

COMMENTARY

Towards a common dialogue: The contribution of the humanities to science education and scientific discovery

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Towards a common dialogue: The contribution of the humanities to science education and scientific discovery

Recently, I was at CERN (the famous European centre for nuclear research) at a conference on the Big Bang. When I said to my teenage son that I was going to talk about the Big Bang, we had a moment of confusion. My mind was focused on quantum fluctuations leading to inflationary, then Hubble, expansion. His mind was somewhere else. He had an image of Dr Sheldon Cooper and the hit US sitcom about science nerds, and a theme tune by a group called the *Barenaked Ladies*.

That moment with my son was a moment of the interface of knowledge, and an eventual move to a common dialogue! My own experience, as both an astrophysicist and a Christian theologian, has had similar but more important moments. I find a range of words are used, such as truth, proof, belief, faith, theory and model, which are understood in very different ways within philosophy and science. Indeed, so different are they, that it is sometimes difficult to even recognise how the other community is using the word. There are some common words, but there are also concepts which do not seem to have any parallel in the other discipline. For example, key to scientific theory is predictive power which has very little use in theology. Meanwhile, the major faith communities of the world speak of the concept of revelation, by which a deity shares knowledge of themselves in historical events, or subjective experience, in seemingly unrepeatable ways.

One might, in such circumstances, take the view that there is little point in looking for a common dialogue. Even if found, it might be of little use. Yet science, philosophy and theology have common passions (Bentley, ²⁰⁰⁸). Most of the time, they are committed to resist irrationality. The popular image of religion as rejecting rationality and just accepting belief on the basis of “blind faith”, may be true for a small percentage of religious adherents but is not supported by empirical studies of the nature of religious belief, indeed, to the thousands of years of theological thinking, argument and scholarship (Meisinger, Drees, & Liana, ²⁰⁰⁶). Then, there is the sense of awe at the complexity and beauty of the universe. Both science and theology have responded to this. Finally, there is the central question of what does it mean to be human – how do we understand human existence and flourishing in the context of the physical and biological universe.

HOW DO WE RELATE THE SCIENCES AND THE HUMANITIES?

In a classic fourfold typology, physicist and philosopher Ian Barbour (2000) set out four relationships of science and theology; which, in fact, can be adapted more generally to science and the humanities. The first is *conflict*. This sees scientific description and exploration in direct conflict with all other forms of knowledge. Indeed, science must conquer other areas. As a physicist, I have often been tempted to the view that the only form of real knowledge is physics. Chemistry is for people who cannot do physics, biology is for people who cannot do chemistry and I will not say what then sociology is! But such a view is an incorrect application of reductionism. Within science, systems have to be taken apart in order to understand their components. However, there are new areas of knowledge which emerge when complex systems form – they are not wholly reducible. The conflict model rules out the fact that science may be enriched by this kind of knowledge – giving a place not only to other sciences but also sociology and indeed perhaps theology. In science education, the conflict model runs the risk of using science to aggressively attack the beliefs of others, which often leads to a sense of threat with the consequences of a religious or philosophical counter-attack on science. While scientists have a duty to expose faulty uses of science for political or religious purposes, the conflict model alienates science from the very people who need it (Reiss, 2001).

The second relationship is that of *independence*. This was embodied in Stephen Jay Gould's non-overlapping magisteria (NOMA) of science and religion (1999). Gould was concerned about the attack of creationism on science and argued that science and other forms of knowledge should be pursued separately. There is some merit in this approach. At a practical level, in the pressure and hectic activity of scientific research programmes, this is often the default position. However, it seems to me that this is far too neat and tidy, and does not do justice to the way that science raises questions which lie beyond its own domain to answer. For example in cosmology, even a full and convincing quantum fluctuation "theory of everything" does not answer all of the questions. It raises questions of where the fundamental laws of physics come from, why are they intelligible and what is the nature of time? These are metaphysical questions. Then, philosophy might help scientists in thinking about the relationship of scientific models to reality, the provisionality of scientific theories, and the role of human judgement in the process of scientific discoveries from Polanyi's tacit skills (1958) to Kuhn's scientific revolutions. Perhaps, most importantly, independence fails when scientific progress raises ethical questions such as environmental impact or issues of the beginning or end of human life. In science education, independence is an easy option, but students and the general public

will want to always ask the questions which break out of the tightly sealed boxes.

The third relationship, that Barbour traces in both history and contemporary culture, is that of *integration*. This is the attempt to see science as subservient to philosophy or theology (or vice versa). Thus, religious groups will only teach science from within their own worldview using it to support their particular doctrines. For example, the Big Bang may be used to prove the existence of God. Such approaches are often only possible within institutions which have a particular and strong religious or ideological foundation. It seems to me that such an approach is both dangerous and in error. Once again it does not see the more fluid and open relationship of science and the humanities.

Barbour's final relationship is that of *dialogue*. This seems to be most authentic to the history and nature of science within society. It recognises that science and the humanities have different foci, but that occasionally, their areas of influence will overlap. In the resulting conversation, both can learn. This model underlies the idea of the traditional university, where colleagues in both science and humanities, should have opportunity to engage with each other, both informally and in the occasional research programme (Epstein & Klyukanov, ²⁰¹²). Yet, in the ever expanding horizon of knowledge and the frenetic activity of research, it is difficult to find the time and indeed the space for points of contact.

Sometimes, this has to be done intentionally. Here, in the UK, a material sciences lab working on quantum theory has had a "philosopher in residence". At my own Durham University, we have pioneered a project to bring senior religious leaders, such as Bishops, to spend time in our science faculties. The reaction to this has been excellent, not just from the religious leaders, but also from the scientists, who found themselves challenged to think and see things in different ways. There are, then, research projects which we have found, involve colleagues from both sciences and humanities. For example, the nature of narratives which control how the general public see science and, particularly, what builds fear of science has united colleagues from physics, geography, modern languages, philosophy and theology (Macnaghten & Guivant, ²⁰¹¹).

The operation of the dialogue model in science education means an openness of approach to explore questions of the history and philosophy of science and possible religious and ethical implications within the science curriculum.

There are, however, a few areas which may need special attention and some further work. First, the dialogue between the academic language and the popular language. One of the strongest proponents of the conflict approach is the media portrayal of science. Some journalists and producers think that interesting stories inevitably involve putting science in conflict with religion or non-scientific

approaches. Indeed, some scientists themselves, when they move into the popular arena, seem to lose their cautious commitment to the provisionality of science, in order to become universal authorities on truth.

There needs to be further work on the way that the lens of the media both clarifies, and distorts, the interface of knowledge. Perhaps, part of the training of research students might include something about this. In addition, it would be good for scientists to continually support and affirm the work of popular science authors, journalists and producers.

Second, the dialogue between the language of mathematics and the language of philosophy needs to be scrutinised. I have continually been in conversations between physicists and philosophers, where the problem of time has caused great confusion. The philosopher, Raymond Tallis (²⁰¹²), in a recent article in *Philosophy*, commented that “Now many physicists despise the kinds of arguments I have presented. Their feeling about philosophers (or even physicists) who want to make other than mathematical sense of what physics tells us about the fundamental nature of things could be summarised in David Mirmin’s ‘Shut up and calculate!’ Steven Hawking has dismissed philosophers as poor sods who haven’t kept up with physics. It is important not to lose one’s nerve and to note that physicists who dismiss philosophy are often doing philosophy themselves, but very badly.”

Such mutual distrust needs to be broken down, but it will need considerable work. Mathematics is the great language of physics, and this presents a fundamental problem for those who don’t speak the language. The same is true when physicists talk about the “beauty” of the equations of the physical laws, or the learned art of weighing evidence. We must not dismiss each other but develop a humble approach to those outside of our direct subject area. In addition, we must follow Einstein in striving to make everything as simple as possible, but not simpler than that!

DIALOGUE IN COSMOLOGY AND METAPHYSICS

One of the really interesting examples of dialogue in recent decades has been some of the questions around Big Bang cosmology, which, in fact, was the subject of the conference referred to right at the beginning of the article. While there have been those who have pursued the conflict model (Hawking & Mlodinow, ²⁰¹⁰; Krauss, ²⁰¹²) there are many other voices who have raised metaphysical questions from the science (Barrow, ²⁰⁰²; Davies, ¹⁹⁸³; Gingerich, ²⁰⁰⁶;

Holder, ²⁰⁰⁴). They argue that that we encounter questions such as:

a. *Why the universe?*

Hawking himself states that “although science may solve the problem of how the Universe began, it cannot answer the question: why does the universe bother to exist? I don’t know the answer to that” (¹⁹⁹³). The philosopher Leibniz had asked many years ago, “why is there something rather than nothing?” This is not to resurrect the first cause argument; it is to recognise that the purpose and meaning of the universe lie beyond science.

b. *Where do the scientific laws themselves come from?*

If the universe emerges as a quantum fluctuation, we need to ask where quantum theory itself comes from. Where does the pattern of the world come from, and how is it maintained? Kepler was “carried away by unutterable rapture” as the correlation between orbital periods and mean diameters, which showed that the planets moved in elliptical orbits, was disclosed.

c. *Why is the universe intelligible?*

Einstein once said that the most incomprehensible thing about the universe is that it is comprehensible. Yet, why should this be the case that the mathematics of our minds resonates with the mathematics of the universe.

d. *What is our significance in the universe?*

The anthropic fruitfulness of the universe; that is, the laws and circumstances of the universe seem to be just right for the existence of life, poses the question of is there a deeper story to the universe (Davies, ²⁰⁰⁶). This is not to try and build any kind of proof for the existence of God. Indeed, some will invoke multiverses to try and give an explanation (Rees, ²⁰⁰⁰), yet the question continues to be asked.

These and other questions invite an interesting dialogue with philosophy and theology.

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