2012-08-21

No Time for Time: Trans-temporal Creation of a Time-bound Realm

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The radical contingency of all scientific laws is now recognized, owing to new vistas opened by research in Quantum Field Theory, a contingency that implies the dependence of the structural parameters and developmental trajectories of the universe upon the creative power of God. This essay delineates a specific model of atemporal causation, which elucidates the relationship between a time-bound universe and a God who is beyond time.

Classical theism engenders for itself an interesting and yet vexing conundrum: It posits a God that exists beyond time and the vicissitudes of change, and yet it is this God who must somehow 'act' to produce the whole spectacle full of sound and fury. The God who cannot change is the creator of all change. This is the problem of Aristotle's 'unmoved mover.'

Nonetheless, the modern theist who wants to take science and its methods seriously cannot take Aristotle's way out. God cannot play the role of the final cause of the cosmos, first of all, because this would constrain God's influence upon creation to a necessary outworking of God's mere subsistence—God had no choice but to create—and secondly, because science in its physical incarnation brooks no appeals to final causes.

From the perspective of general relativity, or even classical mechanics, the same problem appears in a different garb. Theists want to say that God is the creator of the entire spatiotemporal realm and its contents. But whatever could they mean by this locution? They could mean that God is the cause of the existence of the universe. But, this will not do. Within these theories, causality is always articulated in terms of chrono-geometric relatedness. That is to say, two entities or events are said to be causally related only if they can be placed on the same manifold. Since, by hypothesis, God is beyond this manifold, it would not make theoretical sense to speak of God as the 'cause' of anything within it, let alone the manifold itself. So classical scientific models of causality fail to be models of divine creativity. Instead, they serve to set in sharp relief the current lack of a theological model that satisfies the sentence, "God is the creator of the world."

However, recent developments in Quantum Field Theory allow for a specific model of atemporal causation, which elucidates the relationship of a God who is beyond time to a time-bound world. These developments consist in the setting forth of various quantum models of cosmology. What is interesting about these models is the way in which they explicitly rely on the ontological efficacy of the mathematical formalism that underlies their construction. The emergence of such models seems to abet theists who espouse a logos-centered cosmogony, whereby God creates or determines the nature of reality by means of the defining structures of rational or linguistic form.[1] It provides them with a clear way of making sense of the sentence, "God creates the world through the power of God's word"; and it does so without submerging either the temporal or trans-temporal perspectives.

Of course, immediately pertinent is the question of how the construction of a coherent model of divine causality helps to learn anything about God. When one says that one has learned something concerning an object of inquiry, it usually means that one has come to know something about it. Mere consistency does not entail correspondence, and it is precisely this correspondence that is sought. In response, the question may be inverted: How, indeed, does one suppose to learn anything at all about the world without the mediation of some theoretical model?

Perhaps an example is in order. In trying to find out why a gas, released into one side of a sealed chamber, distributes itself evenly throughout the chamber, what is the first thing to do in order to begin answering this question? A causal mechanism is sought that explains this dispersion. But such a mechanism, by the nature of the case under consideration, would not involve observable entities. So the first thing is to formulate a model of a gas as an infinite ensemble of microscopic particles in constant motion and interaction with each other. Then, this model is utilized to construct a theory of the evolution of the gas to a state of equilibrium that pictures the outcome of this process as a consequence of the motions and collisions of the constituents of this ensemble.

It is only after the model is constructed and it has passed the tests of coherence and explanatory efficacy that one comes to the question of truth. Indeed, without the model the question cannot even get off the ground. One is left in a state of blissful bewilderment, musing over an apparent mystery of nature. The situation is the same in the case of learning about God's creative agency in and of the world. The development of a coherent model of atemporal causation sets the stage for an inquiry that would have been inconceivable without it—a sort of groping around blindly for a way in which to ask the question meaningfully. Now the subject of veracity can be broached.

Quantum cosmologies treat the universe and its evolution like the history of a subatomic particle and its change of state between any two points in phase space. In so doing they can ideally determine a unique state function for the universe. This function assigns a probability for the appearance of a particular classical spacetime, namely this one. It is significant that the mechanism of causation brought into play here is not physical in the vulgar or intuitive sense. Instead, the existence of the state function is relied upon. This mathematical function occupies the role of the determinative as well as the descriptive factor in an explanation. And since the occurrence of a particular spacetime is to be solved for, the notion of determination or causality, in this context, cannot be time-dependent; it must 'transcend' the manifold it seeks to specify.

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John Wheeler's model of quantum origination, in my opinion, combines the theoretical insights of earlier theories utilizing path integrals.[2] However, before delving into the details of this formulation, it is necessary to achieve a rudimentary understanding of the path integral approach to quantum dynamics. When determining the classical path of a particle between two points, the principle of least action is used. In a

one-dimensional illustration, where a particle moves from a point **A** at an initial time t_a to a final point **B** at t_b. By fixing the endpoints, a path between **A** and **B** is specified that satisfies two requirements: 1) the time required by the particle to travel from **A** to **B** along this path is less than that required by any alternative path arbitrarily close to the postulated path; and 2) the difference between the total energy of the particle and its potential energy is a minimum along all points of the path. This is called the "path of least action," and the quantity that gives this path is called the Hamiltonian. Now this interest in the Hamiltonian as the value of the extremum path between point **A** and point **B** carries over completely into the quantum formulation—except, instead of the Hamiltonian providing the actual path of the quantum particle, it becomes the value on which the determination of the probability amplitude of any possible path between the two points is uniquely dependent.

In the path integral approach to calculating the amplitude, the final amplitude is the summation of all possible paths whose amplitudes constructively or destructively interfere. The summation, however, is not strictly democratic. In fact the contribution of any particular path ***e*** is directly proportional to the Hamiltonian. Amplitudes that differ substantially from this value can be pictured as being completely, or at least nearly completely, out of phase with the classical path. Hence, destructive interference cancels out its contribution to the final probability distribution. This, of course, portends a positive contribution of the values of those paths that are most nearly in line with the classical path, which implies a stabilization of the amplitude peak around the vicinity of the classical path. But in order to achieve this result, which removes intractable infinities, the time variable must be rotated to imaginary values in the complex plane. This transforms the metric from a Lorentzian to a Euclidean path integral.[3]

Several alterations need to be made in this account, before it can be generalized to determine a state function for the history the universe. First of all, the usual state function is time-dependent. That is to say, the evolution of state for a quantum particle is formulated as a function of a background space and time. Since the universal state function is supposed to calculate a probability amplitude associated with the obtaining of spacetime itself, the function has to be reformulated in terms of certain internal parameters that will serve analogous roles. The most common way to go about this is the utilization of an infinite dimension vector space called 'superspace.' Roughly speaking, this is a way to geometrize intuitions concerning certain complex physical quantities—quantities that are functions of multiple parameters or conditions—by shrinking the coordinate systems through which they are represented to individual points on superspace. By doing this, their relations with other quantities can be depicted geometrically.

Implicit within the Hilbert derivation of general relativity are the basic principles that make up superspace. Add to this a quantum formulation for the determination of the action integral; only, instead of dealing with the paths of individual particles, the wave function is utilized to determine a sequence of spacelike surfaces of simultaneity in superspace, or a series of three dimensional surfaces between two bounded hypersurfaces. This can be accomplished because the infinite dimensionality of superspace allows each 3-geometry to be treated like a point. Using coordinate-free geometrical parameters, state functions for each pointlike 3-geometry are formulated that depend on what is fixed at the two endpoints:

$$\Phi = \Phi({}^{3}\mathbf{g})$$

In the quantum analysis, however, these state functions constitute probability amplitudes. Hence, the 3-geometries with appreciable probability amplitudes are far more

numerous than can be accommodated in any one integration between the two boundary points. This can be dealt with by treating any possible sequence of 3-geometries like a possible 'path' between two endpoints. The amplitude to go from one boundary point to the other is the sum of the amplitudes for each interfering alternative path:

$$\Psi = \sum_{\text{over all paths from a to b}} \Psi({}^{(3)}g),$$

where **Y** is a classical spacetime path between two 3-geometries **a** and **b**.

The amplitude for a given path has a phase proportional to the action, **S/h/2π**, where the value of **S** is given by the extremal value of the action integral. Now, since the extremal is assumed to be the path of classical action, the derivation of the classical spacetime is permitted to within arbitrary limits. In such a scenario, the action is very large compared to **h**. Therefore, neighboring paths have different actions which, because of the smallness of **h**, have very different phases. As a result, their contributions cancel each other out. Only in the vicinity of the classical path, where the action changes little when the path varies, will neighboring paths contribute in the same phase and constructively interfere, thus magnifying the amplitude of the classical trajectory.

However, there is a price to be paid for this type of fixing of successive 3-geometries. In doing this, the notion of a rate of change from one state to another must be discarded. In other words, the 3-geometry alone on an initial spacelike hypersurface may be determined to within arbitrarily narrow limits. But the reciprocal uncertainty in the rate of change will then be directly proportional to the degree of specificity attached to the 3-geometry. Therefore, it would appear as if the superspace derivation of a state function for the universe allows only limited validity to be attached to the notion of time. This limited validity does not imply the illusory nature of time. Rather, time must be redefined in such a way that two perspectives become equally necessary in any delineation of the nature of temporal process. Here is where the notion of an internal time coordinate comes in handy: the notion of a change of state or spatial configuration is used to interpret directly what is meant by 'time coordinate' in the first place. In order to do this, a sequence of different state configurations must be selected that are asymmetrically and linearly ordered, thus mirroring the ordering of the time coordinate. Since what is desired is to specify a classical spacetime with a positive matter/energy density—i.e., a universe like this one with a Robertson-Walker metric—the scale factor or the volume of the universe can serve this purpose rather well. To see how this works, picture a particle at point **A** at time **1**. In order to express the fact that this particle changed position over a specific interval of time, one must merely specify the change of position at a different volume of the background space. Specifying anything over and above this would be redundant.

If God extrinsically determines the character of every moment by means of some trans-temporal mode of action, and if these modes of action ensure the exact determination of everything that occurs at these space-like slices, then nothing in the spatiotemporal matrix is self-determined. There is no freedom or contingency in any concrete sense.

This allows a view of time from two different, and yet compatible, perspectives: from the perspective of the whole, and from the perspective of any particular member of

the temporal series. Of course, in fixing the whole of the sequence—say, by means of solving for the state function of this spacetime—there is neither before nor after. The determination of the entire metric takes place outside of the temporal sequence, and yet is intimately related to every point within the sequence. So although the determination is not temporally related to any point in the sequence, it is, nonetheless, causally or constitutively related. Now, why does this not do away with the notion of before and after? Precisely because the internal relatedness of each member in the series is just as real or fundamental as that of any other member. The fact that what is determined is a linear asymmetrical ordering guarantees this.

For those who hold that time is an open flow, indeterminate as to the fixing of future possibilities, this account cannot do justice to what intuition wants to say about time. To them, this openness to the future and its possibilities is the necessary element in any satisfactory account of contingency and, hence, freedom. So, it makes sense to ask how the fixity of all temporal moments can allow for contingency, and, thus, open the door for human freedom. There are two answers to this question, one logical, and the other culled from the treasuries of the quantum theory of origination, presently being formulated. First of all, logical contingency does not depend on time. Consider a being that exists eternally, that is, at all points in time. Does the being's eternal existence imply that it exists necessarily? Certainly not! One cannot posit the being's existence at some point in time and then go about denying its existence at some other point in time. But a possible world can be constructed where it is true that this being exists at no point in time. There is no inconsistency here—or if there is, it cannot result from the mere fact of the being's eternality. In other words, an eternal being can exist as a mere matter of fact. But then, contingency does not depend on being in time; something can be eternally fixed without being necessary.

Nevertheless, admitting this does not provide extrication from the original conundrum. If God extrinsically determines the character of every moment by means of some trans-temporal mode of action, and if these modes of action ensure the exact determination of everything that occurs at these spacelike slices, then nothing in the spatiotemporal matrix is self-determined. There is no freedom or contingency in any concrete sense.

However, quantum theories of origination do not ensure the actuality of anything, even in their ideal form. They only provide a probability for the obtaining of a particular spacetime. So, the problem has been shifted a bit. Now the question becomes: How can quantum laws of determination be taken as God's modes of creative action, when they seem to render God powerless to determine the outcome of anything? In view of this, it really seems as if God does "throw dice.' My contention is that the fault is not in the theory, but in ourselves—that is, in the interpretation of the notion of probability in this global context. In normal scientific contexts, assigning a probability to the occurrence of a certain event may mean one of several things. It may mean to measure the subjective degree of confidence

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as to the certainty of a particular outcome. But this interpretation of probability seems to imply that, in fact, the outcome is deterministic, contrary to the results of the Aspect experiments, which seem to make quantum probabilities an objective feature of the physical situation.[4]

A second way to interpret probability statements, and by far the most popular among physicists, is to take them as a measure of the frequency of the occurrence of a particular phenomenon. So in assigning a tossed coin a 0.5 probability of landing on heads, we really mean to say that if tossed ten times, it will land on heads five times. It is obvious that this notion of probability is time dependent. Thus, it cannot function as a model for the probability of a singular occurrence, and, *a forteriori*, it makes no sense in the atemporal case. The universe and its obtaining, by hypothesis, is not an occurrence; it cannot happen a certain number of times.

A third way is the statistical interpretation, where there is an ensemble of actual worlds, a certain number of which are instances of classical spacetimes, like our own. But there cannot be any uncertainty in the obtaining of this particular spacetime, since, by hypothesis, every possible world is already actual. Moreover, there is a problem with interpreting the path integral approach in this manner, as different worlds would need to be associated with interfering paths. If all of these paths are actual, the confluence of contradictory actualities would have to be postulated. Even the spacetime paths that differ only slightly and, hence, constructively interfere would still be incompatible in the details. Thus, either they could not interfere at all, or else those that do interact would have to be completely identical. Nor does interpreting probabilities as innate propensities help here, since it is not at all clear what would be meant by a tendency, apart from some measure of relative frequency.

I believe that the only way to render coherent the notion of a numerical probability within the context of atemporal origination is to interpret probability as relative informational specificity. It is already clear that the quantum evolution of a particle is completely compatible with intervals of completely deterministic evolution.[5] In other words, the quantum system can be prepared in such a manner as to have a concrete eigenvalue apart from any measurement of the system with respect to that quality. It is also the case that at the same time the particle can be in a state of coherence with respect to other eigenvalues. That is to say, it is consistent to view the system as a whole as embodying only a partial collapse of its wave function. In the same manner, one can speak of the path integral as God's way of canceling out possibilities by means of creative informing. For example, fixing the boundaries ensures that an infinity of otherwise-possible alternative universes do not become actual. The Euclidean rotation to the complex plane guarantees destructive interference among paths of completely different phases, and hence functions at an even greater level of specificity.

One can speak of the path integral as God's way of canceling out possibilities by means of creative informing. For example, fixing the boundaries ensures that an infinity of otherwise-possible alternative universes do not become actual.

The upshot is this: specificity of information cancels out possibilities, thereby engendering greater and greater degrees of actuality. In many ways this formulation captures what is meant by a state of affairs being actual. Consider the case where I am building a house. Once I have laid the foundation, it will be *actually* the case that my

house occupies a certain position on the block. Thus, the objective embodiment of a specific set of information cancels out any other possible location, and, in so doing, produces a concrete actuality. Of course, the house is not completely determined by the laying of the foundation. Degrees of actuality are measured by differing levels of abstraction. A general fact concerning an individual's existence does not determine the specific identity of the individual, and the determination of the specific identity of the individual in question does not decide the precise state that this individual exists in. Complete actuality is obtained only when all possibilities with respect to every facet of an entity's being are excluded, with the exception of one. Thus, the act of creation is equivalent to the stipulation of new patterns of information through God's intentional orchestration of God's own actuality. This is what is meant by God's creative decree.

The uniquely ontological and efficacious status of the formalism in quantum theories of origination was noted earlier. Hence, the intuitive dichotomy between physical matter and conceptual information or structure phases out at this level of discourse. There is no problem with talking about God creating the world by means of canceling out possibilities through God's aboriginal actuality. Furthermore, the quantum picture of origination allows this God the ability to leave the universe open to a certain extent. God specifies the parameters of the world's development in such a way as to have these parameters converge on a certain level of actuality, but this actuality is never so complete that it excludes the possibility of certain segments of the universe developing through self-specification. Thus, to hearken back to the house-building analogy, God as the master builder has the prerogative to hire out subcontractors who contribute to the erection of the finished product, called creation. There may be no "time" for time. But there certainly is a "place" for it.

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Endnotes:

1. See, for example, Peacocke, Polkinghorne.

2. Wheeler; Hartle and Hawking; Vilenkin.

3. See Feynman and Hibbs.

4. See Clauser and Shimony.

5. Isham , p. 86.

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This essay was awarded a Second Prize.