

An Intelligent Universe

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Survival necessity surely offers an explanation of why evolutionary process has shaped our brains in such a way that we can make sense of the world of our everyday experience. If we could not figure out that it is a bad idea to step off the top of a high cliff, we might not be around for very long. However human powers to understand the world go greatly beyond anything needed for mundane survival. In an astonishingly creative leap of human imagination, Isaac Newton was able to see that the same force that makes the high cliff dangerous is also the force that holds the Moon in its orbit around the earth, to discover the mathematically beautiful law of universal inverse square gravity, and in terms of that law to explain the behaviour of the whole solar system. It was a great achievement, but it had not direct utility for matters of everyday survival. After all the famous fictional detective, Sherlock Holmes, expressed indifference about whether the Earth went around the Sun or the Sun around the earth, saying what did it matter for his daily work as a detective?

Human access to intelligibility has proven to be remarkably extensive beyond the limits of what might be derivable from ordinary experience, embracing not only the extraterrestrial reality of the universe as a whole, but also the subatomic world of quantum physics, remote from any immediately discernable impact upon mundane matters and requiring for its understanding ideas that are strange and totally counterintuitive in terms of everyday expectation. The universe has proved to be astonishingly transparent to scientific inquiry. Scientists agree that this is so and respond by eagerly exploiting the opportunities that it affords, but as scientists they can offer no explanation of why this should be the case. Yet it would surely be intolerably intellectually lazy simply to treat this remarkable fact as if it were just a happy accident. Albert Einstein said once that the real mystery of the universe is its comprehensibility. The pursuit of science is motivated by the human thirst for understanding, and this quest should not be allowed to stop at the frontiers of science. If the intelligibility of the universe is to be made intelligible, that will certainly take us beyond the self-limited domain of scientific insight alone.

And the mystery is even deeper than that, for it has turned out that the ultimate key to unlocking the cosmic secrets is provided by that seemingly most abstract of academic



subjects, mathematics. It is an actual technique of discovery in fundamental physics to seek theories whose mathematical expression is in terms of beautiful equations. Mathematical beauty is a somewhat rarefied form of aesthetic experience, involving the discernment of qualities such as economy and elegance, but it is one which the mathematically literate can recognize and agree about. This quest for mathematical beauty is no act of aesthetic indulgence on the part of the physicists but a proven heuristic technique that, over three centuries, has time and again led to fundamental discoveries. The greatest physicist whom I have known personally was Paul Dirac, who made his many great discoveries by a relentless and highly successful quest for mathematical beauty. Indeed, he once said that it is more important to have mathematical beauty in your equations than to have them fit experiment! Of course, Dirac did not mean that ultimately empirical adequacy could be dispensed with, but if it was not apparent at first sight, then there were at least some possibilities that might still save the day. Maybe you had made an incorrect approximation in solving the equations, or maybe the experiments were wrong (we have known this happen more than once in physics), but if your equations were ugly ... really there was no hope! The whole history of fundamental physics testified against the possibility of their being right.

Dirac's Nobel prize-winning brother-in-law, Eugene Wigner, once expressed in epigrammatic form the challenge that this role of mathematics presents to us. He asked, "Why is mathematics so unreasonably effective?" Why is it that some of the most beautiful patterns that the mathematicians can conceive of in the course of their abstract logical thinking, are found actually to occur, instantiated in the structure of the physical world around them? What links together in this remarkable way the reason within (our mathematical thinking) and the reason without (the order of the intelligible universe)? Again, it would be intellectually lazy not to seek to answer this question.

Thus the universe has proved not only to be astonishingly rationally transparent but also astonishingly rationally beautiful. As a recompense for the labours of research, the cosmos offers physicists the reward of wonder at the marvellous order revealed to their enquiry. These facts surely call for some form of explanation, and I have already stated that this will have to be found outside the domain of science itself, which simply accepts the laws of nature as the unexplained basic brute fact from which it then seeks to derive its understanding of cosmic process. I suggest that these laws of nature have so remarkable a character of accessibility and beauty that they seem to point beyond themselves, and to demand a further and deeper context of intelligibility than that which unaided science can provide.

So, "Why is science possible in the deep way that it is?" And "Why is mathematics so unreasonably effective?" These profound metaquestions, arising from scientific experience but transcending science itself, certainly call for answers. They are too deep to receive a response of a kind that all will immediately have to agree upon without further argument,



but I wish to maintain that the most satisfying and intellectually persuasive answers are to be found in the theological recognition of the universe as a divine creation. One could summarise the transparent rational beauty of the cosmos as revealing to us a world whose nature is shot through with signs of mind. I am proposing that we take absolutely seriously the idea that it is indeed the Mind of the Creator that lies behind the deep order of the universe. The unreasonable effectiveness of mathematics, the unexpected consonance between the internal reason of our minds and the external reason of the physical world, can then be understood to arise from the fact that our mental abilities and the structure of the laws of nature have a common origin in the rationality of the God who is the ground of both human nature and of the physical world that we inhabit. In my opinion, science is possible in the profound way that it has proved to be, precisely because the universe is a creation and we, to use an ancient and powerful phrase, are creatures made in the image of our Creator. This approach to the intelligibility of the universe represents a revived and revised form of natural theology^[1]. This latter discipline is the attempt to learn something of God through the exercise of reason and the inspection of the world, complementing and contrasting with the approach of revelational theology, which appeals to specific acts of divine disclosure believed to have occurred in the course of history. I believe that an adequate theology needs to seek insight from both these sources, but here I am concentrating on natural theology, since it offers a valuable bridge between the insights of science and the insights of religion. I believe strongly that these two great human quests for truth are consonant with each other, rather than being in mutual conflict. It is important to recognise that this new natural theology is significantly revised from the form that it took in the eighteenth and early nineteenth centuries at the hands of people such as William Paley. Their line of thought sought to appeal to the great aptness of living beings to life in their environments and it made play of such matters as the optical system of the eye whose complex existence was asserted to be evidence for the direct work of an intervening divine Designer. Of course, this form of argument was given a death blow by the evolutionary insight of Charles Darwin, whose great theory showed how the patient sifting and accumulation of small differences over very long periods of time could lead to the appearance of design without calling for the direct intervention of a Designer. With hindsight we can see that Paley and his associates were making a fundamental mistake about the nature of the relationship between science and religion. We have every reason to believe that scientifically stateable questions will ultimately receive scientifically stateable answers, even if some of these answers may prove very hard to find - for example, the process by which life first began. However, we also have every reason to believe that there are many questions that are meaningful and necessary to ask, and to seek to answer, which lie outside the self-restricted field of scientific enquiry. We have been considering two such questions when we asked "Why is science possible? Why is mathematics so unreasonably effective?" These are metaquestions, arising from scientific experience but necessarily taking us beyond science's own power of answer. The new natural theology does not seek rival science within the latter's legitimate domain, but its aim is to



locate science's insight within a broader and deeper context of intelligibility.

If the universe is indeed a divine creation, it is not to be expected that it will be full of objects clearly stamped "Made by God". The Creator is subtler than that. What we may expect is that there will be hints of the presence of a divine Mind behind cosmic order and a divine Purpose behind cosmic history. The Creator is not a kind of celestial Artificer, repeatedly intervening to constructs new forms of creaturely life, but God is the One who has endowed the given physical fabric of the world with an inbuilt potentiality that will lead to a designedly fruitful history. That potentiality has been made actual through the specific contingencies of evolutionary processes. As Darwin's clergyman friend, Charles Kingsley said, the Creator has chosen to make a universe in which creatures are allowed, to an appropriate degree, "to make themselves". I do not believe that five-fingered homo sapiens was decreed from all eternity, but equally I do not believe that the emergence of some form of self-conscious, God-conscious beings was simple an incredibly happy accident. The insights of the cosmic anthropic principle^[2], the exquisite fine-tuning of the given character of the fundamental physical law which is necessary if a universe is to be capable of evolving the richness of carbon-based life, would be a familiar and striking example of how there can be intrinsic design without having to appeal to repeated divine interruption of the process of creation. The latter idea is, in fact in danger of theologically incoherence with its implication of an intervening God acting against the divinely ordained and sustainable order of creation. Science is one sector of the great human quest for truthful understanding, attained through well-motivated beliefs about the nature of reality. The question of truth is as central to religion as it is to science, so that theology is also a sector of this grand human endeavour. Of course there are differences between the characters of the two enquiries. Science limits itself to encounter with an impersonal dimension of reality in which repetition of experience is possible, giving it its great secret weapon of experiment. This enables science to attain an impressive degree of intersubjective agreement. Yet we all know that there are many other dimensions of reality - broadly the domains of personal encounter - in which repetition is not possible, since all individual experience posses a degree on uniqueness. We never hear a Beethoven quartet twice in exactly the same way, even if we replay the same disc. In the realm of the personal, whether in art or in music, human relationships or encounter with the transpersonal reality of God, truthful understanding has to be gained through commitment and trust, rather than by putting matters to repeated testing. In this domain there is an irreducible uniqueness of experience, and issues of meaning and value, which science by its own self-definition brackets out, are paramount.

Despite these striking differences between science and religion, there is also sufficient commonality between the two in their search for truth for there to be some lessons that are common to both. If science teaches one anything about the world it is that reality is often surprising beyond our rational powers to anticipate. Who in 1899 could have supposed that



something could behave sometimes like a wave (spread out and flappy), and sometimes like a particle (a little bullet)? Any philosopher could easily have “proved” the impossibility of such an oxymoronic combination of properties. Nevertheless, as we all know, that is how light has actually been found to behave and the subsequent discovery of quantum field theory has been this strange behaviour intelligible to us. The English biologist J.B.S. Haldane, commenting in the late 1920s on the discoveries of his physicists colleagues, said that the universe had not turned out to be queerer than we thought, but queerer than we could have thought without help of the actual nudge of nature.

Consequently, the natural question for a scientist to ask, within science or beyond it, is not “It is reasonable?”, as if we thought we knew beforehand the shape that rationality had to take. Instead the natural question for the scientist is one at once more open and more demanding in its character, “What makes you think that might be the case?”. This for of question does not seek to impose prior conditions on the character of an acceptable answer, but if something strange and unexpected is being asserted, it will only be accepted if motivating evidence is presented for it.

I believe that this is the right question to ask in every sector of the quest for truth, including theology’s search for religious truth^[3]. If the physical world has proved surprising beyond our prior expectation, it would scarcely be strange if that were not also true of that world’s Creator. At the heart of the Christian belief lies the duality of the human and divine natures in Jesus Christ, a belief even more counterintuitive to natural expectation than the wave/particle duality of light. Nevertheless, I believe that there is motivating evidence to support this belief, though this is not the place to pursue this matter^[4].

Instead, I turn to another cousinly relationship between science and theology that I believe to be of significance. The strange character of the quantum world, in which, for instance, electrons can be simultaneously be both here and there, and are part of a reality that is partly veiled from us by the Heisenberg uncertainty, has given rise to much philosophical discussion of the degree of reality to be assigned to such elusive entities. Some have suggested that quantum physics is no more than an instrumentally useful manner of speaking about phenomena, whose actual reality is limited to the clear perceptions accessible to us at the level of classical measuring apparatus. However, almost all physicists have resisted this dismissal of quantum reality, in my view rightly believing that there are really electrons, and even such intrinsically hidden entities as quarks. Reality is not to be identified with a naive objectivity of a classical kind. To suppose the contrary was the mistake that Einstein made and which led to his persistent hostility to the quantum theory come-of-age, of which he had been the grandfather. Of course, the quantum world cannot be known with the clarity of Newtonian physics, but it has to be met on its own terms, respectful of its Heisenbergian cloudiness. Just as there is no single form that rationality has to take, so there is no single form



that epistemology has to take. Entities have to be known in accordance with their natures. We can know the microworld of quantum physics in one way, the macroworld of classical physics in another way, persons in a third way and the transpersonal reality of God in a fourth way. How then is the reality of the quantum world to be defended against its critics? I believe that it is intelligibility that gives us the key^[5]. We believe in the reality of photons and electrons because that belief gives us satisfying understanding of a great swathe of more directly accessible phenomena, from the periodic table of chemistry to the behaviour of devices such as the laser. In an analogous way, religious belief in the reality of the unseen God can be defended because it makes intelligible great swathes of well-testified spiritual experience, as well as affording us an understanding of the deep intelligibility of the universe in the manner that we have been exploring. A theologian who placed the criterion of intelligibility at the heart of his theological method was Bernard Lonergan. He wrote in the tradition stemming from Thomas Aquinas, which sees the search for understanding, pursued with vigour and without reserve, as being the ultimately quest for God. I shall end with one of my favourite quotations from Lonergan: "God is the all-sufficient explanation, the eternal rapture glimpsed in every Archimedean cry of Eureka"^[6]. This speaks both to the scientist and to the religious believer in me.

References

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2. See for example R.D. Holder, "God, the Multiverse and Everything", Ashgate, 2004
3. J.C. Polkinghorne, "Theology in the Context of Science", SPCK 2008 / Yale University Press 2009.
4. See J.C. Polkinghorne, "Science and Christian belief", SPCK, 1994 / "The faith of a physicist", Fortress, 1996, Chapters 5-7.
5. See J.C. Polkinghorne, "Quantum Theory: A Very Short Introduction", Oxford University Press, 2002, Chapter 6.
6. B. Lonergan, "Insight", Longman, 1958, page 684.