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This is a long chapter with many arguments and moving parts. One cannot hope to cover them all, and even summarizing is not easy. I concur with most of what Tim does here, especially the series of critiques with which he opens the chapter. I am not at all sure that Tim has avoided nominalism in his constructive view, but he has certainly avoided the version of nominalism he sets up for critique. The issue of nominalism does, as Tim says, revolve around what status one gives to particulars, and if one defines particulars as wholly actual, then yes, you have actualism plus nominalism.

But including *potentiae* in the category of particulars does not solve this problem; it only softens the edges. Tim, along with Epperson, Kastner, and a number of others who might accept Tim's potentiae, have traded hard actualism, hard determinism, and the procrustean bed of the Copenhagen interpretation, and traded it in for the mattress of *The Princess and the Pea*, because way down under all that fluffy potential padding is an actual pea, in a simple location they still have not managed to excise from their account. The continuing presence of space-time in their accounts attests to this. They assert that something must be actual for anything to be possible, and this is simply not knowable.

I seem to have fallen into the unassigned role of defending Whitehead's view, and I do not want to seem like some purist. Like my colleagues, I too want answers to today's questions, and I do not want to be hide-bound by Whitehead's system. I don't believe that I am. But I have to insist that the logoi framework and the idea of potentiae goes only part of the way toward a view that has a real shot at re-working the current physics and cosmology in a way that is genuinely empirical and does not use the model of actuality, as it belongs to us in its perfect contingency, as a model for the whole order of the real. If you accept that the actual condition of the universe did not have to be the way it is, then none of it had to be the way it is. You therefore cannot sneak necessity in the back door by appealing to the actual, regardless of whether we know it in part (as Tim holds), or don't know it at all. When we model the order of the real in a way that privileges anything actual, even if it's just a space-time pea, we betray our own basic affirmation of the openness of the real.

Lying behind this account is a conviction that the past cannot be changed. I grant that this looks like a. secure assumption, but it is in fact a conjecture based on the order we observe in our immediate epoch. We don't even know that such an assumption holds for the rest of our cosmic epoch beyond the immediate epoch –reminding everyone that all physical laws we know about belong only to the immediate epoch, in Whitehead's terms. To take the basic characteristics of the immediate epoch and generalize them to our cosmic epoch is a conjectural activity. We cannot even be confident about the rules that would apply to such a generalization. But to use the

model of the actual past as a basis for scientific physical knowledge may be practical for our near purposes, but it is not worthy of the name "cosmology."

The problem with taking the conjectural assertion of past actuality, however it is modeled, as the measure of knowledge is that we may be unable to discover where we have confused a truth about the universe with the application in which it was discovered, to use Whitehead's formulation when he was criticizing Einstein. Physics is just physics. It is at most a perspective on the real. Cosmology must be more than that; it must seek the real, imaginatively, openly, not just a physical model of it. And so I am content with the step forward Tim is taking. It is certainly preferable to the views he is criticizing. And yet, his view shares more common ground with the view he criticizes than I can accept, when the questions are cosmological, the study of order, as opposed to the most general questions of physics.

I certainly agree that the quantum theory is the path forward. But the quantum is not, in the most basic sense, anything limited by or modeled from *past* actuality. The quantum is the idea that whatever the order of the real may be, we can find, or, more precisely, create a scalable unit, which pervades the entire order whatever it may be, that will provide an account that is adequate, applicable, and logically rigorous. That unit will be an actual or possible (not potential, which is conditioned by the actual) division of the hypothesized coordinate whole with which our inquiry begins. Whitehead teaches us how to do this, but evidently it is hard to learn. It seems very clear to me, and yet I find that I cannot get even very smart people to grasp the idea that the actual entity is not a thing, it is an ideal unit that *explains*, from any *possible* standpoint, the wor5ld it belongs to. The scale of that unit changes as the purpose of the account varies. Our immediate epoch can be treated as the actual entity that belongs to and explains our cosmic epoch –not because we know how to generalize it (we don't), but because whatever the cosmic epoch turns out to be, the immediate epoch is included and must have some relations (not necessarily intelligible to us) with the whole to which it belongs. Properly described, the immediate epoch is extensively connected to the cosmic epoch, is an instance of the orders that are possible in the reality of the cosmic epoch. How the cosmic epoch might be connected to other cosmic epochs is so far beyond us as to defy even the word "conjecture," and yet the one thing Whitehead is willing to venture on this topic is that there will be a quantum, at the very least because our cosmic epoch belongs to whatever greater order there may be that includes it.

The structural features of the theory of extensive connection provides a method for handling both actual divisions of the coordinate whole, and its divisi*bility* (possible, *not just potential*, divisions that might occur or *might have occurred* but did not). The third category is the virtual or hypothetical analysis of indivisibles, such as prehensions and actual entities. The theory of extensive connection allows for an account that shows the structural characteristics of everything, possible, potential, and actual. Why people cannot understand Whitehead's theory of eternal objects is a mystery to me. It isn't that complicated and it has nothing whatsoever to do with the simplistic theory of forms people habitually attribute to Plato. But I have had my say on that topic.

I want to move on to another topic which shows, I believe, why contemporary physicists need to pay attention to Whitehead's account of space –and this is space without simple location of any sort, so it is different from the theory favored by Tim and Epperson, and the wonderful group of theorists whose perspective is being explained in these sessions. Their soft actualism, which includes potentiae that are conditioned by the actual, presupposes both simultaneity and simple location. Granted, they have re-defined this physical reality as the full complement of relations it has to the world, relational realism. Yet, they exclude completely the real relations their actual entities bear to what they might have been but are not, and by implication, to what they genuinely might be, but won't be. The relational realist count is better at dealing with the might be than the might have been, but in sum, it denies the reality of the might have been and therefore denies the possibilities in the future that might be but won't be.

This is evident in Tim's distinction between causation and causality, borrowed from the literature. It is a good distinction, and important. But it falls well short of Whitehead's idea of causal efficacy. Certainly causality is a better option than the hidebound causation, so easily dismantled by Hume's arguments. Hard actualism and determinism are, as Tim says, incoherent. Causality is probably the best idea for the soft actualism of relational realism, and yet it does presuppose that actual pea beneath the fluffy relational fabric that a good quantum physics talks about. Causality does not include the structure of possibility, but more importantly, it assumes that space is definable in terms that set it in contrast to time. Tim says in numerous places that his entities come to be localized. I think this is not the best way to understand them.

First, there are no entities in any permanent sense, there are processes. The processes have a multiplicity of temporal characteristics disjoined until their plurality concresces around a nexus. These conscrescences are a residuum of the indefinite transition, most of which would not be intelligible to us and makes up both the immediate epoch and presumably the cosmic epoch. The nexus appears wherever there is concrescence above a negligible temporariness. The nexus is causally efficacious –this is not causality and it is certainly not causation. Causal efficacy implies a minimal eddying of transition that includes a plurality of temporal characters. It can create space, but there is no reason to believe that it *must* do so. In a way, this is the necessity that Tim and Epperson and Kastner are sneaking into their account. They would basically have to say that if no space is created, there is no way to know anything about the nexus. That negation is unwarranted, and in fact, Whitehead provides an account that enables us to know somethings about the nexus that may create no space. This is the theory of transition. It is complete temporalism. Complete temporalism, where we hypothesize that all space is concrescing plural time, is the best theory for both cosmology and thus for the foundations of physics. The multiplicity becomes a plurality, disjunction becomes conjunction along many axes, but for cosmology, these axes are existence, explanation, and obligation. That coordinate whole is what physics studies. It is the gift of cosmology to physics, as well as to any other endeavor we want to call "knowledge."

Tim comes to the threshold of this point when he talks about pre-space. I would like to hear more of his thinking on this topic. Just what is pre-space? For Whitehead it is transition. The problem

of pre-space implies the need for a theory of the creation of space. And that demand is independent of Whitehead; anyone who speaks of pre-space will need a theory of the creation of space. I have published such a piece, combining Whitehead and Bergson. I will send it to anyone who is interested (Springer, 2017).

But Whitehead also has such a theory –causal efficacy *becomes* presentational space via symbolic reference. In short, the space created is the dynamic symbol of the time that created it. This is not causation or causality, it is the creation of an image stable enough to be present both to the cosmos and to itself. A cosmic epoch is one such image, a space of presentation; the immediate epoch in which we live is an image included in that first image. The immediate epoch faces the cosmic epoch in the sense that all that concresces in the immediate epoch is an evaluation of the cosmic epoch. For the cosmic epoch, the immediate epoch is a nexus, an eddy of temporal variability that has coalesced into a plurality from the disjoined multiplicity. Every presentational space derives from a nexus included in a broader temporality that, to it, is transition. Every concrescence is a reflective evaluation of the whole of that transition.

None of this activity presupposes humans or minds or individuals. It would happen this way without us. The cosmos evaluates itself in every concrescence. We happen to be very temporary, very intense evaluations, insofar as we are conscrescing, of the temporality that is presented to us as space. Our space is not space as such, it is adjusted to our modes of concrescnce. Very different evaluations come from chairs and rocks and insects and planets and solar systems. Each has a presentation of the time span, the duractional epoch that has been taken up as a nexus and evaluated in a concrescence. Symbolic reference as theorized in PR is not about language, although it includes language as a nearly insignificant case. Symbolic reference is how Whitehead describes the analogy of presented spaces to the modes of time that create them.

Thus, causal efficacy is about variable process and the effects it has, some of which present that time to itself as an event. The event character of this presentation is not something Whitehead attempts to describe in any great detail, but there is no basis for attributing necessity of any kind to it. Tim's use of Hartshorne in this chapter is an indication that he still holds onto necessity of an ontological sort –Tim says that his account of causality is intended as "ontic," but most philosophers use the word ontological for what Time is talking about, reserving the term "ontic" for the way Heidegger used it, to refer to the everyday world, in contrast to the deeper account. But that is a merely verbal point.

The philosophical point is this: the soft actualism Tim describes does have points of contact with a cosmology of creativity, but it does not seem to me that Tim is especially interested in trying to get an account of fundamental creativity. He tends to think of creativity in terms of human creativity, as he says "tapping into potentiae," (p. 226). Engaging Whitehead's theory at this level is not his project, but I would like to suggest that the path forward in physics does require that we see how the quantum is the *explanans* and every real the *explanandum*. The quantum gives us access to the order of the possible, unconditioned by actuality. It provides a standpoint on how variable time creates space, and how that space is the symbol of the time that creates it.