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Chance and Providence

This paper considers an area of putative conflict between science and religion, namely, the Chance Worldview. It is thought by many that the existence of chance, allegedly proved in quantum physics, refutes the classical theist doctrine of providence. In this paper I consider the implications of Bell's Theorem for the relation between divine and natural causation.

Key words: chance; providence; divine causation; quantum mechanics.

In this paper I take up an area of alleged conflict between science and religion, namely the Chance Worldview, a twentieth century development thought by some Christians to have serious implications for Christian faith.

The Chance Worldview

The French scientist Charles Ruhla concludes his book *The Physics of Chance* with the words, ‘. . . this book will have achieved its aim if it can help the reader make the conceptual leap from commonsense to the wisdom of physics, and from determinism to chance.’¹ But the view of this author is that, for better or worse, the conceptual leap has already been taken in our culture, and that the Chance Worldview has already taken hold of the popular mind, partly through the recent writings of popularising physicists, such as Stephen Hawking and Paul Davies. The essential element of the Chance Worldview is a metaphysical claim, namely, that our universe is intrinsically chaotic in the sense that its development from moment to moment depends on chance events. The world does not know in full detail where it is going next. This is a metaphysical claim in the sense that it addresses a broad question concerning the nature of reality, although not in the sense that it is not an empirical question, since the claim of the Chance Worldview is that contemporary science indeed provides justification for this central metaphysical claim.

The Chance Worldview, being a world view, involves other dimensions in addition to the central metaphysical claim. It also embodies attitudes towards knowledge, power, purpose and human decision making. Concerning knowledge, the Chance Worldview involves a scepticism about our ability to predict the future. Since the world itself does not know where it is going, then neither can we humans. Further, if the world to some extent is unpredictable, then it is also to some extent uncontrollable,

1 C. Ruhla, *The Physics of Chance*. Oxford: Oxford University Press (1992), p. 214.

and not amenable to our having power over it. If taking a certain medicine will either cure me or have a side effect and the difference is a genuine matter of chance, then I do not have power to use the medicine to control the outcome. So chance limits humanity's capacity to exercise power over nature.

Concerning purpose, it is thought that if there was no reason why something occurred the way it did, then that occurrence had no purpose, and therefore chance events have no purpose. Random events cannot be random and at the same time be deliberate. Decision making also is necessarily affected. If there are inbuilt limits to our ability to predict and control the future, then we need to learn to make the most of this situation and follow decision strategies which allow for genuine chance. Special navigation strategies may be called for. Such strategies have indeed been developed by philosophers, economists and social scientists working on game theory.

The Chance Worldview is not new to humanity—the concept of chaos in the cosmos can be found in ancient Greek and Babylonian cultures, while many other cultures have viewed the world as intrinsically mysterious and unpredictable. However, the Chance Worldview, in our intellectual history, stands in quite stark contrast to the 'Rational Worldview', which has dominated western thought since the seventeenth century. For example, the 17th century philosopher Leibniz held that the world is a designed product of God with every part fitting in for a purpose. All of Leibniz' philosophy is built on the Principle of Sufficient Reason, which states that everything has a reason why it is the way it is rather than some other way.² According to Leibniz God created the world in the beginning with its entire purpose in mind, and then the world developed according to the natural deterministic laws that God had set for it. A deterministic view of the world has held sway until fairly recently.

The rise of probability in science was not necessarily a blow to determinism, because the probability can be interpreted as a matter of ignorance, that is, we do not know what the underlying reasons and causes are. So, we know that there is a 50:50 chance that if I am a heavy smoker I am going to die of some smoking related disease, but we do not interpret this observation as support for a chancy world. We think rather that there are certain factors that we just do not know about, which is why we invest money into research to find out what those factors are. Just because there is probability in science does not mean that we have moved away from a Rational Worldview.

In contrast, the twentieth century has seen the rise of something philosophers call 'objective single-case chance'. This is where the state of a system together with all the laws of nature fail to fix what the subsequent state will be. Objective single-case chance is a probability that cannot be interpreted merely as reflecting our ignorance and as having underlying

² Leibniz, G. W. 'Philosophical Writings', In Parkinson, G. (ed) *Philosophical Writings*. Totowa: Rowman and Littlefield (1975).

causes yet to be uncovered. It is widely held that quantum mechanical probabilities are objective single case chances. So, for example, if a particular atom has a 50:50 chance of decaying in the next 60 seconds, then that is an objective chance, because there are no underlying factors about that atom that determine exactly when it will decay. If it decays after 30 seconds, then there is no reason why it decayed then rather than a bit earlier, or rather than a bit later. The probability is the full story; there are no further factors underlying it, according to the standard view of quantum physics. Therefore chance is inherent in the basic nature of microscopic processes.³

How does a Christian respond to this kind of development? Arthur Koestler, not a Christian, said, 'As long as chance rules, God is an anachronism.'⁴ And R. C. Sproul, in his 1994 book *Not a Chance*, writes,

The mere existence of chance is enough to rip God from his cosmic throne. . . . If chance existed, it would destroy God's sovereignty. If God is not sovereign, he is not God. If he is not God, he simply *is* not. If chance is, God is not. If God is, chance is not. The two cannot coexist by reason of the impossibility of the contrary.⁵

Clearly what is at issue here is God's sovereignty and, in particular, God's work of providence. If Sproul is right and quantum mechanics is true, then modern science refutes the providence of God. Then providence and chance are mutually exclusive. So we now turn to the issue of providence.

Providence

Providence is a theological doctrine distinct from creation. Providence is God's continuing action whereby he preserves creation and directs it according to his purposes. At least since John Calvin it is common under the heading of providence to distinguish God's preservation of the world, whereby he upholds all things by his powerful word, from his government, whereby he directs and rules over creation. Government is not just a statement of God's power and the fact that there is no-one to rival him or usurp his power. Rather it refers to the actual exercising of God's control over all areas of creation—over the forces of nature, over the animal world, over the destiny of nations and of kings, over the circumstances of our lives, and even over our inner thoughts, beliefs and desires.

Absolute providence is a particular version of providence that I wish to focus on. According to Calvin, providence is absolute in the sense that it extends to every single detail of the universe. In the *Institutes* Calvin writes, 'Single events are so regulated by God and all events so proceed

3 Dowe, P. *Chance, Coincidence and Chaos*. Book manuscript, Submitted.

4 In Sproul, R. C. *Not A Chance—the Myth of Chance in Modern Science and Cosmology*. Grand Rapids: Baker House (1994).

5 Sproul, R. C. *Not A Chance—the Myth of Chance in Modern Science and Cosmology*. Grand Rapids: Baker House (1994), p. 3.

from his determinate counsel, that nothing can happen fortuitously.⁶ Calvin has a pastoral reason for this that he develops at length: we gain important comfort from the knowledge of God's sovereignty.

An absolute, or completely deterministic providence, means that every event and every aspect of every event is directed by God. This involves at least three claims. The first is that God is the necessary cause of every event and every aspect of every event. If A is the necessary cause of B, then without A, B would not have happened. On this view, no event in our universe would happen if it were not for God. This is part of the idea of God being the sustainer of the world. If God sustains the world at every instant, then that means that every event that happened could not happen without God. If he withdrew from the world, none of it would happen.

The second claim is that God is a sufficient cause of every event and every aspect of every event. If A is the sufficient cause of B then if A occurs then B will occur. A sufficient cause is the full cause, or the active cause, the thing which, when it happens, will ensure that the effect will happen. This does not make it a necessary cause, since there may be alternative ways to ensure that something happens. A sufficient cause is a kind of motor cause, the thing that actually directs the event and makes it happen.

The third claim, which is sometimes overlooked in modern discussions (although it was very well understood in premodern times) is that God provides the complete reason. This is not something that can be understood in terms of a motor cause, or a mechanical reason or a causal chain. Sufficient reason in this sense concerns the purpose for something, which involves intentionality—somebody has a specific intention or purpose for the event. To say that God is the complete reason for every event and every aspect of every event in our universe, is to say that he has a special purpose for everything, a special reason that he has in mind in bringing about this particular event.⁷ This is to be contrasted with the idea of an accident or chance event in Aristotle's sense, signifying an event that does not have a purpose.

There is certainly more to absolute providence than just these three things, but these are the elements that are relevant here. It is usual to contrast providence with Deism, and in particular the idea that God created a world, but one way or another does not have continued involvement in it. For example, one version of Deism we might dub 'uncaring Deism', according to which God is the creator but not the sustainer of the world, and he does not necessarily have a complete reason for creating things the way he did. On this view God may well be a sufficient cause of the present state of the universe, because the universe was thought by deists to be deterministic and so when God creates it in the way that he

6 Calvin, J. *Institutes of the Christian Religion*. London: James Clarke and Co. (1949), p. 176.

7 This is not to be taken to mean that God does not observe the distinction between means and ends. I thank an anonymous referee for pointing this out.

does in the beginning and gives it the laws of nature that he gives it, then that ensures that it evolves in a certain way. But when God created it he did not especially care what was going to happen later on. He may have had some purposes when he created the world, but according to uncaring Deism, God did not have a particular interest in some of the things that are going to happen later on, for example, the events and circumstances in our lives. So, it is not true, according to uncaring Deism, that there is a complete reason for everything that happens.

This view can be contrasted with what could be called ‘caring Deism’. Like uncaring Deism, caring Deism holds that God is (in a deterministic universe) the sufficient cause of everything that happens but is not the necessary cause because the universe has its own power to continue to exist by itself. But caring Deism holds that God does actually have a complete reason for everything. So in creating the world God looked forward to see what was going to happen, and created it so as to ensure that it came out the way he wanted. But having set it up like that, with that concern for what was going to happen in the future, he is able just to let it go and it will run on its own. This is *caring* Deism because God has a concern about what is going to happen, but it is still Deism because he is able to withdraw and does not have to sustain the world.

I mention both versions to bring out the point that what’s at issue in Deism is whether or not God has to sustain the world, ie whether it can exist and have its being independently of God. The theologian Erickson gives the analogy of a power tool.⁸ Some power tools are such that when you let go of the trigger and put them down, they continue to run; but others are such that when you let go of the trigger, they stop so that you cannot put them down and walk away while the tool continues to operate. The tool that keeps going is like the universe according to Deism; and the tool that stops when you leave it is like the universe, according to providence.

Three Models of Providence

In philosophy there are at least three models of absolute providence, or divine determinism: occasionalism, concurrence and one due to Leibniz. These are models of the relation between divine and human action, and are all rivals to Deism. One of the key issues depends on the difference between a direct and indirect cause. An indirect cause is where there is an intermediate link between the cause and the effect. If I tread on Tim’s toe and he yells out, and Derek drops his glass because he is startled, then when I trod on Tim’s toe I actually was to blame for Derek’s dropping the glass and breaking it. I am not the direct cause, because there are a number of links in between, but I am an indirect cause of Derek’s dropping the

⁸ Erickson, M. J. *Christian Theology*. Grand Rapids: Baker House Book Company (1983).

glass. This distinction helps us to see that there are different ways to think about God's absolute providence.

The first position is occasionalism. Most famously, occasionalism was proposed by Malebranche, the 17th Century French philosopher.⁹ According to Malebranche, God does everything directly. God is the direct, not indirect, cause of every event that ever happens in the universe. Strictly speaking, created things do not ever actually cause anything. When a billiard ball hits another one, it is not that the billiard ball had the power to make something happen, it is actually God that makes it happen every time. Likewise, it is not that I am actually making this book fall if I give it a shove; really what has happened is that God made the shove happen, and God made the book fall. Nature has no real power—everything is due only to God. What we call causes are really just the occasions of God's action.

The second alternative is called concurrence, which was promoted by scholastic philosophers and by many more recent theologians such as Berkoff.¹⁰ Concurrence is the idea that every event has two concurrent causes; a divine, or primary, cause—God, who is the primary cause of everything that happens—but also a real, natural, or secondary cause, such as my decision, or the billiard ball moving. So an event has two direct concurrent causes. This faces the problem of over-determination, that something has two sufficient causes. This leads to a number of problems, for example if God is a necessary cause then it actually means I cannot be the sufficient cause.

The third view, which I want to focus on, is due to Leibniz.¹¹ According to Leibniz, God created the world at the beginning complete with all of its causal powers and laws of nature. The world then evolves deterministically, but not independently of God because God sustains everything in its being and in its causal power. But the world has its own God-given power, and God sustains it in that power, and God does not need then to make every step happen by directly causing each one. God is not the direct cause of every event, even though he is the indirect sufficient cause of every event.

God also has a sufficient reason for everything. Before creation God considered in his mind all the possibilities that could happen for the entire history of the universe. On the strength of that God created the world such that the universe, considered over its entire history, would turn out to be the best of all possible worlds, the best of all the possibilities. So when God created the universe he did so looking forward to the details of its future development, creating everything exactly the way he

9 Malebranche, N. *The Search after Truth/Elucidations of the Search after Truth*. Columbus: Ohio State University Press (1980).

10 Berkoff, L. *A Summary of Christian Doctrine*. Edinburgh: Banner of Truth Trust (1938), p. 56 and Mascall, E. *Christian Theology and Natural Science: Some Questions on Their Relations*. London: Longmans, Green and Company (1956), pp. 195–202.

11 See for example, Leibniz, G. W. 'Discourse on Metaphysics', In G. Parkinson, (ed) *Philosophical Writings*. Totowa: Rowman and Littlefield; Dowe, P. 'Recent Work on Leibniz on Miracles', *Leibniz Society Review* (1996) 6, 160–163.

did for specific reasons. In this way God has an intimate interest in everything that happens in the universe right through its entire history.

Yet some people harbour concerns that this is just a veiled form of Deism.¹² One problem that people might have is that there is a kind of temporal distance—God is supposed to be involved in my life at every step, but he seems on this model to be too distant temporally. But on Leibniz' theory God *is* involved in people's lives, because he has thought about every little bit—for example this sparrow falling at this particular time—and has set it up because he is concerned about exactly what happens. Leibniz is not a Deist.

As an analogy, suppose God did something from a spatial distance. Imagine, for example, that you are lying in the bush just having a snooze and a tiger snake slithers up and is going to bite you, and then a neutrino arrives from outer space, just at the right time, into the brain of the snake and zaps something in the brain that makes the snake turn away and go off. Now, all conventional theists will agree that this is an example of God's absolute and special providence, where he organised something to arrive from a star that is right across the other side of the universe.

But if God can organise things from a spatial distance then he can organise things from a temporal distance (as indeed he did in the case of the neutrino). The key thing is that he is interested in what is happening to you, and he has arranged things so that it will happen in the way that he wants them to happen for you, right now.¹³

The subsequent argument about chance is not going to depend on which of these three views is right: the argument should work for any of them. However, I am actually going to draw on the Leibnizian story later on, but I could have used any of them, so if you prefer one of the other ones, then just translate the argument into the terms of that other account.

Quantum Chance

'Chance', as it is used here, means single case objective chance, for example the probability of an atom decaying in the next minute. If there is a genuine chance, then the state of the system right now does not fix what it will be in a minute's time. It could either have decayed or not decayed, and all the facts about it right now, together with all the laws of nature, do not fix which of those two states it will be in.

12 van Inwagen, P. 'The Place of Chance in a World Sustained by God'. In Morris, T. (ed) *Divine and Human Action*. Ithaca, Cornell University Press, (1988), pp. 215, n. 4.

13 And if you think about God as outside time, which is the classical way to think that goes back to Augustine, then it does not really seem to be relevant. We do not think God is over there at that side of the universe just because he sent that neutrino, any more than to believe in providence you have to think that God is located right here. He is everywhere, he is not in space really, he is outside of space, and if you think about time like that, that God is outside of time and time is just part of his creation, then it does not really seem to matter much at what point God came into it.

Determinism is connected to chance. Determinism is the view that the state of the universe right now together with the laws of nature, fixes what the state of the universe will be at any subsequent time.¹⁴ So if determinism is true, there is no chance in our universe. Conversely, if there is any chance in our universe then our universe is not deterministic. So if there is quantum chance then we live in an indeterministic world.

A common reaction to quantum chance is to say, 'Well look, it's got to be ignorance, it's got to be just that you don't know exactly what the full cause is. The scientists haven't found out what the causes are. But how could they prove that there really aren't any causes—that's ridiculous.' But there is a surprising and very powerful physical argument to say that it is not ignorance but genuine chance, and it has to do with a result in physics called Bell's Theorem.

In physics one uses a state function to describe a system. A state function is a piece of mathematics which enables one to predict the results of measurements with a probability; for example that the probability of an atom decaying over one minute is one half. Many quantum physicists since Bohr¹⁵ say that the state function is complete, meaning that there are no relevant factors apart from what are described by the state function, that would give a deterministic account. If a state function which gives only probabilities is complete then there must be genuine chance involved. Other physicists, such as Einstein, rejected the claim that the state function is complete. In a famous paper called the Einstein-Podolsky-Rosen paper,¹⁶ written in 1935, Einstein argued that it was not complete and that there must be hidden factors underlying it, called hidden variables. Einstein expressed this in a famous statement when he said that he did not believe that God plays dice with the universe. For example, if the quantum mechanical state function gives a probability of a half of a certain atom decaying in the next minute, one might think that there must be further factors which are going to tell you why, in this particular case, it decayed right then rather than a bit earlier. There must be hidden variables that we do not know about, so the state function is not complete.

But in 1964 the Scottish physicist John Bell published a result known as Bell's Theorem, which provided a way to experimentally test whether the hidden variable theories, or quantum mechanics, is correct.¹⁷ He showed that the assumption that there are hidden variables underlying the statistical predictions of quantum mechanics which do not interact in a way that violates special relativity leads in certain cases to predictions different to those derived from the quantum mechanical state function. Experimental testing has conclusively shown that the predictions of the

14 Earman, J. *A Primer on Determinism*. Dordrecht: Reidel (1986).

15 Bohr, N. 'Can Quantum Mechanical Description of Physical Reality be Considered Complete?', *Physics Review* (1935), 48, 696.

16 Einstein, A., Podolsky, B. and Rosen, N. 'Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?', *Physical Review* (1935) 4, 777–780.

17 Bell, J. 'On the Einstein Podolsky Rosen Paradox', *Physics* (1964) 1, 195–200.

hidden variable theories are wrong. Thus it is argued that determinism has been proved to be false.

It may be a little difficult at first to conceive just how it could be proved that a certain description is the full story, and that there are no further factors to account for. This brings us to the central puzzle in the interpretation of quantum mechanics, which lies at the heart of the so-called Bell phenomena. Instead of discussing the physics of this remarkable phenomenon, I propose to illustrate the central puzzle by giving an analogy concerning identical twins. This analogy is an imperfect analogy; I have deliberately simplified things in order to focus on the central puzzle, and I hope to show that one does not need to know anything about physics in order to understand the really puzzling feature of the Bell phenomenon.

Suppose there are identical twins from Sydney, Steve and Mark. One of these twins, Steve, moves to Hobart, where he falls foul of a mysterious disease and dies. It is reported that this disease is triggered by excessively cold weather, and a person with the condition will almost certainly die if he is subjected to, say, about 2 or 3 days of continuous cold. This exotic disease has become known as ‘freezerphobia’. The other twin, Mark, stays in Sydney, where he is hit by a bus and dies.

Let us call putting a person in Hobart ‘the cold test’, or measurement. Now, we have heard rumours from scientists that when a pair of twins go to Hobart then often they both die. In fact, it is reported that there is a one to one correlation, namely, that if two identical twins are both cold tested then one dies if and only if the other dies. On this evidence it is reasonable to think that this disease is genetic, and that is why we observe this correlation between identical twins. This means, for any pair of identical twins, if we subject both twins to the cold test, eg take them both to Hobart, then if one dies from freezerphobia then the other will too; simply because the disease is genetic, and identical twins share the same genetic makeup. Therefore, we might reason, given what we know about Steve, we can infer that Mark also had freezerphobia, even though we cannot actually test that, since he is dead, having been hit by a bus.

So we have formed a kind of theory, a mechanistic theory. We think the correlation is due to an underlying mechanism—genetic, probably—which can be traced back to a condition of the unsplit egg from which both twins were produced. That is, we suppose that the correlation has what philosophers call a common cause explanation.¹⁸ It is a reasonable hypothesis, and the reasoning seems to be common sense.

Let us move now from this particular case of our friends Steve and Mark, and look instead at what the scientists are doing about this. In fact we find, already established at St Vincents Hospital in Sydney, the so-called ‘Freezerphobia Register Of Scientific Terminations’ or ‘FROST’ for

¹⁸ See Salmon, W. *Scientific Explanation and The Causal Structure of the World*. Princeton, Princeton University Press (1984).

short. (The significance of the terms ‘Scientific Terminations’ will become clear later.) We find that the scientists have set up an experiment, and also that many of the scientists already had formed a theory similar to our own commonsense idea of an underlying genetic mechanism, but of course they wanted to wait and see how the experiments turned out before they formed any firm beliefs about the matter.

Let us look at the experiment under four headings: the set-up, the method, the results, and the interpretation. Firstly, the experimental set up involves attracting pairs of identical twins from the general population to volunteer as participants. This is done by offering participants free trips to either Hobart or Dunedin, in New Zealand. Two planes have been chartered, and observation cells have been set up in Hobart, Dunedin and Sydney.

Secondly, the method has four steps. 1. A pair of identical twins are taken to Sydney airport. One twin is put on the Hobart plane, and one on the Dunedin plane, and when measures have been taken to ensure that there can be no further communication between the twins, both planes take off. 2. Once in the air, the Dunedin pilot tosses a coin; if it’s heads she heads for Dunedin, if it’s tails she does a big loop and lands back at Sydney Airport. 3. On arrival at whatever destination, the subjects are locked up in the observation cells and are carefully monitored. 4. The scientists simply record whether or not the participants die. These four steps are followed for large numbers of identical twins.

The results of the experiment are divided into two groups, because there are two possible experiments done on a pair: they could end up in Hobart and Dunedin, or in Hobart and Sydney. Remember that it is a matter of chance which of these two experiments is performed on a particular pair of twins. For the Hobart-Dunedin pairs, it is found that 62% of those who get to Hobart die, and 62% of those who get to Dunedin die. In each case the other 38% survive with no ill effects apart from occasional non fatal cases of frost bite, flu, and chilblains. Further, it is noted that there is a one to one correlation among the ones who died: the 62% who died in Hobart were the siblings of the 62% who died in Dunedin (the result I referred to earlier). We should note here that the results so far were regarded by most of the scientists (but not all) as confirming the genetic mechanism theory, because that theory predicts this one to one correlation. So far so good.

But for the Hobart-Sydney pairs the results stunned everyone. They found that 45% of those who end up in Hobart die, while none of those who end up in Sydney die. What is puzzling about that? What is puzzling is that 45% is not the expected result. One would have expected that figure to be about 62%, because that is what the Genetic Mechanism Theory predicts. It should not make any difference to those heading for Hobart whether their twin goes to Dunedin or Sydney. If it is already set by your genes that you will die if coldtested, then it is irrelevant whether or not

your twin is coldtested. These results are very puzzling, and this feature is parallel to the central puzzle in Bell phenomena.

So let us turn to the scientific interpretation of these freezerphobia results. Firstly, let's look again at the Genetic Mechanism Theory. This theory is a deterministic, hidden variable theory. It says that there is a factor l which, if one identical twin has it, then the other does as well; and if a twin has factor l then if he is subjected to the cold test, he will certainly die. Thus the condition of the twins back at the time of conception sets the results of the measurement, were it to be performed, and this condition is 'hidden' in the sense that it does not manifest itself directly in the measurements. But the experimental results are a major setback for the Genetic Mechanism Theory, at least in its present form. In fact, the scientists all agreed that the Genetic Mechanism Theory in its present form is refuted by these data, and being good Popperians, they abandon that theory. But with what can it be replaced?

Well, when the dust settled there were numerous differing views amongst the scientists. But the dominant group, called the Copenhagen school, focussed on the mathematical description of the results of the various measurements. They held that we should simply figure out the mathematical formula, called the state function, that describes all the results of all the measurements, both actual and possible. But we should not ask how to explain it. The state function should be regarded as a mathematical tool for making predictions about the results of measurements, and not as a pointer to underlying mechanisms. 'The state function is complete', was their slogan. Actually, they had not been pleased with the way most scientists had interpreted the first part of the experiment, and were feeling pretty smug about the way the second part had gone. In fact they now claim that the results prove that the state function is complete.

The situation in quantum mechanics is analogous to this parable in a number of important ways. In particular, the situation in Bell set-ups seems to be such that the predictions of 'local realist' theories¹⁹ run into conflict with the predictions of the quantum mechanical state function. Experiments conclusively support quantum mechanics over the local realist theories. But the local realist theories can be derived from very plausible assumptions. This difficulty, first articulated by Bell in 1964, is perhaps one of the most startling conceptual problems in twentieth century science. As one prominent scientist has said, 'Anyone who's not bothered by Bell's theorem has to have rocks in his head.'²⁰

19 See the influential presentation in d'Espagnat, B. 'The Quantum Theory and Reality', *Scientific American* (1979) 241, 128–140.

20 Cited in Mermin, N. 'Is the Moon There When Nobody Looks? Reality and the Quantum Theory', In R. Boyd, P. Gasper and J. D. Trout, (eds) *Philosophy of Science*. Cambridge, Mass.: MIT Press (1991), p. 504.

If the state function really has been proved to be complete then determinism has been disproved, and if determinism is false then there is genuine chance in the world.

Chance and Providence

So, how do we react to the idea of chance, if we believe in providence? Calvin said, ‘The providence of God as taught in scripture is opposed to fortune and fortuitous causes.’²¹ But as we will see, it would be a knee jerk reaction simply to deny the no-hidden variables proof. Yet this is what Sproul does in *Not A Chance*. His argument is that quantum mechanics is refuted because the idea of a quantum jump implies that a particle goes out of existence and comes back into existence, and that is a contradiction, therefore quantum physics is just nonsense.²² But it seems to me that Sproul fails to come to grips at all with the force of the relevant physical argument.²³

Rather than a knee jerk reaction, what is required here is a more careful consideration of the relationship between theology and science. On the other hand, the judgment of William Brown is too hasty in dismissing the problem: ‘the findings of the new physics . . . do nothing to alter a Biblical perspective of the world.’²⁴ The first question that needs addressing is this: When we talk about chance, or indeterminism in the physical world, is this a claim restricted to the physical world, or does it apply to God, as well? In the case of quantum chance, are we saying that the exact moment of decay is not caused by anything physical, or that it is not caused by anything including God? This is a question that has to be answered before one can draw any conclusions about the significance of chance for theology.

So, from the perspective of quantum physics, is it possible that God brings about the events that quantum mechanics deems to be the results of chance? There are two possible answers to this question—either it is possible or it is not. Either it is possible both that an event is a matter of chance and that God causes it, or it is the case that if an event is a matter of chance then it cannot be caused by God.

If the latter is true, then for any event if it is chance then it is not caused by God. Then the no hidden variable proof entails that God does not cause the quantum chance events. By proving there are no hidden variables we

21 Calvin, J. *Institutes of the Christian Religion*. London: James Clarke and Co. (1949), p. 172–173.

22 Sproul, R. C. *Not A Chance—the Myth of Chance in Modern Science and Cosmology*. Grand Rapids: Baker House (1994), p. 44.

23 Actually, I believe there is a loophole in the no-hidden variables argument, and it has to do with backwards in time causation. But this is beyond the scope of this discussion, and in any case it is very controversial. See Dowe, P. ‘Backwards Causation and the Direction of Causal Processes’, *Mind* (1996) 105, 227–248 and Dowe, P. ‘A Defense of Backwards in Time Causation Models in Quantum Mechanics’, *Synthese* In Press.

24 Brown, W. ‘Quantum Theology: Christianity and the New Physics’, *Journal of the Evangelical Theological Society* (1990) 33, 485.

have proved that it is not the case that God has made it that the atom will decay now rather than at another time. Then chance refutes providence.

If the former is true, then we are allowing that God produces what, physically speaking, we call chance. On this alternative, the atom decays after 20 seconds and there is no physical reason, but it is possible that God brought it about that it would decay just at that time rather than at some other time. A further question then arises: does God *in fact* bring about the results of chance events? Donald Mackay for example, took the view that not only is it possible that God causes chance events, but that this always happens. He held that God is sovereign and directs all things, and is the sufficient cause over all natural things including chance events.²⁵

Physical Chance, Divine Cause

According to John Polkinghorne, the fact that the chancy universe is what he calls 'open' is theologically significant, because it shows that (contra Leibniz) God allows the universe to have a degree of independence and maturity in itself.²⁶ Like small children, who, in order to grow up, must be allowed to make their own decisions, so also the universe is given a certain amount of independence. Secondly, Polkinghorne holds that an open universe allows creativity, and it is actually God that is being creative. So God acts in the quantum gaps, the open bits, creatively reacting to the world—if it moves this way he is able to respond to that, like a chess grand master,²⁷ who is able to think very quickly about what has happened, reacting to the developments and influencing it to go the way he wants. Polkinghorne's idea is that in the quantum gaps there is information transferring from God to the physical system, although energy does not flow. In this way chance becomes God's steering wheel.

But Polkinghorne's idea seems to involve a contradiction. God controls the chancy bits, but did not the chancy bits bring independence to the world? But if God is controlling them as well as the fixed bits, then there is no independence for the world. And, further, since God caused the fixed bits by his initial creation and ordering of the laws of nature, why does he need to steer the world? So in what sense is God guiding a world with its own independence? (Perhaps Polkinghorne means that some of the chancy bits are independent, and some of the chancy bits are used by God to turn things back again.)

These difficulties aside, if God directs the chancy developments in the universe then chance is no affront to providence. If God directs the chancy

25 MacKay, D. *The Open Mind and Other Essays*. Leicester: Inter-Varsity Press (1988), pp. 197–211.

26 Polkinghorne, J. *One World: The Interaction of Science and Theology*. London: SPCK (1986), p. 69. See also the review by Doye, J., Goldby, I., Line, C., Lloyd, S., Shellard, P. and Tricker, D. 'Contemporary Perspectives on Chance, Providence and Free Will', *Science and Christian Belief* (1995) 7, 117–139.

27 Cited in Doye et al, 'Contemporary Perspectives on Chance, Providence and Free Will', *Science and Christian Belief* (1995), 7, 136.

bits in the way Polkinghorne envisages, then chance is just a causation which is hidden from us, as opposed to God's more open direction that we can see in the laws of nature. This is not a new idea, it has been urged by theists throughout this century.²⁸

But is this steering wheel model of chance possible in the light of quantum mechanics? In particular, does the no hidden variable proof prove that God did not do it—that quantum chance effects have no cause, physical *or* divine? If quantum mechanics proves that God is not the hidden variable, then it seems that science refutes absolute providence. So is science incompatible with absolute providence?

The answer is no. The reason is that there is an assumption in the Bell proof which is called 'locality'. Locality is the assumption that two separated things cannot signal to each other faster than the speed of light, which follows from Einstein's special theory of relativity. And so, in the freezerphobia case, if the twins are separated far enough and the decision whether to go to Dunedin is made late enough, then one may assume that the Hobart twin's chances of dying are not being influenced by that choice. For example, one suggestion that might come to mind is that there is some kind of telepathy going on, so that the twin that has gone to Hobart knows by (not entirely reliable) telepathy whether the twin has gone to Dunedin and is squealing in pain, or whether she is in Sydney enjoying herself. Locality rules this out.

But the locality requirement would not apply to God. If God really is involved in bringing about events in the way that we are considering in this suggestion about absolute providence, then it would be incoherent to suppose that God is going to be subject to the locality restriction. The reason is simply that God is not located in space. If God knows what happens in the world, and can act at locations in this world, then we can suppose that God deliberately brings about one event knowing instantaneously of the occurrence of another, distant to the first; without requiring a locality-violating physical signal. So the proof simply does not apply in the case of God. It only applies to physical causes, which are subject to the locality condition.

So, the evidence for quantum mechanical chance is not evidence against absolute providence, because of this locality loophole.

But another question arises here, namely, why does God produce the strange correlations uncovered by Bell? Why would God want to do that? It is one thing to use chance as a steering wheel, but that does not explain why the weird correlations uncovered by Bell phenomena are necessary.

One possible answer is that God meant to leave a trace, a trace of his existence, indeed of his providence. Firstly, consider the Kalam Cosmo-

28 See Mascal, E. *Christian Theology and Natural Science: Some Questions on Their Relations*. London: Longmans, Green and Company (1956), pp. 200–202.

logical Argument,²⁹ an argument due for example, to the Islamic philosopher al Ghazali. The first premise is the Law of Causality: everything that comes into existence has a cause of its coming into existence. The second premise is: the universe had a beginning in time. Thus there was a first physical event in the universe, and al Ghazali gave various mathematical proofs as to why there must be a first event in time. From those two premises it follows there has to be something which is not part of the universe which is the creator of the universe, which brings about that first cause. Interestingly, Stephen Hawking seems to believe this argument. In his book *A Brief History of Time*³⁰ Hawking argues like this: if the Big Bang is a singularity in space and time, where it all began, then you could infer that God started it up.³¹ So, Hawking offers his own ‘no-boundary condition’ cosmological model where there is no singularity point; and instead of the standard cone shaped Big Bang the universe is like a big fruit bowl or globe in imaginary time. And at the end of that chapter Hawking says, ‘but if the universe is really completely self contained, having no boundary or edge it would have neither beginning nor end, it would simply be. What place then for a creator?’ The way the story is presented in *A Brief History of Time*, one might be forgiven for thinking that the whole reason for this model is to avoid saying that God is the first cause.

One problem with Hawking’s model is that it appeals to an imaginary axis of time, yet it is supposed to be a model of actual reality. Hawking’s reply is that such models are not supposed to be telling you what is really there; they are just tools for making predictions,³² which is a very strange position for an author who is seeking a theory of everything which will reveal to us the mind of God. But the main point is that Hawking seems to think the Kalam Cosmological Argument is valid; that if the universe began with a space-time singularity then you would have to say that God is there to start it up.

By analogy with the Kalam Cosmological argument, consider the Quantum Cosmological Argument (to my knowledge this has never seriously been proposed). The first premise is the Law of Causality—everything has to have a sufficient cause. The second premise is that there are genuine objective chances in quantum physics—there are things in our world which do not have a sufficient physical cause. So the conclusion is that there must be a non-physical cause—God—to bring about these events. Bell’s Theorem proves God.

I am not seriously proposing this argument, because the Law of Causality itself is very hard to offer any argument for; it is one of those fundamental assumptions that cannot really be proved. It is commonly

29 Not to be confused with the ‘argument from contingents’—which is also called the cosmological argument—as given by Aquinas, Leibniz and many others. See Peterson, M., Hasker, W., Reichenbach, B. and Basinger, D. *Reason and Religious Belief*. Oxford: Oxford University Press (1991), pp. 74–80.

30 Hawking, S. *A Brief History of Time*. Toronto: Bantam Press (1988), ch. 8.

31 *ibid.* pp. 143–144.

32 *ibid.* pp. 147–148.

held that quantum chance shows that it is false. I merely point out an alternative: that the Principle is true, because there is a non-physical cause. This would explain why God has created a world with Bell correlations. He wants to leave us traces of his existence.

Physical Chance, No Divine Cause

Suppose now that where there is objective chance, there is no cause, physical or divine. It then follows from the existence of chance that God is not in complete control of the universe. How serious is this theologically?

Here we can consider a model proposed by the philosopher Van Inwagen³³ which is similar to the model of Leibniz, but with the addition of objective chance (of course Leibniz himself would not have accepted the addition).

According to van Inwagen God's purposes for the universe are achieved by controlling less than everything. The purposes that God has for the universe do not extend to absolutely every fine detail. So, at the beginning God sets up the laws and initial conditions—and possibly the laws involve probability—and then he sustains things in their causal powers. But because there is chance in it, there is not a sufficient cause of everything, but God merely uses the initial conditions to ensure that certain things obtain. So, for example, van Inwagen thinks that God wants to ensure that there are people, but he does not need to ensure that there are particular people doing particular kinds of things. So he sets up a universe which will ensure that there will be conscious beings, but he does not need to do much more than that because his purpose is just to have conscious life one way or another.

This is limited providence, not absolute providence. This would certainly conflict with the kind of providence that I described earlier, where God is involved in every significant bit of people's lives. But if you take a weaker version of Van Inwagen's model and you limit providence to a lesser extent, then Van Inwagen's idea can closely approximate a theologically adequate providence while including chance. To see this we turn briefly to the idea of a coincidence.

Meaningless Coincidences

A coincidence as I will here understand it is where two or more events occur together against all probability, and where there is no reason why they do so. For example, philosophers often tell a story about a mother who had a dream one night about her baby being hit by a chandelier, and despite her husband's scepticism, went into the room and moved the child. Then that night there was a big storm and the chandelier fell down,

33 van Inwagen, P. 'The Place of Chance in a World Sustained by God', In Morris, T. (ed) *Divine and Human Action*. Ithaca: Cornell University Press (1988), pp. 211–235.

right where the baby had been. If the conjunction of these two events—the woman’s dream and the light falling—has no explanation then it is just a coincidence. If there is some explanation then it is not a coincidence at all.

Another example is the case where a mother watches in despair as her child runs out onto a train track just as a train is due to come around the corner but then, for some reason, the train just stops. It could not have stopped because the train driver saw the child, because it had already started to stop before it turned the corner. What happened was that the driver had died just at that moment and by chance he had slumped onto the brake.

This is a coincidence only if there is no reason why the driver died at just the same time that the child wandered on to the track. Leibniz’ Principle of Sufficient Reason, and absolute providence, say that there are no accidents. Every event and every aspect of every event has a reason. So Leibniz held that there are no coincidences. It is no coincidence that the train driver slumped just then—this is part of the world that God had set up from the beginning to be the best possible world, and part of that world was that that child would not die that way. It’s no coincidence—it has a reason.

Coincidences are not explained just if the two separate events each have a sufficient explanation. There may be a sufficient reason why the train stopped right then, in terms of the driver’s condition and the way he was sitting. There also may be a sufficient reason why the child ran on to the track, in terms of the child’s routine, character and desires. But that each of the individual events has a sufficient reason, does not mean that the coincidence has a reason. This requires a reason why the two things happen at the same time.

Consider now meaningless coincidences. The examples just considered both were meaningful, very important in the life of the people concerned. But think of meaningless coincidences, such as a leaf falling from the tree outside my window just at the very instant I wrote the word ‘baby’. That’s a coincidence—it’s just as improbable as the train driver and the child. But it’s also quite meaningless—who cares if a leaf falls just as I write ‘baby’? Such meaningless coincidences occur all the time.

What, in the doctrine of special providence, requires that God has complete reasons for these kinds of coincidences? What reason is there in the Bible for thinking God has reasons for meaningless coincidence? For example, in the texts that Calvin adduces to prove the importance of this doctrine for comforting believers, none are about meaningless coincidences.³⁴ This suggests that the doctrine of Absolute Providence could be relaxed so that it does not apply to meaningless coincidences, without affecting the theological significance of the doctrine. God controls all

³⁴ Calvin, J. *Institutes of the Christian Religion*. London: James Clarke and Co. (1949), p. 171–181.

things that are of importance to his creatures, but may not control all things that are of no importance to anyone. Then some things, such as the timing of the leaf's fall relative to my writing 'baby', have no reason in God's mind. It is just an accident, a coincidence. If so, chance events could occur where God does not determine the outcome, providing the outcome is not meaningful to anyone.

Then there is no reason theologically or biblically to assert that God does have complete reasons for absolutely every aspect of every event. Why should God have purposes for meaningless coincidences? But if he does not, then strictly speaking absolute providence is false.

If quantum chance does not lead to meaningful happenings, God may choose not to control the outcome. So, there could be room for chance in an exactly analogous way to meaningless coincidences. If these chances, ie about atom decays, make no meaningful difference to anybody, then God has no need to control their outcomes in order to ensure his purposes are fulfilled. So, providing it does not impinge on meaningful things in people's lives, then it does not seem to be that chance without Divine causation refutes Providence. Absolute providence is relaxed, but not to any theologically significant degree.

However, some quantum chance may be humanly meaningful. For example, if chaos theory can amplify the quantum chances and affect our weather, maybe the results of atoms decaying will turn out to be humanly meaningful. This is an empirical matter that has not really been settled properly yet, as I understand it. But if this is so, then some chances are humanly meaningful and that would mean that, given a strong view of providence, then one should have to infer that God at least causes some of the objective chances in the world.

Conclusion

So, should Christians be bothered by the Chance Worldview? Does chance refute providence? No. If chance exists then either it is caused by God (and that is allowed by Bell's Theorem) and this is no problem for providence and there is no conflict with science, or chance is not caused by God, in which case it is compatible with strong Calvinist providence providing it does not lead to meaningful consequences. Insofar as chance does lead to meaningful consequences, strong providence entails that God causes that chance.

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