An Unscientific Postscript to "Whiteheadian Actual Entities and String Theory"

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In the June 2012 issue of the *Journal of Cosmology*, I published an article entitled "Whiteheadian Actual Entities and String Theory." Therein I tried to show how two theories, one in the physical sciences and one in philosophy, that thus far lack strict empirical verification (even though they are from a logical perspective internally consistent) could possibly complement one another and thus provide a stronger theoretical framework than either of them individually. The two theories are the cosmology of Alfred North Whitehead, above all, as represented by his major work *Process and Reality* (Whitehead 1978) and string theory in quantum physics as set forth by Michio Kaku in his book *Hyperspace* (Kaku, 1994). As already mentioned, both theories suffer from a lack of empirical verification and to that extent are lacking in immediate practical consequences. Whitehead postulated that "the final real things of which the world is made up" are actual entities, dynamically interrelated momentary self-constituting subjects of experience (Whitehead 1978, p. 18). Actual entities are thus equivalently spiritual atoms with a measure of spontaneity and active interconnection distinct from material atoms which are ordered to one another in various ways by external forces (e.g., gravity) without any evident plan or design. But this is not an empirically verifiable hypothesis in terms of current physical science. Similarly, string theory as presented by Kaku and others presupposes the existence of many more spatial and perhaps temporal dimensions as well for its logical consistency than can be empirically verified at the present time. We human beings experience time and space as a

four-dimensional continuum. Hence conjecture about the logical possibilities of the existence and activity of multi-dimensional entities is certainly interesting but still beyond empirical verification, at least for the moment.

What is to be gained then from the theoretical linkage of string theory with Whiteheadian metaphysics? As I tried to make clear in the earlier essay, showing the complementary character of the two theories might indirectly strengthen the credibility of both of them, since together they would constitute the equivalent of a new world view or *Weltanschauung*. In *Hyperspace*, Kaku quotes Edward Witten, one of the early proponents of string theory, to the effect that a broader world view is what is needed for a better understanding of string theory but that it does not exist yet (Kaku 1994, p. 161). My earlier article was intended then to open (or reopen) that discussion. But, even so, why publish a "postscript" in this subsequent issue of the journal? I continue to think about the need for multi-dimensional space for the mathematics of string theory. Earlier I suggested in line with Whitehead's notion of structured societies, that is, sub-societies within larger and frequently more complex societies (Whitehead 1978, p. 103), that a primitive physical entity like a subatomic particle, taken by itself, might potentially exist in many more dimensions than what it will eventually have within our conventional four-dimensional space-time continuum. For within the latter, it does not exist in isolation but is inevitably linked with other subatomic particles so as to constitute first atoms and then molecules. Equivalently then I suggested that the more structure already present within the physical field of activity in which an entity is actualized, the fewer dimensions the entity has available to it by way of potentiality for its own existence and activity.

What I am suggesting now in this postscript is that the notion of ten-dimensional space is here and now only a potentiality or mathematical probability rather than an empirically verifiable physical actuality. That is, at some earlier stage of the cosmic process ten-dimensional space presumably did exist as the context for the physical entities existing at that time. But ten-dimensional space only exists now in the form of laws of nature which still apply to more complex physical entities existing in the current four-dimensional space-time continuum. In this way, one does not have to claim with Kaku that the unneeded higher dimensions are still actual but are rolled up into a tiny ball so that they are invisible to the human eye (Kaku 1994, 106). For ten-dimensional space must have existed if, as Kaku claims, if it is needed to explain the origin of the current laws of nature (Kaku 1994, pp. 11-16). But here and now ten-dimensional space no longer exists in itself as an empirically verifiable physical actuality, but only as the ontological source for the laws of nature which govern the existence and activity of entities within the present four-dimensional space-time continuum.

My presupposition here is that laws of nature originating at one level of existence and activity within nature are still operative at higher-order, more complex levels of existence and activity as a necessary precondition for the entities at the higher-order levels of existence and activity. For example, the laws pertinent to the existence and activity of atoms are still operative at the molecular level of existence and activity even when they are integrated with laws specific to the molecular level of existence and activity. A molecule, after all, only functions properly if it respects the limits placed upon it by the way in which its constituent atoms necessarily relate to one another. In brief, then, at every level of existence and activity within nature, laws of nature

are operative. But they are increasingly complex in their concept and operation, depending upon the level at which they originate. Yet at every level of existence and activity within nature, laws of nature are actualized by the entities in which they are instantiated. In themselves, they are mathematical probabilities which may or may not be actualized here and now.

My further argument in this Postscript is that all the laws of nature without exception exist within what I call the divine matrix, a structured field of activity shared by God (the cosmic intelligence) and the finite entities of this world. Many years ago I proposed in a book entitled *The Divine Matrix* (Bracken 1995) that implicitly underlying most of the mystical traditions, East and West, was a spatial-temporal reality of infinite proportions, infinite at least in terms of human comprehension. For classical Hinduism, that infinite reality is *Brahman* as opposed to the three primordial deities (Brahma, Vishnu, Shiva). Within classical Buddhism it is Emptiness which is also paradoxically a Fullness. Within Taoism, it is the Tao that cannot be comprehend-ed. Within Christianity, and perhaps to a lesser extent Judaism and Islam, it is what I called the divine matrix, an all-comprehensive divine-creaturely field of activity within which presumably the Big Bang or the start of the current cosmic process took place. Kaku himself seems to have made the same connection: "Only at the instant of the Big Bang do we see the full power of the hyperspace theory coming into play" (Kaku 1994, p. 27). I myself borrowed the idea of a divine matrix in which all entities, finite and infinite, participate from the Jesuit paleontologist, Teilhard de Chardin, in his book *The Divine Milieu* (Teilhard de Chardin 1960). Furthermore, even more than Teilhard, I prefer to conceive this divine milieu/divine matrix in trinitarian terms, namely, as a all-encompassing structured field of activity originally co-constituted by the three divine

"persons" in virtue of their dynamic interrelation as one God but then shared with the finite entities of this world through the divine free choice to create. The structure of this divine-creaturely field of activity is, moreover, not deterministic but once again based on mathematical laws or probability schemes which reflect what de facto happened and yet still have an effect on entities currently existing in the field. Thus, as Kaku suggests, "the beauty and symmetry found in nature can ultimately be traced back to higher-dimensional space" (Kaku 1994, p. 159). But this higher-dimensional space is both logically and ontologically derivative from the divine matrix, a progressively structured field of activity proper to a cosmic intelligence which is somehow shared with finite entities like ourselves.

But, even if this be the case, I still have to make clear how this notion of a divine-creaturely structured field of activity is compatible with Whitehead's philosophical cosmology on which I relied so heavily in my earlier article for the linkage of string theory with White-head's concept of actual entities. Briefly to review the earlier argument, Whitehead was one of the first philosopher/scientists in the 20th century to recognize the need for an event-ontology rather than a thing-ontology as the basis for a new world view which would reconcile the sciences and the humanities with one another as complementary rather than totally opposed approaches to reality. Thus it is not things that endure over time, but events that individually do not last but still contribute to law-like patterns of recurrence over time. These momentary events are then "the final real things of which the world is made up" (Whitehead 1978, 18). Whitehead calls these events actual entities or actual occasions, momentary self-constituting subjects of experience which are influenced in their self-constitution by their predecessors in the same

connected series of events or "society" but which in turn through their own self-constitution have a strong influence on their successors within the same society or connected series of events. The way in which a given actual entity influences its successors in the same society is through the transmission of the structure of its self-constitution here and now as a "superject," its objective self-manifestation (Whitehead 1978, 25-28). My argument in the earlier article was that a tiny vibrating string within string theory is conceivably a superject or objective manifestation of an actual entity, a momentary subject of experience. Where else, after all, is the energy-source for the alleged vibration of the string to be located except in some form of subjectivity which uses the vibration of the string as its specific mode of operation or form of self-manifestation?

According to Kaku, strings like Whiteheadian actual entities are equivalently "the final real things of which the world is made up" (Whitehead 1978, 18; Kaku 1994, 152-155). Hence, in both cases they are virtually infinite in number. For Kaku strings "can collide with other strings to form longer strings" (Kaku 1994, 154). For Whitehead, actual entities do not collide with one another to form societies of actual entities; rather they succeed one another in the ongoing transmission of a given pattern of self-constitution. Thus for both Kaku and Whitehead reality is "atomic" in the sense that little "things" combine to produce larger "things." For Kaku, to be sure, the "things" in question are material realities; for Whitehead world they are psychic realities. But in both cases they combine with one another to produce larger "things" which have spatial-temporal dimensions and occupy a structured field of activity. As Kaku comments, "[a]ll known forms of matter and energy have been expressed in terms of field theory. Patterns, then, like themes and variations in a symphony, are constantly repeated" (Kaku 1994, 156). The only

problem with this comparison of actual entities and individual strings within string theory is that Whitehead in his master work *Process and Reality* does not use the term "field" to describe what he means by a society of actual entities. It seems to be present more by implication than by express statement.

In *Process and Reality*, field-imagery is largely limited to his notion of the extensive continuum, namely, "one relational complex in which all potential objectifications [of actual entities] find their niche. It underlies the whole world, past, present, and future" (Whitehead 1978, p. 66). Later in the same paragraph he adds: "An extensive continuum is a complex of entities united by various allied relationships of whole to part, and of overlapping so as to possess common parts, and of contact, and of other relationships derived from these primary relationships." But curiously he does not link this idea of an all-inclusive relational complex to his later discussion of structured societies, i.e., societies composed of sub-societies but with a structural pattern of their own which is distinct from the structural pattern of the component sub-societies and the self-constitution of their component actual entities (Whitehead 1978, 99-100).

So my own reinterpretation of Whiteheadian societies as structured fields of activity for their constituent actual entities from moment to moment not only solves the problem of permanence or ongoing self-identity of societies within a world of constant change for Whiteheadians, but also provides a much better analogy to Kaku's understanding of string theory as the missing link in the long-sought unification of quantum theory and general relativity. For, as Kaku sees it, string theory only works within the context of a field-oriented approach to quantum physics:

"Field theory. . . has emerged as the universal language of subatomic physics, and perhaps the universe as well. It is the single most powerful weapon in the arsenal of theoretical physics" (Kaku 1994, 156). Finally, treating Whiteheadian societies as objective realities which are distinct though not separate from their constituent actual entities at any given moment allows one to claim that Whiteheadian structured societies exercise downward causation upon their subsocieties and constituent actual entities even as they continue to be gradually reshaped by the never-ending interplay between those same constituent actual entities in the various subsocieties.

This allows me in the present postscript, as already noted, to propose that ten-dimensional space within the present four-dimensional space-time continuum is only a potentiality, not an empirically invisible mini-actuality. The laws of nature which allegedly originated in ten-dimensional space, in other words, are still operative in the current four-dimensional space-time continuum although they are integrated into more complex laws of nature proper to entities in a four-dimensional universe. Could ten-dimensional space, therefore, once again become an actuality so that all the fascinating possibilities (like wormholes and multiple simultaneously existing universes) suggested by Kaku in Part III of *Hyperspace* would be empirically verified? Given that an ontological potentiality, especially one that was de facto actualized in the past of our universe, never ceases to be capable of actualization whether in our own universe at some future date or in some other universe (past, present or future), then the answer has to be yes. But here and now within the current four-dimensional space-time continuum, it does not seem to be achievable.

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REFERENCES

Bracken, Joseph A., (1995). *The Divine Matrix: Creativity as Link between East and West.* Orbis Books: Maryknoll, NY.

Kaku, Michio (1994), *Hyperspace: A Scientific Odyssey through Parallel Universes, Time Warps and the 10th Dimension.* Oxford University Press: New York.

Teilhard de Chardin, Pierre (1960), *The Divine Milieu: An Essay on the Interior Life*. Harper: New York

Whitehead, Alfred North (1978), *Process and Reality: An Essay in Cosmology*. Corrected Edition, edited by David Ray Griffin and Donald W. Sherburne. Free Press: New York.