On the limits of science

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For the dinner I will begin with a parable which is not written down here (I want to reserve it for the occasion). The present document is self-contained.

The first point I would like to make is that to discuss the limits of science is to be a friend, not an opponent, of science. There are opponents of good science in the world. I am not one of them. But to appreciate, practice and celebrate science includes to give thought to what it can and cannot do. It is not hard to argue that it cannot do everything (I will come to that in a moment). When we point this out we are like admirers of the Clifton suspension bridge who have informed themselves of its load-bearing capacity. This is the bridge in Bristol, opened in 1864 and designed by Isambard Kingdom Brunel. Brunel himself would not want us to ignore the limits of his bridge. Ignorance of those limits might lead to disaster. And, if for no other reason than a love of truth, we will want to learn about limits such as those.

For clarity, please note: I have employed this analogy merely to indicate that interest in, and awareness of, limits to science is the attitude of a friend of science.

Sometimes we read in popular books a claim that science could do everything. Quantum field theory, or string theory perhaps, could, it is claimed, account for everything that goes on in the world. There is no question about physical phenomena which the model could not address, and its answer would be correct, so they claim. Or else questions not answered by such a model are non-questions, empty of meaning, and we need not bother with them. But it is easy to find a question which science cannot answer. How about the question,

"What shall I do this afternoon?"

Now you may say that this question has no particular answer. "You can do what you like," perhaps. But that's not right. Shall I spend the afternoon wallowing in hatred and planning a murder? Surely not—and not just because I don't feel like it. There are other considerations: ethical considerations. Shall I be a respectable citizen and accept without protest the unjust systems of the world? Deciding what to do this afternoon is an important, practical, difficult question, and, I will argue, science cannot answer it for us.

Do not be deceived by the informal style of this presentation. Each of the points touched on is cogent and thoroughly thought-through. A short presentation cannot do them justice. This first one concerns the fact that our ultimate values cannot be derived from something else, certainly not from science. They can only be recognized and reached-for.

First, though, what do I mean by science? I mean approximately what we all guess I mean. It is a human activity devoted to making intelligent and well-informed efforts at understanding the processes that go on in the physical world. It is not about pet theories, but about coherent ideas that can be tested, and are tested carefully in the laboratory. It involves fair reporting of findings, and reasoned argument to find mistakes if there are any. Scientists are, by their work, aiming to understand the mechanisms of the physical world, and also, I think, they are more ambitious: they wish to get insight into the nature of being itself. I think science does give such insight. But it is not exhaustive insight. For the scientific method cannot answer ethical questions, and other questions I will come to. It can only inform reasoned discussion of ethics and everything else.

We see this in the attitudes on show in medicine. A surgeon will not regard a patient as merely a physical system on which they can operate. They will first discuss with the patient what they propose to do; they will seek informed consent. Surgery is not mere manipulation of arteries and organs, it is also part of a larger encounter between one person and another. This illustrates that an attitude which regards physical things merely as objects of inquiry or of manipulation is not the whole of what goes on in wise and hopeful human behaviour.

A physicist constructing a string theory is playing with ideas: ideas that they are free to manipulate how they will. But visit an operating theatre and observe an anaesthetist administering sevoflurane. They are not free to play: they may not explore any and all changes in the dosage. They have entered a human relationship based on profound degrees of trust. My point is: if by 'scientific' we mean an attitude that regards all physical things as mere objects of enquiry, then science is simply inappropriate in many situations. And if we try to expand the meaning of the word 'scientific' so as to cover the range of attitudes that are in fact needed to live a human life, then the word begins to be too vague and ends up as a synonym for 'being a good person', but then it leaves entirely open what being a good person would look like in practice. Either way, science has fallen silent.

Another question which rapidly runs up against the limits of science is,

"Why did you do that?"

This touches on free will. If the physical world is not a huge clockwork machine, and I think it is not, then the patterns which science elucidates are not the whole of what is going on. There is also continuous fresh input into the world through the freedoms afforded to the creatures: chiefly humans, but other species too. And when people take up a partnership with God, there is the work of the Holy Spirit in them. This is where prayer comes in. When we pray with the appropriate thoughtfulness and humility then our decision-making gets better. The tools of science cannot entirely grapple with this: they can only show that it is possible. Physics and biology uncover a subtle world, one which could indeed have sufficient openness that free human and divine action is possible within it.

Finally, science does not explain anything at all. Explain in full, I mean. Rather, it is part of a larger framework of explanation. Science cannot be brought to bear on meta-scientific questions, such as "why is the physical world replete with pattern?", or, more tellingly, "why is the type of mathematics on view in physics such a deep and beautiful type?" Another is, "how can physical existence even come about at all?" After all, mere mathematics cannot confer existence on anything. As Stephen Hawking rightly said: " ...It is just a set of rules and equations. What is it that breathes fire into the equations and makes

a universe for them to describe?" Just so. I can write equations till the cows come home, but merely having equations does not mean there will be any cows.

In recent years physicists have sometimes claimed that quantum field theory is able to account for *how there can be something rather than nothing*. Stephen Hawking, on an off day, made such a claim, and so did Lawrence Kraus, for example. It is not true. Indeed, it is complete and utter balderdash. It is like claiming that the Bayeux Tapestry caused the battle of Hastings. Physics, like the rest of science, is *descriptive*. It describes what exists; it is unable to account for how anything came to exist, nor how it continues to be. When field theory suggests the universe went through big transitions early in its history then the situation is like that of an octopus changing the colour of its skin. The skin changes colour, but the octopus is there all along. Similarly, if the universe went from false vacuum to Big Bang, the universe was there all along. The question of how the universe itself came to be is left entirely unaddressed by any description of field dynamics in universes.

A somewhat similar error has been aired in recent years, concerned with morality and evolutionary processes. It is the claim that moral intuitions are merely phenotypes: genetic proliferation mechanisms at one step removed. To expose the illogical nature of this claim, compare it to our understanding of mathematics. When we agree that two plus two equals four, we are using capacities furnished by our evolutionary his-

tory. It does not follow that the capacity is arbitrary, and two plus two might be fifteen, or a marshmallow. Similarly, our ability to have moral insight employs a biological capacity furnished by Darwinian evolution. It does not follow that the capacity is arbitrary, and murder might be right after all. The fact that murder is wrong is no more an outcome of evolution than the fact that two plus two equals four. There is a whole world of goodness, beauty and truth which science does not have the tools to navigate. But navigate it we must.

I would like to leave you with two aphorisms and an image that will stand you in good stead. A good aphorism—a sound bite if you like—contains a truth, but it is not the whole truth. It is an invitation to mull on a nugget and go further. Here is one:

Science is a time series, religion is a Fourier transform.

This sound-bite reminds us that even when a description is complete in its own terms, it may be failing to see in another sense.

Here is an aphorism which I think is due to Alan Turing:

Science is a differential equation, religion is a boundary condition.

Again, there is truth here, but it is not the whole truth. It reminds us that connections within a process are far from specifying or interpreting the process overall. But don't forget that religion is concerned with the whole of life.

I will leave you with an image. The points I have been making can be brought together by seeing the world in a threefold way, which I like to frame as "origins, process, purpose". This needn't be seen as a temporal sequence: 'origins' refers both to origins long ago, and also to the depths of existence in the present moment. And 'purpose' refers broadly to value and meaning, to what can be achieved or should be achieved.

Science is like a suspension bridge hanging between those mysteries of origins and purpose. I call them mysteries because we do not entirely understand them. But don't think of them as ephemeral or vague. They are like great granite cliffs, entirely able to support the relatively fragile but beautiful rope-bridge of science. Science helps us navigate between our origins and our purpose, and it helps us understand the constraints and the possibilities of our existence. But it cannot be, and is not, a bridge floating in the void.

> *Most of the points made in this paper are elaborated more fully in two books by myself:* Science and Humanity *and* Liberating Science*, both with OUP. I mention this in hopes of being helpful to anyone who wants to explore further.*