

Discussion

Professor Peter Harrison

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Bob White: Ladies and gentlemen, I think we'll make a start because time is marching by. Jim Secord has very kindly offered to kick us off with a few thoughts, so I'll ask him to begin.

Jim Secord: First of all, I would like to thank Peter Harrison for his very fascinating talk about the Royal Society and Religion in the late 17th Century. What I would really want to do is raise three or four points very briefly that we might use as a basis for discussion. I have to say also that on almost all these points there are other people here who are more expert than I am, but at least this is a chance to bring some of them together.

The first point I want to raise is one of what is religion in the later 17th Century. Even if we are believers, I think we often tend to assume religion is in some sense separate from the rest of everyday life and I think that's a danger in that. I certainly was a little worried sometimes when Peter mentioned the idea of the "social legitimacy" role of religion. To some extent it might not give an impression of the sense that all life was imbued with the idea that you're in some sort of a religious journey and I think that that idea is very important. I think it comes across, particularly in the earlier Royal Society, in relationship to the idea that the end of the world potentially is quite close. This idea strikes me, following Charles Webster, as actually quite dominant in much of the writing about the Royal Society and in particular in the sense that its goals might be accomplished very, very quickly indeed, that a total transformation in the world order, and in the way that people operate in man's relationship to nature, could happen in a few years. So I think that there's a sense in which that is very important because one of the things I think that happened is there was a sense of disappointment, and to some extent a loss of momentum in the 1670-80s, that the millenarian goals of the Royal Society were not immediately realised and because of that the Royal Society changed tack quite dramatically in a certain way as it entered into the 18th Century. I think there's something about that that might speak to the relationship between science and religion in the Royal Society that would be worth thinking about, and also I suppose partly because I know the people who argue that natural philosophy is about in this period. I would be very interested in knowing what people think about the idea that any kind of enquiry into nature in this period is automatically an enquiry into God. I would tend to think that that makes quite a lot of sense, certainly in the basis of the figures he used as examples, and someone like Boyle or Newton would be examples of that. That would be a question I would want to raise as well.

The second question I have less to say about but I find quite interesting in this context and that of course is that I think a lot of people recognise that 17th Century science is a European-wide phenomenon and it's really quite dominant in certain countries which have very little to do with the specific circumstances of the post-Civil War Britain. You do wonder how far what's happening is actually in some sense potentially independent of a lot of these religious issues. It was one of the things which actually allowed Europe to enter into a period of stability after a period of religious wars and partly that meant moving away from some of these questions. I think there's a general question about how far in the end the general tenor of what they were doing leant towards an even more secular way of approaching things, even if the people specifically involved in the Royal Society projects had very strong religious motivations.

The third issue I am interested in has to do with the relationship between the Royal Society and the Word. Of course, I think we all know that the Word is very central to Christianity, particularly to Protestant Christianity, but it's also something that the Royal Society says: "nothing without words". A lot of historians of science have characterised the work of the Royal Society in terms of ideas about witnessing and what is being witnessed: there are physical actions that you can see with your own eyes as they actually happen. Witnessing in biblical terms is related quite closely to that, but on the other hand the way in which it's communicated, and the notion that it

has been done by groups of people and competent observers in a certain circle, is quite different. So I think there's something going on there which isn't in fact very well explored in the literature I am witnessing in my own field of history of science, but might well be something we could look at a little bit here.

The final thing I wanted to raise was the question about the relationship between the sort of issues that Peter was talking about and where we are now. I was very taken by his point at the end of his talk about how many of the modern Fellows, people within the Royal Society, would be rather surprised if they were taken back into the 17th Century and vice versa: if Boyle was brought back to the modern Royal Society what would he think was going on? I think there's a question here, partly about how in some ways do we use the nature of the early Royal Society and understanding what it really was as a historical institution, and where it comes from, to think about how to resuscitate some of that richness of discussion and tradition and possibility that was present in the Royal Society, potentially for some of our discussions today.

I think in particular the question one of the people raised in the discussion section about the relationship between the moral aspects of science and the ethical aspects of science is particularly telling for us in that regard and it's something that might be worth thinking about.

Bob White: Thank you Jim. A lot of points have been mentioned – does anyone want to pick up on any of those: any of our historians or philosophers?

Peter Collins: Can I try what may be a red herring? It's related to 'The Word'. As Jim was talking I wrote down St John's "In the beginning was the Word" and the Royal Society's "*nullius in verba*". I am interested in word and authority because the Royal Society prides itself on not being subjected to anybody else's authority; and it aims, then as now, to speak with authority; and there is an irony in the very heart of that. Perhaps it takes us a bit away from religion in the Royal Society but I am interested in the institutional waging of authority in this context.

Bob White: That's an interesting point.

Herbert Huppert: You are really using the word "authority" in two different ways there. The Royal Society doesn't want to be controlled by anybody and it doesn't really want to control anybody, it wants to be considered to be authoritative in the sense that it gives due consideration to what it says and hopes that it's really good science; but I've never heard even a president say "The government hasn't taken any notice of what I'm saying".

Peter Collins: I can document many times people complaining that the government didn't take any notice of what we were saying. I can also document that when the Royal Society issues a statement on some position, the correspondence pages in the newspapers then many times say "Well, the Royal Society said this, so that's good enough for me". So the authority card is played, whether by the Society or on its behalf, and there is a fundamental irony there.

Peter Duncumb: But doesn't the authority of the Royal Society lie in presenting the facts, and making unbiased recommendations based on facts, rather than in telling people what to do? It is the respect that it earns in this way that gives it authority.

Peter Collins: We are assigning the authority. Basically in saying that we are doing away with authority, what we are saying is that actually we are re-assigning authority, from Aristotle or whoever, to the Royal Society's presentation of the experimental evidence. The authority doesn't disappear, it is just relocated.

Bob White: Perhaps I can ask the historians here something. In the 17th Century we heard today from Peter that the Royal Society was struggling to get itself recognised and make a

position for itself in society, so that it wasn't just written off. So when did the Royal Society first get the sort of authority that we have been talking about? That's a straight historical question.

Herbert Huppert: 1650!

Peter Harrison: I would say not in the period of history that I'm familiar with, but that peters out somewhere in the 18th Century..

Jim Secord: If you want a simple answer I think it is in the later 19th Century. They began to obtain a growing authority during the course of the 19th Century when it became involved in giving government advice and so forth but it's really after the reform of the Royal Society in the mid-19th Century and then, with increasing power of science generally, the Royal Society becomes a major spokes-place for science and that's when it has a really very significant role in science.

Herbert Huppert: So do you think that the Royal Society didn't have influence when Banks was president?

Jim Secord: It had influence, yes, but a lot of that's due to the personal authority of Banks himself. It does have influence but it's much more organised in the kind of way that 18th Century society is organised, through conversations and associations and friendships rather than as a more bureaucratic organisation and that kind of authority fits in much more clearly with the way things develop in the 19th century.

Jacqueline Rose: I think also if you look at the early members of the Royal Society in the late seventeenth century and ask why they were so keen on having a lot of prestigious ecclesiastical and lay people involved who really weren't active in the practical things they were doing, that in a way comes out of their search for authority. Certainly if you look at some of the things Stephen Shapin is saying about authority and truth deriving from gentlemanly status, this explains why the Royal Society doesn't have artisan members or merchant members very much. It really has to create authority through the kinds of structures that are there at the time, not just from saying that "these are the facts we have verified empirically".

Herbert Huppert: And that's social authority, isn't it?

Jacqueline Rose: Yes.

Peter Harrison: To come back to Jim's original questions, perhaps the link between the motto of the Royal Society – *nullius in verba* – and the issues of witnessing and authority relate back to my suggestions about the significance of religion. One prominent feature of Protestant criticisms of medieval Catholicism was an attack on 'implicit faith', this being a kind of unquestioning acceptance on the part of the laity of the authoritative pronouncements of Church. Subsequently, the Royal Society have their own version of this repudiation of implicit faith, encapsulated in the motto *nullius in verba*. This motto is not so much to do with 'words' – although it is often rendered 'on no man's word'; rather when we take into consideration its original context in Horace, it is perhaps best paraphrased "I give allegiance to the authority of no master". So now authority is vested not in the pronouncements of some individual – such as Aristotle, whose science was still taught in the universities – but in communal witnessing and reliable reports of particular experiences.

Perhaps the other category that we are not familiar with is the category of "experimental religion". The word "experimental" in the 17th Century has a range of connotations, one of which is simply first-hand experiential knowledge. But, surprising as it may seem, "experimental" was a term used to describe many elements of religious experience, too. In fact, if we look at the context in which the terms "experiment" and "experimentally" were used in the 17th Century, the primary context is religious. So part of what is going on in the discussions about the primacy of experiment in the scientific context is a drawing of parallels between the authority of first-hand experience in the two spheres, science and religion. Experimental witnessing, interestingly, is another expression used in both spheres. So when Thomas Sprat talks about experimental

knowledge and witnessing in his very early defence of the activities of the Royal Society, he is cleverly appropriating religious conceptions, and bringing them across into the vocabulary of the Royal Society. In a sense, he is saying that the forms of knowledge that we now regard as being significant in Protestantism are really the epistemological structures that we want to set up here in the Royal Society. Just as Protestant religion represents a reappraisal of the proper source of religious authority, so too with experimental philosophy: both rely on the primacy of personal experience, rather than handed down traditions.

This also goes back to the first question which Jim asked which is a really interesting one – what do we mean by “religion”? This is an important issue because we have a conception of religion now that doesn’t have much in common with the 17th Century conception. It was precisely at this time that we are moving from a notion of “religion as piety” to a more objectified conception of “religion as propositions to which we give assent”, and that’s really important. The intimate link between religion and science actually promotes this new conception of religion because of the new role of natural theology. Natural theology, based on the new science, shows how science can be religiously useful, and so validates a propositional, rational religion, as opposed to a more personal inner religion understood as piety. So if we go back to this original question, it’s very interesting to look at the parallel conceptions of how questions of authority, witnessing and experiment/experience are mapped across from the religious language on to the scientific language.

Denis Alexander: I think I am right in saying that Jonathan Edwards picked this up as well in his writings in the 18th Century. So here you have great theologian and preacher making the connection between preaching the word and natural philosophy as sort of parallel activities, so they should go together.

Peter Harrison: Jonathan Edwards actually explicitly says that just as we have experimental knowledge in the sciences, so we have experimental knowledge in the religious sphere. He says this in his famous *Treatise concerning Religious Affections*. So yes, he makes exactly that kind of link and you’re right, he’s a very interesting case study.

Bob White: So the question is, when did that break happen? When did it change from accepting that religion was a helpful way of looking at the world in parallel to science to the current view in the street either that they’re nothing to do with each other, or that they are opposed to each other, or even that one nullifies the other. Was it not so much to do with science and religion as with power and authority? That’s what I take to be the issue in the big debate between T.H. Huxley and Bishop Wilberforce in 1860. The scientists were trying to become a professional class in the 19th Century and to wrest power away from the church. Is that a valid way of looking at it? What do other people think about that?

Jan Boersema: Maybe it was also a specific kind of religion those people had, which was clearly not opposed to science, because there was no controversy between science and religion I think, as they had a specific kind of religion which goes along quite well with science. Religion of the God does not interfere with normal life, personal God is present in each life. A God makes the order of things that we could discover later on. So it was also the kind of religion they had that created more or less no controversies at all ..

Bob White: In the 17th Century?

Jan Boersema: In the 17th Century yes ...

Bob White: But come the 19th Century things had changed.

Jan Boersema: Yes, right, and then the real problems started.

Jim Secord: I think that’s one thing to realise, that it doesn’t change all at once and it certainly doesn’t change for everyone by any means. One of the reasons the Platonists? become so heated is precisely because there are quite a few people who think that things are actually working rather well together and that’s a really very long-standing kind of view.

I think that the other thing to recognise is that these issues are very widely debated and there are many different points of view, so you can see the origins of some of the science-versus-religion viewpoints going back, well, certainly into the 18th Century Enlightenment but continuing forward from that in various secularising groups. By and large, though, I think as a whole, particularly in Britain, that there's quite a strong alliance between the two and you can see that dialogue continuing.

I think the 17th Century is interesting because these issues are so present, in some ways at their very deep level between the sciences. If you look at something like Newton's attitude towards these questions and the way they come across in his work and then you look at some of the later sorts of people, Faraday for example, it may have come through his work in various kinds of ways but it's certainly not on a page in the same kind of way or something like that. I think that's a big difference in terms of the way they present it. But I think in the 17th Century these issues were very much in the fore and I've always thought the argument that in some sense 17th Century science comes out of religion is actually quite a powerful one.

John Polkinghorne: There surely must have been some serious development of the controversies through the growth mechanistic ideas in the middle of the eighteenth century, the encyclopaedists and so on. Isn't that part of the story?

Peter Harrison: I think you are exactly right. There are two things: we shouldn't think the mechanical philosophy is all sweetness and light in terms of its implications for religion – serious work needs to be done to show their compatibility. In fact, one of the reasons the Royal Society is so keen to establish its religious credentials is that the mechanical philosophy, or at least atomic matter theory, had traditionally been regarded as incipiently atheistic. Thomas Hobbes, for example, is often regarded as exemplifying the atheistic potential of mechanical philosophy (even though it was very unlikely that he was an atheist). So there's a strong impetus to establish the fact that we can have an atomistic philosophy that is theologically respectable. One argument was that the inertness of matter necessitated divine action. But that said, even though proponents of the atomic philosophy in the 17th Century are quite confident that they can reconcile these things, there is tension. Descartes, for example, had trouble squaring his matter theory with the Catholic doctrine of transubstantiation.

This brings me to the second point, namely that in France I think the story is rather different, partly because – again this is an over-simplification – I think the natural philosophical community to some extent finds itself over and against a Catholic establishment in a way that wasn't the case in England. Some figures in the French Enlightenment thus seem to be subscribing to an atheistic materialism that seems at odds with religious conceptions. But there's an Enlightenment in England too, remember, and that's a very different kind of proposition. I think that this is an undertaking where to some extent religion is the core of the Enlightenment principles that are being expressed by people like Locke and so on, and the role of science in that is quite different. I think we're certainly right to say, and I think this was one of the points that Jim made earlier – his second point – that other contexts are worth taking seriously. But the context I was concerned with today was the English context.

Derek Burke: I want to ask Peter a question about Enlightenment values, which I gather have different meaning in different cultures. As I understand it, enlightenment values were integral to the founding of the Royal Society, though I'm not a philosopher or a historian – but they are used now by people like Harry Kroto and Richard Dawkins as a bludgeon to beat the religious because Enlightenment values, they say, argue for pure reason and nothing else but pure reason, and therefore anything we just believe is rubbish. I even notice that the Prince of Wales today has said that it's about time that we got rid of Enlightenment values because they are two hundred years old (laughter) – that will really cheer historians up! – and he wants a holistic philosophy where we work with the grain of nature, whatever that means.

But seriously, it would be helpful for people who are outside this debate if you could clarify what are Enlightenment values.

Bob White: Do our other philosophers want to come in there?

Tom Simpson: I don't feel qualified to comment on the historical context. The only other tidbits that might be worth throwing in is that the title page of Hume's treatise is very explicitly an attempt to introduce the experimental method of reason into the moral sciences, so there's a *volte face* there of philosophy meaning to emulate success in the natural sciences and trying to bring that into more subjects.

Peter Harrison: Thinking about Hume, he is a kind of exemplar of the Scottish Enlightenment and I think the tendency is for historians to see different Enlightenments in different national contexts, in much the same way that we see that science and religion issues vary in a different national contexts. One interesting point about Hume, in relation to applying the experimental approach to the moral sciences, is that the experimental method takes seriously, and is premised on, the idea that our cognitive abilities are seriously limited. Hume believed that we need to rely on experiment/experience precisely because our reason and cognitive faculties are so weak. Clearly by the time we get to Hume we have a somewhat secularised view about cognitive limitation, but in the 17th Century this idea was underpinned by the theological notion that the human mind was weak on account on the Fall. Of course Hume is not going to invoke original sin, but nonetheless by this stage he has appropriated this idea of human cognitive limitation and taken it as a given. So there's this really interesting story about the historical origins of these conceptions and the extent to which they still make sense, if we no longer subscribe to theological underpinnings that originally gave rise to them. I think the question is worth asking in the philosophy of science, in regard to laws of nature, for example. It's very interesting that the eminent philosopher of science Nancy Cartwright is highly sceptical about the existence of laws of nature and part of that, I think, is because she understands the history of this conception – that is, that laws of nature were originally conceived to be laws literally promulgated by a Deity.

But to get back to the general question I don't think we should take too seriously the invocation of the Enlightenment and 'Enlightenment values' by people like Harry Kroto. Harry Kroto knows as much about history as I know about astrochemistry! These discussions often make flag-waving statements about 'enlightenment values' and the primacy of reason, but these bear little relation to the historical reality. Hume, remember, famously said that reason is, and ought only to be, the slave of the passions. There's a deep scepticism and suspicion of reason in key Enlightenment figures that is completely at odds with the breezy, epistemological optimism of those who now wish to invoke them. Generally, moreover, in the English context I think it's pretty clear that fundamental Enlightenment values arise out of a religious understanding of things. Not all historians would agree with this, and in the French context it's rather different. But there remain very interesting and open questions about the origin of our modern conceptions of human rights, for example, and the role played by religion.

Jan Boersema: What do you make of the distinction of Jonathan Israel between a radical Enlightenment and the Enlightenment?

Peter Harrison: I should say first of all, that Jonathan Israel is a very gifted historian and I have learned a lot from his work. I also think that it is useful to distinguish between various 'Enlightenments' in the way that he does. Most historians would now agree that there really was no such thing as *the* Enlightenment. That said, there are few historians who accept the very broad claims he makes about the role of the radical Enlightenment in giving birth to modern enlightened values.

John Polkinghorne: For those who don't know, could you put in a nutshell what this discredited thesis is?

Peter Harrison: Jonathan Israel's thesis is essentially that we can distinguish between a moderate enlightenment and a radical enlightenment. Whereas the latter, which is clearly indebted to religion for many of its central tenets, has typically been regarded as the progenitor of the values of modern liberal democracies, Jonathan Israel contends that it is the radical enlightenment, which is far less sympathetic to religion, which is the true source of the values

and freedoms that we now hold dear. The radical Enlightenment, he argues, has its origins in the philosophy of Spinoza. The scholarship behind this is very impressive, but I think that it's fair to say that the big thesis has not convinced many intellectual historians. That's it, in essence. There are two very fat books, John, with another still to come!

Jacqueline Rose: What arises out of this, but which is also a question I had from the lecture and from what Jim said, is this: You made an effective case for the Royal Society and science arising out of a Protestant context in England rather than a Puritan or a Latitudinarian one. I want to ask: why then was it England, why was it not somewhere like the United Provinces which is also Protestant, that this comes together? It seems to me you need another factor as well as Protestantism.

Peter Harrison: That's an excellent question, I think. At the end of my recent book, *The Fall of Man and the Foundations of Science*, I pose this question myself, and ask for somebody out there to please answer it! One of the implications of the general line that I take is that you might expect something similar to happen in Holland where, to some extent, a similar religious environment prevails. If you want to say what would we predict as a consequence of this thesis and one of the things I think is exactly that. And perhaps the other thing is to think about Harold Cooke's version of what's going on in Holland, in his recent book *Matters of Exchange*, which makes no reference whatsoever to religion: religion is not regarded as a significant factor at all. So all I can say is that for me it's an open question and I don't know, because to be honest I simply don't know the Dutch situation very well, and I don't have the language. The trick would be to look at all the variables, and see what is different. Certainly, the United Provinces did yield very important science. I do know that there are Dutch post-grad students who are exploring this question, because I have had correspondence with them, and I think you're right to say that this is what you would predict on the basis of the argument that I outlined.

Jacqueline Rose: There's another argument arising from what you said a few minutes ago about Hobbes. It seems to me that this does bring religion back in, but in a slightly more contentious sense. There are people in the Royal Society, and people associated with it, who want natural law, but who don't want a Hobbesian version of it; and if the Royal Society had been created in, say, 1648, Hobbes would have been a member because at that point he was a respected writer on science, involved in a lot of the French circles discussing this. What he writes in the 1650s really puts people off. So do you see religion being used in some sort of exclusive manner to keep out people like Hobbes and does that help us refine what sort of religion therefore fits with science?

Peter Harrison: Again, that's a very good question. I don't think Hobbes, who was quite elderly by this stage, was taken seriously in terms of natural philosophical accomplishments. So that's one possibility. Were his imagined religious views part of this exclusion? Also possible, because as I have stressed, one of the things that the early Royal Society were very keen to avoid was religious controversy, and Hobbes might well have injured their reputation. And of course there is also the simple possibility that he had alienated key figures, and Robert Boyle and John Wallis are the likely suspects here.

Peter Collins: Just thinking of Jacqueline's question, academies of science were founded in other countries and I have tried to jot down dates: the Swedish Academy was founded in 1739, the Dutch Academy in 1808, the Leopoldina Academy in Halle in about 1653, so it is happening in other places with slight time shifts one way or another. I don't know if in that you can find the experimental evidence, as it were, for the question of how important forms of Protestantism were. What I am really saying is one can pursue your question.

Denis Alexander: On a slightly different point, I just wanted to come back and raise a question about the mechanical images that were so popular in the 17th Century and the trend to call the new science of the day the 'mechanical philosophy' I had the impression, Peter, that you were suggesting that these mechanical pictures and metaphors might have had anti-religious tendencies. But I have to say that I have always seen them as being much more driven by religious impulses. Boyle likened the world approvingly to the great clockwork at Strasbourg, and

Johannes Kepler once wrote that “My aim is to show that the heavenly machine is not a kind of divine, live being, but a kind of clockwork ..”. It was always God’s machine, but equally we can see that the metaphor is a two-edged sword as it’s always open to the critic to say that the machine is autonomous – and I guess that’s the concern that you were alluding to.

So, machine analogies and pictures, weren’t they rather driven by religious motivations, or have I got that wrong?

Peter Harrison: I think there are a couple of things there. At a very simple level you can say that the Aristotelian picture, crudely speaking, is an organic model – nature is like a vast organism. What happens in the 17th Century is you get the mechanical model. Now one of the advantages of the mechanical model is that you also get the possibility of the analogy of the watch and the watchmaker which you don’t get with Aristotle, partly because Aristotle’s God is not a creator, because Aristotle believes in the eternity of universe. To some extent, moreover, Aristotle’s nature has its own potential and inherent powers, and Aristotle also has this important distinction between the natural and the artificial. It follows from this that the thing that is made – the artefact – bears no analogy to the thing that is natural.

If you introduce a mechanical metaphor now you have the possibility of a new analogy of the creator and the mechanical device, so that’s one advantage of the new system. And the other advantage is that with the mechanical device you evacuate the natural powers of nature, so that nature is not so much autonomous but reliant on some external imposition of order that’s not inherent. So in the organic Aristotelian model you have an inherent order, and it can be to some degree independent of God, whereas in the machine – and this is to introduce not merely the mechanical metaphor now but the atomic philosophy – the particles are inert and have no powers of their own.

Now this is a vast generalisation, but in this world of inert particles what you require is some motivating force in a way that you don’t with organic, vitalistic world. I think we see the significance of this most conspicuously in Descartes for whom God provides that motivating force. In this model all of the motion in the Universe is directly attributed to the divine power, which imposes mathematical laws on particles such that the whole of the motion can be understood in terms of micromechanics. But ultimately the source of the motion is God, not nature, so it’s a very complicated package. The worry about the mechanical philosophy is the possibility that particles have their own intrinsic powers and the possibility of self-organisation, in which case you don’t need God, and that of course raises the spectre of Epicureanism: that if the 17th Century atomism is Epicurean atomism simply reinvented then there’s a worry about whether God has a role. So from the very time when people like Pierre Gassendi start to produce this new atomic philosophy they bend over backwards to insist that God has an important role, and part of that is to say that the particles themselves require an external source of motion.

David Thomson: Could you say that in the Restoration period the English political situation required precisely that God’s power and presence were acknowledged but without religious enthusiasm or conflict, and so perhaps without divine intervention and interference; so if you like there was a perfect fit between the political situation and that particular philosophical science. This then maybe begins to explain why the Royal Society emerges in England, rather than somewhere else.

Peter Harrison: Now that’s a very different point – I haven’t mentioned politics at all, and clearly this is a variable that needs to be introduced. Margaret Jacob, who I mentioned in relation to Freemasonry, has a very interesting set of arguments about the relation between the Newtonian worldview and politics – that the Newtonian ideology fitted very nicely with the new political and ecclesiastical circumstances that followed the Restoration and the 1688 revolution. Historians are a little bit sceptical about this, but historians are always sceptical about any large-scale thesis, partly because there are always problems with the details. But I think it’s a very interesting point and certainly the political situation is a relevant factor here.

David Thomson: If you wanted to throw that forward to your reference to the 1850s, it is interesting that just at the point when science is in a sense wanting to claim its own autonomy and its own sources of authority, that's the point – whether on the Catholic or the Protestant side of the spectrum – when the whole notion of personal enthusiasm, personal religion, begins to bubble up again. It struck me as you were lecturing, Peter, that in the 17th Century it was those who were taking the Word literally who created the environment for the Royal Society. Throw that forward into the 1850s and into the present and we might be in the opposite situation, where we have a different conjunction – that those who take the Word literally might find reasons why they are suspicious of the scientific enterprise.

John Polkinghorne: I get the feel that mechanism in the 17th Century was a kind of cosmic picture - Newton talking about the solar system, the model of the orrery. Aren't the stakes much higher in the eighteenth century, when de la Mettrie wrote *L'homme Machine* (Machine Man); it seems to me that mechanism was being taken increasingly seriously. Is that right?

Peter Harrison: I think that's right. That's the French trajectory. In a sense it was incipient in Descartes. Some were seriously worried about the materialistic implications of Cartesian mechanism, although Descartes, of course, is putatively a dualist. But since we are here, the Cambridge Platonists, who were initially big fans of Descartes, and who sought to introduce him into the curriculum here at Cambridge, all of a sudden get really scared. When Descartes comes up with the beast-machine model, they start going "Oh hang on, we're not buying this at all" because they see where it might all end up, that is, with the kind Hobbesian materialism that they deeply feared.

Jim Secord: To add a little bit to that, I think that certainly Descartes and Hobbes are really crucial for that story. De la Mettrie is interesting in some sense but certainly in Britain it's quite an oddity in some way and doesn't really take off.

I think the other thing to stress is maybe that some of these political things aren't even just analogies or homologies, quite often you have enthusiasm that isn't acted out in people who are really putting forward a whole range of different views of the way that matter works and what it means for the eternal soul and so forth. These kinds of ideas are really very powerful during the period of the 1640s and 50s and so it's not some kind of final idea out there that somebody's put forward, it's actually people on the ground actually putting it forward, in some case the Levellers and Diggers and so forth. That's partly what the reaction after the Restoration is really about. The Royal Society clearly comes out of a concern to have this much more generalised view of "Here's what we all basically can agree about", and the rest of the stuff really has to be put away. They are pretty vehement about getting rid of those people, certainly.

Brian Heap: Peter, I was interested that you frequently referred to the importance of dominion over the planet during this phase of the Royal Society's history, that humankind had the right and responsibility to exploit the resources of the planet to their advantage. Presumably this was associated with the Royal Society's position in terms status, power and influence. Yet at the same time many Fellows were deeply involved in natural theology, but did the idea of stewardship responsibility never occur to them? Why has it come so late? Clearly there were people who were thinking at that time about the importance of caring for the planet in terms of stewardship and sustainability. Even before Malthus, the French mathematician and Enlightenment thinker Condorcet (1795) was expressing the hope that people would reason their way into achieving technical progress as well as behavioural adjustments. He wrote that "A very small amount of ground will be able to produce a great quantity of supplies of greater utility or higher quality; more goods will be obtained from a smaller outlay; the manufacture of articles will be achieved with less wastage in raw materials and will make better use of them". What was happening in the Royal Society at this time? Is this a latter day interest of the Royal Society or was there something in parallel happening?

Peter Harrison: For the 17th Century we need to project back to what I think is essentially John Parnmore's distinction between a stewardship tradition and a dominion tradition. But I also think

for the 17th Century they amount to precisely the same thing, and they amount to precisely the same thing for this reason, that the natural world, so-called, is for the 17th Century, a fallen world, and to that extent it's considered to be "unnatural". The natural world is the world as God originally created it, so the impulse for dominion comes from the attempt to regain dominion, to return the earth to the state in which it was conceived to be originally: the geometrization of gardens, for instance, is a classic example of this. If you compare that to contemporary pictures of the Garden of Eden this is what they thought it was like. So what we would regard as the *despoiling* of nature is understood to be the *restoration* of nature to its original condition. I think that's how it plays. So when you ask the question was there not accountability and stewardship, they thought insofar as they were exercising dominion over nature they *were* being good stewards. Now, obviously from the perspective of the 21st Century, we have reservations about that.

It is also important to remember that the biblical imperative to exercise dominion provided an important incentive for scientific endeavour. Francis Bacon is quite explicit about this – that we should pursue the sciences because they provide the means re-establishing a dominion over nature that was lost as a consequence of the Fall. So while religion redresses the moral losses that accrue from the Fall, science helps us overcome the loss of dominion.

But the other aspect of dominion I haven't mentioned is the political one. I was talking to Jackie earlier and there's a very interesting recent Cambridge PhD thesis by Sarah Irving which links the colonial interests of individuals in the Royal Society to the sciences that this establishment of dominion oversees. So when these figures look at places like America, they see a primitive, fallen place, probably still soggy after the flood, and what they see the colonial enterprise as doing is bringing to these places the Edenic perfection that they once had. Part of the justification is the biblical injunction to "fill the earth and subdue it" and if the locals aren't going to do it, then they will do it for them.

Bob White: Manifest destiny?

Jacqueline Rose: And – just to capture the mentality of the late 17th Century – if you look at someone like John Locke, he says "All men have dominion over nature" because that's what was given to them in Genesis. But then when he talks about improvement, improvement bears both the sense of the moral improvement of the individual and improving the yield you can get from land. For Locke the latter is something you want to do – but then you mustn't waste it, so in that sense you maybe have some sort of stewardship idea coming out at the same time.

Peter Harrison: What's crucial in the colonial context is the Lockean conception of private property. What Locke says is the land becomes ours insofar as we mix our labour with it, so when the British come to Australia, for example, and see no-one engaged in agriculture to 'improve' the land, no-one mixing their labour with it, they regard that land as theirs to take. They consider themselves as having a duty to take it and subdue it.

Jan Boersema: So well into the 19th Century I think there is the idea that the wilderness has to be pushed back, because in a sense the wilderness is chaos and evil so it has to be tamed and domesticated. I think that's even an idea you find with Aristotle, saying that there's good food, you can eat.

Denis Alexander: I think the most powerful passages I have read on sustainability from earlier centuries are those found in Calvin in this commentary on Genesis. For example: "Let him who possesses a field, so partake of its yearly fruits, that he may not suffer the ground to be injured by his negligence, but let him endeavour to hand it down to posterity as he received it, or even better cultivated" ... "let everyone regard himself as the steward of God in all things which he possesses. Then he will neither conduct himself dissolutely, nor corrupt by abuse those things which God requires to be preserved".

Jan Boersema: That's basically agriculture!

Tom Simpson: It's just a very small point – I don't feel qualified to speak on the historical stuff but I can speak with a little more authority about contemporary philosophy. One of the things that there's been in the Philosophy of Religion in the last fifteen years has been the recovery of the idea that sin affects our knowledge of God and Alvin Plantinga in particular has picked that up, but he's not alone in that. I have been really interested to hear you say that it actually had a far bigger vision in the 17th Century than just on knowledge of God, but also all of our knowledge was affected by it; that's something I will be able to take away from this as a lesson and it's a theme that's currently discussed now as well..

Bob White: Does anyone else want to make any comments?

Larissa Johnson-Aldridge: Peter you were talking about how the Fellows of the Royal Society scrupulously avoided meddling with divinity, which is not to avoid religion but to avoid religious controversy. I am wondering to what extent they were successful in that, and how did they actually define what counted as controversy and what counted as either healthy discussion, or defending doctrines that needed to be defended?

Peter Harrison: It's a key question. I think to some extent you have to distinguish what we would call "motherhood" statements in the public utterances of the Royal Society, which include for example talk about their activities promoting the glory of God. These are formulaic statements, to some extent expected and religiously unproblematic. It doesn't necessarily follow, of course, that they were insincere, but there is a certain formality here. Their claim to avoid "meddling with theology" is a formulaic kind of utterance as well. But where to draw the line between anodyne religious utterances and potentially controversial religious claims was difficult to gauge. It is significant that a number of Fellows were annoyed that Sprat had made such robust claims about the intrinsically religious nature of these scientific activities because this aroused the ire of people like Meric Casaubon and Henry Stubbe, who thought "You've got to be kidding". So all I think I can say is, which I think is probably the point you were making, that we can make sense of the idea that there's an uncontroversial core of doctrine and the rest is *adiaphora* – which is to say that is the stuff that we don't have to be *too* concerned with, it doesn't matter if we believe it; you can believe it if you like, but it's not a core thing. But these boundaries are in a state of flux, and that's where the real potential for controversy is. What actually counts as core belief, and what is regarded as an optional extra, is to some extent going to be at issue at any one time.

Bob White: I think that's a good moment to stop. Thank you, Peter. We have worked you really hard tonight – thank you very much again.

Additional comment by **Peter Duncumbe** added after the discussion:

I referred in the discussion after the lecture to "curiosity" and the drive that it gives to scientists – not just to the study of nature but to the application of science in our daily lives. In my experience this has been a pervading force, which if channelled can result in huge leaps forward in basic and applied science as well as in exploring the relationship with religion. In university the channelling is relatively unfettered but in industry it is more object-oriented. I have seen this at first hand in both areas and I believe it to be true of the early Royal Society pioneers. Of course, there are many other ingredients to successful research but this is an important driving force.