

What has theology ever done for science?

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At the recent Darwin Festival in Cambridge there was a session entitled 'Theology in a Darwinian Age'. I have reported previously on the science and religion topics covered more generally in the Festival in an on-line article in The Daily Telegraph:

<http://www.telegraph.co.uk/news/newstoppers/religion/5842511/Science-and-religion-squabbling-but-loving-cousins.html>.

Here I want to pick up on a question posed by Daniel Dennett who sat in on this particular session, which is "What has theology ever done for science?" There was not enough time in the discussion to give this question the attention it deserved, so I'd like to pick up on a few further thoughts here.

In a sense it's a bit of an odd question for one academic discipline to ask about another. Imagine, for example, that someone from the department of mathematics here in Cambridge walks down the road to the history department and demands to know "what did history ever do for mathematics?" or someone from geography wants to know what biochemistry ever did for geography, and so forth. Generally we think of each academic discipline as having its own integrity and independence, although of course interdisciplinary studies soon begin to reveal some fascinating cross-talk as well.

As it happens, in this particular case the beginning of the answer, at least, is fairly straightforward: science itself is a gift from theology. In fact Daniel Dennett made precisely this point, albeit briefly, in his own talk on the Wednesday morning of the Darwin Festival. I bumped into him at a reception later in the same week and double-checked to make sure that I had understood his views correctly. Yes, Dennett confirmed that science itself was framed and motivated by theological concerns. By that of course, neither of us mean that theological concerns were the only ones that mattered in the emergence of modern science – far from it. Economic, political, military, social and personal factors all played their important roles. But having said all that, what is striking as we track the history of science from the Greek philosophers through the hey-day of

Islamic science from the 9th to 14th centuries, and on into medieval Europe and the scientific revolution of the 16th and 17th centuries, is the way that the motivations, tools and concepts of the emerging empirical sciences were provided and shaped by theology.

Science as a gift from theology

Whole books have been written on such topics, so just four historical examples must suffice. First, there seems little doubt that the concept of scientific laws was nurtured by the Christian belief that God has established moral laws for the universe and therefore, *ipso facto*, God must maintain similar laws that govern the physical world. The rational God of Christian theology provided a rationale for seeking intelligibility in the world, as expressed through laws. This is made explicit in the writings of early natural philosophers such as Descartes, Boyle and Newton. As Descartes wrote to Mersenne, on April 15, 1630: “God established these laws in nature, in the same way as a king establishes laws in his kingdom.” The actual origins of the concept of scientific laws is a point still discussed by historians, but its prominence in the rise of the natural sciences through the portal of theology seems unambiguous.

A second theme that we often find in the early natural philosophers is the idea that the contingency of God’s actions encourages an empirical attitude towards the natural world. The God of the Bible can do what he likes, and it is up to natural philosophers to determine this empirically, it cannot be worked out from first principles as the Greek rationalists mistakenly thought. Contingency stems from the free will of the omnipotent Creator. This point was made explicitly by Cotes in his preface to the second edition of Isaac Newton's great work the 'Principia Mathematica' in words clearly approved by Newton himself:

'Without all doubt this world...could arise from nothing but the perfectly free will of God....These (laws of nature) therefore we must not seek from uncertain conjectures, but learn them from observations and experiments.'

Of course Newton himself was a devout believer who wrote far more on Biblical themes than he ever did on physics (in fact more than a million words on such topics, with another million words on alchemy), although his theological writings remained largely unpublished during his own lifetime. Only now is the full corpus of his religious writings being made fully available in the wonderful Newton on-line project run by Rob Iliffe from the University of Sussex (<http://www.newtonproject.sussex.ac.uk/prism.php?id=1>).

The enthusiasm for the new empiricism is equally well illustrated by John Wilkins, an Anglican Bishop with Puritan sympathies, a founding member of the Royal Society (which really started as a discussion group held in his rooms at Wadham College, Oxford), who frequently started his written discussions in science and mechanics with an examination of Aristotle's views on the subject, but then proceeded to express his own very independent ideas. We should not be 'so superstitiously devoted to Antiquity', wrote Wilkins in the carefully chosen words of a 17th century Bishop, 'as for to take up everything as Canonical which drops from the pen of a Father, ... We must labour to find out what things are in themselves by our own experience...not what another says of them.' Obvious to us now – revolutionary at the time: a good example of theological stimulation being provided to assist the emergence of the empirical method.

The third way in which theology contributed to the emergence of modern science is perhaps counter-intuitive and unexpected, and it relates to the Christian doctrine of the Fall and its perceived impact on the ability of natural philosophers to gain access to truth. This is a good example where it's quite hard to try and think our way back into the world-view of these early natural philosophers. The thesis is well expounded in 'The Fall of Man and the Foundations of Science' written by the Oxford historian of science Peter Harrison (<http://www.cambridge.org/catalogue/catalogue.asp?isbn=9780521875592>). What Peter has done in this book is to amass a huge amount of historical data to show that the idea that the mind is fallen, a conviction shared by virtually all the natural philosophers of the early modern period (16th-17th centuries), led them to be suspicious of unaided reason as a way of arriving at truths about nature, using the kind of deductive processes familiar in Greek philosophy. This in turn stimulated the emergence of the empirical method because clearly the only way to establish reliable truths was to do

experiments to find out how nature actually worked - this wasn't something that could be worked out from first principles by fallen minds. So in Harrison's view, at its inception, modern science was conceptualized as a means of recapturing the knowledge of nature that Adam had once possessed, so reversing the effects of the Fall.

The point is well expressed by Robert Hooke, who was curator of experiments at the Royal Society, in the Preface to his book *Micrographia* (1665), where he notes that 'every man, both from a deriv'd corruption, innate and born within him, and from his breeding and converse with men, is very subject to slip into all sorts of errors....These being the dangers in the process of humane Reason, the remedies of them all can only proceed from the real, the mechanical, the experimental Philosophy'. Francis Bacon saw the new experimental philosophy as restoring the knowledge that had been lost since Adam, remarking that 'the subtlety of experiments is far greater than that of the sense itself, even when assisted by exquisite instruments'.

A fourth theme in the scientific revolution that has strongly theological overtones is the enthusiasm of many of the natural philosophers for what came to be known as the new mechanical philosophy, a term virtually synonymous with the new experimental philosophy itself. From our perspective it might seem surprising that machine analogies to describe the properties of the world would be introduced within the context of Christian theology, but the machine for these natural philosophers was always God's machine – they saw no tension between mechanism and meaning. The astronomer Kepler, who initially trained to be a Lutheran pastor, wrote that 'My aim is to show that the heavenly machine is not a kind of divine, live being, but a kind of clockwork....'

Three natural philosophers in particular were responsible for promoting the mechanical philosophy: the French Catholic Rene Descartes (1596-1650); the French Catholic priest Pierre Gassendi (1592-1655) and the English Anglican Robert Boyle (1627-91). Although their approaches were distinctive, they were all united in their enthusiasm for mechanistic analogies in explaining the properties of matter, and they were equally united in believing that such analogies were valuable theologically in helping people to understand God's creative actions. Robert Boyle called the basic units of matter corpuscles, which were of course the basis for his famous laws on the behaviour of gases. Boyle's clocklike universe was constructed by a wise God in such a

way that it needed no constant adjustment. In a comment with relevance to current debates about so-called 'Intelligent Design', Boyle wrote that:

“It more sets off the wisdom of God in the fabric of the universe, that he can make so vast a machine perform all those many things, which he designed it should, by the mere contrivance of brute matter managed by certain laws of local motion and upheld by his ordinary and general concourse, than if from time to time he employed an intelligent overseer, such as nature is fancied to be, to regulate, assist, and control the motions of the parts”.

Often in the theological writings of this period we find repeated the idea of the 'Two Books'—referring to the Scriptures as the Book of God's Word, whereas Nature represents the Book of God's Works. Robert Boyle, for example, said that: “As the two great books, of Nature and of Scripture, have the same author; so the study of the latter does not at all hinder an inquisitive man's delight in the study of the former”. So in many ways the stance of these early natural philosophers reflects a complementarity model of the relationship between science and religion.

As we look at these four themes (and of course there are others besides), what is striking about them is not the way in which they provide the actual content of scientific theories, though we'll come to some examples of that below, but the way in which they help provide the appropriate framework and tool-kit of ideas which are essential for the scientific enterprise to flourish. It is in this sense that we can say that “science is a gift from theology”.

Theological influences on the content of theories.

It is not the task of theology to seek to influence the content of scientific theories. Obviously the anti-Darwinian campaigns carried out in the USA by contemporary enthusiasts for creationism and Intelligent Design provide a good example of just how disastrous that kind of interference can be. Nevertheless, it remains a fact that positive theological influences on the actual content of scientific theories can readily be discerned in the history of science, although such influences are more readily discernible with the

benefit of hindsight. Scientists are not ethereal beings isolated from their cultural milieu, but embedded in their context and history as much as anyone else. So even those who think they are being most 'purely scientific' in their work may, in retrospect, be seen to be influenced in their theorizing or research programs by non-scientific factors.

It is a plausible inference, for example, that Newton's laws of gravity were nurtured by his deep faith in a creator God who could act over vast distances to maintain the mathematically elegant relationships between objects in harmony. Newton was resolutely agnostic over the mechanism whereby gravity operates, leading to accusations that he believed in 'occult forces', but a universe in which unknown forces of gravity acted at a distance certainly seemed more believable when it was ruled over by a benevolent albeit invisible Law-maker.

The 19th century physicist Michael Faraday (1791-1867) was a founder of the science of electromagnetism, architect of classical field theory, discoverer of two laws of electrolysis and of numerous chemical compounds. He was also a person of deep Christian faith, providing another interesting example of the ways in which theology can impact on the development of scientific theories. The earlier literature on Faraday maintained that he kept his science and theology in rather watertight compartments, but more recent scholarship has uncovered some interesting synergies (discussed in more detail in Colin Russell's Faraday Paper No 13: <http://www.st-edmunds.cam.ac.uk/faraday/Papers.php>). In particular there seem to have been theological influences in Faraday's development of his theory of fields. As Russell writes: Faraday's "theology of an all-powerful God led him to the idea of point centres and thus of fields around them".

Arthur Eddington (1882-1944), Plumian Professor of Astronomy at Cambridge, was a practicing Quaker who did much to extend our understanding of relativity. It has been argued that Eddington's openness to spirituality, and robust critique of materialism and determinism, rendered him particularly open to Einstein's theory. There is good evidence that it was Eddington's Quaker theology that led him to promote relativity so strongly, single-handedly bringing the theory into the English speaking world, and explaining it to several generations of laypeople. Further, it was his Quaker pacifism that

helped him bypass the prejudice that prevented Einstein's key scientific paper in German from even entering Britain during the First World War. He was also very welcoming of quantum mechanics as it gathered momentum during the early 1920's, as the theory fitted well with the Quaker suspicion of the closed, deterministic universe that belonged more to the ideas of classical physics.

In providing such suggested influences of theology on the content and direction of scientific theories, and they are only suggestions, it should not be thought that this somehow provides some justification for the truth claims of a certain theological system. Christian theology does not exist for the utilitarian benefit of some particular scientific enterprise. And scientists surely have all kinds of metaphysical beliefs in their heads which influence their science in certain directions, and which no doubt on occasion act as potential brakes in the development of an otherwise fruitful direction of enquiry (there are certainly some examples of atheism hindering progress in science). The point here is simply one of completeness. If one wants to address the question: "What has theology done for science?", then as a matter of fact it has had a significant positive impact on the thinking of a good number of scientists in the history of science in the development of their theories.

Theology and the maintenance of the scientific enterprise

Daniel Dennett would of course want to say at this juncture that whilst it is certainly the case that theology has played an important role in the emergence of modern science, the booster rocket of theology is now no longer needed, and the scientific enterprise can keep its momentum in orbit quite satisfactorily without any further help from theology thank-you-very-much. I have a good deal of sympathy with this view from a purely pragmatic perspective. It is certainly the case that modern science, and its close cousin technology, have become so integrated into the economic, military and healthcare systems of developed societies that it is difficult to see how they could be readily displaced, in the near future at least.

But Dennett as a philosopher is also aware that science is an intellectually difficult enterprise. Many of its favored tenets and theories are counter-intuitive and certainly independent of commonsense. Quantum mechanics is conceptually weird but experimentally completely sound. Folk physics may come naturally to very small babies (who react with interest or alarm when physical objects in the hands of the experimenter do strange things, like disappear), but adult physics is a very different matter. In this respect folk physics and adult physics find their parallel in natural religion and theology. There is plenty of evidence from cognitive psychology that children naturally believe in God – natural religion is equivalent to natural physics. But theology is equivalent to science, much of it counter-intuitive and quite difficult. Think of the Christian doctrine of the Trinity. The early followers of Christ only came to believe in God as Trinity because of their own experience, not from logical deduction. They experienced God as Father via their Jewish heritage, God as Son via their personal encounter with Christ, and God as Holy Spirit at Pentecost. Their counter-intuitive theology of God emerged from their own personal data.

Because science is an intellectually difficult enterprise, there is value in an underpinning metaphysics which guarantees that scientific knowledge has real value. This underpinning was provided during the emergence of modern science by the belief that God had made rational human minds with the ability to gain true insights into a rational universe with properties governed by God's rational laws. True, as noted above, these minds were fallen, so their deficits needed to be supplemented by experimental data. But the data could be trusted because it was God's universe that was being investigated. This optimism in the trustworthiness of human knowledge helped carry science along on its crest for centuries, sometimes pushing scientists over the top of the wave into straight hubris.

Today that optimism in the reliability of knowledge is gone, and the post-modern suspicion of meta-narratives sits uneasily with a scientific enterprise that seeks to maintain the reliability of its knowledge, conveying science to a public that hardly knows what truth is any more. Dennett, if I understand him correctly, thinks that new underpinnings for scientific knowledge have to be invented in every generation, but we

were just getting to that interesting part of our conversation in the reception mentioned above, when we were interrupted by speeches, so I do not wish to try summarizing a view that I never had the chance to hear fully.

But I think this highlights a continuing role for theology in supporting the underpinnings of the scientific enterprise, not least in its theory of knowledge. The philosopher Nancy Cartwright, for example, rejects the very idea of scientific laws, preferring instead to see a “dappled” world in which scientific laws are absent and any unified scientific descriptions become impossible. There is good evidence that Cartwright rejects the idea of scientific laws because, *ipso facto*, they necessitate a law-giver, and her atheistic metaphysics is not favorable to such a being:

“I think that in the concept of law there is a little too much of God. We try to finesse the issue with possible worlds, fictive regularities, and *ceteris paribus* clauses. But in the end the concept of a law does not make sense without the supposition of a law-giver”.

[Nancy Cartwright, “Is natural science “natural” enough? : a reply to Philip Allport”, *Synthese* XCIV, 1993, p. 299].

Such a position could be very damaging for science in the longer-term, because it subverts the scientific quest for more comprehensive laws that bring coherence to ever-broader swathes of data. Science needs to maintain its faith in the explicability of the universe if it is going to continue to drive forward to extend its understanding in new directions. If this is God’s universe, then there is a powerful rationale and motivation to make that happen. All true knowledge is Godly knowledge.

So what can theology do for science in the present? Well clearly we cannot persuade every scientist to be a theist in order to restore a more solid epistemology to the scientific enterprise, although it is interesting to note that the huge current growth in the Church in China is associated with a parallel growth in the vigour, funding and scope of the scientific enterprise. I do not think that these two growths are unconnected. Again and again I have been told by Chinese scientists that their interest in Christianity was aroused by their academic reading of the history of the science in the West, which made it abundantly clear to them if you want your science to advance, then you need the booster-rocket of theology to come along with it. I am not suggesting that this is a significant

reason why so many Chinese have recently become Christians, but it is certainly a factor in the arousal of interest in Christian theology in China more generally.

But even for those segments of populations that might never become theists, I think that the theologies of all three of the Abrahamic faiths can be used to perform a valuable role in reminding people of the historical roots of the scientific enterprise in theology, and of the ways in which those theologies have nurtured and given birth to that collection of tools, ideas and approaches which today we subsume under titles like “the scientific method”. Even more important is the huge value placed upon scientific knowledge by placing the scientific enterprise within a theistic world-view. True knowledge about God’s universe is holy knowledge, and is part of the theist’s worship. Even if that is not a view shared by everyone, its very existence will hopefully rub off sufficiently to help maintain a high view of objective knowledge in a culture heavily influenced by relativistic modes of thought.

So what has theology done for science, and what does it go on doing? I would say, quite a lot.

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