

To the Editor,

John Randall raises many interesting points in his article "Physics, Philosophy and Precognition" (Randall, 1998), and I would like to comment on some of these.

He is right to emphasize that the quantum and relativity theories are mutually incompatible. Indeed, the first theory is expressed by linear equations, whereas the relativistic equations of a gravitational field are notoriously non-linear, so that the discovery of even the simpler solutions is a major mathematical problem. There is no way in which a linear theory can ever give rise to non-linear equations and it follows that either the quantum theory will need major amendment to render it compatible with relativity or, more likely, that both theories will have to be abandoned and replaced by an entirely new structure of ideas.

It is a wry comment on the insularity in time of each generation of physicists that they always believe that the mathematical theories they employ represent the absolute truth about the cosmos and that all that remains for their successors is to dot the *i*'s and cross the *t*'s. Thus, at the end of the last century it was almost universally accepted that Newton's mechanics, his law of gravitation and Maxwell's theory of electromagnetism were sufficient to explain all physical phenomena. As another century draws to its close, some mathematical physicists are confidently predicting that their studies will culminate in a super theory of everything in the year 2000 or, as the new millennium is now rapidly approaching, perhaps this may be delayed until 2010. More reasonably, experience should teach us that physical theories are only elaborate rules of thumb, whose period of currency is limited by the circumstance that the pool of observable phenomena grows inexorably deeper and murkier.

However, I disagree with Randall in regard to the openness of the future. As he remarks, such a view is incompatible with relativity theory. According to this theory, the future cannot be unambiguously defined, some events being in the future for some observers and in the past for others. Thus, there can be no such thing as a precise partitioning of time which sweeps forward and transforms potential events into actual events. This partitioning is an artefact of each individual observer and is the most characteristic contribution of consciousness to the real world. This does not mean that the lapsing of time is an illusion, only that it is subjective to each animal consciousness, i.e. there is no unique objective lapsing of time, but one such is associated with every individual mind—it is a psychic phenomenon. For relativity theory, the physical cosmos is deemed to be a coherent four-dimensional geometrical entity, every region of which is keyed into every adjacent region by cast-iron laws of determinacy. With Einstein, I see no reason to expect that macroscopic determinacy is founded upon microscopic indeterminacy. It is true that the principles of quantum theory permit an observer to predict his future with only varying degrees of uncertainty. But the circumstance that my future cannot, even in principle, be predicted precisely does not imply that this future is indeterminate—as Randall says, the weather cannot be predicted with certainty, but nobody doubts that its course is held in the iron grip of determinacy.

Randall's statement that in quantum theory "the future is most definitely *not* fixed" implies that this theory rules out the block universe even as a possibility, whereas it does no more than rule out the possibility of determining its future features by examination of present data. In a hypothetical block universe whose events were all perfectly random, the future would be completely determinate and yet an observer would never be able to predict his future.

Nevertheless, Randall argues that our conviction that we are creatures exercising free will requires that the future must be truly open and that the indeterminacy inherent in quantum theory is compatible with this conviction. But if he means that the theory gives each of us *carte blanche* at any instant to divert the course of events in some arbitrary manner from their predetermined channel, the results of a steady stream of such choices would soon prove to be inconsistent with the probabilities predicted by the theory and thus free will would be shown to be incompatible with the theory. But I do not believe that the exercise of free will is in any way inconsistent with the most rigid determinacy. At any instant, I am free to behave exactly as I choose to behave—I review the situation in which I am placed, I consider the courses of action that are open to me and the probable consequences for myself and others of each one, and then I choose to act as suits my temperament—maybe altruistically, perhaps malevolently, maybe wisely and possibly not, but coerced by naught but my situation. However, I hold that every one of these decision processes is rigidly determined and that no contradiction arises if we imagine an omniscient observer watching the unfolding of the drama in the same frame of mind as that of an astronomer monitoring an eclipse of the sun as it proceeds to its inevitable conclusion. Thus, we act as we choose, but what we choose is rigidly determined. Those who continue to insist that the concepts of free will and determinism are incompatible must explain in what manner a person, whose brain processes are governed by natural laws, will ever feel himself forced against his will to react to his circumstances in a manner other than that in which he chooses to act. Of course, my adversary may accept the force of my argument, but then insist that free will on these terms is, in some strange way, derisory; in which case I leave it to him to coin a phrase which he feels to be more appropriate to the case. Randall argues that "if my thoughts are predetermined by physical processes I have no reason for believing them to be true rather than false". I do not accept this stricture. The truth or falsity of my beliefs can be checked by well-known tests and the results are quite independent of the processes by which they are generated. That the thoughts of both the sane and the insane are caused by the same physical processes does not imply that an observer is unable to distinguish which are compatible with reality.

Thus, as the years have gone by, I have become steadily more convinced that Minkowski's fatalistic view of reality as a space-time continuum is the only viable one. If, instead, we insist upon a three-dimensional space evolving in time, we are faced with the problem of accounting for the creation of the world in the year dot (the big bang). A space-time continuum, on the other hand, is never created, since the concept of the lapse of time never arises—the continuum just is. The big bang is then reduced to the status of one space-time point amongst a myriad others, albeit having very singular geometrical

properties. Randall's objection that Minkowski multiplied his time coordinate by the imaginary number $\sqrt{-1}$, thereby indicating that his space-time cannot be regarded as a true picture of reality, is misconceived. $\sqrt{-1}$ may for historical reasons be termed imaginary, in the same way that $\sqrt{2}$ is termed irrational, but the status of neither of these quantities is less soundly based than are the integers. In fact, Minkowski's geometry can be perfectly well expounded without the introduction of $\sqrt{-1}$, although this "analytical device" (Eddington) enables us to reduce space-time to a simpler quasi-Euclidean form.

Thus, I accept the block-universe view of reality and do not agree with Randall that I am thereby excluding the possibility of free will. As explained above, the two are perfectly compatible. Given then that precognition occurs, we are faced with the problem of the precognized event which causes me to exercise my free will to prevent its occurrence. Randall reviews some modified block-universe theories that involve additional dimensions of time, but does not refer to Jon Taylor's Principle of Intentionality (Taylor, 1995). This states: *A precognition can only occur when, as a result of the precognition, the percipient is either unable to change, or does not intend to change, the future event precognized.* If such a principle can be established, it seems to me that there is hope that the phenomenon of precognition can be assimilated into the block-universe model without the necessity for drastic amendment.

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 Taylor, J. (1995) Precognition and intuitive decisions: an answer to the problems of free will and causality. *JSPR* 60, 353–370.

John Randall replies:

I am grateful to Prof. Lawden for his perceptive comments on my paper in the October *Journal*; however, I cannot agree with his conclusions.

Lawden agrees with me that quantum and relativity theories are mutually incompatible. It follows from this that they cannot *both* be valid portrayals of reality. Unless one is prepared to adopt something akin to Bohr's 'Principle of Complementarity', then one or other of the two theories must be wrong. Lawden accepts relativity in the form of the 'block universe' and must therefore conclude (as Einstein did) that there is something wrong with quantum theory. However, of the two theories it is clear which one has the greater experimental verification. From the 1930s onwards the predictions of quantum mechanics have been tested repeatedly and have never been known to fail. The theory has been applied successfully to particles which are ten million times smaller than those for which it was originally devised. It is used routinely in such disparate fields as organic chemistry, optics, laser technology, nuclear physics, electron microscopy, cosmology and computer technology. It has predicted the occurrence of such totally unexpected and counter-intuitive

phenomena as the Einstein-Podolsky-Rosen effect, and these phenomena have been confirmed in the laboratory. In short, quantum mechanics is the most successful scientific theory ever to have been devised by the human mind. In choosing to side with Einstein against the founding fathers of quantum theory, I fear that Prof. Lawden may have backed the losing side!

As is well known, there have been numerous attempts to put some philosophical flesh on the bare bones of the quantum formalism. But most commentators would agree with Davies and Gribbin (1992) when they tell us that "quantum fluctuations are not the result of human limitations or hidden levels of mechanistic clockwork; they are *inherent* in the workings of nature on an atomic scale" (p.26; their italics). Whether we like it or not, it seems that God *does* play dice with the world. This inherent indeterminism seems to me to rule out any interpretation of relativity which involves a block universe. Whether or not Einstein's equations *necessarily* imply such an interpretation is a moot point, and one which I deliberately left on one side when writing my paper. It may be worth mentioning, however, that the formal equations of special relativity were derived independently by Lorentz and Fitzgerald, on totally different assumptions from those of Einstein, *before* he published his famous paper of 1905 (cf. Jeans, 1950, pp.292-3). Therefore there may be other ways of interpreting those equations which do not involve a block universe and a deterministic view of reality.

With all due deference to Prof. Lawden, I shall continue to believe in a future which is at least partially open, since this agrees with my innermost conviction that I have some freedom of choice, as well as with my knowledge of quantum mechanics.

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Jeans, J (1950) *The Growth of Physical Science*. Readers Union.

To the Editor,

In his efforts to show where and how I have erred in arguing for a clear paranormal explanation of (as examples) messages from Mrs Piper and the Cross-Correspondences, Dr Coleman (1998) is getting himself into ever deeper water; and once again the authorities he cites do not help him.

He first suggests that I have forgotten what both he and I have written, but he fails to provide examples of this, or show how it is relevant to the dispute. He then reiterates his inability to understand what I would think any reader would regard as clear and unambiguous, namely my statement that "the evidential value [of the Cross-Correspondences] cannot be assessed by any statistical method but only by common sense". From this he draws the conclusion that I lack the specialised knowledge to assess the evidence. But it must surely be quite plain to all except Coleman that only figurative