inasmuch as divine wisdom surpasses all human judgement and speculation.²

With regard to the principle of the priority of demonstration, Galileo and his opponents may have had different ideas about what would constitute ‘a proven truth about nature’. It is not clear, however, that he thinks the Copernican theory falls into this category.³ In the opening paragraphs of the letter to the Grand Duchess, Galileo does make some strong claims in favour of the Copernican view.⁴ But in his own notes on Bellarmine’s letter to Foscarini he takes a remarkably modest view of the evidence in its support. The Ptolemaic theory, he writes, ‘is undoubtedly false’, while the Copernican ‘may be true’.⁵

4.2.2 Two Forms of Prudence

There is, however, a problem here. If Galileo really held to the principle of the priority of Scripture and believed the Copernican view to be not yet

¹ McMullin, ‘Galileo on Science and Scripture’, p. 295.
³ See chap. 5, ‘Galileo’s Quest for Certainty’.
⁵ Galilei, ‘Considerations on the Copernican Opinion’, p. 85.
demonstrated, he should have agreed that the literal sense of Scripture should be preferred. But in fact he does not. He argues that even if the Copernican view is not yet proven, we should not invoke biblical authority against it. Why not? Because we may in the future have decisive proof it is true. If we do come to have such proof, then the Church’s condemnation of the theory would be a cause of scandal.¹ A view of this kind does find some support in Christian tradition, for even St Augustine articulated what McMullin calls a principle of prudence. But Galileo gives this principle a new twist, leading to a position his opponents were unable to accept.

Let me begin with St Augustine’s principle. What St Augustine argues is that Christians should be careful about claiming there is a conflict between Scripture and natural philosophy, for if they are mistaken they risk bringing the faith into disrepute. As he writes,

> even a non-Christian knows something about the earth, the heavens, and the other elements of this world, about the motion and orbit of the stars and even their size and relative positions, about the predictable eclipses of the sun and moon, the cycles of the years and the seasons, about the kinds of animals, shrubs, stones, and so forth, and this knowledge he holds to as being certain from reason and experience. Now, it is a disgraceful and dangerous thing for an infidel to hear a Christian, presumably giving the meaning of Holy Scripture, talking nonsense on these topics; and we should take all means to prevent such an embarrassing situation, in which people show up vast ignorance in a Christian and laugh it to scorn.²

Now Galileo’s view is not identical with this, so in order to distinguish Augustine’s principle from Galileo’s, I shall label it the principle of prudence; (note the subscript). As expressed by Ernan McMullin, it reads as follows.

**Principle of Prudence:** When trying to ascertain the meaning of a difficult Scriptural passage, one should keep in mind that different interpretations of the text may be possible, and ... should not rush into

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¹ Galilei, ‘Considerations on the Copernican Opinion’, p. 81.

4.2.2 Two Forms of Prudence

premature commitment to one of these, especially since further progress in the search for truth may later undermine this interpretation.¹

But when Galileo urges prudence in the interpretation of Scripture, he does so in a rather different way.

Galileo’s principle of prudence is best understood as a modification of the principle of the priority of demonstration. This holds, you may recall, that one should not insist on the literal sense of Scripture if it contradicts something that has been scientifically demonstrated. This implies that propositions with evidence in their support fall into two categories, which we might call ‘the demonstrated’ and ‘the (merely) probable’. But Galileo introduces a third category, that of propositions that are demonstrable in principle but which have not yet been demonstrated.² He argues that one should not give priority to the literal sense of Scripture if it is even possible that natural philosophy will later demonstrate this to be false.

This is clearest in another passage in the letter to the Grand Duchess. Galileo first of all makes the traditional distinction. There are, he writes, propositions about which we cannot be certain: the most we can have is probable opinion.³ There are also propositions about which we can have ‘complete certainty on the basis of experiments, long observations, and necessary demonstrations’.⁴ What about the Copernican hypothesis? This, he suggests, falls into the third category of matters about which we could have certain knowledge, even if we do not yet have the required evidence. His suggestion is that one should not invoke Scriptural authority in opposition to propositions of this kind.

This amounts to a very different kind of principle of prudence from that which St Augustine defended. I shall describe Galileo’s principle as the principle of prudence².

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³ A modern philosopher might hold that the whole of science falls into the first category, since we can never be certain about any scientific theory (see chap. 5, ‘Science and Certainty’), but this was not Galileo’s view.
Principle of Prudence: Where a proposition about the physical world apparently conflicts with the literal sense of Scripture, a literal reading of Scripture should not take priority if it is possible that the truth of that proposition will one day be demonstrated.

As Galileo writes,

> I should think it would be very prudent not to allow anyone to commit and in a way oblige scriptural passages to have to maintain the truth of any physical conclusions whose contrary could ever be proven to us by the senses and demonstrative and necessary reasons.¹

The problem is that, on the assumption that scientific theories could be proven in this way, this is equivalent to Galileo's principle of limitation. It entails that the authority of Scripture should not be invoked against any promising scientific hypothesis.

Bellarmine and the consultants of the Holy Office may well have believed that decisive proof of the Copernican view was impossible.² If so, they would have had little fear that the Church’s judgement on this matter would later be overturned. After all, they regarded the Copernican view as ‘foolish and absurd in philosophy’ as well as ‘formally heretical’.³ But even if they had not believed this, they could not have accepted Galileo’s modified principle of prudence (the principle of prudence) or his principle of limitation. Their starting-point was the authority of Scripture, of which at least Bellarmine took (as we have seen) a particularly strong view. All other beliefs, in their view, had to be brought into conformity with the established interpretation of Scripture. Galileo’s starting point, by way of contrast, was what he called ‘physical and mathematical arguments’,⁴ with which our interpretation of Scripture ought to be brought into conformity. With such different starting-points, it seems inevitable that the two sides would come into conflict.

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² McMullin, ‘Galileo on Science and Scripture’, pp. 283, 323.
³ Cited in Finocchiaro (ed.), The Galileo Affair, p. 146.
⁴ Galilei, ‘Considerations on the Copernican Opinion’, p. 81.
4.2.3 Our Knowledge of the Literal Sense

The views I have outlined are those held by participants in the Galileo affair. But what about Christian thinkers today? Someone wanting to adopt the Augustinian solution in our own time may wish to modify it a little, for the way in which I have presented that solution overlooks a key question. The literal sense of Scripture may well take priority, when the science is in doubt, but how confident can we be about the literal sense of Scripture? St Augustine was certainly not unaware of this problem. His first attempt at writing a commentary on the literal meaning of Genesis, between AD 393 and 395, was left unfinished. We know it as the *De Genesi ad litteram imperfectus liber*: the ‘unfinished book’. His completed commentary took him about fourteen years, being finished only around AD 416, and he made no secret of the difficulty of the task.

Oddly enough, this hermeneutical question appears not to have featured prominently in the Galileo affair. The reason may be that Roman Catholics were bound to a tradition of interpretation, stemming from the Fathers and finding its most recent expression in the Council of Trent, which to some degree settled the issue. It was this tradition that revealed the literal sense of Sacred Scripture and Catholics were expected to hold to it without hesitation. But an Augustinian in our own time may not accept the Roman Catholic view.

One way in which this question might be addressed has been outlined by Alvin Plantinga. Plantinga shares with other Protestant thinkers the idea that in matters relating to salvation, the meaning of the Bible is ‘per-spicuous’, that is to say sufficient clear to the rightly disposed reader. But he recognizes that Christians do disagree about the meaning of the biblical text. It follows, he says, that we cannot assume we have understood what God is intending to convey. (This is, of course, an expression of St Augustine’s ‘principle of prudence’, the *principle of prudence*.) Note that if there is any doubt here, it is not about the authority of the Bible, as such. That God is speaking in and through the words of Sacred Scripture is a non-negotiable claim, as we shall see. But there may be some doubt as to whether we have understood his revealed word correctly.

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1 See chap. 5, ‘The Claimed Certainty of Faith’ (section 5.1.3).

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It may be helpful at this point to introduce an idea which comes from the work of Dan Sperber. It has to do with what Sperber describes as 'reflective beliefs'. Such beliefs are not simply particular ways of representing the world; they are also held in association with what Sperber calls a 'validating context'.\(^1\) This might involve reference to some authority who guarantees the truth of this belief or it might involve reference to some line of argument that lends support to it. Sperber’s examples include the following.

1. I remember that, the day we first met, it was raining.
2. There are indubitable signs that someone has been searching the house.
3. It is a scientific fact that a glass of wine a day is good for the heart.

We might add a fourth, namely

4. The Bible teaches that Jesus rose from the dead.

Phrases such as ‘I remember that’, ‘it is a scientific fact that’, and ‘the Bible teaches that’ place the proposition believed in a validating context. If we think of the proposition believed as a representation of an (actual or merely imagined) state of affairs, we can symbolize it as \(R\). If we then symbolize the validating context as \(V\), we can think of a reflective belief as having the form \(V(R)\).

Using this terminology, we can express Plantinga’s idea by saying that there is no doubt about \(V\), the validating context. Christians have traditionally regarded biblical authority as beyond question. But there can be doubt about \(R\), the content of the belief, since we cannot be entirely confident we have understood it correctly. What, then, can we do in the case of an apparent conflict between religion and science, between what we take to be the meaning of the biblical text and some scientific theory? Plantinga’s answer is that we must ‘weight up the relative warrant, the relative backing or strength, of the conflicting teachings’, for on both sides ‘we will have much more warrant for some apparent teachings than for others’.

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4.2.3 Our Knowledge of the Literal Sense

It may be hard to see just what the Lord proposes to teach us in the Song of Solomon or Old Testament genealogies; it is vastly easier to see what he proposes to teach us in the Gospel accounts of Christ’s resurrection from the dead. On the other side, it is clear that among the deliverances of reason is the proposition that the earth is round rather than flat; it is enormously harder to be sure, however, that contemporary quantum mechanics, taken realistically, has things right.¹

To put this in more clearly Augustinian terms, Christians need to weigh up the likelihood that they have understood the literal sense of Scripture and compare it with the likelihood that a scientific theory is correct. Only then can they make a judgement about which is to take priority.

This is a slightly more sophisticated view than that employed by participants in the Galileo affair. But it is important to note that it could result in just the same outcome. Christians could decide that they are reasonably confident about the literal meaning of the Bible on a topic and much less confident about the scientific theory that apparently clashes with it. In this situation, the biblical teaching will prevail. Indeed Plantinga suggests that this ought to be the case when it comes to Darwin’s theory of evolution by natural selection.

4.3 Has Anything Changed?

When Pope John Paul II restored Galileo to favour in 1992, he endorsed what he presented as Galileo’s view of biblical interpretation.

Paradoxically, Galileo, a sincere believer, showed himself to be more perceptive in this regard than the theologians who opposed him. ‘If Scripture cannot err’, he wrote to Benedetto Castelli, ‘certain of its interpreters and commentators can and do so in many ways’. We also know of his letter to Christine de Lorraine (1615) which is like a short treatise on biblical hermeneutics.²


It was Galileo’s view, the Pope suggested, that had been accepted by a
general council of the bishops of the Catholic Church, namely the second
Vatican Council, in 1965. This is, however, a case of wishful thinking on
the Pope’s part.

If we look at what the second Vatican Council actually taught, we find
that it carefully avoided endorsing anything like Galileo’s principle of lim-
itation. The key passage here is from the Council’s *Dogmatic Constitution
on Divine Revelation* – commonly known (after its opening words) as *Dei
Verbum* – which deals with the inspiration and the authority of the Bible.
The first part of paragraph eleven deals in relatively traditional terms
with the doctrine of inspiration. But the key text for our topic is to be
found in second part of the paragraph. The wording is as follows.

Since therefore all that the inspired authors or sacred writers assert
ought to be held to be asserted by the Holy Spirit, it follows that the
books of Scripture are to be declared to teach firmly, faithfully and
without error the truth which God wished to be consigned to the Sacred
Letters for the sake of our salvation.

The history of this much-debated text highlights the care with which it
is worded. As the document went through its various drafts in the autumn
of 1964, the Council Fathers grappled with the difficult question of biblical
inerrancy. The form of the text produced for discussion at this time stated
that the Scriptures ‘are to be acknowledged as teaching firmly and faith-
fully, in its fulness and without error the truth of salvation’.

But when
this reached the Council for debate, a number of the Fathers expressed
concerns about the phrase ‘truth of salvation’. This expression seemed to
them to limit the inerrancy of Scripture to matters of faith and morals, a
position which they saw as contrary to Catholic tradition.

In response to these concerns, the Theological Commission (which ad-
vised the Council Fathers) argued that the key phrase ‘truth of salvation’
should be retained, since it did not necessarily limit the scope of either in-
spiration or inerrancy. But the more conservative Council Fathers were

1 The Latin reads, *veritatem salutarem*; cited in A. Grillmeier, ‘Chapter III
of the Dogmatic Constitution on Divine Revelation’, in H. Vorgrimler
(ed.), *Commentary on the Documents of Vatican II* (London: Burns &
not satisfied with this and their concerns lead to the intervention of Pope Paul VI. On 17 October 1965 the Pope sent a letter to Cardinal Ottaviani, himself a deeply conservative figure who was head of the Theological Commission. The letter suggested that the Commission consider afresh the wisdom of this phrase, since it was at least susceptible of a false interpretation. After an intense debate, the Commission (and later the Council) accepted the present formulation, which was originally offered by a group of seventy-three Council Fathers as a way out of the difficulty.¹

The intention of these changes was clear. The abandonment of the phrase ‘truth of salvation’ was intended to avoid any suggestion that the scope of biblical authority is limited to particular kinds of knowledge.² To use the language of scholastic philosophy, the new wording suggests not a material distinction but a formal one.³ It suggests the particular purpose for which the whole of Scripture was inspired. It makes it clear that not only matters of faith and morals, but other matters too – matters of history or of natural science – could fall under the authority of Scripture, if

¹ Grillmeier, ‘Chapter III of the Dogmatic Constitution on Divine Revelation’, pp. 211–15. It is interesting to note that the Commission subtly but significantly altered the wording of the formulation presented by the seventy-three Fathers. Their proposed formula had read veritatem, quam Deus, nostrae salutis causa, libris sacris consignare voluit, where the phrase ‘cause of our salvation’ could be read in apposition to ‘God’. The clause would then have to be translated as ‘the truth which God, the cause of our salvation, wished to consign to the sacred books’. The Commission not only altered the active infinitive (consignare: ‘to consign’) to a passive (consignari: ‘to be consigned’), to emphasise once again the fact of the human authorship of the Bible. It also removed the commas, so that the word causa would naturally be read in the ablative rather than in the nominative case, as an adverbial qualification of consignari. In the final text, the phrase nostrae salutis causâ clearly indicates not the role of God as saviour, but the purpose for which these matters were being consigned to writing.


they can be shown to relate ‘to our salvation’. In other words, the second Vatican Council’s decree was expressly formulated to exclude what I have called a principle of limitation: the idea that the authority of Scripture could not be invoked in matters relating to science. This was, as we have seen, the principle for which Galileo argued.

It follows that Pope John Paul II was simply wrong when he asserted that the Council had endorsed Galileo’s hermeneutical principles. The Church’s attitude to biblical authority today may be slightly more flexible than that of Cardinal Bellarmine, but even this is not entirely clear. The Council’s formulation suggests that not everything in Scripture was placed there ‘for the sake of our salvation’. But it does not say that those matters recorded for another purpose lack the guarantee provided by biblical authority.¹ Many of the Council Fathers surely intended this more liberal view, but it is nowhere set out explicitly, presumably because of the break with traditional attitudes it would entail.² When it comes to the Church’s view of biblical authority, little has changed.

¹ This does seem to have been the intention of some Council Fathers (Grillmeier, ‘Chapter III of the Dogmatic Constitution on Divine Revelation’, pp. 205–9), but Vatican II nowhere explicitly abandons the de dicto principle of biblical authority articulated by Cardinal Bellarmine.

² Something very close to Bellarmine’s view of biblical inerrancy had been endorsed by at least two modern popes, namely Leo XIII (in 1893) and Pius XII (in 1943): see J. J. Megivern, Official Catholic Teachings: Bible Interpretation (Wilmington, NC: Consortium, 1978), §§ 337–38 and § 718.
5. THE QUESTION OF CERTAINTY

Lurking in the background of this debate about biblical interpretation was a question regarding certainty. After all, even Galileo’s opponents admitted that if the Copernican view could be conclusively demonstrated, they would be forced to reinterpret the relevant biblical passages. But could the Copernican view be demonstrated in this way? More generally, what degree of certainty was science thought to yield and how did this compare with the certainty of faith? If the two were put in the balance, on which side were the scales likely to fall?

5.1 The Claimed Certainty of Faith

In the centuries before Galileo’s conflict with the Church, Christian theologians had affirmed that the ‘obedience of faith’ (as it was widely known) yields knowledge of the highest possible degree of certainty.

5.1.1 ‘More Certain than Science’

We find this view clearly expressed in the work of Thomas Aquinas. In his *Summa theologiae*, Aquinas addresses the very question with which we are concerned: that of whether faith yields greater certainty than science. By ‘science’, of course, Aquinas does not mean the mathematical and experimental science of which Galileo was a pioneer. He means a body of knowledge in which conclusions about the world are drawn, by deductive reasoning, from self-evident principles.1 His answer is that faith does yield a greater degree of certainty. He admits that this seems surprising. It might appear that matters known by faith are less certain than those known by natural philosophy. After all, in natural philosophy we can grasp the reasons why things are as they are, whereas many Christian doctrines remain mysterious, since they speak of matters that surpass human understanding. Nonetheless, even if we cannot fully understand such doctrines, we know them to be true with a certainty that human reason can never attain, because of their divine origin.2 Their degree of certainty therefore surpasses that of any other form of knowledge.3

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1 Aquinas, *Summa theologiae*, 1a, qu. 1, art. 2.
2 Aquinas, *Summa theologiae*, 2a 2ae, qu. 4, art. 8.
When medieval writers such as Aquinas speak about certainty, what they are speaking about is *firmness of assent*. In general, a proposition can be described as certain when it is one to which we give our assent without fear of being mistaken. There are, however, *degrees* of certainty. One can give one’s assent to two different propositions – say, that ‘fire is hot’ and that ‘whole is greater than any of its parts’ – without fear of being wrong in either case. But one can have a greater degree of confidence about the second proposition than about the first. One can at least *conceive* of a fire that is not hot, while one cannot conceive of a whole that is not greater than any of its parts.\(^1\) What is clear, however, is that for Aquinas no degree of certainty can match that provided by God’s word. A demonstration that takes as its premises an article of faith will always trump any demonstration whose premises are drawn from merely human reasoning. In an early work, Aquinas suggests that reasoning based on faith will trump even demonstrations made on the basis of self-evident principles (such as that regarding parts and wholes).\(^2\)

It follows that the doctrines revealed by God can be used to judge all other claims to knowledge. There may seem to be excellent reasons, for instance, to adopt the Aristotelian doctrine of the eternity of the world. But if this really does contradict what Scripture teaches, then it is the Aristotelian doctrine that must give way. Why? Because Scripture enjoys noth-

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ing less than divine authority, whereas the sciences enjoy a lesser degree of authority, that of ‘natural reason’. It follows that any scientific conclusion that is contrary to Scripture ‘must be condemned as false’.\(^1\) Or, as Aquinas puts it more colourfully, it is to be ‘spewed out’.\(^2\) Since what we know by faith enjoys a greater degree of certainty than what we know by natural reason, ‘natural reason should be subservient to faith’.\(^3\)

While this doctrine is most clearly taught by Aquinas, it also underlines what I have called the principle of the priority of Scripture, which featured so prominently in the Galileo affair.\(^4\) This holds that in the case of an apparent conflict between science and Scripture, if there is any doubt about the scientific theory in question, the literal sense of Scripture is to prevail. The only qualification here is that we may not always understand what a divine revelation is telling us. A demonstrative proof of a theory that apparently contradicts Scripture would be a good indication that we have not understood Scripture correctly. (This is, of course, the complementary principle of the priority of demonstration.) But to say this is not to give scientific reasoning a priority over divine revelation. Far from it. If we knew the correct interpretation of the Bible, then no evidence drawn from merely human reasoning could be permitted to overturn it.

Galileo, of course, thought that Scripture was being misunderstood when it was invoked against Copernicus. His problem is that he was not permitted, as an individual, to offer a new interpretation of Scripture. He could, perhaps, argue for it, but at the end of the day he was obliged to give the assent of faith to the interpretation laid down by the Church. As Bellarmine had reminded Foscarini, ‘the Council [of Trent] prohibits interpreting Scripture against the common consensus of the Holy Fathers’.\(^5\) Only a decision by the Church authorities to reinterpret Scripture could free Galileo from this obligation. In the meantime, he was obliged to treat

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1 Aquinas, *Summa theologiae*, 1a, qu.1, art. 6, ad 2.
3 Aquinas, *Summa theologiae*, 1a, qu. 1, art. 8, ad 2.
4 See chap 4, ‘Dealing with Apparent Conflict’.
the established, literal interpretation of Scripture as though it represented the very Word of God.¹

5.1.2 ‘The Secret Testimony of the Spirit’.

The view that faith yields certain knowledge was not unique to Roman Catholicism. The Protestant Reformers had developed their own version of this doctrine. They opposed the Roman Catholic idea that it was the authority of the Church that gave certain knowledge, but emphasized with equal vigour the certainty of what was known by faith. In fact, the Protestant Reformers went further than Aquinas. Aquinas had emphasized the objective certainty of faith: that the doctrines believed rest on an unshakeable foundation, namely divine revelation. But the Protestant Reformers also insist that faith gives rise to a subjective sense of certainty in the heart of the believer.

We see this view expressed in the work of John Calvin. Calvin’s particular target is the Roman Catholic view of faith, which involves the acceptance of what the Church proposes for belief. He complains that this subjects the authority of Sacred Scripture to the ‘merely human’ judgement of the Church. This reliance on human judgement, he insists, is fatal to the believer’s sense of assurance. Faced with the infinite holiness of God and our own unworthiness as sinners, how can we be confident of salvation, if not through the unshakeable authority of God’s own Word?² The question then becomes: What gives us this assurance of salvation?

¹ Modern, liberal Roman Catholic theologians are inclined to make distinctions between different types of Church pronouncement and to argue that Catholics are obliged to give the assent of faith, in the fullest sense of that term, only to those that enjoy the highest level of authority. But Galileo’s opponents were making no such distinctions. As I noted earlier (chap. 3, ‘The Church’s Response’), even if belief in the Copernican theory had not been formally defined as heretical, it was being treated (on the basis of the consultants’ report) as though it were (Finocchiaro, Defend ing Copernicus and Galileo, p. 143).

Calvin first suggests that our confidence comes from a kind of immediate apprehension of the truth of Scripture.

It is as if someone asked: Whence will we learn to distinguish light from darkness, white from black, sweet from bitter? Indeed, Scripture exhibits itself fully as clear evidence of its own truth as black and white things do of their color, or sweet and bitter things do of their taste.\(^1\)

The problem is that this looks like another case of subjecting biblical authority to merely human judgement, in this case the judgement of the individual believer. So Calvin goes on to insist that the source of this certainty is God himself: it is nothing less than the Holy Spirit working within the heart of the believer. This ‘secret testimony of the Spirit’ is a higher authority than human reasons, judgements, or conjectures. It is ‘more excellent than all reason’.\(^2\)

Calvin does offer what he calls ‘external evidences’ of the authority of Scripture, based on rational arguments. But these arguments are intended to support a faith that is already established;\(^3\) to an unbeliever they will seem unconvincing.\(^4\) The believer has no need to subject Sacred Scripture to proof and reasoning, since its certainty arises not from reason but from ‘the testimony of the Spirit’.\(^5\) Both medieval and later writers distinguished between differing degrees of certainty,\(^6\) but it is clear how Calvin would respond to this. The authority of Scripture, he would insist, enjoys the highest possible degree of certainty, greater than that provided by any merely human reasoning.

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3 Calvin, *Institutes of the Christian Religion*, book 1, chap. 8, § 13
5.1.3 The Locus of Certainty

Calvin’s account of the certainty of faith is connected with the reading of Sacred Scripture. But there remains what I earlier called the hermeneutical question. How can we be certain we have understood Scripture correctly? This was the issue addressed by Alvin Plantinga, when he argued that we should be cautious about claiming that Scripture and science are in conflict, since we cannot be certain we have understood Scripture correctly.¹ His attitude here resembles that expressed in St Augustine’s ‘principle of prudence’.² But it needs to be balanced against another doctrine to which Plantinga claims allegiance, that of the ‘perspicuity of Scripture’.³ This is the idea that on matters essential for salvation the meaning of Scripture is sufficiently clear to any rightly disposed reader.

One could argue that this doctrine has patristic roots, but it was certainly emphasized by the Reformers, particularly by Martin Luther. In his work On the Bondage of the Will, Luther vigorously rejects a suggestion made by Erasmus of Rotterdam: the idea that certain teachings are not clearly expressed in Scripture and that Christians are not, therefore, bound to them.⁴ Luther responds that the meaning of the Bible is ‘plain’ and that the believer is therefore capable of grasping it, although he insists that it is by means of the Holy Spirit that this understanding is achieved.⁵

The same doctrine was picked up by later Christian thinkers and is perhaps most concisely expressed in the Westminster Confession of 1646.

All things in scripture are not alike plain in themselves, nor alike clear unto all; yet those things which are necessary to be known, believed, and observed, for salvation, are so clearly propounded and opened in

1 See chap. 4, ‘Our Knowledge of the Literal Sense’.
2 See chap. 4, ‘Two Forms of Prudence’.
5 Luther, ‘On the Bondage of the Will’, p. 112.
some place of scripture or other, that not only the learned, but the un-
learned, in a due use of the ordinary means, may attain unto a suffi-
cient understanding of them.¹

It is true, of course, that not all modern Protestant Christians would ac-
cept this idea. Indeed it would be difficult to find any doctrine to which all
modern Protestant Christians adhere. But it is a cornerstone of any tradi-
tional form of Protestant theology.

Once again, Dan Sperber’s work can shed light on this question. Re-
member the proposition:

The Bible teaches that Jesus rose from the dead.

Sperber’s idea is that the initial phrase, ‘the Bible teaches’, describes the
‘validating context’ of the belief (in this case, that Jesus rose from the
dead). What Luther and Calvin are saying is that it is not merely the ‘val-
idating context’ of central Christian beliefs that is beyond doubt. It is not
the case that while the authority of the Bible is certain, what it teaches is
uncertain. Luther and Calvin would freely admit that there are times
when we cannot be certain we have understood Sacred Scripture. This is
why even Protestants need theologians. But when it comes to those beliefs
that are necessary for salvation, the Holy Spirit guides the believer to un-
derstand the Bible correctly. Believers can be certain about these key bib-
lical teachings.

The role of the Holy Spirit in Calvinist thought has its parallels in Ro-
man Catholic teaching. Here, too, it is the Holy Spirit that guarantees we
have understood Sacred Scripture correctly, at least when it comes to the
central articles of faith. But the Holy Spirit does not work simply by way
of an inner testimony. It also works by way of the external guidance
provided by the teaching authority of the Church. This idea found its most
vivid expression in 1870, with the definition of the doctrine of papal infal-
libility at the first Vatican Council. This doctrine does not entail that
everything a Pope teaches is divinely guaranteed. But it does mean that
when a Pope pronounces on a matter that is central to the Catholic faith,
he is preserved from error.

¹ Westminster Confession of Faith, chap. 1, art. 7.
Such an idea has parallels in other religious traditions. A striking example is the mainstream Shi’ite Muslim belief in the twelve infallible Imams, descendants of the Prophet through his daughter Fatima and son-in-law ‘Ali. Here, too, the underlying idea is that it is not enough to have a divinely guaranteed Sacred Scripture. One must also have a divinely guaranteed way of ensuring that it is understood correctly. On such a view, then, whether Muslim or Christian, the certainty of faith extends not just to the fact of divine revelation; it extends also to certain ways of understanding that revelation, that is to say, particular beliefs derived from Sacred Scripture.

5.2 Galileo’s Quest for Certainty

What about the sciences? Do they make comparable claims to certain knowledge? There was a time when natural philosophers held to an ideal of certain knowledge, although they rarely claimed to have achieved it. But with the growth of modern science, even this ideal was abandoned. By way of contrast, leading religious thinkers continue to insist that faith gives a level of certainty that human reason can never attain.

5.2.1 The Aristotelian Ideal of Science

Let me begin with the natural philosophy of Galileo’s day. Within natural philosophy, there is a tradition dating back to Aristotle that distinguishes sharply between knowledge and opinion. Aristotle had argued that we enjoy knowledge, as opposed to mere opinion, when we know the causes of the phenomena. But to know the cause of a phenomenon is to grasp the necessary connection that exists between the cause and the effect.¹ The most natural way of expressing this is by way of a syllogism, i.e., a deductive argument that has the fact to be explained as its conclusion. Aristotle’s best known example of such an argument is:

All objects near the earth do not twinkle.
The planets are near the earth.
Therefore, the planets do not twinkle.²

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The reason why the planets do not twinkle – the cause of this effect – is given by the second premise (the ‘minor’ premise).

A key question for Aristotelian thinkers is how we know the premises to be true. After all, the conclusion of such an argument cannot attain any higher degree of certainty than is found in the premises. Let’s start with the second (‘minor’) premise. Aristotle thinks that observation coupled with a simple process of reasoning can lead to the conclusion that the planets are close to the earth. The reasoning in question would run as follows:

The planets do not twinkle.
All objects which do not twinkle are near the earth.
Therefore, the planets are near the earth.¹

This is not yet an explanatory syllogism; it merely establishes a fact. But the fact it establishes is one we can use in our explanation. What about the first (or ‘major’) premise of the explanatory syllogism: ‘all objects near the earth do not twinkle’? In Aristotle’s view, this is also derived from observation. Indeed he firmly rejects the idea that the premises of an explanatory syllogism in the natural sciences are a matter of innate knowledge, insisting that they must be drawn from sense perception.²

The problem is that it is far from clear that sense perception can do what Aristotle demands. Even leaving aside sceptical doubts about the reliability of our senses, Aristotle’s ideal of science demands that our minds can grasp what is necessarily true of objects, what is essential to them.³ But can we do this by way of the evidence of the senses? We can observe, for instance, that the heavenly bodies are apparently unchanging or that they move in circles. But that doesn’t tell us that they are essentially unchanging or that it is of their very nature to move in circles.⁴ Aristotle

ends up positing a kind of intellectual intuition that is capable of grasping such truths, but its nature is mysterious.

Late medieval thinkers were not unaware of such difficulties. Many had come to accept that while we can be entirely confident of the first principles of reason (such as ‘the whole is greater than any of its parts’), we cannot always be so confident about matters known by experience. Duns Scotus, for instance, holds that while empirical knowledge (as we would call it) can sometimes be traced back to self-evident propositions, there are occasions when it cannot. We can observe, for instance, that a lunar eclipse occurs when the earth is found between the sun and the moon. We can be certain that this fact explains the eclipse when we combine it with a ‘self-evident’ principle, namely that when an opaque body is placed between a visible object and the source of light, the transmission of light is impeded. But in the case of other matters known by experience, such as the properties of certain herbs, we lack such a principle. Our conviction that a particular herb cures an illness may be supported by the fact that has regularly done so in the past. But this constitutes ‘the very lowest degree of scientific knowledge’. If the premises of our scientific reasoning are of this kind, drawn from nothing more than the constant conjunction

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of certain observations, their conclusions will have nothing more than a high degree of probability.¹

Those who held to such views did not abandon the Aristotelian conception of deductive science (as modern scientists have done). But they did recognize that natural philosophy could not always attain the highest possible degree of certainty.² A particularly interesting discussion of this question is found in the work of a thinker we have already encountered, namely John Buridan.³ Buridan distinguishes between the certainty which arises from logical necessity – the kind of necessity that even God could not alter – and natural necessity.⁴ The idea that there is some necessity that even God could not alter might seem odd, since God is supposed to be omnipotent. But most theologians believed that God could not create something that would involve a contradiction,⁵ such as a square with a diagonal equal to one of the sides.⁶ Natural philosophy, Buridan continues, can attain the level of certainty associated with second kind of necessity,

³ It is interesting to note Buridan’s remarks regarding the ‘subjective’ certainty that accompanies religious belief. He notes that a person can enjoy the highest degree of subjective certainty even though what he believes is false. This is clear, he writes, from the example of those heretics who will die rather than renounce their views. See J. Buridan, *Summulae de Dialectica*, treatise 8, chap. 4; ET: *Summulae de Dialectica: An Annotated Translation with a Philosophical Introduction* by Gyula Klima, Yale Library of Medieval Philosophy (New Haven, CN: Yale University Press, 2001), p. 710; see also Buridan’s Buridan’s *In Metaphysicen Aristotelis Questiones argutissimae*, book 2, chap. 1, cited in Pasnau, ‘Medieval Social Epistemology’, p. 31.
⁵ Aquinas, *Summa theologiae*, 1a, qu. 25, art. 4.
but not that associated with the first. It can never exclude the possibility that God might alter the way the world operates.

Lurking in the background here may be Archbishop of Paris’s condemnations of 1277.¹ One of its targets seems to have been the idea that God’s actions are restricted to the way nature regularly operates.² What the theologians wanted to defend was God’s absolute power, his ability to act in any way that is consistently describable (or ‘logically possible’, as philosophers say).³ Buridan does not, of course, deny that God has such power, that he might step outside the natural order and work miracles. But his point is that the natural philosopher does not need to worry about this possibility.

Since this view sheds light on Galileo’s difficulties, it is worth citing the key passage in Buridan’s work, which distinguishes the two kinds of certainty involved. ‘One sort of certainty’, Buridan writes,

> is that which pertains to a proposition so firmly true that it, or one similar to it, can by no power be falsified. ... But this sort of certainty is not required for natural science or metaphysics, nor even in the arts or morality. Another sort of human certainty ... is that of a true proposition that cannot be falsified by any natural power and by any manner of natural operation, although it can be falsified by a supernatural power and in a miraculous way. And such certainty suffices for natural sciences. And thus I truly know, by natural science, that the heavens are moved and that the sun is bright.⁴

To put this more simply, we can be certain with a natural certainty that the heavens move, but we cannot exclude the possibility that God could bring their movement to a halt. But this need not be of concern to natural philosophers, who do not deal with miracles. Their subject, writes Bur-

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¹ See chap. 1, ‘The Debates regarding Aristotle’.
³ Grant, ‘The Condemnation of 1277, God’s Absolute Power, and Physical Thought in the Late Middle Ages’, p. 214.
idian, is ‘the common course of nature’: what happens ‘for the most part’ and by way of natural causes.¹

This means that there was, as Edward Grant charmingly puts it, ‘a degree of uncertainty ... within Buridan’s concept of certitude’.² Natural philosophy might operate by deductive reasoning, in which true premises cannot give rise to false conclusions. But the premises employed were falsifiable. They were falsifiable not merely on the grounds that God could work a miracle. They were also falsifiable by reference to observation. It is true that both Duns Scotus and Buridan share Aristotle’s confidence in the power of the human mind to draw reliable conclusions from empirical data.³ But since at least some principles of natural science are not self-evidently true, being drawn from observation, they could be revised in the light of new evidence.⁴ On this view, then, natural philosophy cannot claim absolute certainty for many of its conclusions.

5.2.2 Galileo’s Impossible Task

While Galileo’s ecclesiastical opponents claimed that what Scripture teaches is certain, enjoying a higher degree of certainty than any scientific conclusion, they were prepared to admit that it might need to be reinterpreted. We might alter our view of what Scriptures teaches. We would have to do so, departing from the literal sense of a biblical passage, if a natural scientific conclusion that contradicted it could be proven. So to compel the Church authorities to reinterpret Scripture, Galileo needed a demonstrative proof of the Copernican theory.

⁴ Grant, ‘Science and Theology in the Middle Ages’, p. 237.
In the same way as late medieval natural philosophers, Galileo holds to the Aristotelian ideal of science. Early in the *Dialogue*, his spokesman Salviati contrasts the kind of knowledge available in the humanities or law with that yielded by the natural sciences. He insists that scientific conclusions are "true and necessary".¹ But what this means will depend on how one understands the necessity involved. What kind of demonstration is required here? If what is required is demonstration in the strict sense, then Pope Urban VIII’s argument that Galileo had inserted into his *Dialogue* seems unanswerable.² Galileo was faced with an impossible task.

The Pope’s argument held that even if the Copernican theory were the best available explanation of the astronomical phenomena, it is always possible that God may be bringing about the same phenomena by other means, unknown to us. To insist that the Copernican view is the only possible explanation would be to limit the omnipotence of God. We do not need to believe in God to see the force of this argument. As philosophers of science have often noted, no scientific theory is ever conclusively proven, since there is always more than one possible explanation of any set of data.³

Take for example, Galileo’s key argument for Copernicanism: that it would explain the movements of the tides. If this is supposed to be a demonstrative argument, then it looks like an instance of the fallacy of affirming the consequent.⁴ To base one’s support for the Copernican theory on the argument that if it were true, it would explain the movements of the tides looks suspiciously like an argument of the form:

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¹ Galilei, *Dialogue Concerning the Two Chief World Systems*, p. 53.
² See chap. 3, ‘The Trial of Galileo’.
5.2.2 Galileo’s Impossible Task

The path outside my window is wet.
If it had been raining, the path would be wet.
Therefore, it has been raining.

The problem here is that something else could have caused the path to be wet. (My wife could have been watering the garden.) As it happens, this was precisely the problem with Galileo’s argument. There was another potential explanation that was closer to the true one: the idea that the tides are caused by the influence of the moon over the seas. Galileo rejected this because it seemed to him to involve a mysterious, occult force.¹

But while the Pope’s argument might seem a good one, it was putting Galileo in an impossible position. It was demanding that he produce arguments enjoying a level of demonstrative force that was unattainable. The point is not merely that it seems unattainable to us, who have a rather different view of scientific proof. It would have seemed unattainable to anyone familiar with late medieval discussions of scientific knowledge. What was the Pope demanding? He was insisting that Galileo rule out the possibility that God brings about the tides in some other way. Since God can do anything that can be consistently described, the Pope was demanding that Galileo rule out the bare *logical possibility* of another explanation. To do this, he would have had to produce an argument whose conclusion was ‘so firmly true that it … can by no power be falsified’.² As Buridan had argued, natural philosophy could not hope for this, but must settle for a lesser degree of demonstrative force.

To the best of my knowledge, Galileo never comments on the degree of certainty attainable in natural philosophy. But we know he was familiar with late medieval discussions of the Aristotelian ideal of science.³ In one

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¹ Galilei, *Dialogue Concerning the Two Chief World Systems*, p. 462. Galileo did attribute to the moon an *indirect* influence over the tides (*Dialogue Concerning the Two Chief World Systems*, pp. 451–54); an explanation of its *direct* influence had to await Newton’s theory of universal gravitation.


³ A. C. Crombie, ‘Sources of Galileo’s Early Natural Philosophy’, in M. L. Righini Bonelli and W. R. Shea (eds), *Reason, Experiment, and Mysticism*
of his earliest surviving writings, he refers to the very distinction upon which Buridan relies: between a necessity that even God could not alter and one that reflects the common course of nature.\(^1\) He relies on the same distinction when he remarks that what natural philosophers seek to discover is not ‘that which God was able to do, but that which He has done’.\(^2\) But if he did hold to the same view as did Buridan – that in natural philosophy a less than absolute degree of certainty must suffice – it would explain why he is so quick to dismiss the accusation that his argument was logically flawed.\(^3\) It may also be the reason why he concedes the force of the Pope’s argument without allowing it to sway his own judgement in favour of Copernicus. He would have known that the Pope’s demand was unreasonable.

Did Galileo think that he had, in fact, provided a demonstration of the Copernican theory? It is difficult to say. Possibly he did,\(^4\) on the grounds that while the Copernican theory was not the only possible explanation of the movement of the tides, it was the only plausible one. He may have thought that this constituted the nearest one could come to a demonstrative proof in such matters. It seems more likely, however, that he thought he had good reasons to favour the Copernican view, while realizing that


\(^{2}\) This is from Galileo’s response to a work by Jean-Baptiste Morin (1583–1656). See Galileo Galilei, ‘Note per il Morino’ (1631), in *Favaro (ed.), Le Opere de Galileo Galilei*, vol. 7, pp. 562–68, on p. 565 (translation my own).


5.2.2 Galileo’s Impossible Task

these fell short of demonstrative proof.¹ Galileo certainly recognised existed arguments of this kind, which an Aristotelian would have called ‘dialectical’ arguments.² His spokesman Salviati freely admits that at least one argument in favour of the Copernican theory does not constitute ‘a necessary demonstration’, but merely shows its ‘greater probability’.³

Note, too, that if Galileo thought that his arguments were less than demonstrative, it would make sense of his modification of the traditional Augustinian principle of prudence.⁴ Galileo shares with his contemporaries the view that biblical authority should not be invoked against demonstrated scientific theories. But he also insists that it should not be invoked against theories that might one day be demonstrated. This insistence would be understandable if he thought the Copernican theory fell into this category.

It is, however, difficult to tell just what Galileo thought his arguments had achieved. The reason for this may be that the Church’s edict had put him in a bind. If he did think he had a demonstrative proof of the Copernican theory, he could not state so openly, for fear of being seen to violate the Church’s prohibition. If, on the other hand, he thought he had ‘good enough’ arguments – arguments that supported the theory but that fell short of demonstrative proof – he could not argue for this, either. Firstly, claiming that the Copernican view was merely probable could also be seen as violating the Church’s edict. Indeed this is how his judges did see it, since they pointed out in their condemnation that no opinion can be considered probable that contradicts Scripture.⁵ Secondly, if the Copernican

¹ Wallace, Galileo’s Logic of Discovery and Proof, p. 233 n. 40.
³ Galilei, Dialogue Concerning the Two Chief World Systems, pp. 118; Finocchiaro, Galileo and the Art of Reasoning, pp. 113–14, 178.
⁴ See chap. 4, ‘Two Forms of Prudence’.
⁵ Cited in Finocchiaro (ed.), The Galileo Affair, p. 289.
5.2.2 Galileo’s Impossible Task

theory were merely probable, then the Church would have no reason to abandon the literal sense of the biblical passages that contradicted it.

5.3 Religion and Certainty

In Galileo’s case, then, an ecclesiastical authority claiming certain knowledge faced a new natural philosophy which aspired to certainty, but which had difficulty producing the arguments required to attain this goal. But is this still the case? One might expect that religious thinkers no longer claim certainty for the knowledge that comes from faith. Surely they have learned some humility in the last four hundred years? On the other side, what about scientific knowledge? What degree of confidence does modern science claim for its findings?

5.3.1 Against Enthusiasm

The seventeenth century saw the emergence of a changed attitude to knowledge. Richard Popkin refers to this changed attitude as ‘constructive’ or ‘mitigated’ scepticism.¹ Proponents freely admitted what the ancient sceptical tradition had pointed out: that we can enjoy little or no certainty in matters of fact. But constructive sceptics insisted that this does not matter, since we can be content with a high degree of probability, an assurance that falls short of certain knowledge.² A number of these

¹ This was in part a reaction to the more radical scepticism of thinkers such as Michel de Montaigne (1533–92). The more radical position is sometimes known as Pyrrhonian scepticism, after Pyrrho of Ellis (360–270 BC). Oddly enough, it was often used to lend support to religious beliefs, on the grounds that if human reason is so unreliable, we must rely on divine revelation; see R. H. Popkin, ‘Prophecy and Scepticism in the Sixteenth and Seventeenth Century’, British Journal for the History of Philosophy, 4 (1996), pp. 1–20, on pp. 12–13. The more moderate, ‘constructive’ or ‘mitigated’ scepticism was also known as Academic scepticism, since its original proponents were leaders of Plato’s Academy, or Carneadian scepticism, after Carneades (213–129 BC). On the differences between these two types of scepticism, see R. H. Popkin, The History of Scepticism: From Savonarola to Bayle, Revised Edition (New York: Oxford University Press, 2003), pp. xvii–xix.

² Popkin, The History of Scepticism, p. 112 et passim.
thinkers were so bold as to extend this moderately sceptical attitude to the Christian faith. They were content with something less than certainty in matters of religious belief.¹

We see something of this attitude in the work of the seventeenth-century jurist Hugo Grotius. Grotius held that in matters of religion we must be satisfied with no greater a level of proof than we employ in history and in everyday life. Indeed, he argues, God chose to make the evidence in support of religion less certain than that of sense perception and demonstration. He did this in order to ‘try men’s honest dispositions’, since the evidence is sufficient to persuade anyone ‘who is not obstinately bent against it’.²

A similar view is found in the work of William Chillingworth. Chillingworth argues that while religious faith – ‘an assent to Divine revelations upon the authority of the revealer’ – differs from mere opinion, it shares some of the characteristics of opinion. Among these is the fact that it is ‘built on less evidence than that of sense or science’. Over against the Catholics, who demand ‘a certainty of faith above that of sense or science’, Chillingworth argues that this is not required. It is sufficient if the strength of our faith is ‘equal or proportionable to’ the evidence that can be produced in its support.³ Chillingworth’s ideas are picked up by John Locke, in his Essay Concerning Human Understanding (1689), and it is Locke’s view that I would like to examine more closely.

Locke’s particular target is what he calls religious ‘enthusiasm’. The ‘enthusiasts’, in the language of his day, were those who claimed religious

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² H. Grotius, The *Truth of the Christian Religion* (1627), tr. J. Clarke; 15th edition (London: Richard Baynes, 1818), book 2, sect. 19 (pp. 122–23); Grotius may also have been influenced by the conceptions of probability to be found in legal reasoning. For his views on that topic, see Franklin, *The Science of Conjecture*, pp. 79–80.

knowledge on the basis of what was thought to be a direct communication from God. Enthusiasm was widely feared among seventeenth and eighteenth European intellectuals.\footnote{1} Indeed their attitude to enthusiasm closely resembles our attitude to fundamentalism. What lay behind the fear of enthusiasm was ‘the fury of the millennial sects, expressed by those who have figured in the Peasants War in Germany and the Anabaptist rebellion at Münster’.\footnote{2} England had seen nothing quite so radical, but memories of the Civil War (1642–51) and Oliver Cromwell’s Puritans were still strong. Religious enthusiasm had a frightening ability to turn the world upside down.

Locke begins his discussion with what looks like a very traditional distinction between faith and reason. This has to do with the source of what is believed. ‘Reason’, he writes,

\begin{quote}
I take to be the discovery of the certainty or probability of such propositions or truths which the mind arrives at by deduction made from such ideas, which it has got by the use of its natural faculties; viz. by sensation or reflection.\footnote{3}
\end{quote}

‘Reason’, then, is simply Locke’s term for our ability to reflect on ideas arrived at by using our natural faculties.\footnote{4} Faith, on the other hand,

\begin{quote}
is the assent to any proposition, not thus made out by the deductions of reason, but upon the credit of the proposer, as coming from God, in some extraordinary way of communication. This way of discovering truths to men, we call revelation.\footnote{5}
\end{quote}
The key insight here is that there are matters we cannot know on the basis of our own reasoning, but can learn about on the authority of others. On the face of it, this seems quite right. Much of our knowledge is indeed based on testimony. I may not be able to offer you the evidence that \( e = mc^2 \) (\( e \) being energy, \( m \) mass, and \( c \) the speed of light), because I do not know enough mathematics and physics to do so. I believe it to be true on the authority of those scientists who understand Einstein’s work. Religious faith involves a similar belief on authority, the difference being that in this case the authority is that of God. On the basis of divine authority we could believe things for which we have no direct evidence. Indeed in this case, we could believe things that human beings could never know by reason. The fact that they are divinely revealed would be sufficient evidence of their truth.

As Locke points out, if we knew that something had been revealed by God, this would be an excellent reason for believing it, at least on the assumption that God is omniscient and morally perfect. Such a being, to use a traditional formulation, could neither deceive nor be deceived. If we knew with certainty that something was revealed by God, we would also know with certainty that it was true, even if we could offer no other arguments in its support.

So far, so good. This is a very traditional view of faith. Where Locke departs from tradition is in his insistence that we need reason to believe that something is revealed by God. We also need reason to believe that we have understood that revelation correctly. (That was, you will recall, the key issue in the Galileo affair: whether the Bible was being understood correctly by those who used it to oppose Copernicus.) What Locke is doing here is picking up a distinction made by Chillingworth, one that is commonly neglected by theologians. He distinguishes between (a) the certainty a proposition would enjoy on the assumption that it is divinely revealed and (b) the degree of confidence with which we can believe it to be divinely revealed. The latter, he suggests, will always be less than the former. To fail to make this distinction, he argues, is to fall into the error of the enthusiasts.

Locke also agrees with Chillingworth that our degree of assent to an alleged divine revelation must be proportioned to the evidence available. We should not believe that certain truths are revealed by God with any
greater degree of confidence than is warranted by the evidence that supports this belief. More precisely,

our assent can be rationally no higher than the evidence of its being a revelation, and that this is the meaning of the expressions it is delivered in. If the evidence of its being a revelation, or that this is its true sense, be only on probable proofs, our assent can reach no higher than an assurance or diffidence, arising from the more or less apparent probability of the proofs.¹

In fact, Locke seems to think that probable proofs are the most we can achieve in this area.²

Some care is needed here. Locke is not even moderately sceptical about belief in God. He thinks this can be proven beyond reasonable doubt.³ He even holds that human reason can give us some knowledge about God, in particular that God is an all-powerful, all-knowing, and providential law-giver, who is to be worshipped and obeyed.⁴ What he is (moderately) sceptical about is the belief that particular religious doctrines have been divinely revealed. While he seems reluctant to make this view fully explicit, it seems to play a role in his support for religious toleration.⁵ If we cannot be certain about any allegedly revealed truths, then we should be tolerant of competing claims regarding divine revelation.

For Locke, then, faith certainly goes beyond reason: it can tell us (on the authority of God) of things we could never know otherwise. But it also

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⁵ Black, ‘Toleration and the Skeptical Inquirer in Locke’, pp. 489–90. The key argument is found towards the beginning of Locke’s *Third Letter Concerning Toleration*.  

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rests on reason, since we must have reason to believe that God has spoken and that we have understood what he has said. What is interesting is that this view undercuts the very distinction with which it began. No longer is religious faith thought of as a source of knowledge that is distinct from reason. There is, of course, still a distinction between believing propositions for which I have direct evidence and believing those for which I have only indirect evidence, namely the authority of the person telling me they are true. But if we should believe someone’s testimony only when we have reason to believe she is a reliable witness, then we are believing on the basis of reason, namely our evidence that she is reliable.

This is not just my conclusion; it is one accepted by Locke himself. He writes that while he is discussing faith ‘as it is ordinarily placed, in contradistinction to reason’, it is in fact nothing other than ‘an assent founded on the highest reason’. What follows from this is the theologically scandalous idea that ‘reason must be our last judge and guide in everything’. The tradition of ‘constructive scepticism’ represented by Locke’s view did have an influence on conceptions of scientific knowledge. But it had little influence among religious thinkers, who generally rejected an even moderately sceptical attitude in matters of faith. Edward Stillingfleet, Bishop of Worcester, was one of the first to do so. While he had originally shared the views of thinkers such as Chillingworth, he later adopted a more traditional stance. Worried by what the use made of Locke’s ideas by the freethinker John Toland, Stillingfleet argued that they would lead to sceptical conclusions, in particular to the idea that faith cannot produce certain knowledge. The dominant religious attitude remained that which Luther had expressed in his correspondence with Erasmus: ‘The Holy

5.3.1 Against Enthusiasm

Spirit is no Skeptic, and it is not doubts or mere opinions that he has written on our hearts, but assertions more sure and certain than life itself.¹

5.3.2 Liberal Theology and its Aftermath

There did develop, in the late eighteenth and early nineteenth centuries, a tradition of liberal Christian theology, hints of which we have already seen in the work of Andrew Dickson White.² This was characterized by a move away from what is sometimes called ‘supernaturalism’: the idea that there exists a special, miraculous mode of divine action, which breaks into the regular order of nature. Over against this view, liberal theologians insisted that there was just one mode of divine action: that which accompanied and guided the kind of laws discoverable by science.³ This rejection of supernaturalism went hand-in-hand with a thoroughly historical view of religions, including Christianity. Liberal theologians, like secular scholars of religion, sought natural rather than supernatural explanations of the origins and history of religious traditions.

The founder of modern liberal theology, Friedrich Schleiermacher, retained a surprisingly traditional view of the certainty of faith. He held not only that faith remains a distinctive form of knowledge, but that it involves a kind of ‘intuitive certainty’, which theology can simply presuppose.⁴ Just as faith in God involves ‘a certainty concerning the feeling of absolute dependence’, so faith in Christ involves a certainty regarding the possibility of redemption.⁵ But later liberal theologians pointed out that Schleiermacher’s work did not go far enough, suffering as it did from a kind of residual supernaturalism.⁶

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² See my Introduction, on ‘Andrew Dickson White’.
5.3.2 Liberal Theology and its Aftermath

One thinker who took these ideas further was Ernst Troeltsch. We see this in Troeltsch’s view of the value of the Christian religion. He argues (on various grounds) that Christianity is ‘the highest and most significantly developed form of religious life that we know’.¹ But he admits that this is a provisional judgement, since we cannot be certain what direction the future religious development of humanity will take. It is at least conceivable that in the religious development of humankind a ‘higher revelation’ may yet emerge.² By the traditional standards of Christian theology, this is a remarkably modest claim.

Liberal theology is not entirely dead. Its aims continue to be pursued by those whom I shall later call ‘critical’ (rather than ‘confessional’) theologians.³ These thinkers follow in the tradition established by Troeltsch: they make relatively modest claims for the knowledge attained by faith. Indeed one recent theologian, Gordon Kaufman, argues that Christians ought to repent of their previous ‘claims to knowledge and certainty’.⁴ But twentieth-century Protestant theology also witnessed a decisive move away such modesty, its characteristic feature being what William Warren Bartley called a ‘retreat to commitment’.⁵ The most influential representative of this trend was Karl Barth, whom no less a figure than Pope Pius XII described as ‘the greatest theologian since Thomas Aquinas’.⁶

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³ See chap. 6, ‘Critical Theology’.
In conscious opposition to the liberal theologians of the nineteenth century, Barth reaffirms the idea that faith offers a form of knowledge that must be regarded as certain. What the believer may not doubt, he holds, is the authority of the biblical witness to the Word of God. In spelling out this idea, Barth refers to what he calls ‘the Protestant scripture principle’, which regards the authority of Scripture as simply a given, a principle from which theology begins but which it cannot be permitted to question.

Following Calvin, Barth claims that the authority of Sacred Scripture is, in a certain sense, self-authenticating. It is, to use John Calvin’s Greek term, *autopistos*: to be believed of itself. If you ask why we should believe the biblical witness, all one can say in response is that the Bible itself says we should. It follows that if we do not already accept the authority of the Bible, we will see no reason to do so. The doctrine of the Word of God is ‘a logical circle ... of self-asserting, self-attesting truth’. You are either inside the circle or you are not. The authority of the biblical witness is ‘either already known and acknowledged or it is not accepted’.

What this means, incidentally, is that no arguments in support of biblical authority are needed. Nor are they permitted. We are forbidden to submit that authority to any argument or proof. Barth acknowledges that the Protestant Reformers did produce arguments of this kind. They did not.

92, on p. 789.


4 Barth, *The Göttingen Dogmatics*, § 8.3.

5 Barth, *Church Dogmatics*, vol. 1, part 2, § 19.2.

6 Barth, *The Göttingen Dogmatics*, § 8.3.

7 See, for example, Calvin, *Institutes of the Christian Religion*, book 1, chap. 8.
not regard such arguments as decisive, since they believed the Bible ultimately does not require them. Yet even offering such arguments was a dangerous and regrettable move. It was regrettable since it brings us into a sphere in which the pros and cons are secretly or openly set out alongside one another, in which we cannot do more than advance probabilities, and in which it is not impossible that one day the opposite might be stated and proved.

Read that sentence again. The greatest theologian since Aquinas is saying that it is dangerous to put forward arguments in support of the authority of Sacred Scripture, since any arguments you produce may be defeated.\(^1\) It is hard to imagine anything more directly opposed to the scientific ideal, as outlined by the philosopher Karl Popper. This holds that scientists should put forward theories which have a high degree of empirical content, since if such theories are mistaken, there is a good chance that they will be falsified and discarded.\(^2\)

In any case, Barth’s claim that the authority of the Bible is ‘self-authenticating’ is difficult to take seriously. Self-authentication is just too easy. Here is a proposition I would like you to believe.

Everything written in this book is true. How do you know this proposition is true? Because it is written in this book and everything written in this book is true. You might feel justified in withholding your belief if this is the only argument I can produce in its support.

How do both Calvin and Barth find themselves holding so ridiculous a view? They do so because they cannot avoid the question of how we know the Bible to be a divine revelation. For Calvin, this question has become pressing since he must defend his exclusive reliance on biblical authority against his Roman Catholic opponents.\(^3\) For Barth, the question has become pressing because he lives in an age in which religious authority in

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\(^1\) As Barth says elsewhere, ‘revelation is denied when it is regarded as open to discussion (Barth, *Church Dogmatics*, vol. 1, part 2, § 17.1).


general has been called into question. The problem is that once the question has been raised and acknowledged, the believer has only two possible responses. She can either produce reasons in support of her belief, which means subordinating the authority of Scripture to that of human reason. But if she does this, she can no longer claim that faith is distinct from reason. Or she can claim that Scripture is in some sense self-authenticating, however unsatisfactory that answer may be.

5.3.3 ‘A Certitude No Longer Open To Doubt’

The continued commitment to the idea that faith yields certain knowledge is not unique to Protestant Christianity. It has plenty of parallels within Roman Catholic thought. Take, for example, the prominent twentieth-century theologian, Avery Dulles. Like Robert Bellarmine, Dulles was a Jesuit eventually elevated to the rank of Cardinal. In his discussion of Christian faith, Dulles deals with the topic of ‘certitude and doubt’. He notes that Christian tradition has always insisted on ‘firmness of conviction’: religious faith, he insists, is incompatible with regarding what is revealed as ‘merely probable’.1 Dulles’s point is not merely that the believer must regard what is revealed is objectively certain, because of its divine source. It is that the believer’s subjective attitude ought to be one of certitude: faith ought to involve a firm and unwavering assent.

Dulles is in good company here, for only a few years ago the same idea was reaffirmed by Pope John Paul II. The Pope contrasts the certainty of faith with the level of knowledge attainable by (mere) human reason. All human beings, the Pope writes,

seek a final explanation, a supreme value, which refers to nothing beyond itself and which puts an end to all questioning. Hypotheses may fascinate, but they do not satisfy. Whether we admit it or not, there comes for everyone the moment when personal existence must be anchored to a truth recognized as final, a truth which conveys a certitude no longer open to doubt.2

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2 John Paul II, Fides et Ratio: Encyclical Letter of the Supreme Pontiff John Paul II to the Bishops of the Catholic Church on the Relationship
It is this certainty which, in the Pope’s view, Christian faith provides.

There is some evidence that this attitude to religious knowledge is not unique to Christianity. Insofar as any religion regards certain texts, individuals, or institutions as sacred, what those sources tell us will be regarded as unquestionable. This point has been made recently by the anthropologist Roy Rappaport, who draws on the work of a Polish logician and Dominican priest, Józef Bocheński. Rappaport notes that religious beliefs fall into several categories. These include (a) ultimate sacred postulates, which are the core beliefs of a tradition, (b) sanctified sentences, which are derived from these core beliefs, and (c) heuristic rules, which spell out where the core beliefs are to be found and how they are to be interpreted. Within Christianity, the ultimate sacred postulates correspond to those doctrines whose truth is guaranteed by what Protestants call ‘the perspicuity of Scripture’ or (for Catholics) the authority of the Church.¹ They are considered unquestionable. As Rappaport notes, they are most emphatically not held in the way in which scientific hypothesis are held: as explanatory claims that could be revised.²

It is true that not all the claims proposed for belief within a religious tradition have this status. Those that have the status of sanctified sentences will be thought to enjoy a lesser degree of certainty. While these derive their sacred status from their relation to the ultimate sacred postulates, they are considered revisable, at least in principle. Particular ethical commands are often understood in this way. Within Islam, for instance, the commands explicitly stated in the Qur’an or the reports of the sunna (practice) of the Prophet are considered unquestionable. But there are other commands that are derived from the Qur’an and sunna, by analogical reasoning. Often these deal with new situations that have arisen since the time of the Prophet. Muslims are expected to adhere to the con-

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¹ See ‘The Locus of Certainty’, above.

sensus view of the scholars on such issues, if indeed there is a consensus. But that consensus may change over time.

A similar situation can be found within Roman Catholicism. Here, too, there are certain papal teachings that are considered unquestionable: they cannot be changed, since on the occasions when they are put forward the Pope is considered infallible. But there are other papal teachings that Catholics are expected to adhere to, but which most theologians do not consider to be unquestionable. An example would be the current papal teaching regarding contraception.

It is, however, the ultimate sacred postulates that I am concerned with here. As we have already seen from the work of Aquinas, these are considered to enjoy the greatest conceivable degree of certainty. Describing these ultimate postulates as ‘p-sentences’, Bocheński notes that they have to be considered as possessing the probability 1. In most theologies it is even asserted that the certainty of the p-sentences is by far greater, indeed belongs to a quite different order, than the certainty of any other sentence. This, however, is a psychological matter; logically there is no probability higher than 1.¹

Logically, of course, this is true: no proposition can have a degree of certainty great than 1. But believers can and do consider their central beliefs to have a higher degree of certainty than any other form of knowledge. The implication is clear. If the ultimate postulates of religion are thought to enjoy a greater degree of certainty than the theories of science, then it is not hard to see which will be given priority when they come into (at least apparent) conflict.

## 5.4 Science and Certainty

Within the world of Christian thought, then, leading thinkers and key authorities continue to maintain that the act of faith yields certain knowledge, a firmness of assent that excludes any possible doubt. This attitude seems characteristic of religions in general, insofar as they regard certain sources of knowledge as sacred and therefore unquestionable. But this fact

stands in stark contrast to the kinds of claims made by modern scientists and philosophers of science.

One of the developments that occurred in the seventeenth century was the abandonment of the old ideal of demonstrative knowledge. We have seen that for many centuries, natural philosophers identified *scientia* with demonstrated knowledge. Of course, many realized that this was an ideal, which could rarely be attained. But at a certain point in the development of modern science, even that ideal was abandoned. As one recent scholar writes,

in contrast to Aristotelian epistemology with its emphasis on universal, true, first principles, our modern science proceeds on the assumption that everything is up for grabs. Nothing is certain, all claims for universality are equally fallible.\(^1\)

The abandonment of this demonstrative ideal of science seems related to the tradition of ‘constructive’ or ‘mitigated’ scepticism that we find in the work of John Locke.\(^2\) But whatever its origins, there is no doubt it occurred.

If I had to put a date on the event, I would choose 1690, when Christian Huygens published his *Treatise on Light*. Optics had long been regarded as one of the mathematical sciences, where a high degree of precision was possible. But in the preface to that work, Huygens contrasts the degree of confidence that optics can achieve with the certainty of pure geometry. While optics *employs* geometry, it does not achieve the *certainty* of geometry. The best it can achieve is a high degree of probability.\(^3\) It does so by means of what we now call ‘hypothetico-deductive’ reasoning. We deduce from our theory a wide range of observations and check to see if those predicted observations are verified. If we can do this, then we can be very confident about the theory. But, it seems, a high degree of confidence is now the most we can hope for.

\(^2\) See ‘Against Enthusiasm’, above.
This is certainly the attitude taken by modern scientists. Scientists accept that no theory can ever be said to be conclusively proven. It may have a high degree of evidential support, but it is never certain. At a popular level this fact is not sufficiently well known. Many people appear to believe that science offers certain knowledge or that if it does not offer certain knowledge, then its conclusions are ‘merely’ a matter of opinion. My own students are inclined to think there are only two options when it comes to knowledge: certainty, based on the kind of proof that no rational agent could doubt, and a scepticism that denies we know anything at all. But modern science was born from the attempt to find a middle path between these two extremes. In the course of finding that middle path, it abandoned claims to certainty regarding its theories.

Philosophers of science have found various ways of articulating this insight. Some formalize the approach pioneered by Huygens in speaking about the ‘probability’ of scientific theories. This approach often makes use of a theorem developed by Thomas Bayes (1701–61), which calculates the degree to which a particular piece of new evidence should increase the confidence with a belief is held. The details of Bayesian theory need not detain us here. All I want to note is that Bayesian theorists assume that in science we are dealing with degrees of probability, not certainty. In the words of two leading proponents of this approach,

suppose \( h \) is some scientific hypothesis. Experimental data can never conclusively prove that \( h \) is true, even if it is true. So you are never absolutely certain of \( h \)’s truth, only more or less. The inductive inference consists in assessing the degree of certainty warranted by the evidence.\(^1\)

On this view, then, the degree of probability of a scientific theory will never be 1 (i.e. certainty).

In assigning degrees of probability to a theory, Bayesians are relatively conservative. Karl Popper, for instance, rejects the idea that we can speak of probability when it comes to scientific theories.\(^2\) He holds that the most we can claim for a scientific theory is (a) that it would, if true, account for the facts we are trying to explain and (b) that it has not yet been falsified.


5.4 Science and Certainty

We can, perhaps, be confident that with the progress of science our theories are coming closer to the truth. But even if we had a true theory, we could not know that it was true.\(^1\) At one point Popper offers a vivid metaphorical expression of this idea. ‘The empirical basis of objective science’, he writes, ‘has nothing ‘absolute’ about it’.

Science does not rest upon rock-bottom. The bold structure of its theories rises, as it were, above a swamp. It is like a building erected on piles. The piles are driven down from above into the swamp, but not down to any natural or ‘given’ base; and when we cease our attempts to drive our piles into a deeper layer, it is not because we have reached firm ground. We simply stop when we are satisfied that they are firm enough to carry the structure, at least for the time being.\(^2\)

It is difficult to imagine a clearer expression of the idea that science does not offer certain knowledge.

Such a view is not found merely among Bayesians and Popperians. It is also found among the intellectual descendants of Immanuel Kant (1724–1804).\(^3\) On the modern Kantian view, defended by Michael Friedman, the goal of science is an ideal state towards which we may regard our scientific theories as gradually converging. We cannot ever assume that this ideal state has been achieved, nor can we assume it will ever actually be achieved. Indeed, if scientists ever believed they had reached this goal, it ‘would halt scientific progress dead in its tracks’.\(^4\)

It is interesting to contrast this attitude with that expressed by Pope John Paul II. The Pope, you will recall, argues that what we are seeking is a truth that ‘puts an end to all questioning’.\(^5\) But this is certainly not what scientists seek, for the end to all questioning would be the end of science.

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3. See also chap. 6, ‘Science and Criticism’.
The modern sciences have come a long way from the ancient medieval quest for demonstrative knowledge. We may, as the Pope believes, long for certain knowledge, and we may flee to religious faith in an effort to attain it, but the quest for certainty is a quest the scientific community has long renounced.
6. CRITICAL THOUGHT IN RELIGION AND SCIENCE

The differences I have identified between the two sides in the Galileo affair are not unique to early modern Europe. They are characteristic of any form of scripturally based religion and any form of science. To better understand those differences, I want to go beyond the immediate lessons of the Galileo affair, with its concerns regarding authority and certainty. My aim is to offer some tentative suggestions about the place of critical thought within the world of religion, in order to compare it with the place of critical thought within the sciences. They are tentative suggestions, since they are inevitably a little speculative. But they are consistent with the historical evidence examined so far.

In speaking of ‘critical thought’ I do not mean merely what is taught in introductory classes on critical thinking: the examination of arguments with a view to identifying sound or fallacious reasoning. This is clearly important, but I mean something broader. What I am interested in is something closer to what the philosopher Immanuel Kant urged in his 1784 essay, ‘What is Enlightenment?’

Enlightenment is man’s release from his self-incurred tutelage. Tutelage is man’s inability to make use of his understanding without direction from another. Self-incurred is this tutelage when its cause lies not in lack of reason but in lack of resolution and courage to use it without direction from another. Sapere aude! ‘Have courage to use your own reason’ – that is the motto of enlightenment.¹

If we combine this Kantian idea with a recognition of the importance of social relations, we can arrive at a broader understanding of critical reason. On this view, critical thinking involves a willingness to question ‘established forms of thought and established forms of collective life’². That questioning is especially directed at those forms of thought and ways of life whose authority is generally taken for granted.

One might think that critical thinking in this sense is a distinctively modern ideal. As Kant’s essay reminds us, it is often associated with the period tendentiously referred to as ‘the Enlightenment’: the seventeenth and eighteenth centuries in Europe. But it has deeper historical roots, going back to the philosophical traditions of ancient Greece. Nor is it entirely absent from religious communities. Here, too, there are people who are prepared to question established beliefs and collective forms of life.¹ What I shall argue, however, is that religious thought is bound to the foundational myths of its community to an extent that scientific or philosophical thought is not. There are more or less clearly defined limits to criticism in religion: religious communities do not allow it to be carried too far. In the sciences, however, there are no such limits. Within science there are no ideas that are out of bounds, no beliefs that may not be subject to critical scrutiny.²

6.1 Foundational Myths

Scripturally based religions can be characterised by their foundational narratives, which I shall refer to as ‘myths’. I am not using the word in its popular sense, in which a myth is simply a false belief.³ My use of the term corresponds to that common among anthropologists. On this view, myths are sacred narratives which tell stories of origins or transformations, shape the rituals of the communities that hold them sacred, and function as patterns that are used to interpret later events. They tell of events that can be known only by way of the sacred texts in which these narratives


² In chap. 8, I shall qualify this conclusion, noting that there may be assumptions underlying the practice of science – ‘hinge beliefs’, to use a Wittgensteinian phrase – that are unable to be questioned within science, since they are essential to its practice. But if there are such beliefs, they are assumptions that no human being could abandon without ceasing to be a rational agent.

³ In order to avoid this idea, I shall follow Merlin Donald in using the adjective form ‘mythic’ instead of the more disparaging ‘mythical’. For Donald’s work, see my Introduction, ‘Locating the Conflict’.
are found.¹ What makes a story a ‘myth’ in this sense is not its truth or falsity, but the way it is regarded and its function within the community that transmits it.

Many of the stories in the Sacred Scriptures of Judaism, Christianity, and Islam can be seen as myths in this sense.² The most obvious example is the creation story found in the biblical book of Genesis, which not only tells of the beginning of the world, but has profoundly shaped the Christian understanding of sexuality and sin. It is also tells of God’s rest on the seventh day, which forms the pattern for the Jewish practice of sabbath observance. Within Judaism, the Exodus of the Hebrew slaves from Egypt is recalled every year in the Passover Haggadah, the victory of the Maccabeans during the celebrations of Hanukkah, and the tragedies that have befallen the Jewish people on the fast day of Tisha B’Av. Within Christianity, the birth of Jesus is commemorated at Christmas, his resurrection at Easter, and the events of his death and resurrection at the Eucharist (the Lord’s Supper or ‘Mass’). Within Islam, the story of Abraham (Ibrahim) is recalled and re-enacted yearly in the rituals of the hajj, the pilgrimage to Mecca. As these examples suggest, the myths of these three scripturally based religions are not identical, but they do overlap. Judaism and Christianity share a set of Sacred Scriptures, namely the Hebrew Bible (the Christian Old Testament), and many of the biblical stories are found in the Qur’an, although narrated in subtly different ways.

Not only are these stories continually retold; they also function to shape and give meaning to the lives of believers.³ On 3 April 1968, only hours before he was killed, Martin Luther King gave a speech in which he said:

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6.1 Foundational Myths

Like anybody, I would like to live a long life. Longevity has its place. But I’m not concerned about that now. I just want to do God’s will. And He’s allowed me to go up to the mountain. And I’ve looked over. And I’ve seen the Promised Land.¹

In uttering these words, he was taking the biblical story of the Exodus and using it to interpret the contemporary struggle of African-Americans. In doing so, he was following in a long tradition, one that dates back to the biblical writings themselves, and which has been repeated throughout Jewish and Christian history. It is found also in the Qur’an, where the story of the life Ibrahim is retold in such a way that it calls to mind the life of Muhammad, showing the Prophet to be following in the footsteps of the first person to embrace monotheism.²

6.2 The Authority of Myths

Central to the Galileo affair, as we have seen, was the authority of the Bible, which was thought to embody a divine revelation yielding certain knowledge. The belief in a divine origin is a common feature of myths. Since these stories are divinely guaranteed they enjoy an unparalleled degree of authority within the communities that regard them as sacred. Indeed, this seems to be one of the defining characteristics of a sacred narrative: the fact that its authority is regarded as unquestionable.³ While it can be reinterpreted, it cannot be abandoned.

The authority of religious myths is particularly evident in the attitude of believers to what we might think of as metaphor. As modern readers, we might describe mythic narratives as useful fictions, conveying some spiritual truth, or perhaps as metaphors or allegories. But the mythic narratives of religious communities have not traditionally been regarded in this way. Even if sophisticated thinkers (such as St Augustine) felt com-

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¹ K. D. Miller, Martin Luther King’s Biblical Epic: His Final, Great Speech (Jackson, MS: University Press of Mississippi, 2012), p. 182.
² See, for example, Qur’an 21:58, 68 –71 and 29:28.
6.2 The Authority of Myths

pelled to interpret some sacred texts figuratively, their preference was to retain both the literal and the figurative meaning.

It is important to appreciate this when assessing claims about religion and science. Opponents of the conflict thesis often avoid a clash of scientific and religious doctrines by suggesting that the biblical narratives were written as allegories or extended metaphors. Karl Giberson, for instance, is anxious to harmonize Genesis with the modern theory of evolution. He does so by suggesting that ‘multiple elements in the Genesis story of creation suggest a figurative or symbolic, rather than a literal reading’.1 Another defender of evolution, Kenneth Miller, also favours a broadly symbolic interpretation of Genesis. ‘To reveal Himself to a desert tribe six thousand years ago’, he writes, God spoke ‘in the direct and lyrical language of Genesis’.2 Well, perhaps he did. But that does not mean that the authors of Genesis 1–3 regarded what they were writing as poetry.

There are two questions here. The first has to do with what the authors of Genesis intended. The second has to do with how these narratives were used at a later date. With regard to the first, it is difficult to know what was intended by unknown authors writing more than two and a half thousand years ago. But it is worth noting that mythic narratives in tribal societies are rarely, if ever, regarded as ‘merely’ metaphorical.3 This point was made by the philosopher Ernst Cassirer in his study of myth. We think of a metaphor as an imaginative representation of the object to which it is applied. This entails making a distinction between the object


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6.2 The Authority of Myths

represented and a particular way of representing it. But such a distinction, Cassirer argues, is foreign to mythic thought in tribal societies.

Where we see mere ‘representation’, myth, insofar as it has not yet deviated from its fundamental and original form, sees real identity. The ‘image’ does not represent the ‘thing’; it is the thing; it does not merely stand for the object, but has the same actuality, so that it replaces the thing’s immediate presence.¹

In this context the idea that myths are ‘merely metaphorical’ is likely to be strongly resisted.

Let me illustrate this with an example drawn from the history of my own country. The Māori people of the South Island of New Zealand identified a local range of mountains with the Tākitimu canoe that brought their ancestors to this land. We are inclined to say that this is a ’legend’, based on some kind of metaphorical identification of the mountain range with an upturned canoe. But this description trivializes the role of the myth within that culture. The early twentieth-century ethnographer who interviewed local elders wrote:

The canoe is said to have been wrecked in Foveaux Strait and the Tākitimu Mountains were named to keep the canoe in memory, but this prosaic explanation has no vogue amongst the southern natives. They assert that this great range of Takitimu is the veritable canoe turned into stone, and I did not risk my life by contradicting them.²

To call it a ‘legend’ or a ‘metaphor’ does not do justice to how seriously such stories are taken in traditional societies.

Whatever the authors of Genesis may have intended, medieval and early modern interpreters did have a more sophisticated view. A clear distinction between myth and history was first made by Greek historians of the fifth century BC,³ and late medieval authors had developed their own


understanding of the role of myth.1 But they remained resistant to regarding the words of Sacred Scripture as merely metaphorical. We see this in the Augustinian principle of the priority of Scripture, that is to say, the literal sense of Scripture. A figurative reinterpretation is legitimate only under strictly defined circumstances.2 Medieval authors would certainly have resisted the idea that the biblical history is nothing more than an allegory.3 Thomas Aquinas, for instance, accepts that a scriptural text may have multiple meanings, but insists that any figurative meaning must be built on the literal meaning. There are cases of straightforward metaphor, such as the statement that ‘God is a rock’. But in the case of the biblical narratives, the literal meaning refers to actual events. It is those events, not merely the words of the text, that point to realities beyond themselves.4

6.3 The Criticism of Myths

If myths have such authority within the communities in which they arise, how do they ever come to be questioned? There are, it seems, individual sceptics in every age, those who are inclined to take a distanced attitude toward the sacred beliefs and practices of their society. In his famous study of the Azande of the southern Sudan, Evans-Pritchard noted the existence of sceptical opinions regarding witchcraft and oracles among his informants.5 But the existence of individual sceptics does not yet make for

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4 Aquinas, Summa theologiae, 1a, qu. 1, art. 10; Chenu, ‘The Symbolist Mentality’, pp. 116–17.
a tradition of critical thinking. It is a tradition of critical thinking that is required for the emergence of science.

6.3.1 The Origins of Critical Thinking

One society that produced such a tradition was that of ancient Greece. It may not be the only society to do so. If we accept the idea of an ‘axial age’ revolution in human thought, then a similar transition occurred in a number of cultures at about the same time: between 800 and 200 BC. But I shall focus on ancient Greece, because the revolution that occurred there contributed directly to the rise of modern science. Even Galileo appeals to the natural philosophers of the classical and Hellenistic world. His mathematically-oriented physics was inspired by Archimedes, whose work Galileo refers to more than one hundred times.

A key development in ancient Greece occurred among the Milesian philosophers: those early thinkers associated with the city of Miletus, in Asia Minor (modern-day Turkey). We should not read the work of such thinkers anachronistically, seeing them as materialists or empiricists, in some modern sense. They were neither, as we shall see. But they do seem to have pioneered a critical attitude to traditional myths, including the religious myths of Greek society. Rather than merely accepting and repeating those myths, these philosophers began to discuss them and to invent new stories of their own, which they regarded as more adequate accounts.

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5 E. E. Evans-Pritchard, *Witchcraft, Oracles and Magic among the Azande* (Oxford: Clarendon Press, 1937), pp. 183, 193, 255. Note, however, that such scepticism was limited to particular instances of witchcraft; it was not directed towards the very possibility of magic.


of the nature of the world.\footnote{K. R. Popper, ‘Back to the Pre-Socratics’, Proceedings of the Aristotelian Society, NS 59 (1958–59), pp. 1–24, on p. 19; K. R. Popper, Conjectures and Refutations (1963), Routledge Classics (London: Routledge, 2002), chap. 4.} It is this tradition of critical thought that laid the foundation for later science.\footnote{While I have traced the emergence of a critical attitude to the early Greek philosophers, there may be other ways of telling this story. Yehuda Elkana, for example, has argued that a critical attitude – he calls it ‘second-order thinking’ – first emerged in the realm of political theory rather than that of cosmology. But even on this account, the outcome of the process is the same. We witness the emergence of a critical spirit, a way of thinking in which ‘nothing was any longer taken for granted’. See Y. Elkana, ‘The Emergence of Second-Order Thinking in Classical Greece’, in S. N. Eisenstadt (ed.), The Origins and Diversity of Axial Age Civilizations, SUNY Series in Near Eastern Studies (Albany, NY: State University of New York Press, 1986), pp. 40–64, on pp. 48–49, 57.}

It was not the only such foundation. The development of science also required a new conception of the natural world. G. E. R. Lloyd refers to this as a ‘discovery of nature’.\footnote{G. E. R. Lloyd, Early Greek Science: Thales to Aristotle, Ancient Culture and Society (London: Chatto & Windus, 1970), p. 8.} It involved the idea that there exists a natural order which functions in predictable ways and whose workings can be explained without reference to the gods. Thales of Miletus, for example, offers a natural explanation of earthquakes, which previously had been attributed to the will of Poseidon.\footnote{Lloyd, Early Greek Science, p. 9; see also R. D. McKirahan, Philosophy Before Socrates: An Introduction with Texts and Commentary (Indianapolis, IN: Hackett Publishing, 1994), pp. 28–29.} It is this view of the natural world that was revived, in a slightly modified form, in the twelfth century.\footnote{See chap. 1, ‘Between Athens and Jerusalem’.} A third step in the development of science was taken only a little later, with the emergence of an experimental attitude among the Greek medical writers associated with the school of Hippocrates.\footnote{}
6.3.2 The Criticism of Religious Ideas

But even if a critical attitude is only a precondition for the emergence of science, it is a necessary precondition, and one that remains central to scientific endeavour. More importantly, it was quickly extended to religion, a move that almost immediately provoked a backlash. Xenophanes, for example, does not merely satirize his contemporary, Pythagoras.\(^1\) He also criticizes Homer and Hesiod for their depictions of the gods.

The works of Homer and Hesiod were not Sacred Scripture, in the Christian sense. But they did have a foundational role in the creation of Greek religion. As the ancient historian Herodotus writes, it was Homer and Hesiod who ‘first fixed for the Greeks the genealogy of the gods, gave the gods their titles, divided among them their honours and functions, and defined their images’.\(^2\) More importantly, there existed a widely held tradition that saw a great poet as analogous to a prophet, both being intermediaries between the gods and humanity.\(^3\) Hesiod, for instance, begins his work by invoking the divine Muses.\(^4\) Although such invocations be-

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1 Lloyd, *Early Greek Science*, p. 11.


4 Hesiod, *Theogony* (*Theogonia*), lines 22–25; Dodds (*The Greeks and the Irrational*, pp. 80, 117) suggests this claim was intended quite literally. In Hesiod’s other complete work, he speaks of dedicating a tripod-cauldron to the Muses at the place ‘where they first made me start on the way of beautiful singing’; see *Works and Days* (*Erga kai Hémerai*), line 659; ET: *The Poems of Hesiod*, tr. R. M Frazer (Norman, OK: University of Oklahoma Press, 1983), p. 131
came increasingly formulaic, they were originally taken quite seriously. The status of Homer is also highlighted by the fact that his verses are found in magical texts, presumably because they were thought to have divine power.

Xenophanes, however, is not discouraged by the status of these writers. He rejects their depiction of the gods on moral grounds, declaring that Homer and Hesiod have ascribed to the gods all deeds which among men are a reproach and a disgrace: thieving, adultery, and deceiving one another.

Xenophanes is no atheist. Indeed, he wants to offer a new theology to replace the old. His conception of God resembles that which would later be put forward by Aristotle: a divinity who is ‘eternal, self-sufficient, independent and master of everything, and unmoving’. What is worth noting here, however, is that his criticism of religious myths is not an attempt to purify the mythic tradition from within, by using its own resources. Xenophanes’s theology is rational theology, based on human reason rather than a purported divine revelation.

To appreciate this, it will be useful to look more closely at Xenophanes’s view of knowledge. He is, perhaps, the first philosopher to espouse what we now call ‘fellibilism’: the idea that what we believe we know is never certain, but is always hypothetical and subject to correction. As he writes, no man has seen nor will anyone know the truth about the gods and all the things I speak of. For even if a person should in fact say what is absolutely the case, nevertheless he himself does not know, but belief is fashioned

1 Commager, The Odes of Horace, pp. 2–16.
4 Xenophanes, DK 21B11 (cited in McKirahar, Philosophy Before Socrates, p. 60).
5 McKirahar, Philosophy Before Socrates, p. 62.
6.3.2 The Criticism of Religious Ideas

over all things [or, in the case of all persons]. The last line is obscure, the general sense of the saying is clear. Xenophanes does not deny that our existing beliefs may be true. But even if they are true, we cannot know they are true. This fallibilist view of knowledge is coupled with a rejection of the idea that we can have certain knowledge through divine revelation.

By no means did the gods reveal all things to mortals from the beginning, but in time, by searching, they discover better. We can come to know the truth, including the truth about God, only through the exercise of human reason.

Xenophanes's criticism of religious myth is picked up by later Greek writers, including Plato, who is equally critical of the stories related by Homer and Hesiod and urges their censorship. Like Xenophanes, Plato wants to purify, rather than destroy, the traditional conceptions of divinity. But some writers in this critical tradition go further. Protagoras, for example, is reported to have expressed a view that corresponds to what we would call 'agnosticism'.

Concerning the gods I am unable to know either that they are or that they are not or what their appearance is like. For many are the things that hinder knowledge: the obscurity of the matter and the shortness of human life.

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6 Xenophanes DK 21B34 (cited in McKirahar, Philosophy Before Socrates, pp. 66–67).
2 Note that Xenophanes is prepared to apply this principle even to his own work; Xenophanes DK 21B35 (cited in McKirahar, Philosophy Before Socrates, p. 67).
3 Xenophanes DK 21B18 (cited in McKirahar, Philosophy Before Socrates, p. 67).
4 Despite the plural ('gods') here, Xenophanes is apparently a monotheist: see DK 21B23 (McKirahar, Philosophy Before Socrates, p. 62).
6 Plato, Republic, books 2–3 (377c–392c).
7 DK 80B4 (McKirahar, Philosophy Before Socrates, p. 387).
Thrasymachus is said to have argued, on the basis of the evils we see around us, that

the gods pay no attention to human affairs; if they did, they would not have ignored justice, which is the greatest good for men.¹

Such ideas went too far for Plato, who condemned those who hold that there are no gods or that the gods are indifferent to human affairs.²

It was not just Plato who imposed limits to critical thought when it came to religion. The ancient Greeks had no set of religious beliefs to which individuals were expected to subscribe and no formal religious authority charged with ensuring orthodoxy. Even so, some of those who engaged in critical thinking about the gods came to grief. The Greeks may have had no sacred beliefs, but they certainly had sacred practices, the maintenance of which was seen as essential to the well-being of society. As Athens suffered from a series of crises, not least of which was the interminable war with Sparta, its citizens became increasingly anxious about the effects of ‘impiety’. We see this in the ‘moral panic’ occasioned in 415 BC by the vandalism of the herms (figures of the god Hermes) and a rumour that the Eleusinian mysteries had been mockingly performed in a private home.³

A number of the new critical thinkers of the age were caught up in this reaction. The most famous of these was, of course, Socrates, who was tried and executed in 399 BC on charges of ‘not recognizing the gods of the city’ and ‘corrupting the young’.⁴ Socrates is perhaps best regarded as a scapegoat,⁵ a victim not just of religious reaction but also of malicious rumours about his teachings. We see such rumours reflected in the work of

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⁴ Plato, *The Defence of Socrates (Apologia Sōkratous)*, 24b.

the playwright Aristophanes. But the trial of Socrates was not an isolated event. About 432 BC, a professional interpreter of oracles, Diopeithes, had sponsored a decree which stated that ‘anyone who did not pay due respect to divine phenomena or who offered to teach others about celestial phenomena should be impeached’. It is difficult to know what effect this had. There is some evidence of a series of prosecutions, which included that of Protagoras. While this evidence may not be entirely reliable, it seems there did occur a religious reaction to the views of the philosophers. Even if it was occasioned by social and political factors, it was focused very clearly on what was seen as 'impiety'.

6.4 Religion and Criticism

The religion of ancient Greece was a very different kind of religion from Christianity, which harks back to an alleged divine revelation. Even so, there were limits to the critical thinking Greek society would allow, in matters religious. If this is true of Greek religion, it is even more evident in the history of scripturally based religions. There is a long and distinguished history of critical thought within Judaism, Christianity, and Islam. What is striking, however, is that it can operate only within limits. It can reinterpret, but it cannot seriously question, the foundational narratives of its community.

There are two ways in which critical thought can be exercised within religious traditions. The first is by way of internal reform. Religious reformers critique the existing beliefs and practices of their community by reference to that community’s foundational myths. They ask if these beliefs and practices in accordance with the revelation originally given by

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6 An influential work here may have been Aristophanes’s *The Clouds*; see Plato, *The Defence of Socrates* (*Apologia Sókratous*), 19d.


God and embodied in Sacred Scripture. The second way in which critical thought can be exercised is by reference to standards drawn from outside the religious tradition. The particular form of external criticism in which I shall be interested is that of critical theology. The critical theologian assesses the community’s beliefs and practices by reference not only to its foundational myths, but also to more general standards of evidence and argument. Those more general standards are generally, although not always, drawn from philosophy.

The difference between internal and external forms of criticism is nicely illustrated by Joachim Doron. In an important study of what he calls ‘Jewish self-criticism’, Doron examines the disparaging attitude of the early Zionist leaders towards the way of life characteristic of the shtetl (the traditional Jewish village of Central and Eastern Europe). He begins with the attitudes of the liberal (or ‘reform’) Jews of nineteenth-century Europe. It was these thinkers, he writes, who ‘first indulged in Jewish self-criticism’.¹ This may seem a surprising claim, for the Bible itself witnesses to reform movements within Jewish religious life. The prophets, for instance, frequently admonished their fellow Jews for their failings. But as Doron notes, this criticism was derived from what was seen as the Divine Law. It was an internal self-criticism. The self-criticism that arose in the liberal Judaism of the nineteenth century was different from this: it criticised the Jewish communities of its day for failing to live by the rational standards of modernity.

While these two forms of critical thought can overlap, in the sense that one person can engage in both, they often stand opposed. Some religious reformers are so intent on faithfulness to their community’s foundational myths that they oppose the employment of general standards of rationality. The Protestant Reformer, Martin Luther, for instance, had no interest in a philosophically-oriented theology. Philosophy might have some limited value in dealing with worldly affairs,² but when it attempts to speak

about God it is nothing more than ‘the devil’s greatest whore’.¹ Similarly, the most influential thinker behind modern Islamic revivalist movements, Sayyid Qutb, was openly hostile to philosophy. The moment when Muslim thinkers began using Greek philosophy was, in his view, the moment when they fell away from the true faith.²

6.3.1 Reform and Renewal

Let’s begin with the tradition of internal religious reform. As Doron’s article on Jewish self-criticism makes clear, it is not unique to Christianity. While the term ‘reform’ is a Jewish and Christian one, a similar word (islāh) is also found within Islam. Muslims also speak of ‘renewal’ (tajdīd) in religious contexts and cite a tradition that in every century God will raise up a ‘renewer’ (mujaddid) who will restore the true religion.³ But whatever it is called, internal reform typically takes the form of efforts to purify the religious tradition from later accretions. It seeks to return to the tradition’s foundational myths. Reformers typically complain that the authority of these foundational narratives has been forgotten or neglected and demand that it be implemented anew.

It follows that while they may speak of ‘renewing’ their tradition, religious reformers are not attempting to introduce novelties. Within Islam, in particular, the idea of ‘innovation’ (bid‘a) is deeply suspect. As one scholar writes, ‘innovation is the introduction of something new, unattested by the Prophet Muhammad. It is abhorrent to pious orthodox Muslims unless it tallies with, or at least does not contradict, the orthodox views and customs’.⁴ Orthodox views and customs are those found in the practice (sunna) of the Prophet and his companions. Like reform within

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³ This is based on a report (a hadīth) from the Prophet Muhammad, in which he says ‘Allah will raise for this community at the end of every hundred years the one who will renovate its religion for it’.
6.3.1 Reform and Renewal

Judaism and Christianity, renewal within Islam is a ‘making new’ by returning to what once was.

Within the three monotheistic traditions examples of this kind of reform are not hard to find. The biblical books of Kings tell of a reform movement initiated in the sixth century BC under King Josiah. That movement begins, as the story is told, with the discovery of a book of the law in the Temple (2 Kings 22: 8–13). One can question whether this book of the law actually existed (rather than being a convenient fiction), but this question need not delay us. The point is that the reform movement is presented as the recovery and re-implementation of an original divine revelation. The same is true of the reform movement led by the biblical prophets following the catastrophe of the Babylonian Exile in 586 BC. This, too, is presented as a return to the observation of the original Law (Torah), from which Israel had fallen away. The Protestant Reformation of the sixteenth century took the form of a return to what was thought to be the original and pure form of Christianity found in the New Testament. In a similar way, the revivalist (salafi) movements within Islam today call for a return to the original, pure Islam expressed in the teachings of ‘the pious forefathers’ (al-salaf al-sālih), found among the first three generations of Muhammad’s followers.

Internal religious reform does represent a kind of critical thought in the realm of religion, since it involves criticism of the community’s existing practices and ways of thinking. Yet because this critique takes the form of a return to the community’s foundational myths, it does not question their authority. Reformers do, at times, recognize that these foundational narratives cannot be taken at face value; they need to be reinterpreted. But reformers assume that these foundational narratives are telling the truth, even if that truth lies beneath the surface meaning of the text.

6.3.2 Critical Theology

The second way of exercising critical thought seeks to apply general norms of rationality to religious beliefs. This is most clearly expressed in the practice of what I shall call critical (rather than confessional) theology. I am using this phrase in a broad sense, to refer to any kind of theology that is responsive to more general standards of evidence and argument. The contrast here is with a theology whose standards are entirely internal to
the tradition within which it is operating. Here is a useful rule of thumb for distinguishing the two. If a theologian provides a reasoned defence – whether good or bad – of her appeal to what she is regarding as a divine revelation, then her work is an example of critical theology. If, on the other hand, she acts as if this alleged divine revelation is a non-negotiable starting point, which needs no argument, her theology is confessional.

Readers familiar with contemporary theology might be interested in some examples. In my view, the work of Gordon Kaufman and David Tracy would be clear instances of critical theology.\(^1\) Kaufman’s work is particularly interesting, for in a later edition of his *Systematic Theology* he records his own attempt to break with what he calls the ‘authoritarian’ character of theology.\(^2\) The theology of Karl Barth, on the other hand, is unashamedly confessional,\(^3\) as is that of more traditional modern theologians, such as Louis Berkhof. Other thinkers can be more difficult to classify. More recent theologians, for instance, have begun to employ general forms of argumentation, but only as a preliminary move, in order to justify their subsequent adherence to norms that are internal to their own tradition. The so-called ‘postliberal’ theology of George Lindbeck is a good example.\(^4\) Making use of the later work of Ludwig Wittgenstein, Lindbeck defends what is, in effect, a confessional theology.\(^5\)

A detailed discussion of the tradition of critical theology would take us too far afield. But it is not required, since the point I want to make here is

\(^1\) My classification has something in common with that of Hans Frei, who also offers these two examples. See H. Frei, *Types of Christian Theology*, ed. G. Hunsinger and W. C. Placher (New Haven, CN: Yale University Press, 1992), pp. 28–34.


\(^3\) See chap. 5, ‘Liberal Theology and its Aftermath’.


\(^5\) As David Tracy remarked of Lindbeck’s work, ‘the hands may be the hands of Wittgenstein and [Clifford] Geertz, but the voice is the voice of Karl Barth’. See D. Tracy, ‘Lindbeck’s New Program for Theology: A Reflection’, *The Thomist*, 49 (1985), pp. 460–72, on p. 465.
a simple one. While critical theology can be remarkably bold, there are limits beyond which it will not be permitted to go. When it carries its critical analysis too far, it meets with opposition, either from religious authorities or by way of a popular backlash.  

Let me begin with the external pressures. It would be easy to cite examples of theologians who have come into conflict with Church authorities because they carried their critical thinking too far. But the example I shall take is that of the twelfth-century theologian, Peter Abelard. Abelard is best known today for his tempestuous affair with Heloise, the niece of a canon of Notre-Dame, whom he had been tutoring. But his significance in this context stems from the distinctive character of his theology. Abelard shared with a number of his twelfth-century colleagues a critical attitude to authority in general. Abela...
Abelard’s aim in doing this was not to encourage scepticism.\textsuperscript{1} It was to show that we must apply our own judgement in matters of faith, rather than merely accepting what others have said. As he writes in the prologue to that work,

we have undertaken to collect diverse sayings of the Holy Fathers, which stand out in our memory to some extent due to their apparent disagreement on some question. This may provoke weak readers to the greater exercise of seeking the truth and render them more acute as a result of the investigation.

The ‘first key of wisdom’, he writes, is ‘assiduous or frequent questioning. ... By doubting we come to questioning and by questioning we perceive the truth’.\textsuperscript{2}

What is particularly interesting about Abelard’s theology is that it subjects the Christian faith to scrutiny in the light of more general norms of rationality. Abelard began his academic life as a teacher of dialectic (what we would call ‘logic’). Even when he turns to theology, he remains a philosopher, ‘Christ’s philosopher’, as Peter the Venerable called him,\textsuperscript{3} but a philosopher nonetheless. Nowhere, perhaps, is this more evident than in his \textit{Collationes},\textsuperscript{4} also known as the \textit{Dialogue of a Philosopher with a Jew and a Christian}. This is not so much a dialogue between three people – the Jew and the Christian never speak with each other – as a questioning of both Jew and Christian by the philosopher.

\begin{thebibliography}{9}
\bibitem{3} Clancy, \textit{Abelard}, p. 2.
\end{thebibliography}
6.3.2 Critical Theology

It is the philosopher who takes the lead because, he says, ‘it is the task of philosophers to investigate the truth by reasoning and in all things to follow the lead of reason, not people’s opinion’. Accordingly, his first challenge to both Jew and Christian is to ask them if they have reasons for their beliefs.

Is there some reason which led you to your particular faiths, or are you here following common opinion alone and love of your own people? Should the first alternative be the case, it deserves full approval, whereas the other alternative is entirely unacceptable. To hold to a religious position because you have reasons for it is good; simply to follow in the footsteps of your ancestors is not.

What is striking about this work is that both the philosopher and the Christian adopt a position that seems at odds with a traditional view of faith. This view is expressed in the work of both St Augustine and St Anselm (Anselm of Canterbury, 1033–1109). St Augustine undoubtedly values reason in matters of faith; indeed he defines faith as ‘thinking with assent’. But he often suggests that the assent should take priority over the thinking. As he remarks, ‘unless you believe, you will not understand’. The Christian, on this view, should not seek to understand so as to believe, but should believe so as to understand.

1 Abelard, Collationes, p. 3.
2 Abelard, Collationes, p. 9.
3 The ‘philosopher’ here is, admittedly, a character in a dialogue, but other passages in Abelard’s writings reflect a similar attitude. See Marenbon and Orlandi, ‘Introduction’, p. lvii.
6 Augustine, In Evangelium Ioannis Tractatus, tractate 29, § 6 (on John 7:14–18); ET: ‘Lectures or Tractates on the Gospel according to St John,’
repeated by St Anselm, who famously defined theology as ‘faith seeking understanding’.1

In Abelard’s work, however, the Christian agrees with the philosopher that nothing should be believed unless it is first understood. It is not ‘reasonable’, the Christian says, ‘to accept what is doubtful, unless the reason why it should be accepted is first proposed’.2 It is hard to know what falls under the scope of the phrase ‘what is doubtful’. It could be that the basic tenets of the faith are not subject to such a demand, although this would hardly be consistent with the dialogue as a whole. In any case, the same idea is found in Abelard’s autobiographical sketch, the Historia Calamitatum (‘History of my Misfortunes’). Abelard notes that he wrote his first book on theology because his students were always seeking for rational and philosophical explanations, asking for reasons they could understand rather than mere words, saying that it was futile to utter words which the intellect could not possibly follow, that nothing could be believed unless it could first be understood, and that it was absurd for anyone to preach to others a thing which neither he himself nor those whom he sought to teach could comprehend.3

‘Nothing can be believed unless it is first understood.’ While this is a report of his students’ views, Abelard does not distance himself from it and it may be an implied criticism of St Anselm’s position.4

I have described Abelard as perhaps the first example of a ‘critical’ theologian. But ‘criticism’ here does not mean ‘finding fault with’. Al-

2 Abelard, Collationes, p. 91.
though Abelard may find fault with certain theological views, such as a particular understanding of the atonement,¹ he does so only out of loyalty to the Christian tradition as a whole. He, too, is no modern rationalist. Ironically, however, the use of reason in support of the faith can be just as challenging to religious authority as the use of reason to undermine it.

Abelard believed, for instance, that the doctrine of the trinitarian nature of God was accessible to those outside the Christian tradition.² To affirm that God is triune, he argues, is to affirm that he has the three attributes of being powerful, wise, and benign. Since these are the qualities that any intelligent person will attribute to the divinity, this apparently distinctive Christian doctrine is knowable by reason.³ The problem with this view is that it renders a special act of divine revelation all but redundant. Faith now becomes a simple acceptance of a truth that is evident to any reflective observer.

Abelard is careful to affirm that knowledge of the divine can come about only through revelation.⁴ But he understands ‘revelation’ in a way that makes it all but indistinguishable from reason. After all, he not only claims that pagan philosophers grasped these truths about God. He also argues that they would have been saved by living in accordance with what they had understood.⁵ So Abelard’s conception of revelation may be like his conception of divine grace: it is something that God provides to all,

⁴ Abelard, Theologia Christiana, book 2, in Patrologia Latina 178, col. 1220; Abelard’s Christian Theology, p. 68.
⁵ Abelard, Theologia Christiana, book 2, in Patrologia Latina 178, col. 1173; Abelard’s Christian Theology, p. 60.
simply by creating them as they are. Such a view is not easily reconcilable with the traditional conception of faith, which involves the acceptance of truths on the authority of God, truths that in some cases we could never attain on our own. When it comes to trinitarian belief, for example, Aquinas would expressly reject that idea that the triune nature of God can be known by ‘natural reason’.

Abelard was accused of particular doctrinal errors. But it seems to have been his critical approach to matters of faith that provoked the wrath of St Bernard of Clairvaux. St Bernard may be regarded as representative of an older style of theology, associated with the monasteries rather than the cathedral schools. The theology of the cathedral schools and (later) the universities differed from that of the monasteries insofar as it drew on the authority of philosophers as well as that of the Bible. Its primary tool was the method of disputation, in which differing opinions were set out and discussed. The monks frequently regarded this style of theology with alarm. Their preferred style of theological reflection was a continuation of that found among the Church Fathers, closely tied to the authority and

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2 See chap. 7, ‘Faith and Belief’.
3 Aquinas, *Summa theologiae*, 1a, qu. 32, art. 1.
4 D. E. Luscombe, *The School of Peter Abelard: The Influence of Abelard’s Thought in the Early Scholastic Period*, Cambridge Studies in Medieval Life and Thought, Second Series, 14 (Cambridge: Cambridge University Press, 1970), p. 111. This is, admittedly, something of an oversimplification, since (as Constant Mews writes) ‘there were many monks who were keenly interested in the theological writings emerging from the schools’, to which monks sometimes went to study; see C. J. Mews, ‘Bernard of Clairvaux and Peter Abelard’, in B. P. McGuire (ed.), *A Companion to Bernard of Clairvaux*, Brill’s Companions to the Christian Tradition (Leiden; Boston: Brill, 2011), pp. 133–68, on p. 168. But the clash between Bernard and Abelard can still be considered representative of two styles of theology: that of the monasteries, on the one hand, and the cathedral schools on the other.
language of the Bible. They shared the Fathers’ suspicion of knowledge for its own sake, the seeking of which they regarded as a vice, that of vain ‘curiosity’.\(^1\)

This is certainly true of St Bernard, who held that theology should proceed ‘through prayer rather than through disputation’.\(^2\) He shared with his fellow monastics the fear that a theology based on the independent use of reason would overstep its proper bounds. William of St James of Liège expressed the monks’ concerns very precisely when he spoke against the ‘innovators who apply to faith the yardstick of reason’ and who ‘make faith derive from understanding rather than understanding from faith’.\(^3\)

St Bernard does list a number of what he considered heretical propositions drawn from Abelard’s work.\(^4\) But he seems particularly concerned with the freedom with which Abelard applied reason to matters of faith. Here’s the beginning of St Bernard’s letter to Pope Innocent II, denouncing Abelard.

We have in France an old teacher turned into a new theologian, who in his early days amused himself with dialectics, and now gives utterance to wild imaginations upon the Holy Scriptures. He is endeavouring again to quicken false opinions, long ago condemned and put to rest, not only his own, but those of others; and is adding fresh ones as well. I know not what there is in heaven above and in the earth beneath which he deigns to confess ignorance of: he raises his eyes to Heaven, and searches the deep things of God, and then returning to us, he brings

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1 Leclerq, *The Love of Learning and the Desire for God*, p. 252.


4 For a summary and evaluation, see Luscombe, *The School of Peter Abelard*, pp. 114–42.
back unspeakable words which it is not lawful for a man to utter, while he is presumptuously prepared to give a reason for everything, even of those things which are above reason.¹

In St Bernard’s view, Abelard’s theology is nothing less than human reason overstepping its proper bounds.² St Bernard goes on to cite a remark by St Gregory the Great (AD 540–604), that ‘the kind of faith for which human reason provides proof has no merit’.³ Ironically, this is one of the first propositions set out for discussion in Abelard’s Sic et Non. Abelard at times seems to endorse this (entirely traditional) view,⁴ and it would later be defended by Aquinas.⁵ But in the Dialogue of a Philosopher with a Jew and a Christian, Abelard puts a scathing response into the mouth of the philosopher. He suggests that those who cite St Gregory’s saying do so because they lack the ability to engage in the necessary reasoning.⁶

Abelard survived not one but two condemnations of his work – one in 1121 and another in 1140 – and died, safely out of the public eye, under the protection of Peter the Venerable, the powerful Abbot of Cluny. But if practitioners of a critical theology are lucky enough escape censure by religious authorities, they may still encounter a popular backlash to their ideas. The most striking example of such a backlash is the movement known as ‘fundamentalism’.

⁴ See the editors’ note in the Collationes (p. 90, n. 24), which points out two occasion on which Abelard uses this quotation in a way that suggests he approves of it, and one other in which he uses it disparagingly.
⁵ See chap. 7, ‘Aquinas on Faith’.
⁶ Abelard, Collationes, p. 91.
Fundamentalism is a complex phenomenon. It is a reaffirmation of the authority of its community’s foundational myths at a time when these have been called into question. So it emerges, or at least becomes visible, at particular periods of religious history. But it is a reaffirmation of an attitude that always exists, one that is characteristic of scripturally based religions. Such religions, as we have seen, regard their fundamental beliefs as divinely revealed: these beliefs are, to use Rappaport’s phrase, sacred postulates.¹ What fundamentalists do is to act upon this conviction, taking it more seriously than many of their fellow believers.

It follows that fundamentalism is not a perversion of the ‘true’ religious spirit, as some of its critics like to think. Rather, it embodies an attitude towards knowledge that is normative within religious communities. That attitude holds, among other things, that religious beliefs should take priority over any ‘merely human’ claims to knowledge. This is particularly dangerous when religious thinkers have an ‘expansionist’ view of scriptural authority: one that refuses to limit its scope. But as my earlier discussion has shown, this view also has roots in Christian tradition and is echoed in modern statements of Roman Catholic teaching.²

What the work of Abelard signified was the emergence of a critical attitude to religious authority, rooted in the new epistemic norms of the cathedral schools and (in the following century) the arts faculties of the universities. Abelard did not, of course, question the divine origin of Sacred Scripture, although he did warn against scribal errors and noted that even prophets and apostles have sometimes fallen into error.³ There were sceptics even in medieval Europe,⁴ but openly to deny biblical authority would have been suicidal. In any case, there is no indication that Abelard wanted to do so. What he was questioning were traditional interpretations of the Bible. But even this provoked a backlash. A more radical question-

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¹ See chap. 5, ‘A Certitude No Longer Open To Doubt’.
² See chap. 4, ‘The Scope of Biblical Authority’ and ‘Has Anything Changed?’
³ See the prologue to Abelard’s Sic et Non.
ing of biblical authority would occur only at a later date, in the seventeenth century.

A key figure here was the Jewish philosopher Baruch (or Benedict) Spinoza, who suffered the fate of so many critical religious thinkers, being excommunicated from the synagogue. Spinoza outlined a program for what came to be known as the ‘historical criticism’ of the Bible, treating the Scriptures in the same way as any other set of ancient documents. This program reached its high point in the nineteenth century, when an increasing number of scholars set out to interpret the Bible ‘like any other book, by the same rules of evidence and the same canons of criticism’. It is this movement that shaped the liberal theology of thinkers such as Ernst Troeltsch, who embraced what he called a ‘historical’ rather than ‘dogmatic’ approach to theology. The same movement also influenced the work of Andrew Dickson White. White sees the Bible as one of a number of sacred books that reflect the development of human ethical and religious thought, although in ways that are cloaked in myth and legend. He devotes almost a third of his second volume to the development of this new understanding of Sacred Scripture, reserving particular praise for Spinoza. But while White and the liberal theologians embraced this new understanding of the Bible, fundamentalists decisively reject it.

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4 See chap. 5, ‘Liberal Theology and its Aftermath’.
6.3.3 Limits to Criticism

What gave the modern fundamentalist movement its name was the publication, between 1910 and 1915, of a series of pamphlets known as *The Fundamentals*. These were widely distributed, free of charge, with the aid of money from Lyman and Milton Stewart, the founders of the Union Oil Company of Los Angeles.¹ Amongst the doctrines that they set out to defend was the divine inspiration of the Bible, which they claimed historical criticism had called into question. As one of their authors wrote,

the formative forces of the Higher Critical movement were rationalistic forces, and the men who were its chief authors and expositors ... were men who had discarded belief in God and Jesus Christ Whom He had sent. The Bible, in their view, was a mere human product. It was a stage in the literary evolution of a religious people. ... it certainly was not given by the inspiration of God, and is not the Word of the God."²

The same author condemns the liberal theologians of his day: those who *claim* to be believers in biblical authority, but who employ the methods and assumptions of the historical (or 'higher') critics when studying the Bible. In this author’s view, there should be no compromise between Christian faith and the critical spirit of modern thought.

The ongoing influence of fundamentalism, particularly in the United States, scarcely needs to be documented. The young-earth creationist movement, which opposes the theory of evolution by natural selection, is its most visible sign. Roughly 47% of the American population will agree that ‘God created man pretty much in his present form at one time within the last 10,000 years’.³ Nor is the influence of such movements limited to the United States or to Christianity: creationism has become a global phenomenon and has spread to other faiths. Even in apparently secular and sceptical European countries, such as Switzerland and Germany, young-

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earth creationists represent about 20% of the population. Among Asian countries, Korea now has a flourishing and influential creationist movement. While modern creationism has Christian origins, by the late twentieth century it had also spread to Islam (particularly in Turkey) and among orthodox Jews worldwide.

In practice, then, the project of critical theology – that of assessing the articles of faith by reference to more general norms of rationality – can succeed only within limits. These limits are not, however, simply imposed from without, by fundamentalist reactions to critical thought. They arise from the very nature of theological thinking. If the theologian intends to speak about the Christian God (or the God of Judaism or Islam, as the case may be), then her theology must begin with the acceptance of the community’s foundational narratives. One does not need to be a theologian to appreciate this; the anthropologist Clifford Geertz makes the same point. ‘The basic axiom’, he writes, ‘underlying what we may perhaps call “the religious perspective” is everywhere the same: he who would know must first believe’. Geertz is, of course, echoing a traditional Christian view, reflected in St Augustine’s ‘unless you believe, you will not understand’. It follows that even when theologians take on the task of reinterpreting their community’s myths, they continue to be bound, at least to some degree, by their authority.

What is true of theology is true of religious beliefs in general: cut off from their mythic origins, such beliefs would be nothing more than series of disconnected philosophical and ethical propositions. Mythic narratives are what hold a religious tradition together and give it its distinctive identity. Liberal theologians, it must be said, feel less bound to traditional formulations than their more conservative colleagues. They keep to a minimum those propositions they regard as unquestionable. But even liberal

1 Numbers, The Creationists, p. 409.
5 Augustine, De libero arbitrio, book 1, chap. 2, para. 4; see chap. 6, ‘Critical Theology’.
thinkers cannot entirely evade the constraints imposed by an authoritative tradition. Gordon Kaufman, for instance, is one of the most influential of liberal theologians. Yet even he admits that the starting point of theological reflection must be ‘the categories and concepts and images provided by tradition and history’, the tradition in question being that of Christianity. These Christian ‘categories and concepts and images’ are of interest because they are presumed to convey some truth, a presumption that is at least analogous to the traditional act of faith. We can access that truth, Kaufman writes, ‘only by studying these traditions and attempting (at least imaginatively) to appropriate them, making their commitments ours’.

6.5 Science and Criticism

Modern science has inherited and extended the critical spirit of the ancient Greeks, including (of course) a critical attitude towards religion. In contrast with religion, it is not bound to any particular set of doctrines. The critical spirit of modern science goes hand in hand, as it did for Xenophon, with a fallibilist view of knowledge, which recognizes that even our best-supported scientific theories may one day be overturned.

A useful statement of this attitude is found in a famous essay, published by the sociologist of science Robert K. Merton in 1942. Merton’s focus was on what he called ‘the normative structure of science’: the set of cultural norms and values governing how science is practised. He identified four such norms, which, he argued, constitute the ‘ethos of science’. The first of these is universalism: the fact that the ‘race, nationality, religion, class, and personal qualities’ of a scientist are treated as irrelevant

2 Kaufman, In Face of Mystery, pp. 450–51.
3 Kaufman, In Face of Mystery, p. 28.
factors in the assessment of her scientific work. As Louis Pasteur wrote, ‘The scientist has a nationality; science does not’. The second is what Merton calls communism: the idea that the results of science are considered to belong to all. They ‘constitute a common heritage in which the equity of the individual producer is severely limited’. This is, Merton notes, why priority disputes are often so fierce: the claim to be the first to make a discovery is really the only claim a scientist can make with regard to her results. The third norm is disinterestedness. Individual scientists may be passionately committed to their own theories, but the norms of the community ensure that their partiality will not distort the science. Fraud, for instance, is relatively rare, not because scientists are more virtuous than other people, but because ‘the activities of scientists are subject to rigorous policing, to an extent perhaps unparalleled in any other field of activity’.

It is, however, the last of Merton’s norms that is of particular interest here. It is what he calls organized scepticism: it involves ‘the temporary suspension of judgment and the detached scrutiny of beliefs in terms of empirical and logical criteria’. The ‘organized scepticism’ of science means that no ideas are exempt from critical examination. This, of course, assumes what I have already argued: that no scientific theory represents certain knowledge. Once cannot set out to be sceptical about claims that are established beyond doubt. Individual scientists may act as though their theories were the last word in the field, but the community as a whole will not accept this idea. It will regard no scientific theory as beyond revision.

The reader will not be surprised to learn that Merton’s ideas have themselves been subject to criticism. Critics have claimed, among other

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1 Le savant a une patrie, la science n’en a pas, cited in Merton, ‘The Normative Structure of Science’, p. 272 (translation my own). The saying distinguishes nicely between Merton’s two levels of analysis: that of collective and individual norms. (See chap. 9, ‘Orthodoxy and Dissent’.)
5 For an extensive list of such criticisms, see N. Toren, ‘The Scientific Ethos Debate: A Meta-theoretical View, Social Science & Medicine, 17
things, that his so-called ‘norms’ are too vague to effectively constrain behaviour;¹ that this alleged ‘ethos’ is nothing more than an ideology, undergirding power relations among scientists and in society at large,² and that violations of such norms can and sometimes do produce first-rate science. (James Watson’s less than flattering account of the discoverers of DNA is often taken as a case in point.)³) But the least contestable of Merton’s claims is that regarding organized scepticism. If the scientific community does anything, it provides a context within which particular claims can be treated sceptically and critically tested, if not by their authors then certainly by others.

I shall come back to this point.⁴ In the meantime, let me add just one qualification. The sceptical spirit that characterises the procedures of scientific communities will not entail a scepticism carte blanche, for it will be impossible to subject all our beliefs to critical scrutiny at any one time. We need to take some beliefs for granted, at least for the moment, so that we can have a basis on which we can criticise others. This idea was given vivid expression by the philosopher of science Otto Neurath.

We are like sailors who on the open sea must reconstruct their ship but are never able to start afresh from the bottom. Where a beam is taken away a new one must at once be put there, and for this the rest of the ship is used as support. In this way, by using the old beams and driftwood, the ship can be shaped entirely anew, but only by gradual reconstruction.⁵


4 See chap. 9, ‘Orthodoxy and Dissent’.


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Science can subject its evidential base to critical examination only in a piecemeal fashion. But no part of that evidential base is sacrosanct. The beliefs that we have taken for granted at one moment can be subjected to criticism at a later date. The result may eventually be the rejection of an entire system of beliefs, as in the case of the replacement of Newtonian physics by that of Einstein in the early twentieth century.¹

It is true, too, that not all our scientific beliefs are equally likely to be subject to criticism. Some features of the structure of scientific knowledge are more foundational than others and are therefore less likely to be abandoned. In the experimental testing of Newtonian physics, for example, Euclidean geometry was not under any immediate challenge. It was taken for granted, since it was assumed to be the only kind of geometry there was. It took four hundred years for this assumption to be overturned, but overturned it was. The physics of Einstein employs a (deeply unintuitive) non-Euclidean geometry, drawn from the work of nineteenth-century mathematicians such as Georg Friedrich Riemann.

Are there any scientific principles that are truly unquestionable, perhaps assumptions that one must make in order to do science at all? One might argue that there are, but I shall return to this question later.² For the moment I need note only that science ‘makes scepticism a virtue’ in a way that religion does not.³ This is not true merely of modern science. We have seen hints of this attitude in the natural philosophy of the twelfth and thirteenth centuries, which revived both the ancient sense of a natural order – what I have called ‘the rediscovery of nature’ – and a sceptical attitude to authority. Then, too, this attitude met with opposition from religious thinkers, especially when it was extended to theological matters. The root cause of this conflict is the idea that faith is a source of knowledge, one that is distinct from and more reliable than ‘mere’ human reason. It is to this idea that I must now turn.

² See chap. 8, ‘Scientific Acts of Faith’.
7. FAITH AND KNOWLEDGE

What I have been arguing is that there exists a clear contrast between religion and science. It can be found in the differing attitudes to knowledge characteristic of religious and scientific communities. Religious communities have traditionally insisted on the certainty of their claims to knowledge, which are resistant to radical criticism in ways that have no parallel within science. What I have not yet done is to examine the root cause of this difference.

What gives rise to these contrasting attitudes is the idea that religious faith offers a source of knowledge that is distinct from human reason. Religious and scientific claims sometimes overlap: they would (if true) have a common referent, even when that referent is described very differently. But religious believers consider themselves to have a source of knowledge that science lacks. Their claims to knowledge are based not merely on human insight and reflection, but also on faith. We can think of this idea — that knowledge arises from both faith and reason — as a kind of ‘epistemological dualism’. It is time to examine the conception of faith that underlies this view.

7.1 Religious Faith

Let me begin with an observation. There exists a misunderstanding of religious faith, which is common among philosophers. It assumes that religious faith falls into one of our familiar categories of belief. Philosophers, it should be noted, use the term ‘belief’ very broadly. To believe something, in the philosophical sense, is simply to hold it to be true. We can hold things to be true with varying degrees of conviction. I may be entirely confident, for instance, that there is a coffee cup on the desk in front of me. In these circumstances, I would probably not say that I believed it; I would

1 See my Introduction, ‘Goals and Means’.
simply assert what I see as a fact. (‘There is a coffee cup on my desk.’) But as far as philosophers are concerned, it would still constitute a belief.

There are some things we cannot help but believe: we cannot avoid taking them to be true. The existence of other people, with minds of their own, seems to be one of these. To seriously consider that other people might be merely a figment of my imagination – not just taking this as a possible state of affairs, but actually suspending belief in their existence – is to risk insanity. (I shall come back to this point later.) But outside of such special cases, many philosophers argue that we should proportion our belief to the evidence available. This position is often referred to ‘evidentialism’ and is found in the works of both John Locke and David Hume. Indeed it seems to many philosophers almost self-evidently correct. A common criticism of religious belief is that it is not proportioned to the available evidence. It is held in the absence of adequate evidence and is not given up, or even weakened, in response to counter-evidence. Why is this?

This phenomenon becomes less puzzling when we realize that religious faith is not simply another instance of belief. My point is not merely that religious faith adds something to belief. The religious person does not merely hold certain propositions to be true. Her belief has an affective dimension and is accompanied by a commitment to live a certain way of life. This is surely true, but the differences go deeper. They relate to the grounds on which one believes. Religious belief (as traditionally understood) is not the kind of belief that all human beings form spontaneously, and which we cannot avoid forming, when placed in the right circumstances. (It is not what philosophers call a ‘basic’ or ‘non-inferential’ belief.) But nor is it the kind of reflective belief that is formed in response to evidence and arguments. It forms a third category of belief, which is formed in the absence of adequate evidence by a deliberate choice, an act of the will.

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3 See ‘An Assessment’, in the present chapter.
I shall provide support for these claims shortly. For the moment, let me note that they help to explain a feeling common among atheist philosophers: that the arguments put forward by believers are merely post hoc rationalizations. They are not actually the grounds on which such thinkers hold their beliefs, but are being produced merely to defend them. Atheists are likely to regard this as inappropriate. But it corresponds to a widely held Christian view of how faith and reason should interact. On this view, the act of faith is independent of rational considerations; the only appropriate role for reason is to lend it support.

This view of faith is perhaps most clearly expressed in the work of Thomas Aquinas. Aquinas is certainly a dominant figure within Roman Catholic thought. Not only does he shape later Catholic tradition, but his work reflects ideas found in earlier Catholic writers. St Augustine, for example, resembles Aquinas in holding that faith is the product of a rightly guided will (voluntas), rather than of any evidence that might be produced in its support.\(^1\) The Protestant Reformers of the sixteenth century departed from Catholic tradition on many matters. But despite these disagreements (regarding, for example, human freedom), their views on faith also resemble those found in Aquinas.\(^2\) What about more recent Christian thinkers? I cannot claim that all modern theologians would accept Aquinas’s view of faith, but something closely resembling it has been defended by the twentieth-century Calvinist theologian Louis Berkhof and by the philosopher William Lane Craig.\(^3\) So we can regard Aquinas as broadly representative of a major stream in Christian tradition.\(^4\)

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7.1.1 The Faith of Demons

A helpful place to begin is with Aquinas’s discussion of what he calls ‘the faith of demons’. The idea that demons have faith may seem odd. They are, after all, fallen angels who have rebelled against God. But the New Testament states that the demons do believe, while also noting that this faith will not save them (James 2:19). This poses a theological problem. In what sense can demons be said to have faith? If they do have faith, why is this faith of no religious value? Why does it not bring them salvation?

It is of the essence of faith, Aquinas holds, to assent to some truth in the absence of insight into the facts that make it true. Aquinas believes that demons have angelic intellects which are greatly superior to ours. Even so, there are truths about God which they cannot grasp unaided. If they are to know these truths, they can do so only by means of divine revelation. But the demons are clever enough to recognize the signs that what the Church teaches is divinely revealed. So they are forced, despite themselves, to recognize that there exist truths that are revealed by God and must, therefore, be true.

This is a type of faith, but Aquinas holds it to be quite different from religious faith, properly so-called. The faith of demons lacks merit: it does them no good in the eyes of God. Why does it lack merit? It does so because it is motivated by evidential considerations: the demons’ belief is brought about by signs that these propositions been revealed by God. Aquinas holds that any act of faith that is the result of evidence and arguments lacks merit. The believer does not lose any merit, in the eyes of

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1 Aquinas, *Summa theologiae*, 2a 2ae, qu. 5, art. 2; *De veritate* qu. 14, art. 9 ad 4.
3 As Aquinas says (*De veritate*, qu. 14, art. 9, ad 4), the terms ‘belief’ is ‘predicated equivocally’ of men and demons.
God, if she seeks out reasons that support her belief after making the act of faith. But her faith would not be properly religious if the reasons in question preceded and brought about her act of faith.¹

This, too, was not a new idea. The reader may recognize it as the view expressed by St Gregory several hundred years earlier, and which is echoed in St Bernard’s arguments against Abelard: ‘The kind of faith for which human reason provides proof has no merit’.² It had been reaffirmed in the instructions of Pope Gregory IX to the theologians of Paris in 1228.³ But while this is an entirely traditional view, it has some striking implications, which are rarely made explicit. It means, for instance, that if a Christian philosopher succeeded in arguing a non-believer into accepting Christian doctrines, the latter’s acceptance of those doctrines would not constitute an act of faith, properly understood.

Aquinas believes there are truths about God that you could be argued into accepting. He thinks, for instance, that there are good arguments in support of the existence of God. But even these truths ought to be the object of a properly religious act of faith. The believer, as believer, is not to accept them on the basis of the arguments that can be marshalled in their support. There is nothing to prevent one person from assenting these truths on the basis of reason and another doing so by faith.⁴ It may also be possible for the same person to assent on the basis of reason on one occasion and by faith on another.⁵ One might, for instance, be predisposed to believe by rational arguments and then later make an act of faith.⁶ But faith and reason remain distinct ways of attaining knowledge.⁷ Indeed

¹ Aquinas, Summa theologiae, 2a 2ae, qu. 2, art. 10.
² See chap. 6, ‘Critical Theology’.
³ Jaroszyński, Science in Culture, p. 81.
⁴ Aquinas, De veritate, qu. 14, art. 9.
⁵ Aquinas at least suggests this: Summa theologiae, qu. 2, art. 10, ad 2.
⁶ This seems to be what Aquinas is saying in De veritate qu. 14, art. 9 ad 9; for comment, see Jenkins, Knowledge and Faith in Thomas Aquinas, p. 198 and Shanley, The Thomist Tradition, p. 25.
⁷ I am assuming that Aquinas regards faith as yielding knowledge, since he holds that Christian theology is a kind of scientia (Summa theologiae, 1a, qu. 1, art. 2) and scientia involves knowledge.
7.1.1 The Faith of Demons

they are, in a certain sense, *mutually exclusive* ways of attaining knowledge.\(^1\) If you grasp a revealed truth by reason, you cannot simultaneously have faith in it; if you have faith in it, you cannot simultaneously grasp it on the basis of reason.\(^2\)

7.1.2 A Non-E evidentialist View

There are those who will reject this sharp distinction between faith and reason. They will argue that Aquinas holds something much closer to an evidentialist view: that while the religious act of faith may go *beyond* reason, it is based *on* reasons.\(^3\) The reasons in question are those that support the claim that what we believe is divinely revealed. While such a conception of faith may well be defensible — it resembles that held by John Locke\(^4\) — it cannot plausibly be attributed to Aquinas. As we shall see in a moment, Aquinas insists that faith requires an act of the will. But he elsewhere makes it clear that the intellect cannot help but accept evident truths.\(^5\) So if the reasons in support of the faith were *decisive* arguments, no act of the will would be required. Faith would be a simple matter of intellectual insight. If, on the other hand, the act of faith were the result of merely *persuasive* arguments (which fall short of demonstration), this would make nonsense of the idea that faith yields certain knowledge. Aquinas does have a doctrine of the ‘preambles of faith’ (*praemaculae fidei*), but these are not arguments that lead to faith.\(^6\) They are simply beliefs that the act of faith presupposes and which can, at least in principle,

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1. This does not, of course, mean that what is believed cannot *later* be supported by reasons. As we have seen, for Aquinas it can (*Summa theologicae*, 2a 2ae, qu. 2, art. 10). But this is a different issue.
4. See chap. 5, ‘Against Enthusiasm’.
5. Aquinas, *Summa theologicae*, 1a 2ae, qu. 17, art. 6; *De veritate* qu. 14, art. 1.
6. This was the central point of the ground-breaking article by G. de Broglie, which tried to correct what had been a widespread misunderstanding of Aquinas; see G. de Broglie, ‘La vraie notion thomiste des “praemaculae fidei”’, *Gregorianum*, 34 (1953), pp. 341–89.
be proven rationally. Knowledge of such arguments is neither necessary nor sufficient for faith.\(^1\)

For Aquinas, the act of faith is not a simple response to evidence, because it is not simply an intellectual affair. It is a decision, an act in which the will commands the intellect to believe. Philosophically minded readers might hesitate at this point, for it is not clear that we can choose to believe something. (Try it. Choose to believe – not merely to imagine or to entertain the idea – that I was sitting in a café as I wrote this.) If we cannot do so, then some reinterpretation of Aquinas’s view may be needed. Rather than saying that the will commands belief, it might be better to say that the will commands us to accept that certain truths are revealed by God. We commit ourselves to regarding them as true, to taking them as premises in any relevant process of reasoning.\(^2\) But since Aquinas does not make this distinction, I shall continue to talk about ‘belief’.

However we think about the act of faith, we must still try to understand its grounds. If it is not a simple response to arguments and evidence, to what is it a response? Aquinas’s discussions of this topic seem to distinguish two kinds of motivations.\(^3\) The first consists of those factors that predispose a person to believe. The second is the motivation that is involved in the act of faith itself.

Let’s start with that which predisposes a person to believe. We may be predisposed to believe by rational arguments in support of the faith. But Aquinas holds that these arguments will fall short of proof; they will not

\(^1\) Shanley, *The Thomist Tradition*, p. 21.


\(^3\) This is, perhaps, clearest in his *Commentary on the Gospel of St John* lecture 5, sect. 2, § 662, where Aquinas distinguishes between those arguments that lead one to faith and that which motivates the act of faith itself. If I depart from some other recent commentators on Aquinas, it is in making this distinction clear, although it is also found in Rosental’s account (*Lessons from Aquinas*, pp. 109, 121).
be decisive. We know this because not everyone is persuaded by such arguments.

As regards ... man's assent to the things which are of faith, we may observe a twofold cause, either of one of external inducement, such as seeing a miracle, or being persuaded by someone to embrace the faith. Neither of these is a sufficient cause, since of those who see the same miracle, or hear the same sermon, some believe, and some do not. Hence we must assert another internal cause, which moves man inwardly to assent to matters of faith.¹

In other words, it is not only the evidential considerations that predispose us to believe. There is another motivation, which appeals to the will rather than the intellect.

Aquinas sometimes suggests that what motivates the will is a realization that belief is appropriate, that it is, in some sense, what we ought to do. When this happens,

our understanding is determined by the will, which chooses to assent to one side definitely and precisely because of something which is enough to move the will, though not enough to move the understanding... This may happen when someone believes what another says because it seems fitting or useful to do so. Thus, too, we are moved to believe what God says because we are promised eternal life as a reward if we believe. And this reward moves the will to assent to what is said, although the intellect is not moved by anything which it understands.²

On this view, one of the reasons belief is appropriate is that it is a necessary step to obtaining what God has promised. It follows that we are predisposed to the act of faith by our desire for these goods, a desire that is itself the work of God.³ As Aquinas writes,

when goods are proposed to someone, first he wants them; second, he wants to cleave to them; third, he wants to hope for them; and fourth

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¹ Aquinas, *Summa theologiae*, 2a 2ae, qu. 6, art. 1.
² Aquinas, *De veritate*, qu. 14, art. 1, in the translation by R. W. Mulligan.
he wants to believe them; so that by believing he may thus hope, love, and possess.¹

This desire is, however, merely a first step, leading to the act of faith. It is not an appropriate motivation for the act of faith itself.

To appreciate Aquinas’s view of the act of faith itself, we must switch from the language of philosophy and psychology to that of theology. For Aquinas, the desire for what God promises is already a divine gift, but faith itself is a theological virtue, something brought about within us by God. It is not something we can achieve on our own. What does the grace of God do, in this context? It makes it possible for us to accept that those things proposed for belief are revealed by God. This cannot mean that we have an intuitive grasp of the truth of the proposition, ‘These things are revealed by God’.² If the truth of this proposition were intuitively clear, the act of faith would no longer be voluntary, since we cannot help but accept an evident truth.³ Rather, what the grace of God does is to enable us to accept what God has revealed for no other reason than that he has revealed it.

At this point, the reasons that might originally have attracted us to the faith become irrelevant, or (at best) secondary. We have a new motivation for believing: we believe what God has revealed because of our love for God as the first truth. As Aquinas writes,

when ... a person has been led to believe, she can say that she believes not on account of any of these things: not on account of natural reason nor the testimony of the law, nor the preaching of others. Rather, she believes only on account of the truth itself.⁴

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² Jenkins (*Knowledge and Faith in Thomas Aquinas*, p. 192) comes close to suggesting this, but it seems incompatible with the idea that the act of faith remains voluntary.

³ Aquinas, *Summa theologicae*, 1a 2ae, qu. 17, art. 6; *De veritate*, qu. 14, art. 1. Calvinists might insist that we are free only to refuse God’s grace, but even on this view the act of faith has a voluntary component.

⁴ Aquinas, *Commentary on the Gospel of St John* lect. 5, sect. 2, § 662, in Marshall, ‘Quod scit una uetula?’, p. 31 n. 66.
To put it simply, the religious believer believes what God has revealed on the authority of God. As later followers of Aquinas would put it, ‘the authority of God is simultaneously that which and that by virtue of which one believes’. It is by one and the same act that one believes in the proposition revealed and the fact of revelation.

What about the certainty of faith? The certainty to which the act of faith gives rise does not come from any new arguments or evidence. Objectively speaking, the arguments and evidence remain no more or less convincing than before. If they were the basis for belief, they would not give certainty. But this fact is simply irrelevant to the believer. She may initially have been attracted by arguments and evidence, but they are not the basis of her act of faith. The certainty of faith comes from what it is we commit ourselves to, in making the act of faith. We commit ourselves to taking the propositions in which we believe as objectively certain, for we are taking them as divinely revealed.

It is true that we may not feel certain about the truths to which we assent, in the way in which we would if we had a decisive proof. But this lack of insight into the truth of what is believed does not, and may not, amount to doubt. On the contrary, Aquinas insists that the assent of the will must be ‘unwavering’. Peter Abelard might have believed that ‘through doubt we come to inquiry, and through inquiry we perceive the


3 Shanley, *The Thomist Tradition*, p. 34.

4 I take this to be close to what Aquinas meant when he wrote that it the case of faith the movement of discursive thought ‘is not yet brought to rest’, as it is when we have a decisive proof, and that for this reason ‘a movement directly opposite to what the believer holds most firmly can arise in him’ (*De veritate* qu 14, art. 1).

5 The believer assents *firmissime*: Aquinas, *De veritate* qu. 14, art. 1.
truth',\(^1\) but this is one reason he found himself in trouble. It is certainly not what Aquinas believes about faith. When it comes to religious belief, doubt is simply incompatible with faith.

### 7.1.3 The Sinfulness of Unbelief

The act of faith, then, involves a commitment to regard certain propositions as non-negotiable and irrevocable. But it also has a moral dimension. A failure to make this commitment, or a turning back from it, once made, is not some kind of simple cognitive failing. It is not like a failure to grasp a mathematical proof. Rather, it has moral implications. A failure to believe, when presented with the truth, is a vice: it is morally blameworthy.

It is for this reason that faith has traditionally been regarded as incompatible with doubt. Some modern religious thinkers appear to disagree. Ian Barbour, for instance, has written that religious faith does not exclude doubt. 'If faith were the acceptance of revealed propositions', he writes, 'it would be incompatible with doubt. But if faith means trust and commitment, it is compatible with considerable doubt about our theological interpretations'.\(^2\) The problem with this view, however, is not only that it is deeply untraditional; it is also confused and misleading.

Barbour’s claim is confused because it involves a false dichotomy. We cannot set ‘trust and commitment’ in opposition to ‘the acceptance of propositions’. This was recognized even by the great liberal theologian, Ernst Troeltsch. ‘For some people’, writes Troeltsch,

faith means submission to the accepted truths of revelation, whereas for others it means an attitude of confidence. But it cannot be an either/or. ... Faith is both: confidence in something, and believing something to be true. Confidence makes no sense unless I know what I have confidence in; and insofar as I know it, it is a matter of knowledge, of believing something to be true.\(^3\)

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1 Abelard, *Sic et Non*, Prologus (p.103).
Indeed the view of faith found in Aquinas entails the acceptance of certain propositions on the basis of what we might call ‘trust and commitment’.

Barbour’s expression of this view is also misleading, insofar as he speak of doubt regarding ‘theological interpretations’. This, of course, has always been permissible, for such interpretations lie in the realm of what Roy Rappaport calls ‘sanctified sentences’ rather than ‘ultimate sacred postulates’. But this is very different from doubt regarding the basic articles of faith. If what Barbour means is that a believer is permitted doubt the basic articles of faith, his view would be rejected by all traditional theologians.

The traditional attitude is clearly expressed by John Henry (later Cardinal) Newman. ‘The Church’, he writes, ‘does not allow her children to entertain any doubt of her teachings; and that, first of all, simply for this reason, because they are Catholics only while they have faith, and faith is incompatible with doubt’. A Catholic, writes Newman, is permitted to investigate the grounds of his faith, and even to consider the arguments that have been brought against it, when he has a good reason for doing so. But he is not permitted, under pain of divine punishment, seriously to question whether what he has believed is true.

One might argue that such a view shows signs of its age and would not be held by Catholic thinkers today. But this is not the case. The work of Avery Dulles offers a clear example of the same attitude. While insisting on a firm and unwavering assent of faith, Dulles admits that for many believers this may seem difficult. The reflective believer may be aware of the many objections that can be raised to religious belief. But Dulles cites in this context Newman’s remark that ‘ten thousand difficulties do not make one doubt’. Once the commitment of faith is made, the believer is obliged to avoid doubt. She may not seriously consider the possibility that what is being proposed for belief might be false. There is, of course, room for dis-

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1 See chap. 5, ‘Religion and Certainty’.
agreement about whether certain propositions are revealed by God. But once it is determined that they are (perhaps by the relevant Church authorities) to continue to doubt constitutes a vice rather than a virtue.

If mere doubt is sinful, then apostasy – the act of falling away from the faith after having believed – is an even more serious offence. Aquinas makes this abundantly clear. Those who have accepted the faith, and fallen away from it, can be compelled to make a new act of submission and appropriately punished if they do not.1 This, of course, was the fate facing Galileo. (The Catholic Church did not accept the principle of religious liberty until 1965; from the time of St Augustine, Church authorities had vigorously opposed it, on the grounds that ‘error has no rights’.2)

What about a mere failure to believe? Aquinas recognizes that there can be a kind of unbelief that is purely negative: it is the lack of belief that is found in those who have never heard the Christian message. This is not, in itself, sinful. Although those who lack faith on these grounds will still be damned, their being damned is on account of other sins, rather than the sin of unbelief.3 Such sins can be forgiven only through an act of faith. But both Aquinas and Newman insist that for those who have heard the Christian message a failure to believe is itself sinful.4 Nor is this merely a Roman Catholic view, for it is shared by John Calvin. Indeed Calvin’s view seems to be even more uncompromising. Inspired by St Paul’s letter to the Romans (1:19–23), Calvin held that all human beings possess an innate ‘sense of the divine’ (sensus divinitatis). This is not, by itself, sufficient to bring them to salvation. But it is sufficient to make them culpable if they fail to believe.5 This is why God can justly punish them.

Aquinas is aware of the difficulties such a view creates. It seems to mean, for example, that someone who was ‘brought up in the forest or

\[ \text{1 Aquinas, Summa theologiae, 2a 2ae, qu. 10, art. 8.} \]
\[ \text{3 Aquinas, Summa theologiae, 2a 2ae, qu. 10, art. 1.} \]
\[ \text{4 Aquinas, Summa theologiae, 2a 2ae, qu. 10, art. 1; Newman, ‘Discourse XI’, pp. 224–25.} \]
\[ \text{5 Calvin, Institutes of the Christian Religion, book 1, chap. 5, § 14.} \]
among wolves’ (and who therefore had no opportunity to believe) would inevitably be damned.¹ His response is that if such a person sought good and avoided evil, God would give him the opportunity to make an act of faith, however minimal its content. A somewhat more expansive version of this idea is found in the teachings of the second Vatican Council. The Council repeats the traditional view, affirming that any person who knowingly declines God’s invitation to believe will be damned. But it also states that God will not deny salvation ‘to those who, without blame on their part, have not yet arrived at an explicit knowledge of God’, provided they live a good life.² This seems to entail that one could, at least in principle, be a blameless atheist. Avery Dulles takes a similar attitude to apostasy. He cites the first Vatican Council’s statement that

those who have adhered to Catholic truth through the heavenly gift of faith ... [and] have received the faith under the teaching authority of the Church, can never have any just cause for changing their faith or calling it into doubt.³

Does this mean, he writes, that those who have abandoned the faith are condemned to eternal punishment? It would do, he says, if it were the case that their faith had been entirely extinguished. But there may be some ‘embers’ of faith in their hearts that will result in their salvation.⁴ Other Christian writers, however, are content to adopt a more uncompromising position, even in our own day. William Lane Craig, for example, writes that ‘when a person refuses to come to Christ’,

it is never just because of lack of evidence or because of intellectual difficulties: at root, he refuses to come because he willingly ignores and rejects the drawing of God’s Spirit on his heart. No one in the final ana-

¹ Aquinas, De veritate, qu. 14, art. 11, ad 1.
² Vatican II, ‘Dogmatic Constitution on the Church’ (Lumen Gentium), chap. 3 (emphasis mine).
³ Vatican I, ‘Dei Filius’, chap. 3, in Denzinger and Schönmetzer, Enchiridion symbolorum definitionum et declarationum de rebus fidei et morum Enchiridion symbolorum definitionum et declarationum de rebus fidei et morum, § 3014.
⁴ Dulles, The Assurance ofThings Hoped For, pp. 252–53.
7.1.3 The Sinfulness of Unbelief

lysis really fails to become a Christian because of lack of arguments; he fails to become a Christian because he loves darkness rather than light and wants nothing to do with God.¹

So not only is the certitude of faith not open to doubt, but if you fail to embrace the faith, it is because you are sinful. I need hardly note that there is nothing comparable to this attitude in the world of the sciences. A failure to accept a scientific theory when confronted with the evidence may be a sign that you are dim-witted, but it is not understood as a sign that you are wicked.

7.1.4 An Assessment

The problem with Aquinas’s view of faith will be evident to any philosophically minded reader. Faith may be a gift of God through which he moves our will to assent to doctrines he has revealed for no other reason than that he has revealed them. But this merely raises the question of how we can know that God exists and has revealed these doctrines. Aquinas holds that there are good arguments in support of Christian faith, but he also holds that such arguments are neither necessary nor sufficient for the act of faith.² To say that we are predisposed to believe because of a desire for God only seems a good reason if this desire was implanted by God. Otherwise, faith would be nothing more than wishful thinking: we would be believing something simply because we want it to be true.³ But the assumption that this desire is implanted by God merely begs the question: it assumes the very conclusion it is supposed to support.⁴ To say that faith is a divine gift may be true, but it offers no help at all to someone who wonders if all this talk of divine gifts has any basis in fact.

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⁴ Jenkins (*Knowledge and Faith in Thomas Aquinas*, pp. 120–21, 186) adopts an ‘externalist’ approach to the issue of faith, focusing on the mechanisms giving rise to the belief rather than evidence for the truth of the belief. But while this certainly reflects Aquinas’s own approach, it merely avoids the question at hand by changing the topic.
Perhaps this objection is not fatal, although I know of no good response to it. In any case, Aquinas’s view of faith continues to have its defenders. One of the most clever of these is Alvin Plantinga. Plantinga defends what he calls the ‘Aquinas-Calvin’ view of faith by assimilating Christian faith to one of our more familiar categories of belief: that of ‘properly basic’ or ‘non-inferential beliefs’. But this immediately leads him astray. The classic example of a ‘properly basic’ belief is one that arises from everyday sense perception. I believe there is a coffee cup on my office desk, not because of any (conscious) inference I have made, but simply because it seems to me that there is. But this belief could be defeated. (As philosophers say, it is ‘defeasible’.) I could discover that what appears to be a coffee cup in front of me is no coffee cup at all, but is a clever holographic image created by a colleague from the Physics Department. So if Christian faith involves a belief of this kind, it would also be defeasible, as Plantinga freely admits. (Plantinga, of course, denies that it has been defeated, but that is another question.)

Aquinas’s view is quite different, for he is clear that the Christian faith is not up for grabs in this way. It is not open to philosophical assessment. Philosophy, on his view, is sometimes a useful tool for the theologian, and one of its roles is that of countering arguments against the faith. But since what Christians believe is not derived from reason, it cannot be defeated by rational arguments. In the words of William Lane Craig, who is himself citing Martin Luther, reason has only a ministerial, not a magisterial role: it serves the faith rather than standing in judgement on it. Faced with an apparently successful argument against the faith, the believer’s

 duty is not to abandon her faith, but to find some way of countering the arguments.

### 7.2 Religion without Faith

Is a faith of this kind essential to religion? Even if it is true that scripturally based religions demand it, could there be a form of religion that does not? Could there be a religion without revelation, a ‘religion within the bounds of reason’?

#### 7.1.1 A Kantian Proposal

The phrase I have just used echoes the title of one of Kant’s works, *Religion within the Boundaries of Mere Reason*. In Kant’s view, such a religion would be an ethical religion: it would consist in little more than ‘the recognition of all our duties as divine commands’.¹ Its doctrinal content is quite minimal, being only what is required to support this ethical idea. ‘The universal true religious faith’, Kant writes,

> is faith in God (1) as the almighty creator of heaven and earth, i.e., morally as *holy* lawgiver; (2) as the preserver of the human race, as its *benevolent* ruler and moral guardian; (3) as the administrator of this own holy laws, i.e., as *just* judge.²

While this is a variety of religious faith,³ its basis is practical reason. This is why it can be universal, not restricted to any particular group of people. It has nothing to do with the acceptance of a divine revelation.

Kant, interestingly enough, does not believe that this pure rational religion is sufficient for human beings, at least not in their present state. Given the ethical weaknesses from which we suffer, we need a moral com-

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² Kant, *Religion within the Boundaries of Mere Reason*, pp. 141–42 (Ak. 6, 139).

community. Such a community will be governed by a ‘church-faith’ or ‘ecclesiastical faith’, which will be founded upon writings regarded as Sacred Scripture. But for Kant the status of such Scripture is contingent and provisional. We should accept it only insofar as it promotes the aims of a pure rational religion, and it is always to be interpreted in ways that are consistent with that religion.¹ Kant rejects the idea that we must have faith in such a scripturally based revelation in order to be saved. This, he writes, is nothing more than a dangerous ‘delusion’.²

This is a fascinating account of religion without faith, or at least without the kind of faith described by Aquinas and Calvin. But what I am interested in here is something rather different. It is a religion whose theology employs the same mode of thought as the sciences.³ Such a theology would put forward propositions about the existence and action of God not as revealed truths, to be accepted by faith, but as explanatory hypotheses. Kant, as it happens, would have rejected this idea, for he holds that propositions about God cannot function as explanatory hypotheses. In order to put forward an explanation of some fact about the world, we need to know that what is being proposed is at least possible. ‘Otherwise’, writes Kant, ‘there would be no end to empty fictions of the brain’.⁴ But

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¹ Kant, *Religion within the Boundaries of Mere Reason*, pp. 105–22 (Ak. 6, 93–114).
² Kant, *Religion within the Boundaries of Mere Reason*, pp. 164, 167 (Ak. 6, 168, 171).
³ To use Michael Barnes’s terms, a theology of this kind would employ the *late formal operational thought* characteristic of philosophy and the modern sciences (Barnes, *Stages of Thought*, pp. 205–10; see my Introduction, ‘Locating the Conflict’).
⁴ I. Kant, *Critique of Judgement* (1790), Part 2: *Critique of Teleological Judgement*, tr. J. Creed Meredith (Oxford: Clarendon Press, 1952), § 29 (90), p. 139. This may reflect Isaac Newton’s proposal that a hypothesis should be a *vera causa* (‘true cause’), although Kant’s version demands that we know not that such causes exist, but only that they are possible. For Newton’s principle, see his *Philosophiae Naturalis Principia Mathematica*, book 3 (regulae philosophandi); for an earlier statement of this principle, see Galilei, *Dialogue Concerning the Two Chief World Systems*, p. 421.
nothing drawn from sense experience, Kant believes, can demonstrate the possibility of God’s existence, and the only other kind of possibility to which we could appeal is a bare ‘logical possibility’. But Kant vigorously rejects the idea that we can demonstrate actual possibility – that an object could, in fact, exist – from the mere fact that it can be described without contradiction (which is what logical possibility means).

7.2.2 A Scientific Theology

Now it may be that Kant is right. If he is, then the idea of God that features in proposed theistic explanations is no more than ‘an empty fiction of the brain’. But for the sake of the argument let me assume that Kant is wrong and that one can put forward propositions about God as explanatory hypothesis. After all, most modern arguments for God’s existence take precisely this form. If one could produce a ‘natural theology’ of this kind, then its conclusions would not need to be taken ‘on faith’. Furthermore, it would enjoy no greater degree of certainty than any other scientific hypothesis.

It is true that a ‘scientific theology’ of this kind would differ in some significant respects from the natural sciences. Firstly, its explanations would be personal explanations, invoking an agent having beliefs and desires, rather than impersonal entities and forces that can be described mathematically. But this may not be a fatal objection. After all, we employ personal explanations in everyday life, when we explain people’s actions by reference to the reasons they have for acting as they do. We also employ such explanations in fields such as history and some branches of economics and psychology. So it seems that they are not, in themselves, unscientific.

Secondly, it is not clear whether a scientific theology would allow for experimental testing of its claims. It may be that it would. There have been,

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for instance, experimental trials to test the efficacy of intercessory prayer.\(^1\) But one could argue that these were doomed to fail, since one could not expect to predict how God would act in individual cases.\(^2\) (If we had a population of gods, we might be able to make statistical predictions about their behaviour. But the religions with which I am concerned are strictly monotheistic.) If this is correct, then a scientific theology may be limited to explanations ‘after the fact’, of the kind commonly made within history. Yet these would still be legitimate explanations.

However, even if we set aside these concerns, the idea of a scientific theology faces some weighty objections. First of all, the claim that we need to posit the existence of God to explain some fact about the world is (to say the least) hotly contested. It seems to many that, in the famous words attributed to Pierre Simon Laplace (1749–1827), ‘we have no need of this hypothesis’. Few proposed theistic explanations seem convincing to those who are not already believers. When it comes to science, a theistic explanation would also be an exception to a long-established practice of positing only natural forces and entities. The origins of science, as we have seen,\(^3\) can be traced to that moment in ancient Greece when thinkers such as Thales stopped invoking the gods to explain natural events.

Secondly, even if there did exist successful theistic explanations, it is not clear what kind of religious claims they could be used to support. It may be that belief in God could be supported in this way, as John Locke believed. But what about other traditional religious doctrines? Alvin Plantinga parodies this way of arguing in a striking passage.

> What is the best explanation for all that organized complexity in the natural world and the characteristic features of human life and all the rest of what we see about us? Well, let’s see, perhaps there is an omniscient, omnipotent, wholly good being, who created the world. Yes,

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that’s it; and perhaps this being is one of three persons, the other two being his divine son, and a third person proceeding from the first two (or maybe just the first), yet there are not three gods but one; the second person became incarnate, suffered, was crucified, and died, thus atoning for our sins and making it possible for us to have life and have it more abundantly. Right; that’s got to be it; that’s a dandy explanation of the facts.¹

It is hard to see how many distinctively Christian beliefs could be defended as the best available explanation of some fact about the world.

Finally, there is the question of whether such a theology would be adequate to its object: a God who is generally thought of as utterly transcendent.² ‘The divine substance’, as Aquinas wrote, ‘by its immensity, transcends every form that our intellect can realize’.³ It follows that if we can speak of God at all, we can do so only by way of metaphor and analogy.⁴ This does not, of course, prevent us from speaking about God, but it creates problems for anyone wishing to engage in a ‘scientific’ theology. Philosophically, one could express this by arguing that no finite cause could require us to posit an infinite effect, for the effect would be out of proportion to the cause. As David Hume writes,

when we infer any particular cause from an effect, we must proportion the one to the other, and can never be allowed to ascribe to the cause any qualities, but what are exactly sufficient to produce the effect. A body of ten ounces raised on any scale may serve as a proof, that the counterbalancing weight exceeds ten ounces; but can never afford a reason that it exceeds one hundred.⁵

4 This applies, of course, only to God’s intrinsic predicates: those that tell us something about the divine nature. There may be other predicates, such as ‘incorporeal’, which can be attributed to God in their literal sense. For a discussion, see Dawes, Theism and Explanation, pp. 47–48.
5 Hume, An Enquiry Concerning Human Understanding, Section 11, § 12 (p. 191).
Theologically, one could argue that a theology that dares to speak of such a God could do so only on the basis of a divine revelation. If the nature of God so exceeds the power of the human mind, then perhaps only God can tell us about God.

It may be, of course, that God has told us about God, by means of a divine revelation. One could put forward arguments in support of belief in such a revelation and its embodiment in Sacred Scripture. Since these arguments could invoke premises that any reasonable person would accept, they need not require a religious act of faith. Both Thomas Aquinas and John Calvin thought there existed arguments of this kind, ‘external evidences’ (as Calvin put it) of the divine origins and authority of Scripture, although they did not regard them as either necessary or sufficient for the act of faith. In our own time, Richard Swinburne has offered a very similar style of argument in support of the Christian claim that the Bible embodies a divine revelation.¹

The arguments in question may or may not be persuasive. But this does look like the most promising way of engaging in a scientific style of theology. Let me return, however, to what I argued earlier: that the way in which theistic philosophers make such proposals is misleading. Theistic philosophers are, above all, philosophers. They recognize, at least while doing philosophy, only one source of authority, namely the force of the arguments for and against the position being discussed. They may argue, as Plantinga does, that religious knowledge involves a form of basic belief, akin to my belief that there is a coffee cup in front of me. But philosophers do not just assert this; they produce arguments in support of this view. So they should; this is what philosophers are paid to do. But it means that from a philosopher’s point of view revelation has authority only insofar as it is supported by reason.

7.2.3 From Athens to Jerusalem

It should be clear by now that such a procedure subtly misrepresents the traditions that are being defended. As soon as you present reasons for accepting the authority of Scripture, you have taken the side of Athens.

rather than that of Jerusalem.\textsuperscript{1} The belief you are encouraging is nothing more than what Aquinas would call ‘the faith of demons’. Once again, it is a matter of differing epistemic norms: those that govern the practice of philosophy classroom are quite different from those at work within religious communities. It follows that even if there could be a religion within the bounds of reason, it would look very different from the scripturally based religions that actually exist. Those religions have traditionally rejected the idea of relying on reason. They have claimed that our knowledge has two sources – human reason \textit{and} divine revelation – and that these are distinct. As the first Vatican Council decreed in 1870, in words repeated by Pope John Paul II in 1998,

\begin{quote}
there exists a twofold order of knowledge, distinct not only as regards their source, but also as regards their object. With regard to the source, because we know in one by natural reason, in the other by divine faith. With regard to the object, because besides those things which natural reason can attain, there are proposed for our belief mysteries hidden in God which, unless they are divinely revealed, cannot be known.\textsuperscript{2}
\end{quote}

On this view, religious faith is \textit{different in nature} from merely philosophical reasoning.\textsuperscript{3} Any proposal that reduces religious faith to a form of philosophical reasoning runs directly counter to this idea.

Nor is this true only of Roman Catholic Christianity. As we have seen, the twentieth-century Protestant theologian Karl Barth denied that one should even \textit{attempt} to offer arguments for the authority of Sacred Scripture.\textsuperscript{4} Philosophical reasoning, on this view, should play \textit{no} role in the defence of Christianity. While most of my examples come from the history of Christian thought, similar views may be found in other traditions. Abu Hamid al-Ghazali, for example, recognizes the existence of arguments in

\begin{thebibliography}{9}
\bibitem{3} As John Paul II writes (\textit{Fides et Ratio}, § 9), ‘faith is of an order other than philosophical knowledge’.
\bibitem{4} See chap. 5, ‘Religion and Certainty’.
\end{thebibliography}
support of the authority of the Qur'an, particularly those from miracles. But he seems unconvinced that these are decisive, regarding religious knowledge as derived from a kind of direct apprehension that is distinct from the reasons that philosophers offer. Like the Christian’s act of faith (as traditionally conceived), this is thought to yield certain knowledge.\footnote{R. M. Frank, \textit{Al-Ghāzālī and the Ash‘arite School}, Duke Monographs in Medieval and Renaissance Studies 15 (Durham, NC: Duke University Press, 1994), pp. 67–68.}
8. SECULAR ACTS OF FAITH

At this point defenders of religion will have a host of objections to raise. Even sympathetic readers may be hesitating. I appear to be claiming, they will say, that while religion is based on faith, science is based on reason. But it is not that simple. Religious believers, they will argue, are not alone in making acts of faith, for many of our everyday beliefs are also faith-based. They are beliefs that we hold, and regard as certain, without (it seems) adequate evidence. Even scientists appear to make acts of faith, when taking for granted the fundamental principles underlying their research. If it is acceptable for even scientists to make such acts of faith, then why should we find fault with religious believers for doing the same?

The present chapter will deal with this objection: the idea that we all make acts of faith, scientists included. I shall discuss, first of all, what I shall call our everyday acts of faith. There are, it seems, many beliefs we all hold to be certain, in a way that seems independent of any arguments that could be offered in their support. These are sometimes called 'hinge beliefs', because they are the unquestioned assumptions upon which our lives turn. We all believe, for example, that other people have minds like ours. We feel no need to produce evidence for this belief and no sceptical arguments can shake it. If we are entitled to maintain convictions such as these, are we not equally entitled to our religious beliefs?

This idea can be extended to science, for (it could be argued) scientists also make acts of faith, comparable to those made by religious believers. After all, scientists accept many theories, not on the basis of any evidence they have examined, but on the authority of the scientific community. How does this differ from, for example, a Catholic's acceptance of doctrines on the authority of the Church? Moreover, science as a whole relies on certain assumptions about the nature of the world. Without these assumptions the practice of science would be impossible. But these also appear to be acts of faith. This observation, it could be argued, undercuts my sharp distinction between religion and science.

8.1 Religious and Everyday Beliefs

It is true that there are everyday beliefs that we hold with at least the same degree of confidence as religious beliefs. Like religious beliefs, these
8.1 Religious and Everyday Beliefs

are not open to revision in the light of new evidence. Faced with sceptical questions, we do not abandon these convictions, but try to find ways of countering the objections. The philosopher G. E. Moore drew our attention to a class of such beliefs in his ‘defence of common sense’. They include the belief that

there exists at present a living human body, which is my body. This body was born at a certain time in the past, and has existed continuously ever since, though not without undergoing changes; it was, for instance, much smaller when it was born ... Ever since it was born, it has been either in contact with or not far from the surface of the earth; and, at every moment since it was born, there have also existed many other things [like my body], having shape and size in three dimensions.¹

The belief that I have two hands is another example. We do not doubt matters like this, and if anyone tries to make us doubt them, we refuse to take him seriously. If Moore is correct, then why should religious beliefs be singled out for criticism? Surely they are no more problematic than these everyday beliefs, which are (it seems) also ‘matters of faith’.

8.1.1 A Wittgensteinian Defence

Duncan Pritchard has recently put forward a defence of belief in God that has precisely this form.² He begins with a description of two of the features of faith that I have been discussing. The first is that it is resistant to revision in the light of new evidence. He describes this vividly by comparing religious faith with other kinds of everyday belief.

Compare, for example, the theist’s belief in God with an agent’s belief that her car is parked around the corner. In the latter case, if presented with putative counterevidence to this belief – e.g., someone authoritative coming along and informing our agent that her car has been stolen – then the right thing for the agent to do is clearly to (at the very least) suspend judgement until she can better determine whether this propo-

² His argument had been anticipated by J. H. Gill, ‘Tacit Knowing and Religious Belief’, International Journal for Philosophy of Religion, 6 (1975), pp. 73–88.
tion is true or false. But if someone authoritative presented a theist with evidence that God doesn’t exist – e.g., by introducing her to the problem of evil, a problem she is aware she doesn’t know the solution to at that time – it would be downright odd for her to respond by simply suspending her belief in this proposition.¹

Religious people typically maintain their faith even after being presented with arguments against it, arguments that for the moment they may not be able to answer. Pritchard’s second (and closely related) point is that belief in God forms a ‘fixed point’, as it were, against which other propositions can be judged. These include, as we have seen, scientific theories. Pritchard refers to this as the ‘fulcrum’ role played by religious belief.

So far, so good. This is consistent with the traditional view of faith I have already discussed. The problem facing the theist is: Can this attitude be justified? If I ought to revise my belief that the car is parked around the corner in the light of new evidence, why should I be entitled to hold on to my belief in God, come what may? In developing his defence, Pritchard makes use of one of the later works of Ludwig Wittgenstein, entitled On Certainty. Wittgenstein’s pithy aphorisms are notoriously ambiguous and any interpretation of his sayings will be controversial. But his ideas are worth examining, to see how far the line of argument takes us. As we shall see, it does not take us very far.

### 8.1.2 The Idea of a Hinge Belief

Wittgenstein’s On Certainty was intended as a response to G. E. Moore’s reflections on common sense. Wittgenstein accepts Moore’s point that we regard beliefs of this kind as certain. I am entirely confident, for example, that other people exist and have minds. But Wittgenstein argues that such beliefs should not be thought of in the same way as what we might call ‘empirical’ beliefs. They are not held on the basis of evidence, nor are they revised as a result of further evidence. In this sense, they are simply not comparable to my belief that the car is parked around the corner. Not only do we feel no need to offer evidence in their support, but any attempt to do so would be problematic.

8.1.2 The Idea of a Hinge Belief

It would be problematic, first of all, because we would feel less confident about any evidence offered than about the beliefs we were trying to support. As Wittgenstein writes,

If a blind man were to ask me ‘Have you got two hands?’ I should not make sure by looking. If I were to have any doubt of it, then I don’t know why I should trust my eyes. For why shouldn’t I test my eyes by looking to find out whether I see my two hands? What is to be tested by what?\(^1\)

More seriously, the force of any evidence we might offer would assume the very beliefs we would be trying to prove. Take, for example, the belief that there exists an ‘external world’, a world outside my states of consciousness. I could try to prove this, as Moore did,

by holding up my two hands, and saying, as I make a certain gesture with the right hand, ‘Here is one hand’ and adding, as I make a certain gesture with the left, ‘and here is another’.\(^2\)

Since these are examples of objects external to my own mental life, they show that there is an external world. But would this proof be successful? No, it would not. The alleged proof relies on the very assumption that is to be proven: that such a world exists.\(^3\) One’s hand is evidence for such a world only if it is itself an ‘external’ object.

We may generalize this observation. Our evidential practices – the ways in which we find and present evidence for any proposition – take certain things for granted. In doing science, for example, we assume that the world exists independently of our thought and that it operates in more or less predictable ways. This forms a background picture against which other, more particular facts that functions as evidence. But no evidence is offered, within science, for that assumption. In doing history, we assume


that ‘the earth has existed for many years past’.¹ But this is not itself an item of historical knowledge: it cannot be proven with the methods of history. Those methods presuppose it. As Wittgenstein writes, ‘it belongs to the logic of our scientific investigations that certain things are in deed [in der Tat] not doubted’.² They form ‘the inherited background against which I distinguish between true and false’.³

Wittgenstein employs a series of metaphors for beliefs of this kind.⁴ Some metaphors are foundational: such beliefs are ‘the ground’ of our other beliefs, the ‘bedrock’, the point at which we have reached ‘rock bottom’. They are that which ‘stands fast’, while other things change. On other occasions, such beliefs are thought of as a ‘background’ to our everyday activities, a ‘world-picture’ (Weltbild) that we unhesitatingly accept. But perhaps the most revealing metaphor is that of ‘hinge’ beliefs: they are ‘hinges’ in the sense that our practices turn on them, including our practice of looking for evidence. As Wittgenstein writes,

the questions that we raise and out doubts depend on the fact that some propositions are exempt from doubt, are as it were hinges on which those turn. ... We just can’t investigate everything. ... If I want the door to turn, the hinges must stay put.⁵

Without such hinge beliefs, our practices of inquiry simply could not get underway.

It is easy to see the direction in which this line of thought could be taken, when it comes to religion, and Pritchard does not disappoint us. We can, he writes,

think of religious belief as also involving a hinge commitment to the existence of God which is immune to rational evaluation. ... If Wittgenstein is right then religious belief is on a par with everyday belief on

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³ Wittgenstein, On Certainty, § 94.
⁵ Wittgenstein, On Certainty, §§ 341–43.
8.1.2 The Idea of a Hinge Belief

this score, in that it is in the nature of all belief, religious or otherwise, that it incorporate these hinge commitments which are immune to rational evaluation.¹

Most of us think that it is perfectly reasonable to rely on our everyday hinge beliefs. But if this is true, then surely a religious person is entitled to rely on her belief in God?

8.1.3 Hinge Beliefs as Tacit Beliefs

Is this correct? Pritchard focuses on belief in God, rather than religious belief in general, for he argues that given belief in God our other religious beliefs may have rational grounding. (He calls his view a quasi-fideism.) But what I shall argue is that belief in God differs from hinge beliefs, as Wittgenstein describes them. While belief in God may be regarded as unquestionable and can play a ‘fulcrum’ role in believers’ lives, its genesis is quite different from that of a hinge commitment. Hinge beliefs consist of assumptions that are embodied in our practices. We act on these beliefs – acting as if they were true – but we rarely, if ever, make them explicit and reflect on their status. Hinge beliefs, in other words, originate as (and normally remain) intuitive or ‘tacit’ beliefs. By way of contrast, belief in God originates as a reflective belief. It is acquired by way of explicit teaching and is accompanied with an awareness of those facts that are thought to guarantee its truth.

Let me start with the idea that hinge beliefs are (at least in the first instance) tacit beliefs,² embodied in our practices. (They are certainly not the only variety of tacit belief, but they are tacit beliefs nonetheless.) This means that a hinge belief is best regarded as a kind of know-how, although it can also be regarding as a kind of unreflective knowing that. We know how to undertake certain activities and when we undertake such

² Danièle Moyal-Sharrock (Understanding Wittgenstein’s On Certainty, p. 67) would deny that what she call simply ‘hinges’ are tacit beliefs. Indeed given her strongly ‘non-cognitivist’ view, she denies that hinges are beliefs at all. But I hold that hinge beliefs are beliefs, albeit dispositional ones. If we hold a hinge belief that p, this means interacting with the world as if p were true.
activities we act as if the world were structured in a particular way. When it comes to hinge beliefs, in other words, practice is primary. We acquire such beliefs (if we need to acquire them) by taking part in a ‘form of life’ (to use the Wittgensteinian phrase). The role of such beliefs, writes Wittgenstein, ‘is like that of rules of a game; and the game can be learned purely practically, without learning any explicit rules’. Im Anfang war die Tat, ‘in the beginning was the deed’, as Wittgenstein writes (using a phrase from Goethe). Our belief that other people have minds, for instance, underlies the practice of social life. It is expressed in our ability to interact with other people. The practice of social life comes before any articulation of the belief.

It follows that the certainty with which we hold such beliefs is, in the first place, a certainty about how to act, rather than a reflective certainty about a proposition that we have before our minds. It involves taking certain aspects of the world, whether real or imagined, ‘on trust’. But this is what Danièle Moyal-Sharrock calls a ‘non-evaluative’ trust, a kind of ‘ur-confidence’ that precedes any process of evaluation. As she writes,

the difference between nonevaluative and evaluative trust is similar to that between walking on a smooth, wide road, and walking a tightrope. In the first instance, I do not think about the road being there or whether I will be able to walk. I walk thoughtlessly, and do so expertly. In the second instance, every movement is calculated, and precarious.

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1 At least some of these assumptions may be ‘hard-wired’ into our cognitive apparatus: they may be part of the mental endowment that all humans share. Such tacit beliefs become active, early in infancy, as a result of perceptual experience and motor activity, but they are not derived from such experience. See, for example, E. S. Spelke, K. Breinlinger, J. Macomber, and K. Jacobson, ‘Origins of Knowledge’, Psychological Review, 99 (1992), pp. 605–32, on p. 628.

2 Wittgenstein, On Certainty, § 95.


4 Moyal-Sharrock, Understanding Wittgenstein’s On Certainty, p. 194.
8.1.3 Hinge Beliefs as Tacit Beliefs

The trust in question, in other words, does not arise from any process of reflective judgement; it forms part of my engaging in a particular activity.\(^5\)

Can such beliefs become explicit, so that we do not simply know how to perform certain activities, but become aware of the assumptions underlying our actions? Yes, but only in rather unusual circumstances. Hinge beliefs are made explicit only when we are reflecting on their status (as in the case of a philosophical discussion), or in contexts in which they no longer function as hinges.\(^2\) One of Wittgenstein’s aphorisms highlights the first of these possibilities.

I am sitting with a philosopher in the garden; he says again and again ‘I know that that’s a tree’, pointing to a tree that is near us. Someone else arrives and hears this, and I tell him: ‘This fellow isn’t insane. We are only doing philosophy’.\(^3\)

Once a sceptical philosopher asks an awkward question – ‘How do you know there is a tree there? Could it not be a hallucination?’ – we can become aware that we have such beliefs and that they lack evidential grounding. But even in these circumstance, we do not seriously doubt them, since doubting them would force us to abandon practices that are essential to our everyday activities. In order to function at all, I must consider that my senses are generally trustworthy, even though they are occasionally deceived. If every time I thought I saw an object, I had to seriously consider I might be hallucinating, everyday tasks would become unmanageable. (I am riding my bicycle along the road and see a car coming. But wait, is it really a car, or are my eyes deceiving me?) Even when discussing the reliability of the senses with my students, I assume that I actually see them, sitting there before me. Hinge beliefs, in other words, continue to function as hinges even when we are considering the arguments that can be offered against them.

\(^5\) Moyal-Sharrock (Understanding Wittgenstein’s On Certainty, p. 194) goes so far as to say that ‘the moment I do give the object of my trust a thought is the moment I no longer trust’. But this seems wrong. We can reflect on the hinge beliefs, as philosophers do regularly, without ceasing to rely on them. (I am grateful to Daniel Wee for alerting me to this fact.)

\(^2\) Moyal-Sharrock, Understanding Wittgenstein’s On Certainty, p. 65.

\(^3\) Wittgenstein, On Certainty, § 467.
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There are other contexts in which such beliefs are made explicit, but in these contexts they are no longer functioning as hinges. Wittgenstein himself admits that the status of such beliefs can alter. As he writes, ‘the same proposition may get treated at one time as something to test by experience, at another as a rule of testing’.¹ After a terrible accident, in which my arms were severely injured, I could watch as medical staff remove the bandages and say, with surprise and relief, ‘I have two hands’. But in this context my utterance no longer expresses a hinge belief. It is something I can (and have) doubted, and must now test, by means of my senses.

For the most part, however, such beliefs are not made explicit at all. We never reflect on them and would never dream of making them the object of a ‘profession of faith’. If this is the case, should they be called beliefs at all? Pritchard himself argues that they should not, since they are ‘unresponsive to reasons’.² This has the surprising implication that if belief in God is a hinge belief, then it should not, strictly speaking, be regarded as a belief at all. I find this suggestion unconvincing. These ‘hinge commitments’ (as Pritchard calls them) are assumptions about the way the world is that shape our behaviour. While some of these cannot be abandoned, others can.³ While the latter may be resistant to evidence, they are not entirely ‘unresponsive to reasons’. So I prefer to think of such commitments as beliefs, albeit tacit or intuitive beliefs. They could also be thought of as ‘dispositional’ beliefs, in the sense that they dispose us to act in certain ways.⁴

³ See ‘The Hinge Beliefs of Science’, below.
⁴ I am thinking of a dispositional belief as a tendency to act in a certain way – to act as if the world were structured in a particular manner – rather than simply a tendency to affirm the truth of a certain proposition (although the latter is, of course, itself a kind of action).
Like other beliefs, such commitments may be mistaken. I may fail to achieve some goal because the world is not structured in the way my actions take for granted. In this situation I can be said to have a false hinge belief, an idea that Wittgenstein himself seems reluctant to concede. In this situation, one would expect my course of action to be (sooner or later) unsuccessful: it will fail to achieve its goal. Even when it does, however, I may remain unaware of why it fails to achieve its goal: I may remain unaware of the false hinge belief in question.

8.1.4 Belief in God and Hinge Beliefs

So is Pritchard right? Can belief in God be thought of as a kind of hinge commitment, comparable to those we employ in our other belief-forming practices? I shall shortly address the suggestion that scientists also make acts of faith by relying on the hinge beliefs of science. My argument there will be that hinge beliefs fall into several quite different categories and that those employed by scientists are relatively unproblematic. If there are any non-negotiable assumptions within science, they belong to a class of hinge beliefs that we cannot give up without ceasing to function as rational agents. Since religious beliefs are not of this kind, there is no parallel between religion and science in this respect. But what I am arguing for here is a more radical claim. It is that religious beliefs should not be thought of as hinge beliefs at all.

There are, of course, certain similarities between religious beliefs and hinge beliefs. Religious beliefs, like hinge beliefs, are associated with certain collective ‘forms of life’. Here, too, those forms of life would not be possible if one did not accept the propositions in question. Like hinge beliefs, they are also held with a high degree of confidence, which means they are resistant to criticism. They can, however, be doubted. Pritchard suggests, as we have seen, that a person who ceases to believe in God in the fact of atheistic objections never really believed at all. But while one can define religious faith as ‘a commitment that is never abandoned’, the definition

1 Moyal-Sharrock, *Understanding Wittgenstein’s On Certainty*, pp. 33–51. It may be that certain hinge beliefs cannot be demonstrated to be true or false, given their foundational role, but they can be false: they can represent the world in ways that do not correspond to the way it actually is.

2 See chap. 9, ‘The Hinge Beliefs of Science’.
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seems arbitrary. Aquinas is certainly clear that a person can cease to believe in God, although he regards the wilful loss of faith as a grievous sin, that of apostasy. So while faith in God is resistant to criticism, this does not mean that we cannot abandon it.

What distinguishes belief in God from hinge beliefs has to do with its origins. Hinge beliefs are embedded in our practices, in the context of which they are simply taken for granted. They are rarely made explicit, at least while continuing to function as hinges. In other words, they originate as, and almost always remain, *intuitive* beliefs. Religious beliefs, on the other hand, are acquired by transmission. They originate as, and normally remain, *reflective* beliefs.

As the reader may recall, this distinction comes from the work of Dan Sperber. Intuitive beliefs are those we typically hold without any reflection on how we arrived at them or the evidence that might lend support to them.¹ They are automatically treated as ‘data’, being employed in making spontaneous inferences.² Such inferences are important for various reasons, one of which is that they underlie our perceptual beliefs. As Sperber writes,

> you see autumn leaves under a bare tree, and you spontaneously form the beliefs:

> [1] There are leaves under this tree.
> [2] This tree has lost its leaves.

You see your friend Martha frowning, and you spontaneously form the beliefs:

> [1] Martha is frowning.
> [2] Martha is worried about something.³

What Sperber describes as the ‘spontaneous forming of beliefs’ can also be thought of as a process of ‘unconscious inference’.⁴ Such inferences depend on intuitive beliefs. We spontaneously judge that Martha is worried because we know, intuitively, what facial expressions signify. We sponta-

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² Sperber, ‘Intuitive and Reflective Beliefs’, p. 68.
³ Sperber, ‘Intuitive and Reflective Beliefs’, p. 82.
⁴ Sperber, ‘Intuitive and Reflective Beliefs’, pp. 77–78.
eously judge that the tree has lost its leaves because of our background knowledge about trees. Those items of knowledge are intuitive beliefs, which make possible our everyday inferences. Wittgenstein’s hinge beliefs also seem to be paradigmatic instances of intuitive beliefs, although (of course) the category of intuitive (or ‘tacit’) beliefs is much wider.

By way of contrast, reflective beliefs are ‘explicitly held, often stored in a linguistic format, and their transmission requires deliberate teaching’. As we saw earlier, such beliefs are held in association with what Sperber calls a ‘validating context’. This might involve reference to some authority who guarantees the truth of this belief or it might involve reference to some line of argument that lends support to it. An example from a religious context would be:

The Bible teaches that Jesus rose from the dead.

The phrase ‘the Bible teaches that’ places the proposition believed in a validating context. In more general terms, a reflective belief has the form \( V(R) \), where \( R \) is its content (a ‘representation’, in Sperber’s terminology) and \( V \) is the validating context.

My argument is that Wittgensteinian hinge beliefs are initially intuitive beliefs. They may become reflective beliefs, in the sense that we become aware of them and of the role that they play in our actions. But they may not. Unless we are philosophers, there is a fair chance that they will never cease to be merely intuitive. By way of contrast, we acquire religious beliefs as reflective beliefs. Belief in God is not a taken for granted assumption underlying a set of practices that are almost always regarded as

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2 See chap. 4, ‘Our Knowledge of the Literal Sense’.

8.1.4 Belief in God and Hinge Beliefs

unproblematic. It is something the believer consciously affirms, having acquired the belief in question from a particular community.

There is some recent research in social psychology that may appear to cast doubt on these claims. Such research has highlighted the existence of what are sometimes called ‘intuitive religious beliefs’. A few years ago, for instance, Deborah Kelemen proposed that children might be ‘intuitive theists’. The phrase has become familiar to scholars of religion, but it is, perhaps, misleading. A closer reading of Kelemen’s work shows that her conclusion was more cautious than this phrase might suggest. What Kelemen argues is that ‘children make sense of the world in a manner superficially approximating adult theism’.¹ What this means is that children (a) can reason accurately about superhuman minds shortly after acquiring the capacity to reason about human minds, (b) are over-inclined to detect agency and purpose in the natural world, (c) make a clear distinction between ‘mind-stuff’ and matter, and (d) are disposed to believe in fantastical beings and magical powers. Such ways of thinking may well be intuitive. They certainly predispose us towards the acceptance of culturally acquired religious ideas. But they ‘are not themselves religious in nature and will not produce religious cognition in the absence of other psychological and environmental factors’.²

So while there may be intuitive religious beliefs, in some broad sense of the term ‘religious’, they must be distinguished from the cultural representations proposed for belief by religious communities.³ Those representations, when accepted by an individual, are consciously held reflective beliefs. They may draw on our intuitive ways of representing the world


(which helps to account for their appeal), but they are explicitly held in conjunction with claims that lend them support. Traditionally, such claims have to do with authority, in particular the authority of God. Within Christian tradition, belief in God is not seen as ‘groundless’; it is seen as guaranteed (albeit in a circular fashion) by the authority of God himself. As Aquinas teaches, religious faith involves accepting something for the sole reason that God has revealed it. But religious beliefs would also be reflective beliefs if they were held on the basis of a line of argument, such as a proof of God’s existence. Knowledge of the proof would then act as a validating context. This makes religious beliefs quite different in character from hinge beliefs, which we do not reflect on or attempt to validate until they are somehow called into question.

Is it possible that even culturally acquired religious beliefs might become intuitive beliefs, given the right circumstances? Take, for instance, a person brought up within a religious tradition, in a social context in which its beliefs were never questioned. An example might be the nineteenth-century ‘Breton peasant woman’ to whom Louis Pasteur is said to have referred. Brought up in a devout, unquestioning Catholic community, would her beliefs not be intuitive beliefs, of the kind that are taken for granted and used to make spontaneous inferences? Admittedly, such a situation would be rare today. Almost all religious believers today live in contexts in which their beliefs are continually called into question. But is it not possible that religious beliefs could be intuitive beliefs?

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3 Pasteur is alleged to have said, ‘The more I know, the more nearly is my faith that of the Breton peasant. Could I but know all I would have the faith of a Breton peasant woman’ (cited in the article on Pasteur by J. J. Walsh in vol. 11 of *The Catholic Encyclopedia* [New York: Robert Appleton, 1911]). There is some question regarding the authenticity of the saying.
Perhaps. There is certainly nothing to prevent a belief that was once reflective becoming intuitive (and vice versa). I might, for instance, learn from a railway employee that the last Sunday train to Oxford is at 11.45. I would immediately form the belief

[1] The railway employee (who is to be trusted on such matters) said that the last Sunday train to Oxford is at 11.45.

I might later forget who told me this and form a simple, intuitive belief


But it is unlikely this would occur in the case of culturally acquired religious beliefs. Even in the case of the Breton peasant woman, her religious beliefs would almost certainly remain reflective beliefs.

Why is this? It is because in the practice of a religion the validating context of its key beliefs is continually affirmed: religious beliefs are typically presented in the form $V(R)$, even within religious communities. The Breton peasant would often have heard, at the end of a reading from Scripture, the phrase *Verbum Domini* (the Word of the Lord), and would have frequently been told that the authority of the Church lay behind her inherited beliefs. As far as belief in God is concerned, she would have explicitly affirmed that belief whenever she recited the Nicene Creed, at Mass every Sunday or when her children were baptised. So at least while she continues to practise her faith, her belief will remain a reflective belief. If, on the other hand, she abandons the practice of her faith, it seems likely that her sense of conviction will also disappear.

It seems, then, that belief in God is not appropriately thought of as a species of Wittgensteinian hinge belief. Hinge beliefs are transmitted (if they need to be transmitted) tacitly, by learning how to engage in particular practices. They rarely, if ever, become explicit beliefs. Belief in God, by

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1 Sperber, ‘Intuitive and Reflective Beliefs’, p. 80.
2 Sperber, ‘Intuitive and Reflective Beliefs’, p. 81.
way of contrast, is a reflective belief, learned in ways that depend upon its verbal expression. In the case of hinge beliefs, the deed comes first: *im Anfang war die Tat*. But in the case of religion, *im Anfang war das Wort* (in the beginning was the Word). It follows that belief in God is a self-conscious and, one might add, precarious affair, more closely analogous to the act of tightrope walking than that of confidently setting out along a road. It may be that religious faith is an act whereby we choose to regard a proposition *as though it were* a hinge belief. Indeed that is not a bad definition of faith. But religious beliefs are not, in fact, hinge beliefs, in the Wittgensteinian sense.

### 8.2 Scientific Acts of Faith

So much for the idea that religious beliefs might be comparable to our everyday hinge beliefs. There is, however, a similar argument that relates directly to science. It suggests that even scientists make acts of faith that are comparable to those made by religious believers. First of all, scientists accept many theories ‘on faith’, that is to say, on the authority of those who propose them, for they cannot investigate first-hand the evidence in support of every theory upon which they rely. How does this differ from the religious believer’s act of faith? Secondly, there are assumptions without which science would not seem to be possible at all, such that there is an external world or that nature acts in a uniform and predictable manner. Science itself cannot provide evidence for such assumptions, so they, too, might seem to be matters of faith.

Such observations sometimes form part of a *tu quoque* (‘you, too’) argument against the atheist. ‘You accuse us of making acts of faith’, says the religious believer, ‘but so do you’. An influential example can be found in John Whitcomb and Henry Morris’s best-selling *The Genesis Flood*, the foundational text of modern young-earth creationism. Whitcomb and Morris protest against what they see as the uniformitarian assumption of modern geology: the idea that ‘existing physical processes, acting essentially as at present, are sufficient to account for all past changes’ that we see in the geological record.¹ They contrast this with what they take to be

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the biblical view, which appeals to divine intervention and a catastrophic flood. Neither of these, they argue, is ‘susceptible of genuine scientific proof’.¹ Both approaches are ‘matters of faith’.² I shall not address this particular argument, except to note that modern geology is by no means as uniformitarian as Whitcomb and Morris suppose.³ My aim here is merely to make some general remarks on arguments of this kind.

### 8.2.1 Accepting Theories on Authority

A first way in which science can be said to rest on acts of faith has to do with the role of authority and tradition. One becomes a scientist, first of all, by embracing a certain tradition. The ethos of science may be one of ‘organized scepticism’,⁴ but someone wanting to become a scientist would make little progress if she doubted everything her teachers were telling her. Tradition is particularly important in learning those skills that are part of any art, including the art of scientific research. The contents of science could (in principle) be learned from textbooks, but the art of science can be learned only from a kind of apprenticeship, following the example of those who have already mastered it. As Michael Polanyi writes,

> by watching the master and emulating his efforts in the presence of his example, the apprentice unconsciously picks up the rules of the art, including those which are not explicitly known by the master himself. These hidden rules can be assimilated only by a person who surrenders himself to that extent uncritically to the imitation of another. A society which wants to preserve a fund of knowledge must submit to tradition.⁵

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⁵ Polanyi, *Personal Knowledge*, p. 53.
It is this that accounts for the importance of laboratory practice in the teaching of many of the sciences. Note, however, Polanyi’s careful qualification: the apprentice must surrender himself to some extent uncritically. Any good teacher of science will hope that her students may one day outperform her, perhaps by pioneering new methods of research.

Even among those who are already scientists, authority plays an important role in the dissemination and acceptance of scientific results. The age of the polymath, the Renaissance man who could claim competence in all significant fields of human learning, has long past. Scientists who can question the results achieved in their own field must, in practice, rely on the judgement of those who have expertise in other fields. But of course the reason they have this confidence lies in the ethos and procedures of the scientific community as a whole. While far from infallible, the procedures of open criticism, peer review, and the replication of experiments are at least intended to weed out error. When they fail to do so, this is recognized as a failing and attempts are made to improve the procedures in question.

So there is a sense in which scientists are dependent on the judgements of their peers, which they must take on trust. But this is even more strikingly true for non-scientists. There are many scientific theories that most of us accept, not because we understand the reasoning behind them, but on the authority of the scientific community. To return to my earlier example, that the formula \( e = mc^2 \) represents the relation between matter and energy is a fact I accept on authority. It is, for me, a matter of faith, since I lack the ability in both mathematics and physics needed to understand the reasoning behind it. Do I note accept this formula in the same way as a Catholic, for instance, might accept the teaching of the Church?

No, I do not. I may take it on faith, but the faith in question is different from that involved in accepting religious doctrines. The truth of the formula \( e = mc^2 \) is a matter of faith for me, but it is not a matter of faith for everyone. Within the community of physicists, the reasoning that lies behind it is well known. I, too, could understand the reasons if I had studied the required mathematics and physics. But this is not true of many key religious beliefs. Take, for instance, Christian belief regarding the trinitarian nature of God. The fact to which this refers, if it is a fact, can be
8.2.1 Accepting Theories on Authority

known *only* by way of an act of faith. There are no arguments that can be proposed, other than exegetical ones, which could persuade someone to accept the truth of this doctrine.¹ It is, therefore, *in principle* a matter of faith in the way a scientific theory is not.²

8.2.2 The Hinge Beliefs of Science

I freely admit, then, that scientists are heirs to a tradition of scientific reasoning and to this extent accept certain theories ‘on faith’, that is to say, on the authority of those who propose them. But if this constitutes an act of faith, it is very different from that made by religious believers. Yet there is a deeper sense in which science may seem to rest on acts of faith, for there are assumptions scientists must make in order to do science at all. The practice of science, for instance, assumes that there is an ‘external’ world, that sense perception puts us directly or indirectly in touch with that world, and that the fundamental laws of nature will not vary in some arbitrary way through time and space. Are these not scientific acts of faith, comparable to those made by religious believers?

Given my extensive discussion of ‘hinge beliefs’ earlier in this chapter, a brief response to this question should suffice. The response will take the form of pointing out that there are different kinds of hinge commitment. This fact is recognized by Wittgenstein himself. Comparing the proposition, ‘the water in the kettle on the gas-flame will not freeze but boil’ with a second proposition, namely ‘the person sitting opposite me is my old friend so-and-so’, he remarks that

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¹ Abelard, as we have seen, would disagree – see chap. 6, ‘Religion and Criticism’ – but his view was not the mainstream, orthodox one. Even Gordon Kaufman (*In Face of Mystery*, p. 419) admits that the normative character of trinitarian doctrine is ‘essentially a faith-claim, not … something that can be established by evidence and proof’.

² D. Sperber, *Explaining Culture: A Naturalistic Approach* (Oxford: Blackwell, 1996), p. 91. Similar remarks could be made about many other religious doctrines, such as the belief that it was the angel Gabriel (*Jibrîl*) through whom the Qur’an was revealed to the Prophet Muhammad. If this is true, it, too, can be known to be true only by accepting the authority of the traditions that bear witness to it.

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there is a difference between the cases. If the water over the gas freezes, of course I shall be as astonished as can be, but I shall assume some factor I don’t know of, and perhaps leave the matter to physicists to judge. But what could make me doubt whether this person here is N.N., whom I have known for years? Here a doubt would seem to drag everything with it and plunge it into chaos. ... If I were contradicted no all sides and told that this person’s name as not what I had always known it was..., then in that case the foundation of all judging would be taken away from me.¹

Unfortunately, Wittgenstein does not develop this insight and produce a classification of hinge beliefs. But others have.

Differing classifications are possible. Crispin Wright, for instance, produces a particularly insightful one.² But the one I shall use is that offered by Moyal-Sharrock, who distinguishes between (a) linguistic hinges, (b) personal hinges, (c) local hinges, and (d) universal hinges.³ Linguistic hinges offer us rules that define our use of words and numbers. ‘This colour is called blue (in English)’ would be one such hinge belief, as would ‘2 + 2 = 4’. (The latter offers us a paradigmatic instance of how to use numbers.) Personal hinges represent knowledge that relates to our individual lives, such as ‘I am now sitting in a chair’ or ‘I am presently in New Zealand’. Local hinges represent assumptions shared only by particular groups of people at a particular time, such as ‘The earth is a planet’ or ‘There is a country called Australia’. Universal hinges are assumptions apparently shared by all human beings, and perhaps some other animals as well. Examples would be ‘the earth exists’, ‘physical objects continue to exist when not being perceived’, or ‘human beings have minds’.

These not only represent different categories of belief; they also differ in the degree to which they are able to be abandoned or renounced. It may be that some of these beliefs could not be abandoned without our ceasing to function as rational agents. If they were abandoned, no reasoning would be possible, for the fundamental principles by which we reason would be called into question. If I doubted that the earth exists or the principles by

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which $2 + 2 = 4$, I could hardly find my way around the world. (Philosophers may claim to doubt such things, but they continue to act as if these propositions were true.) As Wittgenstein remarks, if I did doubt such matters, my thinking would be plunged into chaos: ‘the foundation of all judging would be taken away from me’. Indeed I might even be threatened with madness.

Other hinge beliefs, on the other hand, are open to question. They are not normally questioned, but if they were, the results would not be catastrophic. If I assume, in an absent-minded moment, that I am sitting on a chair and then become aware that I am sitting on a wall, nothing serious would follow. (I may be mildly concerned about my increasing absent-mindedness, but I could continue to function as a rational agent.) Wittgenstein recognizes this with his example of the water that froze rather than boiled over a gas flame. He would be astonished to see such a thing, but content to leave it to scientists to figure out why it happened. Wittgenstein notes, too, that what is a hinge belief at one moment may become subject to explicit evaluation later, an idea nicely expressed in his image of the river and its bed. ‘The river-bed of thought may shift’, he writes. But I distinguish between the movement of waters on the river bed and the shift of the bed itself, though there is not a sharp distinction of the one from the other. … The same proposition may get treated at one time as something to test by experience, and another as a rule of testing. The same idea is expressed in the related image of the river and its bank. The bank, Wittgenstein writes, ‘consists partly of hard rock, subject to no alteration or only to an imperceptible one, partly of sand, which now in one place gets washed away, or deposited’.

It can be difficult to know which beliefs belong to the category of ‘ungive-up-able’ beliefs and which do not. A striking fact about modern science, from Galileo onwards, has been its willingness to abandon our most common-sense assumptions. Given this fact, I am reluctant to suggest any particular hinge commitment is immune to revision. But it is hard to imagine how one could abandon the most fundamental assumptions of the

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sciences – such as the general reliability of sense perception or the uniformity of laws of nature – without catastrophic consequences. In this respect, such commitments differ from religious beliefs. I have argued above that religious beliefs should not be thought of as hinge beliefs at all. But even if they were, they would belong to a category of beliefs that are able to be given up. We know this because many people do so.¹

A critical attitude to knowledge will recognize that we cannot question everything at once.² We may even have to recognize that there are things we cannot, in practice, question at all, since they are what allow us to function as rational agents. To ask if we are entitled to hold such beliefs is akin to asking if we are entitled to the air we breathe.³ Even if this is true, however, we can distinguish between those hinge beliefs that we are able to question and those that we cannot. Crispin Wright ends his discussion of these matters with a variation on the well-known ‘serenity prayer’. The original reads:

God, grant me
the Serenity to accept the things I cannot change
the Courage to change the things I can
and the Wisdom to know the difference.

If we reword Wright’s version so it has the same form, it would read:

Let us hope to be granted
the Discipline to take responsibility for what we can be responsible
the Trust to accept what we must merely presuppose
and the Wisdom to know the difference.⁴

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² J. Gill (’Tacit Knowing and Religious Belief’, p. 85) suggests that those who claim to have given up religious belief remain religious at some deeper level. But even if this were true, such people would still have given up their explicit, culturally acquired religious beliefs.
8.2.2 The Hinge Beliefs of Science

There is a certain irony in ending this discussion of religious faith with an adaptation of a prayer, but I can think of no better way to do so.

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9. SCIENCE AS A RELIGION

My argument so far has been that the epistemic norms shaping religious claims to knowledge differ from those operative within science. Scripturally based religions not only claim a source of knowledge distinct from human reason. They are also bound by tradition, insist upon the certainty of their beliefs, and are resistant to radical criticism in ways in which the sciences are not. This attitude rests on a claim to know certain matters ‘by faith’, a form of knowing that leads to a higher degree of certainty than any ‘merely human’ reason.

I hope I have succeeded in showing that this attitude is characteristic of religion alone. Science does not rest on any comparable acts of faith. But despite my arguments, many readers will want to insist that my view of science is naïve. I am treating science, they will say, as though it were a disinterested activity engaged in by superhuman agents, somehow raised above the messy realities of human history. I am assuming there is a distinctive scientific method that ensures objectivity, which makes science a ‘clearing of rationality in a jungle of muddle, prejudice, and superstition’.¹

The problem here, my critics will continue, is that this view of science is clearly false. In recent decades, historians, sociologists, and philosophers have shown that there is no scientific method, no set of objective canons that are considered binding by all scientists. Even if there were, there is no reason to think its employment would lead to scientific progress. Furthermore, in accepting particular scientific theories, scientists are motivated by much more than a disinterested love for truth. Their views are shaped by social and political factors, as well as by the available evidence.

Some writers have gone so far as to argue that science itself functions as a religion.² Already in 1951 Horace Kallen wrote bitterly about the intolerance sometimes displayed by the scientific establishment.

There is a widespread and dangerous disposition to consider science as in some sense holy, and to attribute to it that assurance of salvation greater than any other which defines the supernatural. In the life of the


mind the communicants of such a religion of science figure as so many
more dogmatists of another intolerant cult, with observatories or labor-
atories for churches and with their formulas as infallible revelations or-
daining the rites and liturgies of their respective specialties. Such reli-
gions of science insist on their own orthodoxies, exercise their own cen-
sorships, maintain their own Index, and impose their own Imprimatur.¹

He illustrates this by the reception accorded to the work of Immanuel Ve-
likovsky, who put forward a deeply 'heretical' view of earth’s history.

I shall return to the Velikovsky case shortly. For the moment, let me
try to spell out the charge more clearly. There are two ways in which sci-
ence can be said to resemble a religion. Firstly, the scientific community can
appear as authoritarian as religious communities. It can seem to have its
own orthodoxy and to be equally intolerant of heretics. (This was Kallen’s
complaint.) Secondly, major scientific theories are often presented as more
than simple statements of fact. They are presented as grand narratives,
structuring our view of ourselves and our place in the universe. They func-
tion, in other words, in ways comparable to the ‘myths’ of religious tradi-
tions.

It is time to address such claims. I shall accept that there is some truth
in what is being alleged. There are certain parallels between religious and
scientific communities. But I shall also argue that these parallels are often
overstated. They do nothing to undermine my central argument: that the
norms and procedures of characteristic of these communities embody con-
trasting attitudes to knowledge.

9.1 Authority within Science

Let me begin with the first objection: that I have embraced an unrealistic
picture of the scientific community. Is that community not just as author-
itarian as religious communities? Does it not have its own orthodoxy? Is it
not equally intolerant of dissent?

¹ H. M. Kallen, ‘Democracy’s True Religion’, The Saturday Review (July
9.1.1 Orthodoxy and Dissent

One could, perhaps, appeal to Robert Merton’s critics in support of this idea. Merton, you may recall, argued that the ethos of science is shaped by four norms: universalism, communism, disinterestedness, and organized scepticism. But Ian Mitroff has argued that these collective norms are often counter-balanced by very different imperatives. The communal norm of scepticism, for instance, is counter-balanced by an individual attitude of dogmatism. As Mitroff writes, ‘the scientist must believe in his own findings with utter conviction while doubting those of others with all his worth’. In fact, however, this insight merely complements the point Merton is making. After all, it is the attitude of doubting the claims of others that gives rise to the organized scepticism of which Merton speaks.

Other critics have noted that when faced with radically new ideas, scientists have been reluctant to criticise their existing beliefs. They will not allow established views to be questioned. When in 1950 Immanuel Velikovsky published his highly controversial book Worlds in Collision, the response of many scientists was (to say the least) intemperate. The book drew upon both documentary evidence (including the Hebrew Bible) and geological and astronomical findings to speak of a series of catastrophes in historical times caused by the close approach of a comet. That comet, the book continued, later became the planet Venus. Despite its scholarly apparatus and extensive documentation, Worlds in Collision was immediately rejected by the scientific community. How can this be said to exemplify the ‘Mertonian’ norms of science?

The problem here is that such criticisms fail to make a key distinction. They fail to distinguish between the attitudes and actions of individual scientists and the collective norms and procedures of scientific communities. Merton’s description of the ethos of science refers to the latter rather than the former.

1 See chap. 6, ‘Science and Criticism’.
than to the former: it involves an *institutional* rather than a *motivational* level of analysis.¹ A distinction of this kind is central to the more recent work of David Hull and Philip Kitcher. Both thinkers recognize that the attitudes of individual scientists may fall short of the scientific ideal.² But they argue that within the scientific community even these attitudes can contribute to the growth of knowledge.³ What accounts for this apparently paradoxical outcome? The answer lies in the collective procedures that scientific communities employ.⁴

An illustration of how this works has to do with the problem of bias. Human beings are much prone to cognitive bias, a distorted view of the available evidence and what it warrants. By rewarding credit for original discoveries, the sciences might appear to make this problem worse, for scientists have a strong motivation to favour that view of the evidence which supports their own theories. Unsurprisingly, there is plenty of bias among scientists. But when the curiosity of individuals is coupled with the collective practices of assigning credit and checking results,⁵ this partiality can be largely overcome.⁶ As Hull writes, science ‘does not require that scient-

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⁴ This is not the say that such procedures could not be improved; indeed Kitcher’s aim is to understand them in order to be able to improve them.


⁶ More precisely, it can be overcome when communities share a common set of normative standards and procedures against which to assess rival views; see R. J. MacCoun, ‘Biases in the Interpretation and Use of Research Results’, *Annual Review of Psychology*, 49 (1998), pp. 259–87, on
ists be unbiased, only that different scientists have different biases'. The combination of their biases can lead to results that approach the goal of objective knowledge.

Similar remarks may be made about the dogmatism of individual scientists of which Mitroff writes: their wholehearted commitment to their own theories. This is more than counterbalanced by the collective procedures of their community. In Hull’s words,

the objectivity that matters so much in science is not primarily a characteristic of individual scientists, but of scientific communities. Scientists rarely refute their own pet hypotheses, especially after they have appeared in print, but that is all right. Their fellow scientists will be happy to expose these hypotheses to severe testing.

Similar observations can be made about the Velikovsky case. The intolerance of some scientists towards Velikovsky’s ideas was counterbalanced by the insistence by others (including Albert Einstein) that he should be given a hearing. Indeed, Velikovsky was given a hearing, at a special meeting of the American Philosophical Society in 1952, and at a meeting of the American Association for the Advancement of Science in 1974.

9.1.2 Scientific Revolutions

A more serious challenge to my view of science comes from work by historians and sociologists. The foundational thinker within this tradition was Thomas Kuhn, whose work has been enormously influential, not just in the philosophy of science, but also in the wider culture. (Every time you

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hear the phrase ‘paradigm shift’, think of Kuhn.) Kuhn’s best known book appeared more than forty years ago, so discussing his work might appear to be ‘flogging a dead horse’. But defenders of religion have sometimes appealed to Kuhn’s views in order to lend support to religious belief. Ian Barbour does this, outlining some of the parallels that exist between the believer’s acceptance of a particular faith and the scientist’s acceptance of a particular research tradition.¹ I myself once took a similar line, as a way of defending the place of theology in a secular university.² So it may be useful to examine Kuhn’s ideas a little more closely.

Kuhn’s interest was in what he called – in the title of his most famous book – ‘the structure of scientific revolutions’. At the heart of Kuhn’s understanding such revolutions is his conception of a paradigm. What unites the practitioners of what he calls ‘normal’ science (science in a non-revolutionary period) is the acceptance of a common paradigm. What characterises a scientific revolution, on the other hand, is the shift from the existing paradigm to a new one. The Copernican revolution that led to the Galileo affair was Kuhn’s chief model of a scientific revolution, one on which he had written an earlier (and excellent) book.

A first problem arises with this term ‘paradigm’, for Kuhn’s use of this word was notoriously vague.³ It can refer, for example, to particular exemplars of scientific practice, such as Isaac Newton’s Mathematical Principles of Natural Philosophy, or to entire disciplines, with their characteristic assumptions. But let me set that issue aside. Whatever Kuhn meant by the term ‘paradigm’, his suggestion was that successive scientific paradigms are ‘incommensurable’: they employ radically different criteria of assessment. It follows that the decision between them cannot be made on strictly rational grounds. External considerations, of the kind studied by sociologists, must enter into the choice. Indeed Kuhn lays great emphasis on the role of scientific communities, to the point of defining

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scientific disciplines sociologically. They consist of groups of researchers united by education, professional interaction and means of communication (such as journals and conferences). Each such community will consist of individuals interested in problems of a certain sort, who also share a view of the kind of solutions that are acceptable.

On Kuhn's view, then, a scientist adheres to a particular paradigm because he has been initiated into a particular community. The choice between competing paradigms, he writes, 'proves to be a choice between incompatible modes of community life'.\(^1\) Within each community, arguments in support of the paradigm are necessarily circular: the paradigm itself is used to argue in its own defence. Defenders of the new paradigm can only invite others to imagine what the world would look like if they shifted their position. Kuhn notoriously compares the shift from one paradigm to another to a religious conversion. It is a choice that some scientists will choose to make, although they are not rationally compelled to do so. Indeed Kuhn suggests that the general adoption of a new paradigm may have to await the death of the last defenders of the old.\(^2\)

If this is true, in what sense can science be said to be a rational enterprise? Is science itself not a form of religion, a church that one enters by way of a conversion experience, with an orthodoxy that one accepts on faith? If this were true, one could argue that scientific theories should be treated in the same way as the beliefs of (other) religious communities. We could, for example, that our school children be free to opt out of science classes, just as they are free to opt out of religious instruction.\(^3\) To assess such claims, we need to look more closely at the vexed issue of the alleged incommensurability of competing paradigms.

It is here that we discover the weakness of Kuhn's view of the history of science. Kuhn overestimates both the consensus which must exist among

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1 Kuhn, *The Structure of Scientific Revolutions*, p. 94.
2 Kuhn, *The Structure of Scientific Revolutions*, p. 152.
9.1.2 Scientific Revolutions

scientists at any one time and the discontinuity involved in a ‘paradigm shift’: the movement from one research programme to another.¹ Even within periods of so-called ‘normal’ science, there can exist fundamental disagreements about the assumptions underlying a particular research programme. Nor is it true that each research programme contains a single, self-contained set of assumptions. Some of the assumptions underlying normal science are shared by scientists pursuing quite different research programmes. So paradigms cannot be as sharply distinguished as Kuhn’s initial presentation suggested.²

It follows that there is no need to regard the movement from one paradigm to the next as an irrational choice, comparable to a religious conversion. Choices between competing paradigms can be made by reference to what Kuhn himself admits are widely shared scientific values.³ In assessing the comparative merit of competing theories, scientists have long made reference to what are called ‘explanatory virtues’: qualities such as simplicity, economy, precision, informativeness, and elegance. It was, of course, the relative simplicity of the Copernican theory – the fact that it could explain many aspects of the phenomena by reference to a few principles – that first made it attractive, even before there was observational evidence in its support.⁴ These criteria of theory choice are accepted by adherents of differing research programmes:⁵ even

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³ Kuhn, *The Structure of Scientific Revolutions*, pp. 184–86.


⁵ Lakatos’s talk of ‘research programmes’ offers an alternative to Kuhn’s talk of ‘paradigms’; see I. Lakatos, ‘Falsification and the Methodology of Scientific Research Programmes’, in I. Lakatos and A. Musgrave (eds),
a Ptolemaic astronomer could recognize the advantages of the Copernican scheme. So there is no need to regard the movement from one programme to another as comparable to a religious conversion.

9.1.3 Why Religion is Different

These points are familiar to any philosopher of science. But even if we set these criticisms aside, the alleged parallel between scientific and religious communities does not extend very far. Kuhn’s book was motivated by his discovery that the history of science did not involve a steady, cumulative growth in knowledge, but involved a series of revolutions. The completion of each revolution may occur only with the demise of the ancien régime. (As is sometimes remarked, science advances funeral by funeral.1) But the new order does eventually triumph. The point to note here is that there are no revolutions of this kind in religious thought. An individual may leave one religious community and join another, but religious communities themselves do not radically overhaul their fundamental beliefs.

It is worth spelling this out in more detail, for it is a point that I myself overlooked. On Kuhn’s view, the gradual accumulation of anomalous data – facts that cannot be easily fitted within the existing paradigm – will gradually lead the scientific community into a state of crisis. It is that state of crisis that motivates a paradigm shift. Religious traditions also face anomalous data, facts that cannot easily be fitted into their foundational narratives. (The problem of apparently gratuitous evil has long bothered Christian thinkers.) But this does not prompt a paradigm shift, that is to say, the abandonment of that community’s foundational beliefs. (Individuals may abandon them, but the community as a whole does

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1 This saying seems to be a paraphrase of a remark made by physicist Max Planck (1858–1947), who wrote that ‘a new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it’; see M. Planck, Scientific Autobiography and Other Papers, tr. F. Gaynor (London: Williams & Norgate, 1950), pp. 33–34.
not.) Those beliefs may be reinterpreted, but there are limits to that process, ‘a point beyond which religion may not go’. The continued identity of a religious community depends on adherence to its foundational narratives, which cannot be simply rejected.

In my 1996 paper, I assumed that religious thought could, and should, undergo revolutionary changes comparable to those found within science. As I wrote, ‘any theology worthy of the name will be prepared, if necessary, to abandon its particular framework of belief, if it has proved wanting and if a more comprehensive alternative is available’. But I now realize that such an option is not permitted within theology, for the epistemic norms of religious communities do not allow such radical revision. The act of faith is not a commitment made pro tem, until a better alternative becomes available. It is a commitment that is intended to be permanent. Abandonment of that commitment in the light of new evidence is not a mark of epistemic virtue, as it would be in science. It is a sin, that of apostasy, which entirely separates a person from God.

It is true that some religious thinkers have questioned these norms. Only a few years ago, Gordon Kaufman suggested that theologians should be prepared to abandon ‘the Christian framework’ if it was no longer serving its intended purpose. But even if church authorities were to accept this proposal, a theology that abandoned its basic framework would lose its identity. It may be true, as Kaufman suggests, that a similar form of inquiry could still be conducted, one that would search for ‘an ultimate point of reference’ for our understanding of the world. But such an inquiry would no longer be theology, which (as the name suggests) has God as its focus. Theologians would have to find new jobs, or at least a new name for their new form of inquiry. Scientific communities, by way of contrast, can

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2 Dawes, ‘Theology and Religious Studies in the University’, p. 60.
3 Aquinas, *Summa theologiae*, 2a 2ae, qu. 12, art. 2, ad 2; see also chap. 7, ‘The Sinfulness of Unbelief’.
4 Kaufman, *In Face of Mystery*, p. 47.
survive radical changes in their underlying assumptions because they are not bound to any particular set of doctrines.

9.2 Grand Narratives and Dodgy Metaphors

So much for the alleged dogmatism of scientific communities. A more interesting claim regarding the way science can function as a religion is made by philosopher Mary Midgley. Her particular interest is Darwin’s theory of evolution by natural selection and its contemporary defenders. As she writes on the first page of her book *Evolution as a Religion*, this theory is ‘not just an inert piece of biological science’. It is also ‘a powerful folk-tale about human origins’ which will inevitably have symbolic force.

In other words, it not only tells us the bare facts regarding human origins; it also shapes our understanding of what human beings are like and how they can and ought to live.

9.2.1 Narratives and Science

At first sight, this might seem entirely appropriate. Surely ethical discussions ought to be shaped by our best available science? The problem Midgley highlights is that the broader narratives we construct are ‘under-determined’, as philosophers say, by the scientific evidence. There is more than one story that can be told on the basis of the scientific theories in question. It follows that if we favour one story rather than another, it will not be on strictly evidential grounds; other factors will come into play. In these circumstances it is important to ask what those other factors are. After all, we could be favouring a particular story not so much because of the scientific evidence in its favour (which is at best ambiguous), but because it lends support to those social and political arrangements from which we ourselves would benefit.

9.2.2 Selfish Genes and Free Markets

Midgley takes this discussion further by identifying some of the wider narratives associated with the theory of evolution. A clear example is what she calls the ‘Social Darwinist’ idea that science has proven human beings to be essentially selfish. On this view, relations between living beings are

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deeply competitive, so that all social feelings and all instances of apparent altruism are illusory. Apparently altruistic actions are merely cunning ways for the individual to attain his own goals. Midgley’s particular target here is Richard Dawkins’s *The Selfish Gene*. While the book is, in one sense, simply an introduction to evolutionary biology, it makes it clear that the science has implications for how we think about human beings. Dawkins says, for instance, that

if you wish, as I do, to build a society in which individuals cooperate generously and unselfishly towards a common good, you can expect little help from biological nature. Let us try to teach generosity and altruism, because we are born selfish.¹

This is a grim conclusion. If we are indeed ‘born selfish’, any attempt to construct ‘a society in which individuals cooperate generously and unselfishly’ will be an uphill struggle.

Fortunately, as Midgley points out, this particular narrative is not supported by the biological evidence. Indeed it arises from a series of confusions. The first is that between *genes* and the *organism* that is their vehicle.² To say that genes are (in some highly metaphorical sense) ‘selfish’ does not entail that the organism will act selfishly. To suggest that it does would involve a second confusion: that between the *evolutionary* and the *psychological* concepts of altruism. An organism behaves altruistically in the evolutionary sense if it reduces its own fitness while increasing that of others.³ This is a matter of biological function, not of conscious motivation. Psychological altruism, on the other hand, is a matter of conscious motivation. A third confusion at work here is that between *proximate* and *ultimate* causes.⁴ A genuinely altruistic impulse, such as one born of empathy,

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² Despite his initial rejection of Midgley’s criticisms, Dawkins (*The Selfish Gene*, p. ix) has recently admitted to this confusion.

³ Sober and Wilson, *Unto Others*, p. 199.

could be the immediate motive (and thus the proximate cause) of the behaviour in question, even if the impulse itself is ultimately the result of natural selection. To take a simple example, parents’ feelings for their children can be genuinely altruistic – truly directed towards their children’s welfare – even if the prevalence of such feelings can be explained by their role in aiding the transmission of genes. The point is that if one focuses on the proximate cause of the behaviour rather than its biological function, altruism can seem just as natural as selfishness.

Dawkins’s comment regarding selfishness could be regarded as a momentary lapse. After all, he does urge readers of a later edition to ignore it.\(^1\) But it is hard to regard as a momentary lapse the attitude taken by biologist Michael Ghiselin. After a chapter that discusses the social behaviour of bees, Ghiselin ends with the following sweeping claims regarding human society.

The evolution of society fits the Darwinian paradigm in its most individualistic form. ... The economy of nature is competitive from beginning to end. Understand that economy, and how it works, and the underlying reasons for social phenomena are manifest. They are the means by which one organism gains some advantage to the detriment of another. No hint of genuine charity ameliorates our vision of society, once sentimentalism has been laid aside. What passes for co-operation turns out to be a mixture of opportunism and exploitation. ... Where it is in his own interest, every organism may reasonably be expected to aid his fellows. Where he has no alternative, he submits to the yoke of communal servitude. Yet given a full chance to act in his own interest, nothing but expediency will restrain him from brutalizing, from maiming, from murdering – his brother, his mate, his parent, or his child. Scratch an ‘altruist’, and watch a ‘hypocrite’ bleed.\(^2\)

One is struck by the similarity of this description to the crude capitalist ideal of unhindered economic competition. But since Ghiselin begins by


taking ‘classical economics’ as a model for biology, the similarity is hardly surprising. What he seems to have forgotten is that while bees (presumably) have no motives, humans do. To suggest that those motives may include impulses to ‘genuine charity’ is not to deny the possibility of an evolutionary explanation of our moral sentiments. Heaven help us if the study of ethics were handed over to biologists, as one of their number has suggested.

Incidentally, it is easy for supporters of science to ridicule those religious believers who reject the theory of evolution. But they often overlook what motivates their opposition to the science. This may be not so much the science itself as some larger narrative about human beings in which it is embodied. Take, for instance, William Jennings Bryan, who was the creationist prosecutor at the 1925 Scopes trial in Dayton, Tennessee. Bryan argued against evolution not only because it contradicted – in his view – the teachings of the Bible, but because he regarded it as destructive of morality. He might have been wrong, but he certainly had some evidence for this belief. The high school textbook that provoked the trial, George William Hunter’s A Civic Biology, not only taught the well-established facts regarding human evolution. It also taught that some humans are merely ‘parasites’ on society. If they were ‘lower animals’, it argued, we would probably exterminate them to prevent their influence from spreading. While ‘humanity’ prevents us from doing this, it doesn’t prevent us from segregating the members of this ‘low and degenerate race’ and preventing them from breeding.

4 G. W. Hunter, A Civic Biology, Presented in Problems (New York: American Book Company, 1924), p. 263. In a later, co-authored work (Science in Our World of Progress, p. 484), Hunter would point approvingly to the laws being implemented in Nazi Germany for the sterilization of the unfit; see S. Selden, ‘Selective Traditions and the Science
I am not, of course, attributing such attitudes to today’s evolutionary biologists. Many are rightly embarrassed by the crude social Darwinism of their predecessors. But we would be naïve to believe that ethical and political convictions play no role in the choice of the larger stories they tell. We need to be careful about this. The history of modern biology offers sobering examples of what can happen when science becomes embodied in the wrong kind of narrative.¹

9.2.3 A Purified Science or Eternal Vigilance?

What is to be done about these broader narratives and dodgy metaphors? It may be that evolutionary theory has gradually liberated itself from such grand narratives, becoming more responsive to strictly evidential norms.² But it is not clear that we can simply eliminate the narratives and metaphors that surround the science. Indeed some of the metaphors seem in-


¹ See, for instance, G. J. Stein, ‘Biological Science and the Roots of Nazism’, American Scientist, 76 (1988), pp. 50–58, on p. 52. I am not, of course, endorsing the idea of any necessary link between Darwinism and Nazism. Here, too, the political ideology is underdetermined by the science. To arrive at such ethically abhorrent conclusions, one had to assume (inter alia) that the laws governing social life should be the same as those governing nature, as did Darwin’s foremost German defender, Ernst Haeckel (1834–1919); see E. Haeckel, The Riddle of the Universe (1899), tr. J. McCabe, The Thinker’s Library 3 (London: Watts & Co., 1929), p. 285. But this assumption was vigorously rejected by Darwin’s foremost English advocate, T. H. Huxley. ‘Let us understand, once for all’, Huxley wrote, ‘that the ethical progress of society depends, not on imitating the cosmic process..., but in combating it’; see T. H. Huxley, ‘Evolution and Ethics’ (1893), in Evolution and Ethics and Other Essays, Collected Essays 9 (London: Macmillan & Co., 1906), pp. 46–116, on p. 83. To his credit, Dawkins follows Huxley rather than Haeckel in this respect; see R. Dawkins, A Devil’s Chaplain: Selected Essays (London: Phoenix, 2004), p. 12.

9.2.3 A Purified Science or Eternal Vigilance?

separable from evolutionary theorizing. Think, for instance, of phrases such as ‘struggle for existence, natural selection, sexual selection, adaptive landscape, dynamic equilibrium, [and] arms race’.\(^1\) The elimination of such metaphors would impoverish the science.\(^2\) Midgley seems to agree. She, too, holds that metaphors and grand narratives are not merely ‘a nuisance to be got rid of’,\(^3\) but an inevitable and essential part of scientific theorizing. But we do need to bring them ‘out into the open’ in order to examine them critically and see what truth, if any, they embody.\(^4\)

It is important to note, in this regard, that such metaphors and narratives are not matters of faith, which must be simply accepted on authority. They are testable scientifically and can be criticised. With regard to the metaphors, once they are translated into the mathematical formulations of population genetics they become testable in a way that mere metaphors are not. With regard to the grand narratives, these, too, can be criticized for the extent to which they go beyond the evidence.

Take, for example, the claims sometimes made by evolutionary biologists regarding gender and gender roles. I shall not dwell on Ghiselin’s suggestion that ‘the ideal female would be an entirely passive organism’,\(^5\) since he does not attempt to spell out its political consequences. But Michael Ruse’s enthusiasm for evolutionary explanations leads him into the very trap against which he has warned. In a recent book, he insists that any study of gender roles must take into account the fact that females, not males, give birth to children. Since sophisticated organisms require a long period of gestation and after-birth care, ‘females are stuck with doing this, whether they want to or not’.\(^6\) Nor are they merely ‘stuck with’ the childcare role; given our evolutionary history, we might expect they will want to undertake it. It follows, writes Ruse, that we ‘should be cautious about

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1 Ruse, *Mystery of Mysteries*, p. 239.
3 Midgley, *Evolution as a Religion*, p. 3.
utopian proposals for complete sexual identity’.¹ Our evolutionary history imposes constraints on how we can live.

Almost thirty years ago Philip Kitcher showed the foolishness of such talk.² How are we to understand the claim that women will, in general, ‘want to spend time with their young children in ways that men do not’?³ It cannot plausibly be understood as an expression of genetic determinism: the idea that it is women’s genes alone that decide what they want. Our dispositions to behave in certain ways are the product of both genetic endowment and environmental influence, and that environmental influence includes cultural factors. So Ruse’s view assumes that there is no achievable social and political environment in which men and women would want to share childcare. How could any biologist, or philosopher, possibly know this proposition to be true? A scientist who makes such claims is simply practising bad science (and a philosopher ought to know better).

9.3 Is Science a Religion?

So is it true that science is itself a kind of religion? If one defines ‘a religion’ broadly enough, then yes, there are certain parallels. Midgley, for instance, remarks that

a faith is not primarily a factual belief, the acceptance of a few extra propositions like ‘God exists’ or ‘there will be a revolution’. It is rather the sense of having one’s place within a whole greater than oneself, one whose larger aims so enclose one’s own and give them point that sacrifice for it may be entirely proper.⁴

It is easy to imagine some scientists regarding the scientific enterprise in this way: as a grand achievement of the human species which gives point to one’s own, small efforts as an individual. Even Richard Dawkins can

¹ Ruse, The Philosophy of Human Evolution, p. 196.
³ Ruse, The Philosophy of Human Evolution, p. 196.
write that ‘science ... has a higher aesthetic. Science can be poetry. Science can be spiritual, even religious in a non-supernatural sense of the word’.

We have seen, too, that scientific results are often presented in the context of a grand narrative about human beings and their place in the universe. Such narratives are more than merely factual claims, since they are used to offer suggestions regarding how we ought to live. The problem is that these narratives are underdetermined by the science itself: there are many different narratives that could be constructed on the basis of the same theories. Sometimes, too, they are based on a confused understanding of the science, as in the case of the idea that human beings are ‘basically’ selfish. But that such narratives exist seems beyond doubt and they sometimes function in ways that approximate the roles played by religious beliefs. There is good reason to be cautious when scientists begin to speak like priests and to subject their claims to particular scrutiny.

All of this, however, has no implications for my central thesis, which is that the norms and procedures of the religious and scientific communities embody very different attitudes to knowledge. After all, even the grand narratives and dodgy metaphors of contemporary science claim to be based upon evidence. They are, therefore, able to be criticized. Scripturally based religions, on the other hand, claim an extra source of knowledge, which goes beyond what fallible human reason can deliver. This alleged knowledge, based on faith, enjoys a degree of certainty that scientists have long ceased to claim for their science (if, indeed, they ever did). It is for this reason that religious belief is considered immune to criticism. So to my critics who say that science itself functions in the manner of a religion, I would respond, ‘Yes. In some respects it does, and we need to be careful about this. But so what?’ The parallels that exist do not undermine what I have argued regarding the deep divide between scientific and religious attitudes to knowledge.

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5 Dawkins, A Devil's Chaplain, p. 31.
CONCLUSION

At what conclusion, then, have I arrived? Historians complain that, despite their best efforts, the idea of a conflict between religion and science has refused to die.¹ But they might want to ask why the idea is so resilient. My answer will come as no surprise: it persists because it is true. It may be that by sheer good luck the teachings of religion and those of science do not, for the moment, come into conflict. But adherents of scripturally based religions are ‘epistemological dualists’. Alongside human reason, they claim a second source of knowledge accessed by faith. Since the matters known by faith overlap those known by science, substantive conflict is always possible.

When such conflicts occur, it is easy to see which side will claim precedence. Since religious claims are based on an alleged divine revelation, they have traditionally been thought to trump all ‘merely human’ reasoning. This is particularly likely to occur today, when the sciences have abandoned all pretence to offer certain knowledge. Galileo could hope to offer demonstrative proof of the Copernican theory, which would force the Church to reinterpret the Bible. Modern scientists could not hope to achieve such a goal.

The Galileo affair represented a conflict on the level of doctrine, namely what is believed. But even if one can avoid such – on the level of what is believed – there is always a conflict regarding the way in which it is believed. One might argue that this difference does not, in itself, constitute a conflict; it is merely a difference. Could the two views not be reconciled within some larger conception of human knowledge? The problem is that it is difficult to see how a reconciliation could be achieved.² When dealing with religion and science, we are faced with stark choices. Is

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² As Richard Blackwell writes, ‘the institutionalized authorities behind science and behind Scripturally based religion have very different, indeed to some degree opposed, characteristics’ (emphasis mine); see R. J. Blackwell, Science, Religion and Authority: Lessons from the Galileo Affair, The Aquinas Lecture 1998 (Milwaukee, WI: Marquette University Press, 1998), pp. 50–51.

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human reason our only means of attaining knowledge? The sciences assume it is; scripturally based religions insist it is not. Are some authorities sacred and unquestionable? Religions insist they are; the sciences assume they are not. Are all our beliefs open to revision? The sciences affirm they are; religions insist they are not. If these do not represent contrasting attitudes to knowledge, I do not know what would.

This is not merely a modern conflict, which emerges only in the seventeenth century. The roots of modern science are to be found in the ancient Greek tradition of critical thinking, a tradition revived in the twelfth century. From the very beginning, this tradition of critical thought ran into conflict with religion. In the fifth century BC it led to a series of trials for ‘impiety’, of which the trial of Socrates is merely the most famous, and in the thirteenth century it led to a conflict between the Church and Aristotelian philosophy, which led to the subordination of philosophy to theology (and thus science to religion). The Galileo affair was merely the high point, or (if you prefer) low point, of this long history.

My examples have been drawn largely from the history of Christian thought, since it is what I know best. But my reference to ‘scripturally based religions’ is intended to embrace any religious tradition that is based on an alleged divine revelation. Similar tensions have certainly arisen within the history of Islam, tensions between religious authorities and free-thinking philosophers. Here, too, the believer’s dependence on what is considered an infallible authority stands in clear contrast to the spirit of free inquiry characteristic of the sciences.\footnote{M. G. S. Hodgson, *The Venture of Islam: Conscience and History in a World Civilization, vol.1: The Classical Age of Islam* (Chicago: University of Chicago Press, 1974), p. 431.} Indeed since such tensions can arise even in apparently tolerant, polytheistic religions, such as that of Athens in the fifth century BC, I feel justified in speaking more generally about ‘religion’ and science.

In making these points, I am not endorsing the sweeping claims and overblown rhetoric of Andrew Dickson White or John William Draper.\footnote{On Draper and White, see my Introduction, ‘The Old Conflict Thesis’.} The revisionist historians who have criticized their work were right to insist that more nuance is needed. But rather than entirely rejecting the
idea of a conflict between religion and science, we should try to uncover what forms such a conflict could take. It is not enough to describe the relation between religion and science as one of ‘rich complexity’. Such an observation ought to be the starting point of a discussion, not its conclusion. Our task is to unravel this complexity, to understand the various ways in which religion and science are related. It is this task that I have undertaken, taking as my starting point the most famous of all encounters between religion and science.

If my revised conflict thesis is correct, why does it matter? It matters because the continued existence of religions of this kind constitutes a potential threat to the scientific enterprise. If believers holding a traditional view of religious faith were to gain political power, the threat could easily become real. If such believers were to perceive a clash between what their faith tells them and the findings of modern science, they would be likely to do what the Church authorities did in Galileo’s time. They would attempt to close down the science. Acting in accordance with the logic of their beliefs, they would insist that the authority of God’s word trumps that of any merely human knowledge. Those of us who value the freedom of scientific research should take care to ensure this never happens.

Philosopher Del Ratzsch once asked why we should assume that scientific reasoning is our only path to knowledge. Well, we should not assume that, nor do I. As John Dupré writes, ‘there are surely paths to knowledge very different from those currently sanctioned by the leading scientific academies’. I have already distanced myself from the view – often called ‘scientism’ – that would restrict knowledge to scientific

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knowledge. But the contrast I have drawn is not between differing forms of our human capacity to know. It is a contrast between the attitude that sees human reason (in its various forms) as our only source of knowledge, and an attitude that claims that religious faith is a separate and superior source of knowledge, alongside reason.

As it happens, I cannot accept that idea. There may be paths to knowledge other than those offered by the sciences. But I can make no sense of the idea that there are paths to knowledge other than those offered by reason, however broadly the latter is construed. I do not deny that there could exist a divine revelation. Perhaps one of the existing sets of Sacred Scriptures embodies such a revelation. What I would reject is the idea that faith represents a shortcut to knowledge: a way of identifying this divine revelation that bypasses our own powers of reflection. If my suspicions are correct, then John Locke was right: ‘reason must be our last judge and guide in everything’. I also think that the only form of reasoning worthy of the name is critical reasoning, which is prepared to abandon its most cherished assumptions when these have been shown wanting.

I have not, however, attempted to argue for those conclusions here. Even if I am wrong, even if religious faith is, in fact, a distinct and superior source of knowledge, the contrast I have drawn would still hold good. Religion and science would still represent contrasting attitudes to knowledge and it is this that lies at the heart of the conflicts between them.

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1 See my Introduction, on ‘Andrew Dickson White’.
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