

Hartshorne, God, and Relativity Physics

by David Ray Griffin

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1. Introduction

Charles Hartshorne rests the case for his philosophy on its coherence and its adequacy to the facts of experience, including the well-established teachings of the physical sciences. And yet he has admitted over the years, and continues to admit in the *Library of Living Philosophers* volume (PCH), that there is one issue on which he has not reconciled his philosophy with physical theory. One of the problems raised in the essay by William Reese is, Hartshorne says, "a problem, even *the* problem, for me: how God as prehending, caring for, sensitive to, the creatures is to be conceived, given the current non-Newtonian idea of physical relativity, according to which there is apparently no unique cosmic present or unambiguous simultaneity" (PCH 616). In responding to Lewis Ford, Hartshorne says: "I also agree that relating the divine becoming to the problem of simultaneity in physics exceeds my capacity. . . . I feel incapable of solving the problem, and it seems clear that Whitehead did not solve it" (PCH 642; see also 724).

The failure to find a solution has not been for want of trying. As Frederick Post helpfully documented in 1973 in "Relativity Theory and Hartshorne's Dipolar Theism," Hartshorne has been perplexed by this difficulty from the earliest period of his writing (TPP 89). And several other writers have joined the effort: John T. Wilcox stimulated much of the discussion with "A Question from Physics for Certain Theists" (JR 40) in 1961; Lewis Ford asked "Is Process Theism Compatible with Relativity Theory?" (JR 48) in 1968; Paul Fitzgerald

published "Relativity Physics and the God of Process Philosophy" (PS 2) in 1972; then Hartshorne himself, after hearing lectures by, and having discussions with, Henry Stapp in 1977, wrote an essay in response (PS 7:183-91); the issue of *Process Studies* in which Hartshorne's essay appeared also contained an essay by Stapp, which was "edited" by William B. Jones (PS 7:173-82). (After receiving Hartshorne's essay, Lewis Ford hoped to obtain from Stapp a summary of his views understandable to non-physicists, so that readers would know something of the position to which Hartshorne was responding; upon failing to get a new essay from Stapp, Ford called upon Jones, who pieced together the essay for PS from some of Stapp's writings.¹ In the next issue, Jones offered his own contribution to the discussion [PS 7: 250-61].)

Hartshorne's response to Stapp's views, which I will discuss near the end of this essay, constitutes a puzzling episode in the history of his thinking on this issue: In this response, Hartshorne seems to say that the problem has been overcome; and yet in PCH, which appeared over a decade later, he refers to it, as we have seen, as *the* problem, freely saying that he has no solution.

This admission by the world's preeminent process theist that he cannot reconcile his doctrine of God with relativity physics, especially after considerable attention has been devoted to the problem by him as well as several other thinkers, constitutes a serious difficulty for process theism. Given Whitehead's background in the physical sciences, process philosophy has been especially concerned to be adequate to and illuminating of those "facts" that are considered to be well established by the physical sciences. To be incompatible with the special theory of relativity would seem to be a serious failure. Indeed, some Critics lift up this incompatibility as a principal reason to reject process thought.² To be sure, Hartshorne is right to say that process philosophy need not solve *every* problem in order to have provided the best cosmology conceived thus far; it need only be superior to all the known alternatives (PS 7:187). Nevertheless, the idea that God as concretely actual temporally experiences the temporal world is so central to theistic process philosophy, especially in Hartshorne's version, that advocates cannot rest content with an unresolved tension between this idea and relativity physics, so long as relativity physics itself is accepted. The same would be true, of course, of an apparent contradiction between process

philosophy and any other apparently well-established result of the sciences. But Hartshorne's testimony that the tension between relativity physics and his theism has been *the* problem for him is reason to consider this tension as at least one of the most serious theoretical problems now facing process theism.

Another reason to devote attention to this issue is that a possible solution might have significance beyond that of overcoming an internal problem within process theology. John Wilcox indicated a somewhat broader significance by pointing out that the problem exists not only for process theists, but for all "temporalistic theists" (JR 40: 294-97). And, indeed, others have been discussing this issue.³ A solution, furthermore, might have significance even beyond that of understanding how a temporal God might interact with the world. This would be the case if the solution took the form not of modifying or rejecting Hartshorne's doctrine of God because of its apparent incompatibility with relativity theory (which has been the dominant approach taken thus far), but of relativizing relativity theory itself (which is the approach I will proffer).

2. The Problem

The problem arises from the fact that process theism (as well as other forms of temporalistic theism) seems to presuppose a cosmic "now," while the special theory of relativity has seemed, at least to most interpreters who have discussed the issue, to entail that no such "now" exists.

To begin with relativity physics: I will not repeat here the detailed explanations, which can be found in the articles by Wilcox, Ford, and Fitzgerald, as to why, according to special relativity theory, a cosmic "now" apparently does not exist. The main point is summarized nicely by Fitzgerald:

according to relativity theory there is no such thing as absolute simultaneity for spatially separated events. Certain pairs of events A and B are such that whether A is to be regarded as occurring before B, simultaneously with B, or after B, depends on the coordinate-system with respect to which one judges. These event pairs, which Whitehead calls "contemporaries" of one another, are picked out by the fact that no light

signal travelling even *in vacuo* from either could reach the other. This entails that what counts as "the past" or "the future" is also relative to coordinate-systems. (PS 2:251)

As Fitzgerald's statement makes clear, the problem exists only with regard to spatially separated events, meaning ones that are contemporaneous with each other in the sense that they cannot be connected by a light signal. Every given event has an absolute past, which affects it, and an absolute future, which it affects. But an indefinite number of events are contemporary with the given event. Of these contemporaneous events, finite observer A will calculate that one set of them will be strictly simultaneous with the given event, observer B operating with a different coordinate-system will calculate another set of events as being simultaneous, observer C may provide yet another answer, and so on. As Wilcox summarizes: "There is physically no unique meaning for simultaneity in the case of causally separate events" (JR 40:294).

Process theism, by contrast, seems to require the existence of a universe-wide "now." Hartshorne, for example, has said: "I suppose God to have this cosmic *now* as his psychological simultaneity" (PI 324f). The reason for this requirement is the idea that God prehends only actual occasions that have, by completing their concrescences, achieved satisfaction. God does not prehend future actual occasions, because there are none to prehend (they exist at most as anticipated probabilities). And God does not prehend actual occasions that are presently concrescing: not yet being "beings," they have no determinate satisfaction to prehend. The divine experience, accordingly, divides the universe, or knows the universe to be divided, into the past universe, which causally influences the present divine experience, the future universe, which the present divine experience will influence, and the present universe, the "cosmic now," which the present divine experience neither influences nor is influenced by. ("Universe" here is taken to mean the totality of finite occasions of experience, even though in abstraction from God's all-inclusive experience it would be more a multiverse than a universe.)

Fitzgerald well sums up the resulting problem: "[Relativity theory's] teaching that the world lacks a unique cosmic advance of time makes it hard to see why a cosmic being like

God should experience a unique one" (PS 2: 258).

Hartshorne's form of process theism, according to which God is a personally-ordered society of divine occasions of experience, makes even clearer than Whitehead's that a cosmic "now" is presupposed. In Whitehead's view, according to which God is one everlasting actual entity, God is in "unison of becoming" with all worldly occasions and yet somehow prehends and is prehended by them. By thereby suggesting that God and contemporary occasions could prehend each other, Whitehead's position does not make so acute the question of whether an unambiguous distinction between past, present, and future occasions could exist.

One difficulty with Whitehead's position, of course, is that it renders problematic the interaction between God and the world. Whitehead had said that God should not be made an exception to general metaphysical principles (PR 343); and yet that contemporaries are causally independent seems to be a metaphysical principle of his system. This principle is not arbitrary, but rests on the fact that an occasion while in the process of concrescence is becoming determinate, so that, before reaching satisfaction, it has nothing determinate to offer. (As has been said of Oakland, there is no there there.) What is particularly hard to understand is how God, if always a becoming subject, could be prehended by worldly occasions. A. H. Johnson reports having asked Whitehead: "If God never 'perishes', how can he provide data for other actual entities? Data are only available after the 'internal existence' of the actual entity 'has evaporated' (PR 220/336)." In response, Whitehead reportedly said: "This is a genuine problem. I have not attempted to solve it" (EWP 9-10).

It was partly to solve this problem that Hartshorne redefined God as a personally ordered society of divine occasions, so that God is alternatively subject and object. But in solving this problem, Hartshorne rendered more acute the problem of the compatibility of process theism with relativity physics.

Some critics of the Hartshornean societal view of God believe that it not only renders the incompatibility between God and relativity physics more acute but actually first creates this incompatibility. Lewis Ford, for example, argued in 1968 that if Hartshorne's view is that "each divine occasion constitutes one particular duration of simultaneity, then God's experience defines a privileged inertial system contrary to relativistic

principles" (JR 48:128), and that Hartshorne's attempts to avoid this conclusion result in a position lacking simplicity and elegance (130). Ford then suggested a solution based on Whitehead's view of God as a single actual entity. In the meantime, however, Ford has decided that that solution is untenable, in part because the attempt to return to Whitehead's view of God involves "insuperable difficulties" (PS 11:171). The chief of these is the one cited above: "Despite some very ingenious efforts to resolve or to avoid the problem, the central difficulty remains: in Whitehead's philosophy two concurrent concrescences cannotprehend each other. If God is an everlasting concrescence, it is difficult to see how it could influence present concrescences." Nevertheless, while no longer using the clash between Hartshorne's idea of God and relativity physics as a reason simply to return to Whitehead's idea of God (rather than modifying it), Ford has continued to cite this clash as the chief problem with Hartshorne's theism, saying that each Hartshornean divine occasion "defines a privileged meaning of simultaneity contrary to relativity physics" (PS 11:170; PCH 315).

The extent to which Hartshorne himself has felt the problem is shown by the fact that he has sometimes been tempted to try to solve it by giving up, or at least severely modifying, the notion of the divine individuality. Instead of speaking simply of "God," we would speak of "God here now." That this would be a drastic move is seen by Hartshorne: "If *God here now* is not the same concrete unit of reality as God somewhere else 'now', then the simple analogy with human consciousness as a single linear succession of states collapses" (CSPM 124). Fost points out that this would be no minor modification on Hartshorne's part, given his earlier insistence that "the unity of our experience is the unity in which everything is initially found, and only by abstraction from or analogy with this unity can we understand any concrete unity" (TPP 91, citing WP 117). Although Fitzgerald has opined that a version of this view, which he calls the God of Infinitely Interlaced Personalities, "does the least violence to relativity theory and process philosophy together" of all the views he considers (PS 2: 273), Hartshorne and Hartshorneans would surely prefer another solution, if one is available.

3. A Possible Solution

The possible solutions surveyed by Fitzgerald, and in fact almost all of the published discussions of God and relativity

physics, have assumed that relativity theory gives us the best clue currently available as to the nature of time. Fitzgerald, for example, says:

If we assume that relativity theory is giving us something close to the truth about space-time, at least in our present cosmic epoch, and is not simply a computational device with no ontological significance, then we must be sure that any form of process theology which we are to accept is tuned to harmonize with it. (PS 2: 254)

Hartshorne himself has generally proceeded on the basis of this assumption. Given this assumption, the question is how to make our idea of God compatible with the fact that physical interaction among worldly events provides no unambiguous meaning for past, present, and future.

But another way to solve the problem would be to suggest that Einsteinian special relativity physics does not provide metaphysical, or even final cosmological, truth about time. This suggestion has been made at least once by Hartshorne, who has said: "there is the haunting question, can physics, judging reality from the standpoint of localized observers, give us the deep truth about time as it would appear to a non-localized observer?" (CSPM 124f). Hartshorne's way of putting the question suggests that the deeper truth about time might be discernible only by God, and this is likely true. But the question for us is whether we, from our standpoint as localized observers, can see some way in which a non-localized omniscient observer, knowing the universe truly, would know it to have a universal "now." If so, we could challenge the assumption that time as defined by relativity physics should be accepted as the ultimate truth about time, even in our cosmic epoch.

A crucial fact about the special theory of relativity, at least as usually interpreted, is that it assumes, in Fitzgerald's words, "that no causal influence can be transmitted faster than the speed of light *in vacuo*" (PS 2: 254). It is this assumption that creates the famous "light cone," which contains an indefinite number of events that are "contemporaries" with any given event. For example, it takes about eight minutes for the light from the sun to reach the earth, and eight minutes for light released from the earth to reach the sun. Accordingly, all the

events in the sun's life for about sixteen minutes are said to be contemporaneous with the present moment of my experience, because those events can neither influence that experience nor be influenced by it -- assuming that no supraluminal influences occur.

But relativity physics can also be interpreted as simply not speaking to the issue of whether or not supraluminal influences occur. On this interpretation, if some such influence *does* occur, it would not necessarily contradict relativity physics. As James Devlin says, "relativity physics is concerned with influence as limited by maximum signal speed, that of light" (PCH 283). "Supraluminal" influence might not involve faster-than-light signals; the influence might be different in kind from that involved in "signals."

Whitehead suggested that some such influence occurs. He did, to be sure, announce his adoption of "the 'relativity' view of time," which entails, contrary to "the classical 'uniquely serial' view of time," that "no two actual entities define the same actual world" (PR 65f). In other words, there is no cosmic "now" that stipulates unambiguously what is past. His adoption of the relativity view is "based on scientific examination of our cosmic epoch" (PR 125); the classical view is rejected because "its consequences, taken in conjunction with other scientific principles, seem to be false" (PR 66).⁴ The "other scientific principles" here would seem to include the limitation of causal influence to the speed of light. And yet elsewhere Whitehead spoke of a kind of causal influence that would seem not to be thus limited. With light signals (and other forms of radiation), the influence between remote loci is transmitted (in Whitehead's cosmology) through a series of contiguous occasions. The speed of light evidently puts an upper limit on the speed by which such causal influence can be transmitted. But Whitehead in places also refers to a kind of influence between remote occasions that is not transmitted through contiguous occasions.⁵

Such direct causal influence between noncontiguous events is implied in his discussion of the world as a transmitting medium.

Any actual entity, which we will name A, feels other actual entities, which we will name B, C, and D. Thus B, C, and D all lie in the actual world of A. But C and D may lie in the actual

world of B, and are then felt by it; also D may lie in the actual world of C and be felt by it. . . . Now B, as an initial datum for A's feeling, also presents C and D for A to feel through its mediation. Also C, as an initial datum for A's feeling, also presents D for A to feel through its mediation. Thus, in this artificially simplified example, A has D presented for feeling through three distinct sources: (i) *directly* as a crude datum, (ii) by the mediation of B, and (iii) by the mediation of C. . . There are thus three sources of feeling, D *direct*, D in its nexus with C, and D in its nexus with B. (PR 226; italics added)

Whitehead's focus in this passage is on the way in which the remote actual occasions are felt through the mediation of occasions that are contiguous with the prehending subject; and yet in passing he mentions that this subject also prehends the remote occasions directly. There is, accordingly, causal influence at a distance. And, insofar as spatial as well as temporal distance is involved, there would be no reason to suppose that this direct influence at a distance would require the same time as that needed for influence transmitted through a sequence of contiguous occasions. The influence might, in fact, be instantaneous. By "instantaneous" here I mean that, as soon as the occasion had completed its concrescence, achieving satisfaction, it would exert a type of influence upon all immediately subsequent occasions, regardless of their spatial locus.

Whitehead discusses this issue more explicitly at PR 307-08. The focus of attention here is on the notion in science of "continuous transmission," which he says must be understood in terms of "the notion of immediate transmission through a route of successive quanta of extensiveness." The term "immediate" here refers, he had explained, to the (direct) objectification of contiguous occasions, in contrast with the (indirect) objectifications of the more distant past, which he calls "mediate." The "successive quanta of extensiveness," he explains, are the "basic regions of successive contiguous occasions." Thus far, in speaking of causal influence as transmitted through series of contiguous events, Whitehead seems to be endorsing what has been the dominant modern view, which is that there is no causal influence at a distance.⁶

But then he adds:

It is not necessary for the philosophy of organism entirely to deny that there is direct objectification of one occasion in a later occasion which is not contiguous to it. Indeed, the contrary opinion would seem the more natural for this doctrine. (PR 307f)

Having affirmed a type of causal influence at a distance, Whitehead then quickly adds two qualifications perhaps designed to assure the reader that this idea, while metaphysically heretical, should not be threatening to cosmologists. Here is the first qualification:

Provided that physical science maintains its denial of 'action at a distance, the safer guess is that direct objectification is practically negligible except for contiguous occasions; but that this practical negligibility is a characteristic of the present cosmic epoch, without any metaphysical generality. (PR 308)

This qualification suggests that the implications of this idea of influence at a distance are almost entirely metaphysical, having little if any significance for science. Because this type of influence is probably "practically negligible" in our cosmic epoch -- assuming, of course, that physical science continues to find no evidence of it -- it can be practically ignored by scientific cosmologists. The second qualification involves a distinction between two species of physical prehensions: pure physical prehensions and hybrid physical prehensions.

A pure physical prehension is a prehension whose datum is an antecedent occasion objectified in respect to one of its own *physical* prehensions. A hybrid [physical] prehension has as its datum an antecedent occasion objectified in respect to a *conceptual* prehension. Thus a pure physical prehension is the transmission of physical feeling, while hybrid prehension is the transmission of mental feeling. (PR 308)

This distinction enables Whitehead to allow for causal influence at a distance without contradicting the widespread

scientific assumption that no such influence occurs with regard to the causal relations studied by physicists, which he identifies as pure physical prehensions.

There is no reason to assimilate the conditions for hybrid prehensions to those for pure physical prehensions (T)he doctrine of immediate objectification for the mental poles and of mediate objectification for the physical poles seems most consonant to the philosophy of organism in its application to the present cosmic epoch. (PR 308)

The lack of revolutionary implications for physical cosmologists is further suggested by the illustrations of influence at a distance offered by Whitehead:

This conclusion has some empirical support, both from the evidence for peculiar instances of telepathy, and from the instinctive apprehension of a tone of feeling in ordinary social intercourse. (PR 308)

Because the only illustrations offered involve human minds, it would be easy for the reader to conclude, given the usual dualistic assumptions, that influence at a distance has no implications whatsoever for physical cosmology.

What Whitehead fails to bring out here, or anywhere else as far as I know, is that this idea might have at least one implication for physical cosmology. More precisely, while it might not have any direct implications for physical cosmology as such (at least if physical cosmology is understood to deal only with those types of causal influences that Whitehead calls *pure* physical prehensions, and if these are indeed effective only between contiguous occasions), this idea of causal influence at a distance would have implications for the *status* of physical cosmology insofar as it embodies the special theory of relativity. This implication would be that this physical cosmology with its understanding of time might not be assumed to be definitive for the ultimate nature of time. This scientific theory would not be assumed to have settled metaphysical (or even final cosmological) truth. That assumption, of course, is what has generated the apparent conflict between temporalistic theism and relativity theory. To cite Wilcox's statement again: "There is physically no unique

meaning for simultaneity in the case of causally separate events" (JR 40: 294). The conflict is generated by the assumption that because there is *physically* no such meaning for events that are causally separate (with "causality" defined in terms of light signals, and hence *pure* physical causality), there is *metaphysically* no such meaning.

This assumption can be seen as depending on what Whitehead has criticized as the "fallacy of misplaced concreteness." The main form of this fallacy is that of taking the abstractions about some actuality that are focused on by some particular science, due to its limited interests, for a complete description of the actuality in its concreteness.

Insofar as physical science, for example, abstracts from the fact that individual eventsprehend the past and anticipate the future, it has difficulty affirming the reality of time in the "physical world." The "scientific" accounts of time have, accordingly, generally regarded the "arrow of time" to have emerged only at that point in the history of our universe in which aggregates of atoms subject to entropy appeared. Time as we humans understand it, as an asymmetrical, irreversible process, is generally thought to be an illusion, or at best to have emerged only with the appearance of life.

Whitehead's position, by overcoming the fallacy of misplaced concreteness involved in the materialistic conception of molecules, atoms, and subatomic "particles," can affirm that asymmetrical, irreversible time exists for individual atoms and electrons. By following Whitehead's analysis of actual entities, accordingly, we need not assume that the usual scientific account of "time's arrow," as depending upon the direction of entropic change (and thus as being in principle reversible), provides us with the ultimate or metaphysical truth about time.⁷ We need not, then, try to figure out how God as temporal could have interacted with a world that was nontemporal for billions of years (let alone try to figure out what that might mean).

A similar situation exists, I suggest, with respect to the relativistic view of time (even though, in this case, Whitehead himself, if my argument has merit, evidently failed to see the implications of his own ontology).

That is, the relativistic view of time could be said to result from that form of misplaced concreteness that involves

equating, at least implicitly, an actual entity's causal influence with that aspect of its causal influence that results from its physical pole, and thus with what can be called (by extrapolation from "pure physical prehension") its "pure physical causation." On the basis of this assumption -- combined with the correlative assumptions, of course, that all pure physical causation occurs between contiguous events, and that the speed of light *in vacuo* is the fastest that such causal influence can be transmitted over distances -- it would follow that there is no causal relation of any kind that exceeds the speed of light. The physical theory would then also state a metaphysical truth, or at least an ultimate cosmological truth.

But Whitehead's more complete account of actual entities in their concreteness suggests that this would not be the case. He says that all actual entities have mental poles as well as physical poles. On the basis of this distinction, he suggests that there must be two kinds of causal influence between actual entities: (what I am calling) hybrid physical causation and pure physical causation. He then adds that, assuming that the pure form occurs only between contiguous events, there is no reason to assume the hybrid form to be thus limited. And, although Whitehead did not spell this out (at least in the published text), the implication would seem to be that this direct causal influence at a distance, not being transmitted through a chain of contiguous events, would "arrive" faster than the speed of light. Whitehead would thereby have seemingly affirmed supraluminal causal influence, so that events that are considered "spacelike separated" in physical relativity theory would not necessarily be causally separated in every sense. The ultimate truth about time, even in our cosmic epoch, would thus not be provided by special relativity theory. Whiteheadian relativity would include, but not be limited to, Einsteinian relativity.

If this *is* the implication of Whitehead's allowance for direct prehension of noncontiguous events, why he did not see it is a puzzle. Perhaps it was because he came to the distinction between pure and hybrid physical prehensions late, while he was hurriedly finishing up *Process and Reality*. If that is the explanation, one might still think that he would, while reading proofs, have reversed or at least qualified his adoption of the relativity view of time. But Whitehead was not a careful proof-reader; and Lewis Ford's reconstruction of the composition of *PR* suggests that Whitehead quite often let passages stand after he had developed a new doctrine. Even if

such considerations can account for Whitehead's failure to qualify his adoption of the relativity theory of time in *PR*. However, we could reasonably expect that some such recognition would appear in later writings. He does indeed, in *Adventures of Ideas*, reaffirm his belief in what he had in *PR* called hybrid physical feelings.

Perhaps . . . although the antecedence and the consequence, -- the past, the present and the future -- still hold equally for physical and mental poles, yet the relations of the mental poles to each other are not subject to the same laws of perspective as are those of the physical poles. Measurable time and measurable space are then irrelevant to their mutual connections. Thus in respect to some types of Appearance there may be an element of immediacy in its relations to the mental side of the contemporary world. (AI 248)

Speaking of the "relations of the mental poles to each other" was evidently carelessness, due to the fact that Whitehead in this passage was focusing on the element of "Appearance" in the experience of the prehending subject. More carefully phrased, the statement would have made clear that the *direct* relation is between the mental pole of the prehended and the physical pole of the prehender. In any case, Whitehead does not in this passage say that his doctrine undermines the assumption that special relativity theory gives us something like the truth about the relations between past, present, and future. He does, however, make explicit one point that was left implicit in the passage at *PR* 307-8: The fact that "measurable time" is irrelevant can be read to mean that the direct prehension of a remote event would result in a superluminal influence. If so, the undermining is somewhat more evident.

If superluminal influences occur, the next question would be: How "super" are they? Do they occur at a superluminal but still finite speed? Or are they instantaneous? The passage does not speak directly to this issue -- unless the reference to "immediacy" suggests an instantaneous relation. In any case, this would be a natural assumption to make. If the present subject *directly* prehends remote as well as contiguous events, then the influence from the remote and the contiguous events would be exerted on the prehending subject simultaneously. (It is generally assumed in parapsychological circles that

paranormal influence, and paranormal influence in general, occurs instantaneously.)

To refer to an instantaneous causal relation between noncontiguous events would *not*, of course, be to speak of a causal prehension of "contemporaries" in the strictest sense, meaning occasions that are in "unison of becoming" with each other. The instantaneous influence at a distance would occur, as with any causal influence, only after the occasion's concrescence had resulted in satisfaction. The "elbow-room" within the universe (AI 195) would still be preserved.

This instantaneous influence *would* mean, however, that most of those remote events that are considered contemporaries within special relativity theory would be connected by causal relations (of the hybrid physical sort) running in one direction or the other. For example, my present experience would be affected, even if negligibly, by all the events occurring on the sun from eight minutes ago up to a fraction of a second ago; and my present experience would exert causal efficacy -- surely of the most negligible sort -- upon events occurring on the sun over the next eight minutes (as well as beyond). Furthermore, if the influence is truly instantaneous, having no travel time, then the effect upon a location a million light-years away would occur simultaneously with that upon a location an inch away. This is a staggering thought, of course; but it would seem to follow, if there truly is some kind of instantaneous influence.

This view would not simply return us to a pre-relativistic universe, for the reason indicated in the next paragraph. But it would seem to give us what could be called a post-relativistic universe, in which all events are unambiguously either in the past of, in the future of, or contemporary with, all other events. There would be, accordingly, a cosmic "now," dividing all events into either the past, the future, or the present, with the present being comprised exhaustively of events in unison of becoming. The assumption behind all this is that, with regard to the kind of causality that is exerted instantaneously rather than with merely the speed of light, different inertial systems would not lead to different assessments of simultaneity. For example, three perceivers in three different parts of the universe and in motion with respect to each other would all agree, insofar as they could detect the subtle kind of influence in question, as to what set of events in

the universe has just occurred.

If these assumptions and conclusions are valid, there would then be no conflict between cosmology and temporalistic theism. Special relativity theory could be retained as a theory with great significance, albeit limited scope. That is, it would be seen as specifying the implications of taking into consideration only that form of causal influence that is generally most powerful, namely, pure physical causation. But it would not be thought to carry the additional weight of indicating an ultimate metaphysical truth about the nature of time. We would come to understand it as a theory only about causality -- namely, the kind of efficient causality that does not (at least usually) occur at a distance and is by far the most powerful kind of efficient causality⁸ -- rather than as also a theory about time. This new interpretation would not, however, break the connection between time and causality altogether: The past, for example, would still be defined in terms of all those events that causally influence the present. The difference is that now it would be the instantaneous hybrid physical causation, rather than the slow-as-light pure physical causation, that would have the privileged position of defining the past, the future, and the present.

One would not need, accordingly, to revise temporalistic theism to make it compatible with cosmology by, perhaps, thinking of God as the chief exemplification of the multiple personality syndrome, or by putting God as a whole back outside of time, or by positing that God creates a cosmic "now" that would not otherwise exist, or by any other stratagem. One could assume, instead, that God knows a cosmic "now" simply by knowing reality as it is. That is, although God, as the all-inclusive perceiver, would be the only being who knows the cosmic "now," this cosmic "now" would not first result from God's perception and/or activity.

I should add that, to overcome the charge that relativity theory rules out the possibility of a temporalistic theism, one need not *prove* the reality of an instantaneous influence that produces a cosmic "now." After all, no one has any proof that such an influence does not occur, and only with such a proof could one argue definitively that special relativity physics provides metaphysical, or even ultimate cosmological truth. The intelligibility of temporalistic theism with regard to this issue is defended if the idea of a cosmic "now" grounded in

instantaneous influences can be made *plausible*.

The idea of instantaneous action at a distance is one that makes many intellectuals, including no doubt some Whiteheadians, very nervous. One of the chief aims of modern ideology has been to discredit this idea and anyone publicly admitting to accepting it,⁹ and this ideology has performed its task well. Two examples: most intellectuals still today cannot study the evidence for paranormal interactions with an open mind, if in fact they will study it at all; and the hostility with which Rupert Sheldrake's hypothesis of formative causation has been greeted by much of the scientific establishment has been due mainly to the fact that influence at a distance is proposed.¹⁰

Nevertheless, things are changing rapidly with regard to this issue, especially in the physics community. Henry Stapp and David Bohm, two physicists known to readers of this journal, are both developing physical theories based on the notion of instantaneous action at a distance, and they have both expressed essential agreement with the proposal I have made above.¹¹

4. God-World Synchronization

I should perhaps add that this proposal is not necessarily burdened with an assumption that has generally been thought to be part and parcel of the Hartshornean view of God as a personally ordered society, and is sometimes used as a basis for rejecting it.¹² This is the assumption that the divine occasions must be extremely thin temporally.

Hartshorne himself is the source of this assumption. In 1941, after having stated his view that the divine present would be "an 'epochal' affair, not a mathematical instant," he continued:

What will be the length of this epoch? I should suppose it would be identical with that of the shortest creaturely unit or specious present, since the perfect perception (physical prehension) will make whatever discriminations are necessary to follow the distinctions in the things perceived, no more and no less. The longer units will then be experienced by God as overlapping several of

the shorter. But this involves problems of synchronization that inevitably baffle my lay mind. (PANW 546)

This assumption was reiterated by Hartshorne in 1964 in a statement that was only partially quoted earlier: "the notion of a 'creative advance of nature' seems to imply a cosmic 'front' of simultaneity as short as the shortest specious present. I suppose God to have this cosmic *now* as his psychological simultaneity" (PI 324f).

The last sentence of the indented quotation above reveals Hartshorne's awareness that difficulties are created by the reasoning that leads to his conclusion. A 1965 statement by John Cobb brings out the extent of the difficulties even more clearly while reinforcing the assumptions behind them:

we must ask how many occasions of experience would occur for God in a second. The answer is that it must be a very large number, incredibly large to our limited imaginations. The number of successive electronic occasions in a second staggers the imagination. God's self-actualizations must be at least equally numerous if he is to function separately in relation to each individual in this series. Since electronic occasions are presumably not in phase with each other or with other types of actual occasions, still further complications are involved. (CNT 192)

One problem with this Hartshorne-Cobb assumption, especially in the light of the Bergsonian background of the Whiteheadian-Hartshornean ontology, is that it involves a reversal of what would seem otherwise to be a universal correlation. Henri Bergson, who anticipated Whitehead's idea of matter as consisting of repetitions of events with finite durations (MM 178, 276, 279),¹³ stressed that in different types of organisms the durations are different. In living organisms the durations are longer than those in subatomic individuals, and in human experience the durations are longer yet (MM 274f, 279f, 332). Bergson to my knowledge never explicitly says that there is a correlation between duration and spatial extensiveness, but the idea seems implicit. He suggests, for example, that photonic durations are to human durations as the latter are to the divine (CM 220f). Whitehead

and Hartshorne seem to presuppose this dual idea that different levels of organisms have vastly different rhythms, and that a positive correlation obtains between spatial and temporal extensiveness. The latter idea seems even more clearly presupposed in Hartshorne, in that he has explicitly stated that events of greater complexity occupy a more extensive spatial standpoint. (The region of the living occasions of the cell includes the regions of all the subordinate constituents of the cell, and a human occasion of experience is co-extensive with the entire brain, or perhaps even the entire nervous system.) It is *prima facie* odd, accordingly, for Hartshorne to say that the divine occasions, while being far more extensive than all worldly occasions, are temporally as thin as, or even thinner than, the thinnest worldly occasions. One would, with Bergson, expect that the divine occasions, being co-extensive with the entire universe, would be of greater duration than any other events.¹⁴ Why is that normal expectation reversed?

The reasons, which are suggested in the above quotations from Hartshorne and Cobb, are brought out more explicitly by John Robert Baker, in an article devoted to showing that the question of the divine present's temporal span is very problematic for a Hartshornean conception of God (PS 2: 201). Baker reconstructs the Hartshorne-Cobb argument thus:

God must be able to prehend the satisfaction of every actual entity of the temporal process. God's omniscience requires this. Furthermore, the satisfaction of a divine occasion must be able to be prehended by every incipient actual entity. God's creative role in the world requires this. It follows then that God's successive experiences must coincide with the inception and satisfaction of every actual entity, lest there be an actual entity for whom God is not available as an initial datum, or an actual entity whose satisfaction is not prehended by God. . . . The frequency of the cosmic present, or the divine "psychological simultaneity," is such that no actual entity fails to be creatively related to God. God's life must be synchronized with the lives of every actual entity. What then is the temporal length of a divine occasion?

God's successive experiences must be as rapid as those of any in creation, lest God's knowledge and creativity be diminished. (PS 2: 203f)

Baker goes on to argue that, because (as the quotation from Cobb mentioned) the actual occasions of the world are surely not in phase, the divine occasions of experience must be temporally even thinner than those of subatomic entities.

Now that the assumptions are before us, they can be questioned. One of the assumptions is that, for God to be prehensible for each occasion of experience in a personally ordered society, such as an electron, there would have to be a divine occasion that occurred after one electronic occasion (call it A) had achieved satisfaction and before the next occasion (B) began. God would prehend A and then, on the basis of knowledge of A, provide an initial aim for B. It is this assumption (combined with the perfectly reasonable presupposition that the trillions of subatomic enduring individuals in the universe are not in phase with each other) that generates the conclusion that the divine occasions must be vanishingly thin. But why accept this assumption?

One reason to accept it would be the view of some -- held as the correct reading of Whitehead and/or as ontological truth -- that only contiguous occasions can be prehend.

Accordingly, a divine occasion would have to be temporally (as well as spatially) contiguous with electronic occasion B for that occasion to prehend it; and that divine occasion would have had to have been temporally contiguous with occasion A to prehend it. But if that view is rejected, both ontologically and as a reading of Whitehead (as I have argued that it should be, and as it is by Cobb), then one need not suppose that a divine occasion occurs between every pair of events in the world. One would then be free to adopt what I above suggested to be the more natural position.

According to that position, the divine occasions of experience, being more extensive spatially than other occasions, would also be more extensive temporally. Let us arbitrarily suppose, for the sake of discussion, that a divine occasion occurs every second. This would mean, assuming that there are ten human occasions of experience every second, that after God has responded to me in one moment, I would have ten occasions of experience prior to God's next response. In that response,

God would become aware of those ten new occasions, then provide aims relevant to at least my next ten occasions. With regard to electrons, of course, the lag would be much greater: Something like a billion electronic occasions would occur between divine responses.

One reaction to this suggestion might be that it would make God's guidance of the universe impossible. But an analogous situation exists, by hypothesis, in the mind-body relation. If every second there are, say, ten dominant occasions of experience and, say, one thousand living occasions in the cells in the brain, there would be one hundred cellular occasions between every dominant occasion. And yet the mind is able to provide tolerable guidance for the body.

A Hartshornean response to this suggestion of lengthier divine durations might be that it does not do justice to the idea of divine perfection, because it fails to portray God as the greatest conceivable being. Compared with a God who responds immediately to every new state of the world, a God who allows ten human occasions of experience, and a billion subatomic experiences, to go by before responding knows the world less perfectly and provides less intimate guidance for the world. (Indeed, when I suggested my view to John Cobb in informal conversation some years ago, he replied with a smile that it would certainly help explain why there is so much evil in the world.) Although what I am calling the more natural view might be more *imaginable* -- I am supposing the Hartshornean reply to be -- the other view is logically possible and hence *conceivable*, and thus must be maintained if God is to be portrayed as a being greater than which none is conceivable, and hence as *God*. The connection between divine perfection and extremely brief divine durations is found, incidentally, in the indented quotation from Hartshorne at the outset of this section, which speaks of "perfect perception," and in the closing line of the quotation from Baker.

But this connection can be questioned, and on Hartshornean principles. Classical theists have long criticized process theism's God as imperfect because not capable of knowing the future and controlling the present. Hartshorne and his followers have long replied that "failure" to do the metaphysically impossible betokens no imperfection, and that, because of the creativity inherent in the creatures, no conceivable being could (completely) control the present or

(infallibly) know the future. Likewise, one dimension of the problem of evil is the question as to why God did not make human beings less dangerous. A Hartshornean reply that I have developed¹⁵ is that a correlation between value and power is inherent in the metaphysical structure of reality, so that any creatures with our high-level capacity for the realization of values would necessarily have power comparable to ours, including our power to deviate from the divine will and our power to inflict suffering upon others. Because this correlation between value and power is part of the metaphysical essence of reality, the fact that God did not create a world with less dangerous human-like beings betokens no divine imperfection.

In the same way, we can suppose the normal correlation between spatial and temporal extensiveness to be metaphysical. Accordingly, if God is the chief exemplification of the metaphysical principles, rather than an exception to them, the divine occasions would necessarily have a longer duration than any worldly occasions. The fact that God does not know each occasion as soon as it has occurred, and does not provide a fresh creative influence between every pair of occasions, accordingly, betokens no imperfection.

This view, I should perhaps stress, is not an essential part of the proposal given in the previous section. I suggest it only as a possible view, to show that the Hartshornean idea of God as a personally ordered society of divine occasions of experience does not necessarily entail the idea that those occasions must be as temporally thin as, or even thinner than, the briefest worldly occasions. My proposal about a cosmic "now" known by God, accordingly, can be considered apart from the question of the duration of the divine psychological present.

5. Hartshorne and the Proposed Solution

My proposal is a way to develop Hartshorne's suggestion that relativity physics perhaps does not give us the "deep truth about time." Hartshorne reports that he had at one time considered the idea of an unambiguously ordered world, but "could not quite believe it . . . since neither common sense (nor past philosophy) nor . . . physics . . . seemed to give any support for the idea" (PS 7:187). I have pointed out that at least one example of "past philosophy," that of Whitehead, did perhaps *implicitly* give support for the idea by referring to a type of causal influence that would not necessarily be limited

to the speed of light, and that might in fact be instantaneous.

The reason that Hartshorne did not explore this option may be due in part to the fact that he has shown little if any interest in the idea of influence at a distance, even in telepathy at the human level. For example, in reply to William Reese's statement that "philosophers agree [on] the lack of direct awareness of other minds" (PCH 194), Hartshorne does not follow Whitehead in referring to telepathy. (Besides the statements quoted earlier from PR 307f, Whitehead had said: "we must allow for the possibility that we can detect in ourselves direct aspects of the mentalities of higher organisms. The claim that the cognition of alien mentalities must necessarily be by means of indirect inferences from aspects of shape and of sense-objects is wholly unwarranted by this philosophy of organism" [SMW 150]. Less tentatively, Whitehead also said: "It is only when we are consciously aware of alien mentalities that we even approximate to the conscious prehension of a single actual entity" [PR 253].) Rather, Hartshorne refers only to one's intuition of "one's own bodily cells" (PCH 617). And, in comparing our interaction with the world to God's, Hartshorne says that "our experiences directly and effectively influence, it seems, only a few billion of the hundred billion bodily cells, and the rest through these" (PCH 649). The possibility of a direct psychokinetic effect of the human psyche upon one's body that is not mediated through the brain, or upon the physical world beyond one's own body, such as the cells in another person's body, is not mentioned. Accordingly, it may be that, partially because of a lack of interest in the idea of causal influence at a distance, it did not occur to Hartshorne to seek to solve the problem created for his theism by special relativity theory by developing Whitehead's suggestion that hybrid physical prehensions might have a different relation to measurable time than do pure physical prehensions.

Another factor that could help account for Hartshorne's failure to exploit this suggestion is that it depends upon Whitehead's distinction between the physical and the mental poles of actual occasions: Hybrid physical prehensions objectify only the mental poles of the prehended occasions. But one of the features of Whitehead's position that Hartshorne has eschewed is the idea of earlier and later phases within an occasion of experience, and this includes the idea of a physical pole followed by a mental pole (TPP 55-56). Hartshorne perhaps ignored Whitehead's suggestion about influence at a

distance in part because it was based upon what he regarded as an untenable distinction.

Whereas these considerations may help account for Hartshorne's distress over the problem of relating his God to relativity theory for most of his career, they cannot by themselves explain his position since his essay in response to Henry Stapp's ideas. I will first discuss Stapp's ideas, as conveyed in the article created by William Jones, then discuss Hartshorne's response thereto.

Stapp argues that Bell's theorem demonstrates that the reality of nonlocal, supraluminal causation is implied by quantum theory. Stapp says: "Bell's theorem shows that . . . spatially separated parts of reality . . . must be related some way that goes beyond the familiar idea that causal connections propagate only into the forward light-cone" (PS 7:174). Bell's theorem specifies, incidentally, only that the principle of local causes must fail "in certain cases" (173). Stapp evidently believes it justifiable to assume that the nonlocal causality obtaining in those cases can be extrapolated to all cases. (I have made a similar assumption by assuming that, if hybrid physical prehensions occur between some events, they occur between all.)

In harmony with these ideas, Stapp proposes "a modified Whiteheadian theory of events." In this ontology, the creative process consists of a "well-ordered sequence" of creative events, in which "all that exists is unambiguously fixed." This view stands in contrast with "a relative concept of existence in which what exists depends on a space-time standpoint." Each event prehends all prior events in the creation, not only those that belong to the Whiteheadian "actual world," understood in harmony with relativity theory -- namely those "events whose locations lie in the backward light-cone" (PS 7:176). Stapp believes that Whitehead should never have tried to bring his ontology into conformity with the demands of relativity theory, and that his (Stapp's) modification of the Whiteheadian view brings it more fully into accord with its own principles. In particular: "One of Whitehead's chief aims was to fulfill the philosophical demand for unity of the world. This unity is destroyed if each event prehends not all of creation, but only its own actual world [understood relativistically]. Thus Whitehead's general philosophy should lead him to embrace the absolute concept of existence" (PS

7:176-77).

One of Stapp's most interesting arguments is that relativity theory should never have been taken to have ontological implications. Having distinguished between "pragmatic science," which seeks only "to make predictions about what will be observed in different situations," and "fundamentalistic science," which seeks "to understand the fundamental nature of things" (PS 7:173), he suggests that the special theory of relativity is an example of the former.

The observations dealt with by physicists depend, as far as we know, on the relative space-time positions of events, but not on the order in which they come into existence. Thus in pragmatic science the question of order of coming into existence is irrelevant: ontological questions need be answered only if one demands an ontology. Thus the theory of relativity, considered as a theory of physical phenomena, says nothing about the issue in question. (PS 7:176)

This observation is one of the factors upon which Stapp seeks to develop a "fundamentalistic science" in which all the events of the world are well ordered.

Although Stapp's article did not discuss the implications of his position for the issue of God's relation to the world, that there are implications is obvious, and Hartshorne spells them out as he sees them. After citing Stapp's statement that causal connections are not propagated only into the forward light-cone, Hartshorne says that the Einsteinian concept of space-time structure has at last been qualified. He cites the portion of Whitehead's statement discussed above that states the qualification "provided physics keeps to its denial of action at a distance" (PR 308). and then comments: "It has not kept to it" (PS 7:184). Hartshorne does not refer to Whitehead's two types of physical prehension (and hence of physical *causation*), but Hartshorne does refer to the idea that the kind of influences assumed in relativity theory -- "influences of the kind dealt with in ordinary life, such as those used to move macroscopic bodies, or to send messages" -- is not the only kind, and that Stapp's idea that time has a "radical directionality," with each event conditioning all those coming after it, depends on "all types of influence (being] taken into

account" (PS 7:187). He expresses the wish that Whitehead had never accepted the relativistic conception, "one of the strangest ideas ever introduced by science By accepting it as ultimate, Whitehead rendered the great doctrine of events as summing up the influences of the past distressingly ambiguous" (PS 7:184).

Hartshorne then hails Stapp's doctrine as solving what had been such a difficult problem for him for so many decades, saying that it overcomes "the difficulty of seeing how the divine Consequent Nature can be compatible with the idea of its taking light years for spatially separated events to be together as data of one prehension" (PS 7:190). In another passage, Hartshorne says that Stapp's revision of Whitehead's cosmology

simplifies, if it does not first make possible, the influence upon the world that Whitehead attributes to divine decisions. They only need be inserted between successive events in the ultimate series. [I have above questioned this aspect of Hartshorne's position.] Only those who know the troubles process philosophers have had in trying to insert divine influences into the world of mutually independent contemporaries know what a relief this doctrine affords. (PS 7:187)

One question I hope Hartshorne can answer is how we can explain his comments about God and relativity physics in PCH, given what he had said in the 1977 comment on Stapp's views. Why, after having so enthusiastically discussed the implications of Stapp's extrapolations from Bell's theorem, does Hartshorne mention this theorem only once in PCH? And in this mention Hartshorne is hardly enthusiastic, saying of James Devlin that "he does not mention my puzzle over Bell's theorem in quantum theory or my admitted inability to relate what I call divine time to worldly time as known to us through physics" (PCH 631). In this statement, rather than seeing Bell's theorem as providing a solution to the problem of God and relativity physics, Hartshorne speaks of it as one more puzzle to put alongside the puzzle of relating God to relativity physics. Furthermore, William Reese, in relation to his question about God and relativity, mentioned Bell's theorem, saying that it goes beyond relativism with the assumption of "superluminal or instantaneous nonlocal interconnections"

(PCH 191). And yet Hartshorne's response, in which he says that Reese has raised what is *the* problem for him, makes no mention of Bell's theorem.

What happened in the intervening years? Did Hartshorne forget what he had written in 1977? Did he come to believe that Bell's theorem had been disconfirmed? Or that Stapp's extrapolations from it were illegitimate? Or did he later come to conclude that Stapp's position is not viable due to a feature of it that I have not yet mentioned, but that was the feature that most piqued Hartshorne's interest in it? This last hypothesis seems most likely to me.

This other, previously unremarked feature of Stapp's position involves a more precise understanding of what he means by a "well-ordered universe." He does not mean simply the view I suggested in my proposal, namely, that from the standpoint of a particular event, every other event is unambiguously *either* in that event's past, *or* in its future, *or* contemporaneous with it (taking "contemporaneous" in the strictest Whiteheadian sense to mean in unison of becoming). Rather, for Stapp, every event is unambiguously *either* in the past *or* the future of every other event; *there are no contemporaries*.¹⁶

It is evidently this feature of Stapp's position that was primarily responsible for Hartshorne's initially enthusiastic response. Perhaps the major distress caused to him by relativity theory has been the idea that it entails that many pairs of events -- all contemporary events -- are related only externally, and he has long believed the idea of wholly external relations between actualities to be philosophically problematic. Hartshorne saw Stapp's rejection of the relativistic theory of time as opening the way to the denial that any pair of events has this relationship of mutual externality. He said:

In spite of these considerations [the philosophical difficulties involved in the idea of wholly external relations], relativity physics has seemed to compel us to accept the symmetrical independence of spatially separated events. For decades I suffered philosophically from this seeming necessity. Now, may Allah bless him, Bell has done away, it seems, with the problem. For he shows that the mathematics of quantum theory . . . is

incompatible with the idea of mutually independent contemporaries. (PS 7:185)

Hartshorne pointed out that this suggestion did not mean a return to his earlier view that contemporaries are (thanks to Allah) interdependent. Rather, he was suggesting, on the basis of the Bell-Stapp view, that there may be a relationship of one-way dependence between *all* events: "either an influence goes from *A* to *B* or from *B* to *A*" (PS 7:185). "What happens here now may condition what happens somewhere else without measurable temporal lapse, although what happens at the somewhere else does not condition what happens here and now (189-90). This view would allow Hartshorne to affirm what he has long wanted to affirm without any qualification: "asymmetry is king, the one-way dependence of creativity in each instance on its *antecedent* instances" (PS 7:190).

Hartshorne's response raises questions. One is whether there really was a *philosophical* problem to be solved. That is, had Whitehead's philosophy, Hartshorne's interpretation notwithstanding, not already shown how two contemporaries, even though neither is *causally* objectified by the other, have a kind of mutual immanence, so that there are no relations between actualities that are *sheerly* external?⁷ But the more germane question here is whether Stapp's view is really one that Hartshorne could accept upon further reflection. I would think not. I see two ways in which Hartshorne might have interpreted Stapp's position, and neither view would be one that Hartshorne could easily assimilate.

One way to read Stapp would be to take his statement that he is providing "a modified Whiteheadian theory of events" to mean that his ontology is essentially the same as Whitehead's, except that he allows for no events that are, strictly speaking, contemporaries. Some support for reading Stapp this way comes from his own statement that "Heisenberg-type actual events are the counterparts in modern science of Whitehead's actual occasions."¹⁸ This reading would have wild consequences. In Whitehead's cosmology, every electron is a temporally ordered society of electronic actual occasions, with about a billion occasions occurring every second. The number of actual occasions in the universe in every second would be the sum of all the occasions occurring in all the temporally ordered societies, such as photons, mesons, neutrinos, atoms, molecules, and psyches, and in "empty space." Accordingly, with Stapp's modification of Whitehead's cosmology into a

well-ordered universe, there would not only be literally trillions of trillions of events happening in every second; but also all of those events would have to be sequentially ordered, without any overlap, so that no two events would be in unison of becoming. If this is how Hartshorne read Stapp, it would be understandable that he might have come to consider the Bell-Stapp position, while not logically impossible, quite implausible.

But that reading of Stapp would be a mistake. When Stapp says that his "Heisenberg actual events" are analogous to Whiteheadian actual occasions, he does not mean that they are the same. There are far fewer "Heisenberg actual events." In speaking of "the Heisenberg actual events associated with measurements and collapses of the wave packet," Stapp explains:

For example, in the spin-correlation experiments, which have been discussed very much in connection with the Einstein-Podolsky-Rosen experiment and Bell's theorem, there is an initial preparation, and then two measurements, which are made much later in two widely separated places. Only these few well-separated events are Heisenberg actual events.¹⁹

The fact that Stapp's example here involves measurement by physicists is merely incidental. His position is similar to Whitehead's in being philosophically realistic: Heisenberg actual events do not depend upon human measurement, and have, accordingly, been occurring during the eons before humans appeared on the scene.²⁰ But his position differs from Whitehead's in that "actual events" occur only when there are macroscopically discernible differences to be decided among.

The world evolves by an alternation between: (1) events that make certain things fixed and settled and that create new potentialities, and (2) evolutions of these potentialities via the Schroedinger equation The necessary condition for an event is the separation of the potentialities at a macroscopic level.²¹

In the Einstein-Podolsky-Rosen experiment cited above, for

example,

there are no "events" during the propagation of the atomic particles between one interaction region and another: there are no actual events there because the process is still at a microscopic level: there are no 'discernible' macroscopically expressed differences developing; the whole process is below the threshold for an actual event.²²

One question about Stapp's position, correctly understood, is whether it avoids the problem raised by the prior (false) interpretation, namely, that there would simply be too many actual events occurring per second for the idea that they are "well-ordered" to be plausible. This is still a problem because, although there would be relatively fewer actual occasions per second than in Whitehead's cosmology, there would still be trillions. Stapp himself believes that the difference between the number of actual events in his cosmology and that of White-head makes this problem not insuperable,²³ but Hartshorne, on further reflection, may have decided otherwise.

Even if Hartshorne did not find this aspect of Stapp's position implausible, however, the fact remains that Stapp's ontology is, in spite of its philosophical realism, considerably different from the view of actual events that Hartshorne shares with Whitehead. Hartshorne may have decided that, whatever the difficulties in the idea of mutually external events, and whatever the difficulties in relating God to a universe without a physically defined "now," the difficulties that would be created by trying to assimilate Stapp's position would be even more formidable.

There are, in sum, many possible reasons as to why Hartshorne, after having at first responded enthusiastically to Stapp's position, may have, upon further study, lost interest. Besides the two possible reasons I have suggested, it may be that William Jones' critique of Stapp's position (PS 7) raised questions in Hartshorne's mind about its viability.

In any case, whatever be the answer to this biographical question -- as to why Hartshorne, after having at one time praised Allah for the Bell-Stapp view, now hardly refers to it - - my main interest is in the response of Hartshorne and others

to the tentative solution I have proposed.

6. A Simpler Solution?

Before concluding, however, I need to consider the possibility that there is a simpler solution. This possibility is raised by the assessment of special relativity given by Stapp (and also Bohm -- see note 11), according to which it is purely pragmatic, making predictions about what will be observed in different situations, and thereby has no ontological significance. Assuming that this is the correct interpretation of special relativity theory, then the fact that it provides no basis for specifying, or even giving meaning to, an unambiguous cosmic present says nothing about whether such a present exists. I have, by supposing that every worldly occasion, as soon as it achieves satisfaction, exerts an instantaneous 'influence upon subsequent occasions, provided one way of understanding how such a cosmic "now" might exist. But might there be a simpler way -- at least one that would seem simpler to those who are squeamish about instantaneous influence at a distance?

One simpler possibility would be to suppose, on the basis of Whitehead's realistic ontology (his own deference to special relativity notwithstanding), that all the events in the universe are unambiguously related to each other either as precedent to, subsequent to, or contemporaneous (in unison of becoming) with. This would apply also to spacelike separated occasions, even apart from any notion of instantaneous influence. Although, without that instantaneous influence between worldly occasions, no nondivine observer would be able to know, even in principle, what complete set of events constitutes the just completed past, that set would nonetheless exist, and would be knowable by divine omniscience.

The problem with this proposal is that it supposes that the temporal relation of "precedence and subsequence" has meaning apart from causal influence. But that supposition runs counter to Whitehead as well as Einstein. For them, to say that A precedes B, or is in B's past, *means* that A exerts causal efficacy on B. The problem can also be stated in terms of the ontological principle. It entails that the relation "precedent to" must be in some actual entity. If A does not causally affect B, then the relation is not in B. One might suppose that it is in some other actual occasions, which would know that A happened before B. But that would simply bring us back to the

problems of special relativity: Some observers would place A before B, but others would place it after B, and still others would consider it simultaneous with B. Without an instantaneous influence from both A and B to those other observers, they would not necessarily agree that A was prior to B. This simpler proposal, accordingly, will not fly.

The discussion of the problem inherent in it, however, points to another possibility that might be more acceptable, at least for those who find the Hartshornean God less problematic than instantaneous action at a distance. One could suppose that the causal efficacy that establishes what set of events is unambiguously in the past is exerted on God, on a divine occasion of experience. Some relations of "precedent to" and "subsequent to" that do not exist in (spacelike separated) worldly occasions would exist in God.

According to this proposal, any divine occasion of experience, being all-inclusive and hence omnipresent, wouldprehend all those occasions in the universe that have reached satisfaction. (The state of "having reached satisfaction" is an absolute fact about an occasion in itself; unlike the state of being "in the past," it is not a relation that can exist only in a subsequent occasion.) From the point of view of the divine occasion, all those occasions would unambiguously be in the past. Then that divine occasion, as soon as it had reached satisfaction, would be prehendedit by subsequent worldly occasions. Those worldly occasions would thereby be unambiguously in the future of the divine occasion in question, and would be known to have been such by later divine occasions.

Those worldly occasions, finally, that were contemporaneous (in unison of becoming) with the divine occasion in question would be known to have been such by the next divine occasion.

Within this set of worldly occasions that are contemporaneous with the divine occasion in question, there would be some, to be sure, that would not be strictly in unison of becoming with each other and yet would not be known by God to be in a relationship of precedence and subsequence (I am presupposing the suggestion in section 4, that the duration of divine occasions would be greater than that of worldly occasions, so that there would be sequences of events all of which are contemporaneous with a single divine occasion). A twofold fact would lie behind this ambiguity with regard to

some events that are contemporaneous with a particular divine occasion. On the one hand, occasions that are spacelike separated from each other would have no relationship of precedence and subsequence in themselves, because, in the absence of any superluminal causal influence, they would have no causal relations of any kind. On the other hand, all of these occasions that had occurred during the duration of the divine occasion in question would be prehended simultaneously by the subsequent divine occasion, which would thereby not establish among these events contemporaneous with itself a relationship of precedence and subsequence that did not otherwise exist (as it would, by contrast, in prehending a limited selection from all the spacelike separated events of the universe, thereby establishing them as precedent to those events that are contemporary with or subsequent to that divine occasion).

It might be thought that, because no unambiguous cosmic "now" obtains within the set of worldly occasions that are contemporaneous with a divine occasion, this proposal would not really solve the original problem. That problem, as often stated, is that, unless there is an unambiguous cosmic "now," the divine occasions cannot accomplish their twofold task of unifying the past world and providing aims for the future. But thus to phrase the problem is subtly to misrepresent it. All that is necessary is that there be, for every divine occasion, a set of worldly occasions that is unambiguously in the past and another set that is unambiguously in the future. The only cosmic "now" that is needed is a *divine* "now." The twofold divine role can be fulfilled without establishing a "now" that also discriminates *all* worldly occasions whatsoever into either past, future, or unison of becoming with respect to each other. It was only, it seems, the assumption that the divine occasions would need to be inserted *between* every pair of successive events that created this more stringent requirement. With the more relaxed view of divine omniscience and providence, according to which each divine occasion can be contemporaneous with many (perhaps billions of) successive events, we can also have a more relaxed understanding of the requisite cosmic "now."

According to this simplified proposal, we would not need to assume instantaneous causal connections between worldly occasions to assume that the universe would, for God, be unambiguously (except for the qualification just noted) distinguished into past, future, and contemporary events. The

role played by instantaneous events in the former proposal would be played in this account by God's instantaneous prehension of all concresced occasions. (It can be instantaneous because, thanks to the divine omnipresence, there is no distance for the causal influence from any worldly occasion to travel.)

In this proposal, some of the truth about time would exist only because of God. A divine occasion would not, to be sure, make it true that those worldly occasions that it prehends have already attained satisfaction; in prehending them it would be learning something that was already true. But in knowing some spacelike separated events as precedent to others, it would be making something true that would have otherwise not been true. (It would have been true, by hypothesis, that some had already occurred and some had not, but not that the former and the latter had the relation of precedence and subsequence, because that relation does not exist apart from some kind of causal influence, either between the events themselves or upon an omnipresent observer.) Accordingly, if "The truth is nothing else than how the . . . organic actualities of the world obtain adequate representation in . . . the 'consequent nature' of God" (PR 12), as Hartshorne agrees, some of the truth about time would be due to God only in the sense that it is adequately known only by God, while some of the truth about time would be due to God in the stronger sense that it is first created by God.

This proposal -- that relativity physics has no ontological significance with respect to time, that there are cosmic "nows," but that those "nows" are knowable only by God and in fact exist only thanks to God's all-inclusive standpoint -- is perhaps the kind of position Hartshorne had in mind in the moments when he asked: "Can physics, judging reality from the standpoint of localized observers, give us the deep truth about time as it would appear to a non-localized observer?" (CSPM 124) Perhaps Hartshorne was not then able to affirm this solution with much confidence partly because there was less support from physicists than there is today (from Stapp and Bohm [see note 11], among others) for the view that the special theory of relativity has no ontological significance with respect to time, and partly because of the difficulties created by Hartshorne's assumption that the divine occasions would have to be unimaginably thin in duration. Or perhaps there are difficulties with this proposal that Hartshorne has

seen that I have not.

In any case, although it seems to me a possible solution -- it is similar to positions taken by other temporalistic theists who understand special relativity physics far better than I²⁴ -- I favor the earlier proposal. One reason is that an understanding of a series of cosmic "nows" that does not depend upon a concept of God for its very meaning will have a greater chance of being perceived as relevant by physicists and philosophers of science. Also, although I am a theist, I find it, as a matter of taste, preferable to think of God as simply knowing the truth about the cosmic "nows" rather than having these "nows" dependent for their very existence upon the divine experiences. I prefer the former proposal, finally, simply because I suspect that it is something like the truth.

Summary

The idea that the special theory of relativity creates problems for temporalistic theisms, such as that of Whitehead and especially Hartshorne arises from a combination of a fact and an assumption. The fact is that this theory does not provide the basis for a cosmic "now." The assumption is that this theory has ontological implications for the truth about time. Combining the fact and the assumption creates the idea that special relativity physics *rules out* the possibility of a cosmic "now." And that idea, if true, would seem to rule out the possible truth of temporalistic theisms in which God and the world interact.

But we need not assume that special relativity physics has ontological implications for the nature of time. One way to relativize its status is to postulate a form of efficient causation that influences distant events instantaneously. In Whiteheadian terms, the principle that contemporaries do not interact causally is still affirmed, because the instantaneous influence is exerted only after an occasion achieves satisfaction. This proposal, which I prefer, is aligned with some positions currently proposed by physicists, in which a cosmic "now" based on instantaneous effects is affirmed. A second way to reconcile temporalistic theism and relativity physics is simply to see the latter as having no ontological implications about time whatsoever, so that the possibility of a cosmic "now" is left open, then postulating that a cosmic "now" does exist for God by virtue of God's all-inclusive standpoint. This second proposal is in harmony with

suggestions by temporalistic theists beyond the process camp.

This essay is presented to Charles Hartshorne, with a biographical question about his apparent about-face with respect to Stapp's views, and a philosophical question (to him and others) about the two proposed solutions.

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Notes

¹I am indebted to a personal letter of April 13, 1992, from Lewis Ford and to a telephone conversation in July of 1992 with Henry Stapp, for this information. I also wish to thank David Bohm, John Cobb, Robert Russell, and Wesley Wildman, all of whom read an earlier draft of this paper and provided valuable suggestions for improvement.

²Royce Gordon Gruenler, who had once accepted process theism, says that process theism's incompatibility with relativity theory was fundamental to his rejection of it in favor of a more classical theism (*The Inexhaustible God: Biblical Faith and the Challenge of Process Theism* [Grand Rapids: Baker Book House, 1983], 16, 75). Gruenler even devotes an entire chapter, "Process and Simultaneity in God: Logical Difficulties in the Process View of Time," to the issue.

³See John Randolph Lucas, *The Future: An Essay on God, Temporality, and Truth* (Oxford, U.K. and Cambridge, Mass.:

Basil Blackwell, 1989); Willem B. Drees, *Beyond the Big Bang: Quantum Cosmologies and God* (La Salle, Ill.: Open Court, 1990); and the essays by John Polkinghorne and C. J. Isham in a volume tentatively titled "Quantum Creation of the Universe and the Origin of the Laws of Nature," ed. Robert i. Russell, William Stoeger, and George V. Coyne (forthcoming from the Vatican Observatory and the University of Notre Dame).

⁴In one place Whitehead suggests that his adoption of the relativity view in place of the classical view is partly "because it seems better to accord with the general philosophical doctrine of relativity which is presupposed in the philosophy of organism" (PR 66). Elsewhere, however, he says that this adoption "is based on scientific examination of our cosmic epoch, and not on any more general metaphysical principle" (PR 125). My discussion will make clear that I think that Whitehead's second statement more correctly portrays his position.

⁵John B. Bennett has argued that Whitehead's statements on this topic are inconsistent. He cites most of the passages that refer to direct, unmediated prehensions of noncontiguous occasions (PR 63/98, 226/345, 284/435, and 307f/468), but believes that they contradict Whitehead's comments at PR 120/183f., which, he believes, "rather clearly suggest that there is prehension of the past only through the mediation of contiguous occasions. . . . Objectification of noncontiguous occasions is effected only through the mediating occasions" ("Unmediated Prehensions: Some Observations," *Process Studies* 2/3 [Fall, 1972], 222-25, at 222). But this interpretation involves misreading. In this latter passage, Whitehead is dealing with the way in which data are transmitted from outside the animal body to the ultimate percipient within the body through chains of contiguous occasions. The issue of whether or not there is also a direct perception of external events, so that the percipient receives data from them that are not transmitted through a chain of contiguous occasions, simply does not come up in this passage. Accordingly, no "reconciliation" of this passage with the others is needed. (The position Bennett offers as a reconciliation, however, is one that I consider not only correct but also important.)

⁶Henry Stapp, in a personal letter to me of April 16, 1992, has commented, with regard to a previous version of this passage:

"In quantum theory, interpreted in terms of Heisenberg's ideas of objective potentia and actual events, the influences are not normally transmitted via contiguous actual events . . . [Rather], the influences between actual events are normally transmitted via 'potentia'. which are represented in quantum theory by the local quantum fields." This different view does not, however, mean that action at a distance is thereby implied: "In physics the normal causal interactions are carried by [local fields], and such causal connections are not considered to be action at a distance, since they are transmitted in a continuous way by a local process involving local quantum fields."

⁷ I have discussed this issue in "Introduction: Time and the Fallacy of Misplaced Concreteness," *Physics and the Ultimate Significance of Time: Bohm, Prigogine, and Process Philosophy* (Albany: State University of New York Press, 1986), 1-50, and in "Pantemporalism and Panexperientialism," forthcoming in a volume edited by Paul A. Harris.

⁸The statement that pure physical causation is more powerful than hybrid efficient causation requires qualification. The statement refers to the causal influence of a single event on another. Viewed in this light, the effect of hybrid physical causation is, in comparison with pure physical causation, probably vanishingly small, especially in the low-grade actual entities studied by physics, which have trivial mental poles (although David Bohm's "pilot wave," which he uses to account for, among other things, the strange results of the two-slit experiment, is explained by him in terms of a weaker form of energy that is similar to Whiteheadian hybrid physical causation [as I learned in personal conversation with Bohm]). The pure physical causation is so much more powerful in terms of one event's influence upon another because the physical energy of an actual occasion (i.e., the creativity embodied in its physical pole) has a compulsive power that is not exerted by its mental energy (i.e., the creativity as distinctively embodied in its mental pole). The statement that pure physical causation is far more powerful needs to be qualified, however, by the recognition that hybrid physical causation, while very weak in itself (i.e., in terms of the influence of one event on another), can have powerful *cumulative* effects. Whereas pure physical causation is evidently exhausted, at least normally, on contiguous subsequent events, hybrid physical causation can influence remote events as well, perhaps with undiminished intensity.

Accordingly, when looking at the physical causation upon a present event from the entire past, the influence of the hybrid physical causation from the past may be as great as or greater than that of the pure. That is, trillions of events in the past in which the same form was actualized can reinforce each other indirectly, as well as indirectly, impressing that form upon the present event. This cumulative effect of a form of causation that is in itself very weak is, incidentally, at the core of Rupert Sheldrake's hypothesis of "formative causation" (see my review article in PS 12/1 [Spring, 1982], 38-40); it can also be used to explain Jungian archetypes, which Jung himself sometimes accounts for in terms of innumerable repetitions in the past of a particular form (see my introduction to *Archetypal Process: Self and Divine in Whitehead, Jung, and Hillman* [Evanston: Northwestern University Press, 1989]).

⁹Brian Easlea, in *Witch Hunting, Magic and the New Philosophy: An Introduction to Debates of the Scientific Revolution 1450-1750* (Atlantic Highlands, N. J.: Humanities Press, 1980), esp. 93-95, 108-15, 121, 132, 135, has argued that the primary motivation behind the acceptance of the mechanical philosophy in the seventeenth century was the desire to rule out the possibility of attraction at a distance. I have discussed this issue briefly in my introduction to *The Reenchantment of Science: Postmodern Proposals* (Albany: State University of New York Press, 1988), esp. 10-12 and 40n.66, and more extensively in "Philosophy and Parapsychology: A Whiteheadian Postmodern Approach," *Journal of the American Society for Psychical Research* (forthcoming April, 1993).

¹⁰The second edition of Sheldrake's *A New Science of Life: The Hypothesis of Formative Causation* (London; A. Blond, 1985) reprints responses evoked by the first (1981) edition.

¹¹In his letter of April 16, 1992 (see n. 6), Henry Stapp wrote: "I agree essentially with your views Physicists have never showed, or claimed to show, that there *could not be* a sequence of preferred global 'nows' that define absolute simultaneity. They simply abandoned the idea for practical reasons (abetted by a positivistic philosophy that is now in disrepute). If the laws of nature exhibit Lorentz invariance, as they currently appear to do, then it turns out to be impossible to ascertain the forms of these preferred global 'nows' from the empirical data available to physicists. Thus there was no compelling reason within physics to hang onto the concept of

global 'nows', and a good practical reason for dropping it; the elimination of the concept made it technically easier to exploit the property of the Lorentz invariance of the laws of physics."

"Few if any physicists of today would claim that any deep metaphysical ontological conclusions could be deduced (with any high degree of confidence) from those practical considerations. For one thing, we are now aware of the 2.7° blackbody background radiation, which appears to define a preferred reference frame within which massive objects tend to move 'slowly'. For another thing, Kurt Gödel has noted that there are preferred definitions of global 'nows' in all the models in general relativity (see *Albert Einstein: Philosopher/Scientist*, ed. A. Schilpp, Tudor). Furthermore, the idea that there is no preferred sequence of global 'nows' seems to entail that the whole spacetime universe already exists, in some absolute sense. That conclusion is hard to reconcile with our psychological feeling of the unfolding of nature, and with the quantum mechanical idea of indeterminism, which says that things are not already all laid out."

"The simplest picture of nature compatible with quantum theory is the model of David Bohm. It explains all of the empirical facts of a relativistic quantum theory, including, in particular, the impossibility of transmitting 'signals' (i.e., controlled messages) faster than light. In spite of this complete agreement with relativistic quantum theory at the level of observed phenomena, and the strict prohibition of all observable faster-than-light effects, Bohm's model is based explicitly on the postulated existence of an advancing sequence of preferred global 'nows', which single out a preferred reference frame for defining absolute simultaneity. In this frame there is an instantaneous action-at-a-distance, which, however, does not disrupt the relativistic invariance at the level of observed phenomena. Bohm's model provides physicists with the simplest way of understanding all of the puzzling features of quantum phenomena in a completely clear way, provided one is willing to accept preferred global 'nows' at the fundamental level."

"One of the most popular quantum ontologies of today is the model of Ghirardi, Rimini and Weber. This GRW model, like Bohm's model, is based on an advancing sequence of global 'nows'. It features a *well-ordered sequence of Heisenberg-type actual events*, each of which induces a large

instantaneous action at a distance. Heisenberg-type actual events are the counterparts in modern science of Whitehead's actual occasions."

"These remarks show that your proposals to accept, at the fundamental level, the concept of absolute simultaneity is very much in line with certain contemporary developments in physics. These developments have grown out of the need to extend quantum theory, in a rationally coherent way, beyond the domain of atomic physics. Hartshorne was, I believe, completely correct in recognizing the importance of this break with the positivistically inspired philosophical ideas of the past. Of course, some physicists remain wedded to the older idea, but the influence of positivism is on the wane: there is a growing feeling among physicists that it was wrong to dismiss the idea that science should provide, among other things, also 'understanding'."

David Bohm, in a letter of May 17, 1992, responded to my proposal in these terms: "I think we are in basic agreement about relativity. However, I would go further and suggest that at a deeper level, relativity doesn't hold *even physically*. More precisely, the idea is that relativity doesn't hold for *individual* quantum processes, but is valid only statistically. (The validity would include the classical limit, which arises when there is a large number of quantum processes, as the movement of grains of sand approximates a continuous movement that is determined by a simple law of flow.) For individual quantum processes, there would be a unique space-time frame, in terms of which "simultaneous contact" would be specified. The latter frame would be determined by the line connecting any given point to the presumed origin of the universe. Empirically, this should be close to the frame in which the mean velocity of the 3°K radiation background in space is zero."

"This means that matter and mind share nonlocality, and have a common frame determining simultaneity. So matter and mind both share in one universal process of becoming."

"I enclose a paper giving more details." (The paper is D. Bohm and B. J. Hiley, "On the Relativistic Invariance of a Quantum Theory Based on Beables," *Foundations of Physics*, 21/2 [1991]:243-50. "Beables" is John Bell's term for things more fundamental than measuring instruments and observables on which to base an interpretation of the quantum

theory. An interpretation based on beables, in other words, would be a realistic, ontological interpretation. The concern of the Bohm-Hiley paper is how such an interpretation *involving nonlocality* can be reconciled with relativity. Their solution involves a new model of quantum processes" based on "a subrelativistic level of stochastic process which is also subquantum mechanical [in the sense that the details of the stochastic process can never be revealed directly in any *quantum mechanical* experiment]." This would mean "giving up the notion that relativity and quantum mechanics are universally valid" (249].)

¹²For example. Marjorie Hewitt Suchocki, in *The End of Evil: Process Eschatology in Historical Context* (Albany: State University of New York Press, 1988), says that "the societal view . . . entails the problem that the number of unifications required in a series in order to match every single finite concrescence whatsoever defy [sic] probability" (171).

¹³I am indebted to Pete Gunter for this and the following references to Bergson's writings.

¹⁴Some Whiteheadians will, no doubt, wish to exploit this principle to argue that, if the divine event is co-extensive with the entire universe spatially, and thus infinite, it should also be infinite temporally -- which would bring us back from Hartshorne's view to Whitehead's, which is that God is a single, everlasting event. (Although Bergson's own view on this is unclear, he at least moved in this direction [see CM 220f].) But, besides the fact that to be co-extensive with the universe is not necessarily to be literally infinite, the correlation between spatial and temporal extensiveness would not, as far as I can see, need to be strictly proportional. In any case, my proposal as to the metaphysical principle involved is only that there must be a positive correlation between duration and spatial extensiveness. I do not include the further specification that this correlation would necessarily be strictly proportional. Whereas I can see some reason to think that such proportionality should hold universally, I find more reason to consider metaphysical the (conflicting) principle that contemporaries (in unison of becoming) cannot interact, and thereby to hold strictly to Whitehead's judgment that "the notion of an actual entity which is characterized by essential qualities, and remains numerically one amidst the changes of accidental relations and of accidental qualities" is "in metaphysics . . . sheer error" (PR 79). Accordingly, I believe

that the system requires for coherence the idea that God is a personally ordered society of divine occasions of experience, not a single, everlasting actual entity. Incidentally, although I suggest in the text below that there may be sixty divine occasions in a minute, that suggestion is purely arbitrary. One could well assume the divine occasions to have even greater durations, thereby moving somewhat closer to proportionality. (Of course, the greater the divine durations, the less specific the divine initial aims for worldly occasions would need to be. But many Whiteheadians have already adopted, on other grounds, a highly general view of initial aims.)

¹⁵See *God, Power, and Evil: A Process Theodicy* (1976; Lanham, Md.: University Press of America, 1991), 291-300, and *Evil Revisited: Responses and Reconsiderations* (Albany: State University of New York Press, 1991), ch. 1.

¹⁶In his letter of April 16 (see n. 6), Stapp says: "the actual events are, at the basic ontological level, organized in a *specific linear sequence*. This arises *automatically* from the Heisenberg ontology if one adopts the so-called "Heisenberg picture," in which the differential causal equations of motion (the so-called von Neumann process II) are equations relating the *Heisenberg local quantum fields* at neighboring spacetime points, and the discrete quantum jumps (the so-called von Neumann process I, followed by a choice of one of the separate possibilities) are jumps in the *Heisenberg state of the universe*. Because there is only one Heisenberg state of the universe, at any stage of the evolution of the universe, there *must be* a well-ordered sequence of quantum jumps. Each such jump represents a new state of "God's knowledge of the universe," and a new set of potentialities for *the next actual event*. *There are no contemporaneous events, in process time*." (By "process time," Stapp means "simply the sequential ordering of the actual events"; it is to be distinguished from the "temporal order," meaning "the time of spacetime.") Leaving no ambiguity, Stapp says: "Thus there is, in the Heisenberg ontology, no unison-in-becoming."

¹⁷Jorge Nobo has provided a strong textual and systematic argument that, in spite of the fact that an occasion cannot be immanent in a contemporary in the mode of causal objectification, contemporaries do have a kind of mutual immanence (*White head's Metaphysics of Extension and Solidarity* [Albany: State University of New York Press, 1986], 21-23, 50f, 55-58, 221). Nobo believes, accordingly

(399-400), that Hartshorne is wrong to think that Whitehead, in speaking sometimes of the mutual immanence of occasions, was simply careless. Whatever one thinks of the details of Nobo's interpretation of the extensive continuum, the textual evidence he marshals, showing that Whitehead at least intended a kind of mutual immanence between contemporaries, seems irrefutable. It may be, then, if the concept is coherent (and Nobo presents a strong case that it is), that one of the chief difficulties Hartshorne has had with Whitehead's position, that it entailed sheer mutual externality between contemporaries, was never there.

¹⁸ This statement occurs in the letter from Stapp of April 16, 1992 (see note 6).

¹⁹ *Ibid.*

²⁰ Letter from Stapp of June 21, 1992.

²¹ *Ibid.*

²² *Ibid*

²³ In his letter of June 21, Stapp says: "There are, of course, trillions of choices between discernible differences to be made each second in the universe as a whole. But I think nature can handle that. But if choices between indiscernible differences are added, the job might get too burdensome."

²⁴ John Randolph Lucas, who has written *A Treatise on Time and Space* (London: Methuen, 1973). *Space, Time and Causality: An Essay in Natural Philosophy* (Oxford and New York; Clarendon, 1985), and (with P. E. Hodgson) *Spacetime and Electromagnetism: An Essay on the Special Theory of Relativity* (Oxford: Clarendon; New York: Oxford University Press, 1990), has said in *The Future* (see note 3, above): "The divine canon of simultaneity implicit in the acquisition of knowledge by an omniscient being is not incompatible with the Special Theory of Relativity, but does lead to there being a divinely preferred frame of reference . . ." (220).

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