

PETER J. BUSSEY**Indeterminacy, Time and the Future**

A recent paper by Lawrence Osborn contrasted two different views of time: a process-oriented view and a unitary view, with particular discussion of the latter. Here the subject is considered from a different perspective, by showing how the introduction of quantum indeterminacy limits our ability to discuss the future, and hence form a unitary description that has validity from a temporal human viewpoint.

Key words: Time, quantum mechanics, future, indeterminacy, eternity, chaos.

Introduction

In his article ‘Spacetime and Revelation’¹, Lawrence Osborn has outlined the difference between two radically different viewpoints on time: a ‘commonsense’ perspective in which time is something that passes, and where past, present and future are different things, and a more ambitious ‘global’ or unitary perspective, which endeavours to consider the entire history and future of the universe as something homogeneous, existing in a kind of ‘eternal present’. This latter is more of a ‘God’s eye viewpoint’ than our own, but physicists and cosmologists such as Einstein have made a strong use of it. Osborn’s conclusions, with which I am in full accord, are that the former, everyday viewpoint is indispensable, and that one does not have to interpret relativity theory in terms of a unitary perspective on time. The following is offered as an attempt to develop and amplify some of the issues which he has discussed.

In particular, I should like to complement Osborn’s focus on the cosmic and all-encompassing by showing that microscopic aspects of existence, described by quantum mechanics, also have important implications concerning time as we perceive it. This in turn has consequences which theology should take into account.

Indeterminacy

The first decades of the twentieth century saw two massive paradigm-shifts in physics, due respectively to the development of relativity theory and of quantum mechanics. Of these, the repercussions of quantum mechanics are perhaps the greater. Here I wish to consider just one of its revolutionary aspects, namely the introduction of indeterminacy into

¹ L. Osborn, ‘Spacetime and Revelation’, *Science & Christian Belief* (1996) 8(2), 111–123.

physics. Its relevance to our understanding of time will then be explained.

Until the 1920s it was assumed that the physical behaviour of any system is in all aspects precisely governed by laws of nature; these provide an exact account of everything that happens in the physical universe. Our ability to evaluate the consequences of these laws is limited, owing to a lack of precise knowledge both of the laws themselves and of the actual state of the universe. Nevertheless, the laws were assumed to exist in such a way that the future of the universe is unambiguously determined by them. Or to put it from another viewpoint, all that happens has a precise efficient cause.

It is these beliefs that have been seriously affected by the introduction into physics of indeterminacy, as part of quantum mechanics. Instead of all aspects of physical behaviour being precisely determined by laws, physicists now believe that an intrinsic element of randomness exists in physics at the atomic level. Radioactive atoms, for example, have well-defined average lifetimes for their decays into other atoms, but the precise moment of decay of a given radioactive atom is unpredictable and has a strong random element. A photon of light interacts with a molecule in a photographic film, but precisely which molecule it interacts with cannot be predicted *even in principle*. Law, up to a point, breaks down, and this conceptual bombshell has taken some time to be assimilated into our culture—if indeed it is fully assimilated even yet. C. S. Lewis remarked,² ‘Those who (like myself) have had a philosophical rather than a scientific education find it almost impossible to believe that the scientists really mean what they seem to be saying.’ Even a minority of physicists, such as the late David Bohm and his followers, have mounted a rearguard attempt to rescue determinacy in physics. They have proposed some rather more complicated alternatives to the present orthodox quantum theory in which the apparent randomness is actually due to the behaviour of so-called ‘hidden variables’ which cannot be observed. Most physicists, however, accept randomness as the simpler and more plausible explanation for what the experiments tell us.

How Authentic is a Unitary View of Time?

In what follows, it is essential to remember that all statements, made by all people, are made at some moment in time. With this in mind there should, on the face of it, be no problem in talking about time using any language that employs tenses. The past was, the present is, the future will be. Given this apparent straightforwardness, how can a static, ‘eternal-present’ description of time even be formulated without indulging in syntactical liberties? How can a human being, living in time, discuss past and future in the present tense?

2 C. S. Lewis, *Miracles*, London; Bles (1947) p.25; Glasgow: Collins (1974) p.17.

What it seems that we do, if we wish to adopt a unitary view of time, is to form first an image of the entire temporal sequences in our own minds. It is probably a static image that we form, in which time is metamorphosed (as Osborn reminds us) into some kind of spacelike visualisable dimension. Or we might indeed try to run a series of processes through our imagination like a piece of re-usable video film. In either case we regard the whole assemblage as being in our mental possession *now*. In this way, indefinite ranges of time can be rendered tractable by being untemporal in our own thinking. Having formed this imagery, we may then be inclined to interpret it as literally true, and to project it on to the universe as something real.

However, to extrapolate a mental device such as this into a statement of an ontological kind is fraught with danger. We are thinking in a certain way about time out of practical necessity. That does not mean that the reality has to *be* like this. Our presumed 'God's eye' view of the universe is obviously not necessarily God's real view of it, nor even our own from an experiential point of view. It is needed if we are to attempt to discuss cosmology; but what starts out as a pragmatic necessity can easily end up by being a conceit! Is a technical device being elevated beyond its station in life?

Talking About the Future

The past, as we well know, is fixed. Statements about it are true or false because the correspondence between the statement and the reality—in other words the events in the past—is well defined. The reality is there, and we can talk about it. However, in the case of the future, the reality is not yet there. We can talk with confidence about the future only if we believe that it is in a fundamental sense determined. This implies that there is a set of laws and principles *now* which govern what *will be*. The so-called classical (i.e. pre-quantum) laws of physics fulfilled this role. Consequently it was in a sense valid for Einstein and others to refer to the future as if it really existed now. Of course, by definition, it did not, but true statements could still be asserted about it. The picture could be formed and claimed to be real in the sense of being truthful.

However, indeterminacy undermines all this. A statement such as 'My next throw of the dice will be a six!' has a truth-value which at the time the statement is made is not determinate, given that the dice-throw is genuinely random. The truth-value becomes determinate only when such an event actually occurs. This is because the reality referred to, namely the outcome of the dice-throw, remains indeterminate until then. The issue, in other words, is not one of our knowledge being imperfect, but rather one concerning the status of the reality referred to, and this varies with time.

The modern development of 'chaos theory'³ is in a sense similarly subversive to classical ways of thinking, as a kind of 'poor man's indeterminacy'. Here, one finds that in many physical systems, even classical ones, our knowledge of the future becomes increasingly limited by the limitations on our knowledge of the present. Any slight imperfection in this develops into a broader and broader degree of ignorance as we attempt to calculate how a physical system will develop with the elapse of time. Nevertheless, the problem here still in principle remains with our knowledge: in the unachievable ideal of perfect knowledge of the present, we could make precise statements about the future. Indeterminacy, by contrast, carries the message that *all* precise knowledge of the future is a vain hope. In fact, when it exists in conjunction with a 'chaotic' system, quantum-level indeterminacy may in principle sometimes give rise to large-scale indeterministic effects, over sufficiently extended times.

All this is in contradiction to our common tendency to think of future realities as there and fixed, all uncertainties lying in our own imperfect knowledge. (Much talk about 'fate' is based on such a point of view.) From this kind of standpoint, it is easy to see perfection of knowledge as a highly desirable goal in life, and this has often been generalised into an attitude that the achievement of a more elevated view of the world is altogether, in its very essence, a matter of 'gnosis'. A broad set of variations on this theme underlie many Hellenistic thought patterns, against whose excessive influence the early Church had to be continually on its guard: knowledge puts you in touch with eternity; knowledge overcomes the limitations of mortality. To be mortal is to be limited to an existence in time, but even more it is to be ignorant. Only through knowledge and the mind does the human situation have a hope of a remedy.

Gnosticism, in its various religious forms throughout the ages, is at heart a search for knowledge that leads to personal salvation. The resulting teaching is often esoteric, even secret, and very far from the more outward-going attitude of science. But something of its spirit still seems to be occasionally present in science, as illustrated by Einstein's remark (quoted by Osborn) that a 'convinced' physicist sees past, present and future as all one, the differences between them being illusory, and death being of no importance. Again, something similar can be sensed in certain forms of futuristic and visionary thinking which have been modern science's frequent half-acknowledged companions. It is of interest that Einstein was firmly opposed to the prevailing interpretation of quantum mechanics which we have drawn on here. It is of interest likewise that Bohm's motivation for advocating a causal 'hidden variables' theory of quantum mechanics seems to have arisen from his Marxist convictions at the time.⁴

3 See for example J. T. Houghton, 'New Ideas of Chaos in Physics', *Science & Christian Belief* 1989 1(1), 41-51; J. Polkinghorne, 'A Note on Chaotic Dynamics', *Science & Christian Belief* 1989 1(2), 123-127.

4 D. Peat, *Infinite Potential: the Life and Times of David Bohm*, Addison Wesley (1996), reviewed by J. Barrow, *New Scientist* (1996) No. 2056, p.48-49.

The presence of indeterminacy, even at the philosophical level, is a threat that seriously undermines all attempts to seize eternity by knowledge, or to impose a futuristic political theory that is 'historically determined'.

Some Connections with Christian Belief

Most physicists and cosmologists believe that the effects of indeterminacy and chaotic development are in practice limited. We can, in fact, hope to calculate the really large-scale, longterm behaviour of stars, galaxies and even the whole universe, up to a point. On the face of it, this is in excellent accord with a theistic outlook. The basic framework of creation is fixed, but the details are not. In the smaller-scale behaviour of things, indeterminacy seems to allow physical systems a degree of freedom which seems to parallel our own sense of ourselves as freely acting beings.

A simple equation of indeterminacy in physics with personal freedom of action is misleading, however. Physical indeterminacy is random while personal freedom is purposive. What one might call a spiritual factor is indispensable to a Christian description of human beings and their personal existence. It may be that quantum indeterminacy makes it easier to incorporate such a factor into our understanding of things, but even in a completely deterministic world we would still be entitled to imagine the incorporation of a spiritual factor additional to the laws of physics. In either case, ordinary physics is added to, rather than replaced or destroyed. It is only the more 'totalitarian' views of a completely law-governed universe that are threatened by an incorporation of spiritual factors. But it is such viewpoints which are required if temporally-bound human beings are to be able to adopt a unitary view of time. Without strict determinism, the future vision becomes at least to some degree cloudy.

Indeed, it would appear that any kind of personal freedom imparts a 'chaotic' element to the development of the human world. Acts by individuals in key places can have large and unpredictable effects on other people and hence on the future development of societies, countries and the world as a whole. Quarrels among rulers, crucial inventions and discoveries, moments of carelessness—all of these have had dramatic effects on the history of humanity. It was not so much 'historical forces', one might thus say, but rather Karl Marx and V. I. Lenin who really produced the Russian Revolution.

There is an interaction between ideas of eternity in time, and ideas of a timeless Eternity, which are beyond the scope of this paper. The temporal 'future' seems to be symbolic for deeper and broader things. At any rate, as beings in time, our ability to lay hold on physically 'eternal' matters is strictly limited. This is due not only to the faintness of our intellectual capabilities, but also to our temporal status as such. In trying to come to terms with these issues, those whose religious thinking has a gnostic element may well end up dismissing the present world altogether, or else living two separate existences, one in this world and one on another plane!

However as Christians, we are already aware of the need to relate to God in other ways than by attempting to grasp the Timeless with the efforts of our minds and imaginations. This would be true irrespective of the existence of indeterminacy in physics, but the latter helps to drive the point home. What is required is a personal relationship with God, rather than an intellectual relationship with Eternal Things. This confirms once again the modern reemphasis on the more 'Jewish' aspects of our faith, as a healthy counterbalance to the overstressing of the intellect that seduces much of academic theology. A knowledge of God by revelation avoids the problematic 'gnostic' issues, and enables us to live existential lives in the real world on the basis of faith.

Finally I would want to emphasize a further point mentioned briefly by Osborn. Given the temporal frame-dependence of our existence and all our knowledge and our statements, and given that we relate in time with a God who is at least largely outside time, all statements we may seek to make about God and time must contain a large element of paradox. We are not and cannot be in possession of God's Frame of Reference. There are issues of humility here. Anything that goes beyond God's own revelation of himself to us has to be filled with uncertainty.

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Science & Christian Belief: <http://www.tcp.co.uk/~carling/scb.html>

[Home Page contains full listing of Contents plus many article abstracts, subscription details etc.]

Christians in Science: <http://www.tcp.co.uk/~carling/cis.html>

[A useful gateway to other useful WWW sites, such as the American Scientific Affiliation site which offers several useful articles]

Press Release address: <http://www.tcp.co.uk/~carling/cispress.html>

[contains Press Release concerning the article by Prof. R.J.Berry, 'The Virgin Birth of Christ' published in Science & Christian Belief 8: 101-110, 1996, together with a copy of this article].