Towards a New Enlightenment

Nick Hawkes

Flinders University, Adelaide, Australia

Abstract

Some areas of science, such as quantum physics, have advanced to such a degree that they are beginning to bump up against metaphysical questions that have to do with 'order' and 'consciousness'. The famous double-slit experiment in quantum physics, together with the extraordinary fine-tuning of the elemental forces of the universe that have allowed sentient life to exist, point to the existence of a mind, i.e. consciousness. This paper explores how mathematics provides the software for building the universe, and the quantum world provides its building blocks. It suggests that the link that transitions mathematics to the quantum world, enabling it to build the universe, is 'consciousness'. It is arguable that Aristotle's 'ultimate cause', banished at the first Enlightenment, is making a comeback… and the times are calling for a New Enlightenment.

It is difficult to overstate the seismic shift in philosophic thinking brought about by The Enlightenment of the 17th to 19th century. Prior to The Enlightenment, the cultural philosophy of the time was based on Aristotelian thinking which factored in an ultimate cause when studying natural science, as articulated in Aristotle's 'Four Causes' (Hankinson, 1998, 159). However, The Enlightenment instituted new principles for doing science that removed all consideration of an ultimate cause. This thinking was articulated particularly by the English philosopher, Francis Bacon [1561-1626], who is considered to be the father of modern scientific method. Bacon was a man of faith and could never have anticipated the impetus his thinking was to give to the atheistic cause. It is like Jean-Paul Sartre taking off with the existentialism of Kierkegaard and turning it into something Kierkegaard never envisioned—something that missed his foundational theistic conviction entirely. In his Essays, Bacon wrote:

> A little philosophy inclineth man's mind to atheism, but depth in philosophy bringeth men's minds about to religion' (Bacon 1625).

Bacon's conviction has not been shared by many scientists in recent centuries. Perhaps this is because the specialist knowledge they have needed to acquire to progress their particular scientific field has left them with little time to explore any philosophy at any depth. They have been so caught up with the 'how' question, they have ignored the bigger and more profound question of 'why'.

Having said this, it would be wrong to give the impression that a-scientific-discovery-a-day-keeps-the-need-for-God-away. Some, in the science departments of our universities, have begun to notice that it is the philosophy departments rather than the science departments that are becoming clubhouses for atheists. The American physicist, Robert Griffiths, the winner of the Heinemann Prize in mathematical physics in 1984, said: 'If we need an atheist for a debate, we go to the philosophy department. The physics department isn't much use' (Griffiths 1987, 18).

Griffiths' comment is, of course, merely an observation. For empirical data, we need to turn to the geneticist, Baruch Shalev. He documented the religious views of all 719 Nobel Prize winners from 1901 to 2000, noting the percentage that were atheists, agnostics or freethinkers. Surprisingly, only 10.5% fell into the godless category. Very significantly, this figure dropped to only 4.7% for physicists, but rose to 35.2% for winners in literature (Shalev 2003). It would seem that those who really know the empirical reality of the universe are those who are more likely to believe in God.

As the West lurches into a post-Christian future and becomes less sure of the foundational truths that have led to its civility and prosperity, science has continued on apace. Some sections of science, such as quantum physics, have advanced to such a degree that they are beginning to bump up against metaphysical questions that have to do with order and consciousness.

God, it would seem, is making a comeback—not for lazy, irrational reasons, but because information, rationally synthesized, suggests a comeback is warranted. Indeed, without allowing for the possibility of an overarching mind—scientists have to be decidedly irrational and believe that everything came from nothing as a result of nothing, via a mechanism that has never been discovered, and for which there is no precedent… and which undermines the law of cause and effect which underpins all science. As such, the science of our times is calling for a New Enlightenment.

A New Enlightenment

Why is a New Enlightenment required? In recent centuries, Francis Bacon's 'method', of doing science transgressed the boundary of logic and became deified. Science became, at least in some people's mind, the 'reason' for existence. It is time to call out this fallacious idea and expose it for the fiction it is. Science explains how things came to be. In and of itself, science causes nothing. It is simply a tool, a language, used to explain already existing processes.

The reality of a prime cause of existence was, as we've said, fully appreciated by Aristotelian thinking—a thinking that held sway until The Enlightenment. Over the centuries, Aristotle's convictions

about the ‘Unmoved Mover’, i.e. God, got expelled from academic discourse, along with his outmoded theory of how the universe was constructed.

However, with the discoveries of quantum physics, and the extraordinary levels of fine-tuning that have allowed the universe to produce sentient life, Aristotle’s conviction concerning God is again knocking on the door of some of the world’s rational thinkers, demanding to be heard. Put simply: the times we are living in are calling for science to be unlocked from the empiricist prison it has been caged in so that it takes better account of reality as we now understand it. What it calls for is none other than a New Enlightenment. To explain why, we need to review some of the recent findings of science, and take note of some of the questions that have puzzled scientists in recent decades.

Quantum Physics

The first finding comes from quantum physics—specifically the discovery that a sub-atomic particle only collapses into a physical particle when it is observed. This was demonstrated by the ‘double slit’ experiment.

The ‘double slit’ experiment involved setting up a ray gun that shot sub-atomic particles, like an electron) at a barrier. This barrier has two vertical slits cut into it. There was a back wall some distance behind the barrier that stopped those particles that passed through the slits. This back wall had the ability to measure where these particles hit. When all this was in place, the scientists fired the gun.

The result was entirely unexpected. Scientists discovered that the electrons didn’t behave like tiny marbles, but behaved like waves. When the electrons passed through the slits, they fanned out in semi-circular ripples. The two sets of curving ripples from the two slits interfered with each other, before hitting the back wall in a wave pattern. Scientists then wondered what would happen if they fired the particles one at a time. Doing this meant there was no chance of particles being able to interfere with each other.

However, a wave pattern still formed on the back wall. The scientists were stunned. Each particle had apparently split itself into two, gone through two slits simultaneously, and interfered with each other, before hitting the back wall. As particles don’t do this, it was concluded that each particle must exist as a ‘wave of potential’, or wave of probability, that allowed it to pass through both slits, yet still be physical enough to interfere with itself.

If that wasn’t strange enough, things soon became even more complicated. Scientists then placed a measuring device near the slits so they could observe which slit an individual electron actually passed through. They then fired the electron gun, shooting one particle at a time toward the two slits, for a

period of one hour. The result of this was stranger than anyone could have imagined. When the electrons were being observed, they stopped behaving like a wave and began behaving like tiny marbles. The electrons now hit the wall behind the slits in two vertical lines.

The double slit. experiment suggests that sub-atomic particles, such as electrons, don't actually exist as physical particles until they are observed. This phenomenon has resulted in some leading quantum physicists speaking of matter as being a 'content of consciousness.' One of the scientists making this claim is the Nobel prize-winning physicist, Eugene Wigner. He said: 'Study of the external world leads to the conclusion that contents of consciousness are the ultimate reality' (Wigner 1959). John von Neumann, also a Nobel prize-winning physicist, shares this view. He said: 'All real things are contents of consciousness' (von Neumann 2011, 21). Whilst not all quantum physicists agree with these scientists, the comments made by Wigner and Neumann highlight the potential role consciousness plays in quantum physics.

Mathematics

Nothing happens to mathematics until consciousness reveals it. Consciousness is the medium that allows mathematics to come to life. But does this mean that consciousness causes mathematics? The fact that consciousness reveals mathematics does not mean it causes it. What can be said is that nothing known to humankind explains the beautiful and highly complex nature of the mathematical software of the universe other than mind (or consciousness). We are therefore suggesting that Consciousness, (capital C), gives rise to consciousness. This is a position that requires a 'leap of faith'. It is therefore a position that should be held tentatively and with a degree of humility. However, it does seem to be a position that is the 'best fit' of the facts as we currently understand them.

Eugene Wigner has written about the amazing ability of mathematics to describe the physical world. He spoke of 'the unreasonable effectiveness of mathematics in the natural sciences' (Wigner 1967, 171). In saying this, he was, in fact, saying no more than Galileo said in the 16th century when he wrote:

> Philosophy is written in the grand book, the universe, which stands continually open to our gaze. But the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed. It is written in the language of mathematics. (Galileo, 1623)

The question is: If mathematics provides the software program for building the universe, how do its instructions cross over to quantum physics, which provides the elemental building blocks of the universe? What is the controlling link between mathematics and the quantum world? The clue to the answer may be provided by the quantum 'double slit' experiment and by the astonishing level of fine-tuning of the basic forces that have allowed life to develop in the universe.

The fine-tuning of the universe

There are four forces that build the universe: 1) gravity, 2) the electromagnetic force, 3) the strong nuclear force, and 4) the weak nuclear force. If the ratio of the relative strengths of the electromagnetic force and the gravitational force had differed by as much as one ten-thousand-trillion-trillion-trillionth; that's 10^{40}; life would not have existed on Earth. If this value were slightly bigger, all stars would be at least 40% more massive than our Sun. This would mean that stellar burning would be too brief and too uneven to support complex life. If the value were any less, all stars would be at least 20% smaller than our sun. This would render them incapable of producing the heavy elements necessary for life to develop.

The ratio of electrons and protons in the universe also had to be exactly right for life to exist. This ratio must be finely balanced to the degree of one part in 10^{37}. If this fundamental constant were any larger or smaller, electromagnetism would dominate gravity, preventing the formation of galaxies, stars, and planets.

The 'strong nuclear force' is the force that holds atoms together. This force had to be precisely right to allow 0.7% of its mass to be converted into energy. If the amount of matter converted were slightly smaller, the universe would consist only of hydrogen. If the amount of matter converted were slightly bigger, nuclear fusion would occur so quickly that no hydrogen would remain, and no galaxies, stars, or planets could have formed.

The Big Bang also gives evidence of extraordinary fine-tuning. The radiation left over from the big bang is referred to as the 'cosmic microwave background'. It is responsible for warming the universe 2.725°*C* above absolute zero. (Absolute zero is minus 273.15°*C*, or minus 459.67°*F*). The radiation is detectable in space at one part in 100,000. If this number were any smaller, the universe would exist only as a collection of gas. No galaxies, stars, or planets would exist. Conversely, if the number were any bigger, the universe would only consist of large black holes.

The rate at which the universe expands had to be finely tuned to one part in 10^{55}. If the universe had expanded any faster, matter would expand too quickly for stars, planets and galaxies to form. If the universe had expanded any more slowly, it would have collapsed under the force of gravity before any stars could have formed.

Finally, the mass density of the universe had to be finely tuned to permit life—to a degree of one part in 10^{59}. If the universe was slightly more massive, an overabundance of deuterium from the big bang would have caused stars to burn too rapidly for the formation of complex life. If the universe had been slightly less massive, a lack of helium would have resulted in a shortage of the heavy elements

necessary for life to develop. These numbers suggest that the universe is precisely constructed in such a way as to allow life to exist. This points to the existence of a Mind. Nothing in human experience can explain the existence of anything so extraordinarily fine-tuned other than consciousness.

Having reviewed the extraordinary fine-tuning of the universe, we can now return to the question: If mathematics provides the software for building the universe, how do its instructions cross over to quantum physics, which provides the elemental building blocks of the universe? What is the medium that links mathematics to the quantum world? In the light of what has been discovered in the quantum world, and also in the fine-tuning necessary to build the universe, it is not unreasonable to suggest that the link between mathematics and quantum physics is provided by 'consciousness'.

The dance between mathematics and physics

Scientists have long understood the extraordinary effectiveness of mathematics in describing the universe. They have also appreciated that whilst a lot of quantum physics is non-intuitive, mathematics describes it very well. However, what is more surprising is that scientists are discovering that there is a two-way conversation between mathematics and quantum physics. Not only is mathematics effective in quantum physics, but quantum physics is increasingly being seen to be effective in modern mathematics. The Dutch theoretical physicist, Robbert Dijkgraaf, writes:

> Ideas that originate in particle physics have an uncanny tendency to appear in the most diverse mathematical fields. This is especially true for string theory. Its stimulating influence in mathematics will have a lasting and rewarding impact, whatever its final role in fundamental physics turns out to be. The number of disciplines that it touches is dizzying: analysis, geometry, algebra, topology, representation theory, combinatorics, probability—the list goes on and on (Dijkgraaf 2017).

Zhengfeng Ji, a Chinese quantum and information scientist who is currently a professor at the University of Technology, Sydney, Australia, has shown how almost infinitely complex mathematical problems can be solved with the help of quantum physics.

The proof of an almost infinitely complex problem can be verified without necessarily requiring a line by line analysis, which would take an impossibly long time. It can be enough to interrogate the solution with just a few questions. If, however, two sources which have the answer to the problem can be questioned, it would give confidence that the answer is right, provided, of course, there is no conferring between the two sources which claim to have the answer. This is called multiprover interactive proof, or MIP. It is a technique that allows scientists to verify a proof without actually seeing it. Zhengfeng, together with a team of colleagues, worked out that quantum 'entanglement' (which

Einstein called, ‘spooky action at a distance’) boosts the power of MIP provers hugely (Ji, *MIP*=RE,* 2020). This illustrates how quantum physics can be of enormous help to mathematics.

Another example of the extraordinary link between mathematics and quantum physics is seen in the ‘Wallis Product’. In 1655, the English mathematician and cleric, John Wallis, produced a formula for pi (π) that was the product of an infinite number of ratios.

$$\frac{2 \times 2}{1 \times 3} \times \frac{4 \times 4}{3 \times 5} \times \frac{6 \times 6}{5 \times 7} \times \frac{8 \times 8}{7 \times 9} = 1.509297$$

$$1.509297 = \text{the ‘Wallis Product’} = \frac{\pi}{2}$$

Scientists were amazed when the same formula was discovered in quantum physics—in their calculations of the energy levels of a hydrogen atom! What these discoveries suggest is an extraordinary level of ‘connectedness’ between mathematics and quantum physics. This prompts the question of what it is that connects and holds things together? Consciousness is one possibility. In fact, at the moment, it is hard to identify another contender. The existence of an overarching consciousness would make sense of what scientists are observing.

Questioning minds

In the penultimate page of his book, *A Brief History of Time*, the late Stephen Hawking wrote:

> What is it that breathes fire into the equations and makes a universe for them to describe? The usual approach of science of constructing a mathematical model cannot answer the questions of why there should be a universe for the model to describe. Why does the universe go to all the bother of existing? (Hawking 1988, 174)

A possible answer to this question, that takes account of what scientists are experiencing, is ‘consciousness’.

When Richard Dawkins, mistakenly attributes to our genes qualities and motives that can only rightly be ascribed to intelligent beings, (Dawkins 1976), he is, in fact, unconsciously pointing to the need to factor in an overarching consciousness.

Similarly, when Paul Davies talks about the need for scientists to have ‘faith’ that the universe is ordered, if they are to do science… and have faith that humankind has the necessary mental ability to unlock its secrets, he is saying something very profound about the universe (Davies 2007). Davies

also reminds us that life is not just about ‘chemical reactions’, it is about information (Davies 2001). In saying this he is pointing to the need for something to exist that very much looks like purpose, i.e. consciousness.

Francis Crick, who with his colleague, James Watson, discovered the double helix structure of DNA in 1953, wondered how nature could invent highly complex nucleic acids such as DNA and RNA, as well as enzymes made of protein that govern their function. He was faced with a chicken-and-egg problem. One couldn’t exist without the function of the other. In the end, he and his colleague, Leslie Orgel, reasoned that life could have arisen elsewhere in the universe (where a compound capable of replacing the function of the enzymes occurred) that was disseminated to other planets like Earth by the deliberate activity of an extraterrestrial society, something which they called ‘directed panspermia’ (Olby, 2009).

Crick, an ardent atheist, could not fathom how life came to be without suggesting a ‘consciousness’. But in his case, he has swapped the consciousness of God for the consciousness of alien life forms! Crick spent the last few decades of his life exploring the nature of consciousness. At the end of his career, Crick believed that he had failed to get any understanding of it. It is entirely possible that Crick’s lack of further enlightenment may have been influenced by his unwillingness to consider the possibility of God.

What is, and is not, being said

Putting forward the theory that consciousness is behind the building of the universe is not a claim aimed at smuggling ‘God of the gaps’ into science. God of the gaps is the lamentable practice of seeing a seemingly impossible complex phenomenon in nature, or the cosmos, that science can’t explain—and lazily saying, ‘God did it.’ Then, as science advances and explains how the phenomenon occurred through natural processes, the need to invoke God is overturned and Christians are made to look stupid.

‘God of the gaps’ is NOT what is being proposed. There are clear empirical reasons to propose ‘consciousness’ as the link between mathematics and the quantum world. It is a theory that fits well with the facts of quantum’s double slit experiment, and with the facts surrounding the fine-tuning of the forces of the universe. If this ‘consciousness theory’ becomes one that is accepted, the implications are huge. It would compel us to consider the possibility of purpose.

Reflections on consciousness

A pertinent question to ask is, whether or not consciousness directs a quantum outcome, that is whether consciousness selects one outcome from a cloud of probability. If God exists and is directing the universe to a desired end, it would make logical sense to say, from a theological perspective, that

the answer is ‘yes’. Certainly, if God does not exist, then the problem of making sense of the observations discussed in this paper becomes very real. If there is no God, what is it that causes the quantum ‘cloud of probability’, i.e. sub-atomic particles in superposition with themselves, to transition from lack of definition and become an ordered universe?

Conclusion

Mathematics provides the software for building the universe, and the quantum world provides its building blocks. This paper suggests that the medium that links mathematics to the quantum world is ‘consciousness’. If this is true, it requires the return of Aristotle’s God, not just as an ‘Unmoved Mover’ who originally set the universe in motion, but one who is more intimately involved—as the consciousness that both causes the universe to exist and also be sustained. The findings of modern science have presented a challenge. Perhaps this challenge will result in a New Enlightenment.

About the Author

Nick Hawkes is a theologian, writer and communicator. He has been a guest lecturer at a number of theological colleges and has written and recorded over 800 “Thoughts for the Day” for Christian radio—both in Australia and the UK. Nick has two degrees in science and two more in theology. He is an apologist who writes about the rational credibility of Christianity. He not only does this through apologetic works that defend Christianity, he also does it through his novels: the ‘Stone Collection’.

Bibliography

Bacon, F, (1625), *Essays, Civil and Moral.*

Davies, P, (2001), ‘The Origin of Life, II: How Did It Begin?’ aca.mq.edu.au.

Davies, P, (2007), ‘Taking Science on Faith’, *New York Times*, 24th November.

Dawkins, R, (1976), *The Selfish Gene*, Oxford University Press.

R. Dijkgraaf, R. (2017), ‘Quantum Questions Inspire New Math’, *Quanta Magazine*, 30th February.

Galileo Galilei, (1623), *Il Saggiatore.*

Griffiths, R, (1987), in: T. Stafford, ‘Cease-Fire in the Laboratory’, *Christianity Today*, April 3.

Hankinson, R.J, (1998), *Cause and Explanation in Ancient Greek Thought*, Oxford University Press.

Hawking, S, (1988) *A Brief History of Time,* New York, Bantam Books.

Ji, Z et al., (2020), ‘*MIP*=RE,’* Cornell University, submitted 13th January.

R. Olby, R, (2009), *Francis Crick. Hunter of Life’s Secrets,* New York, Cold Spring Harbor, Laboratory Press.

Shalev, B, (2002) *100 Years of Nobel Prizes*, Los Angeles: CA. Americas Group.

J. von Neumann, in K. Ward, *Is Religion Irrational?* 2011, 21.

E. Wigner, 1959, ‘The unreasonable effectiveness of mathematics in the natural sciences’, New York University, 11th May 1959.

E. Wigner, ‘Remarks on the Mind-Body Question’, *Symmetries and Reflections*, 1967, 171.