

Whitehead and the Reduction of Matter to Mind

It was Whitehead, with *Science and the Modern World*, who clued me in to the *hard problem* of mind and body. A sensory quality such as redness is no part of mathematical physics. The theoretical entities of physics owe their formulation to conjecture, while entities like redness belong to the immaterial dreamlike experience of sentient mind. Hence, the bifurcation of nature into "the conjecture and the dream." The conjecture, for mainstream physics, has always been about entities located in space and extended in space, a concept automatically inherited from our pre-scientific intuitions. In its careful and rigorous advance, physical theory arrived at the discovery of a limiting velocity for the motion of matter through space, which confounded all expectations. At the same time, quantum theory arose to contradict the infinite divisibility of space and time. Either development was sufficient to discredit Newton's original reduction to space, time, and matter. The pre-scientific intuitions of common sense had run their course and failed.

In *Adventures of Ideas*, I find the ideas I need for solving the hard problem to my satisfaction. The conjecture side of the problem-- theoretical physics-- can be reformulated using temporal succession alone. Then it is only Whitehead's occasions, connected together by time ordering pairwise relations, that constitute the universe. With this development, matter, mass, charge, force, and all such physicalistic concepts are reduced to the temporal succession of purely mental occasions, for a complete reduction of matter to mind.

The formal reconstruction of physics is posted here:

Causal Set Theory and the Origin of Mass-ratio

Quantum theory is reconstructed using standalone causal sets. The frequency ratios inherent in causal sets are used to define energy-ratios, implicating the causal link as the quantum of action. Space-time and its particle-like sequences are then constructed from causal links. A 4-D time-lattice pattern is defined and used to model neutrinos and electron clouds, which together constitute our 4-D manifold. A 6-D time-lattice is used to model the nucleons. The integration of the nucleus with its electron cloud allows calculation of the mass-ratio of the proton (or the neutron) with respect to the electron. Arrow diagrams, along with several ball-and-stick models, are used to streamline the presentation.

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Whitehead himself never reached the reduction of nature to purely mental entities. Up to the end he conceived his occasions as dual-aspect, per this quote from *Adventures of Ideas*:

The universe is dual because each final actuality is both physical and mental. The universe is dual because each actuality requires abstract character. The universe is dual because each occasion unites its formal immediacy with objective otherness. -- Objects and Subjects,

section 23, *Dualism*

Even though Whitehead was largely motivated to formulate a metaphysics that avoids Descartes' "vicious dualism," he ended up with a dual-aspect theory of mental-and-physical occasions, or "dualism all the way down." I shouldn't say that Whitehead "ended up" at all, since he was modest to the point of apologetic about the unfinished character of his speculative scheme. To me, Whitehead was on the threshold of a breakthrough, like Moses at the brink of the Promised Land, unable to enter.

Meeting resistance among Whitehead scholars to my revisionism of his doctrines, I've returned to *Adventures of Ideas*, scouring it for passages by which to explain and clarify my revisions.

Seek simplicity, and distrust it. Think first of Newton's reduction to space, time and mass, as a drastic simplification of the working hypotheses that preceded Newton. Newton sought simplicity, found it, and the world trusted it for 300 years, in a fertile period of scientific developments. Then came the knowledge of the limiting velocity of light, and of the absence of an ether that could explain that limiting velocity. Newton's simplicity now met with distrust. Einstein then formulated "space-time," which complicated physics. Furthermore, Einstein chose to implement a continuum version of space-time, which made quantum theory incompatible with continuum physics -- a mainstream dilemma to this day. Now I've presented a theory of physics in which everything is generated by a temporal successor relation (see "Causal Set Theory and the Origin of Mass-ratio.") Since a single ordering relation, over a domain of generic relata, is the minimum of logical equipment required to define "structure," no further simplification is logically possible. I got to this reduction by reading what Russell and Whitehead have to say about space-time physics, interpreting their words to mean that spatial relations should be eliminated from physics in favor of time-ordering relations alone. Once we set out to develop physics without spatial relations, we have satisfied the strictures of Special Relativity "out of the box," as Rafael Sorkin says, and we can forget about it. Likewise, if we neglect to include any provision for infinities in the theory, we have satisfied the strictures of quantum theory "out of the box," and we can forget about that too. As we model space-time and its particle-like sequences using the temporal successor relation, we can call it "relativistic quantum theory" if we prefer that to "temporal succession."

Here is Whitehead, defining "contemporary events" without resorting to spatial relations or extension-in-space:

It is the definition of contemporary events that they happen in causal independence of each other. Thus two contemporary occasions are such that neither belongs to the past of the other. The two occasions are not in any direct relations to efficient causation.

... the immediate activity of self-creation is separate and private, so far as contemporaries are concerned. -- PPP, Section IV

In the arrow diagrams of temporal succession, Whitehead's term "direct relation," as used above, is represented by an arrow. The arrow is the primitive fact of Whitehead's "efficient causation." An arrow diagram is thus a diagram of efficient causation. For any pair of nodes in any one diagram, one of the pair is in the past of the other, or else they are contemporaries, in accord with Whitehead's definition. The diagram notation thus illustrates Whitehead's meaning in a graphic manner.

Any arrow can be considered a "breach of privacy" between the two occasions that it connects. No one arrow connects two contemporaries, so there is no breach of privacy between them, so they enjoy mutual privacy in their separate activities of self-creation. This is a way of restating what Whitehead says above, combining "causal independence" and "privacy" in describing the relation of contemporaries to one another.

As used here the words "individual" and "atom" have the same meaning, that they apply to composite things with an absolute reality which their components lack. These words properly apply to an actual entity in its immediacy of self-enjoyment when it stands out as for itself alone, with its own affective self-enjoyment. The term "monad" also expresses this essential unity at the decisive moment, which stands between its birth and its perishing. -- Objects and Subjects, section 5, Individuality

I have often termed the "events" of Russell and Whitehead's eventism, "momentary monads." I was glad to find corroboration of this in the above quote. After Descartes, Berkeley was the first to hammer on the unperceivable character of "matter" and of anything that lands outside the domain of sheer phenomena. He opted for just human minds plus God's mind. The latter could coordinate the content of the human minds, without need of a physical world to perform that function. These minds were his only "monads." Leibniz adopted Berkeley's human minds, terming them "monads," but he reasoned that the human body and the physical world might also be real in their own right, composed of hordes of additional, non-human monads. Hume, surveying his own privacy as a monad, drew attention to the present moment of his experience as the surest reality that could survive his skeptical reasoning. Hume's momentary monad-- conceived as pure sentient mentality-- was taken up by Russell and Whitehead as the paradigm constituent of the physical world. Time order, or causal order, was also needed, to connect the momentary monads into a universe of temporal-causal succession. (Russell and Whitehead both conflated time order and causal order.) That is the essential story of the mind-body problem on its way to resolution.

The notion of the contiguity of occasions is important. Two occasions, which are not contemporary, are contiguous in time when there is no occasion which is antecedent to one of them and subsequent to the other. A purely temporal nexus of occasions is continuous when, with the exception of the earliest and the latest occasions, each occasion is contiguous with an earlier occasion and a later

occasion. The nexus will then form an unbroken thread in temporal or serial order. The first and last occasions of the thread will, of course, only enjoy a one-sided contiguity with the thread. -- Grouping of Occasions, Section II

In the above, Whitehead constructs a series composed of occasions. I use a line of arrows, connected head-to-tail, to construct a series. Peano's successor relation does the job most clearly. "Contiguity" is then definable per the above quote, verbatim. There is no profit in confining the successor relation to 1-to-1 seriality, as Peano did, if it is space-time that you wish to construct. Temporal succession must then feature forking and convergent time sequences. Whitehead states clearly, elsewhere, that time cannot be strictly serial.

The simplest example of a society in which the successive nexus of its progressive realization have a common extensive pattern is when each such nexus is purely temporal and continuous. The society, in each stage of realization, then consists of a set of contiguous occasions in serial order. A man, defined as an enduring percipient, is such a society. This definition of of a man is exactly what Descartes means by a thinking substance. It will be remembered that ... Descartes states that endurance is nothing else than successive re-creation by God. Thus the Cartesian conception of the human soul and that here put forward differ only in the function assigned to God. -- Grouping, Section IV

Per the above quote, two human minds-- purely mental "souls" of the sort that Descartes and Berkeley had in mind-- share a common "extensive pattern," and that pattern is known in mathematics as "a series." Each serial mind is a next-to-next succession of occasions. Over any finite span of time-- a second, a minute, a lifetime-- there can only be a finite total number of human occasions that compose the series. Just as my days are numbered, so are my occasions. How many occasions do I have each second of my life? Whitehead never says, but there is a passage in which he homes in on the "immediate past," characterizing it as 1/2 to 1/10th of a second ago. Has any Whitehead scholar commented upon how many occasions per second make up a human mind? Ever speculate on what the number might be? It's a simple key question. I put it at 10 per second, drawing on brain science to decide it.

Also, each of these enduring objects, such as tables, animal bodies, and stars, is itself a subordinate universe including subordinate enduring objects. The only strictly personal society of which we have direct discriminative intuition is the society of our own personal experiences. We also have a direct, though vaguer, intuition of our derivation of experience from the antecedent functioning of our bodies, and a still vaguer intuition of our bodily derivation from external nature. -- Grouping, Section V

The second sentence above reinforces Descartes' meditations on his own

sentient mind as he set up the mental side of his dualism. By now, Whitehead characterizes this mind as a "strictly personal society," which has the "extensive character" of a serial chain of occasions, linked in next-to-next succession. The third sentence implies that occasions of a human personal series have further antecedents in addition to the antecedents that constitute the series. The additional antecedents are occasions that belong to the human body but not to the human series. Additional antecedents to some one occasion of a human series implies that there is a many-to-one convergence of separable time sequences upon that single occasion of the series. Such convergence is a logical requirement for Whitehead's ontology. For its epistemology, Whitehead claims that such convergence (or multiple sources of derivation) is vaguely intuited. The vagueness is such that Whitehead reserves the phrase "discriminative intuition" for our acquaintance with Humean impressions inherent in the human monad. For the multi-source derivation, our vague intuition cannot discriminate just what the immediate bodily antecedents are, where they are, or how many there might be. We see *with* the eyes, but more immediately, we see *with* the optic nerves. We have no intuition of derivation of our visual sensa from the optic nerves, except what we glean from physiology textbooks.

No doctrine of sense-perception can neglect the teaching of physiology. The decisive factor in sense-perception is the functioning of the brain, and the functioning of the brain is conditioned by the antecedent functionings of the other parts of the animal body. Given requisite bodily functionings, the sense-perception results. The activities of nature external to the animal body are irrelevant as to their details, so long as they have the general character of supporting the existence of the total animal organism. The human body is the self-sufficient organ of human sense-perception.

... confining ourselves to the normal modes of excitation, the only important factor in the external event is how it affects the functionings of the surface of the body. How light enters the eye, and a normal healthy state of the body, are the only important factors in normal visual sensation. The light may have come from a nebula distant by a thousand light-years, or it may have its origin in an electric lamp two feet off and have suffered a complex arrangement of reflections and refractions. Nothing matters except how it enters the eye.... Appearance and Reality, Section VI

Whitehead is leveraging scientific knowledge to localize the setting of the human series within the human body. He initially suggests a narrower localization to the human brain, as "the decisive factor in sense-perception." A good way to dramatize this localization is the thought experiment of the "brain in a jar."

Speculative Philosophy can be defined as the endeavor to frame a coherent, logical, necessary system of general ideas in terms of which every element of our experience can be interpreted. ...

Thus speculative philosophy embodies the method of the "working

hypothesis." -- Philosophic Method, Section III

Hypothesis, speculation, conjecture-- these roughly equivalent words express support for the "hypothetico-deductive method" of scientific inquiry that I was schooled in. Radical empiricism refuses to submit to the absolute need for conjecture, demanding first-hand acquaintance with any element of its ontology. When Whitehead pushes his "sense of causation," he wants to justify belief in "causal derivation" without resorting to hypothesis, but rather to vague intuition. I submit that his speculative philosophy could advantageously incorporate the precise speculation that the temporal succession of occasions is all there is to the natural world. He goes beyond empiricism anyway, leveraging scientific knowledge that has been obtained by the hypothetico-deductive method, which is informed speculation. His vaguer and vaguer intuitions as to the causal derivation of our sense data quickly dwindle to nothingness in any case, at which point he resorts to textbook physiology. He might as well drop his sticking point with Hume regarding the epistemology of causal derivation, and rely solely upon the founding ontological premise of temporal-causal succession to justify his belief that there are external causes to our phenomenal sensory data.

This doctrine of sense-organs has a vague, general truth, very important for practical affairs. In particular all exact scientific observation is derived from such data. The scientific categories of thought are obtained elsewhere. ...

Such experience seems to be more particularly related to the activities of the brain. But how far an exact doctrine can be based upon this presumption lies beyond our powers of observation. We cannot determine with what molecules the brain begins and the rest of the body ends. Further, we cannot tell with what molecules the body ends and the external world begins. The truth is that the brain is continuous with the body, and the body is continuous with the rest of the natural world. Human experience is an act of self-origination including the whole of nature, limited to the perspective of a focal region, located within the body, but not necessarily persisting in any fixed coordination with a definite part of the brain. -- Philosophic Method, Section VI

Whitehead published *Adventures of Ideas* in 1933, before the cortical homunculi were discovered in 1950. The series of human occasions is obviously intended by Whitehead to serve as the dominant monad of the human body, supporting our beliefs that we are sentient agencies with efficacy over our gross bodily behavior. The motor homunculus of the cortex is the obvious region of the brain where such bodily control function is afforded. That region is home to the immediate successors of human occasions, when I am exercising volitional control of my bodily behavior. Other patches of cortex have been mapped out for the various sense modalities, and these supply the human occasions with predecessors, which provides the feedback for the motor control. (Whitehead's "Transmutation" enters in at this point, if I read him correctly.) If this is correct, then the human series *does* persist

in fixed coordination with definite parts of the brain. It also persists at a regular frequency (indications are 10 Hz,) since that is a practical requirement for one subsystem to synchronize and control subordinate functions. All that's needed for a coherent account of such mind-brain interaction is the founding hypothesis that temporal succession of occasions is all there is to the brain.

This consideration is the basis of Bradley's objection that relations do not relate. Three towns and an abstract universal are not three connected towns. A doctrine of connectedness is wanted. Bradley writes "Is there, in the end, such a thing as a relation which is merely between terms? Or, on the other hand, does not a relation imply an underlying unity and an inclusive whole?"

Bradley's "inclusive whole" is the connectedness of which we are in search. Throughout this chapter Bradley uses the term Feeling to express the primary activity at the basis of experience. It is experience itself in its origin and with the minimum of analysis. The analysis of Feeling can never disclose anything lying beyond the essence of the occasion of experience. Hence Bradley terms it "non-relational." There are of course grave differences between my own doctrine and that of Bradley. ...

...It is interesting to make a few citations from Bradley, illustrating my general adherence to his doctrine of Feeling, as expressed in his Chapter. "In my general feeling at any moment there is more than the objects before me, and no perception of objects will exhaust the sense of a living emotion." -- Philosophic Method, Section XI

Relations connect their relata, and that's a simple doctrine of connectedness. An instance of the successor relation connects two instances of "occasion." "Occasion" is the universal type of the individuals that found temporal succession. That universal type has its instances, or "particulars." "Successor relation" is the universal type of the relations that connect one occasion to another. Each primitive type of the ontology-- occasion and successor relation-- has its universal character and its particular instances. Particular successor relations (physical prehensions) connect particular occasions together, and the chaining of such connections is responsible for the all-connectedness of this particular universe, which is an inclusive whole.

You can contemplate "the occasion" in isolation from its physical prehensions, or together with its physical prehensions, for more context. In isolation, you understand privacy and presentational immediacy. With the context of physical prehensions included, you understand causal derivation and social connectedness. The two ways of contemplating complement one another, so I see no use for contention about whether relations are internal-versus-external.

Contemporary occasions are of the highest importance. The space-like separation of contemporaries is, on a purely causal theory, a measure of the causal isolation of one contemporary to another. There are no

quanta-- no physical prehensions-- connecting two contemporaries, one to another. Such causal isolation, referring to a lack of any real, connecting, time-ordering relations among contemporaries, is used by Whitehead to define "contemporaries." The genius of the idea is to use the contemporaries, thus defined, to satisfy Special Relativity in the simplest logical way-- by eliminating instantaneous spatial relations as anything real at all. Contemporaries are causally connected by tracing their lineage to common causal ancestors and common causal descendants, so they are connected without the aid of instantaneous spatial relations, which are thus eliminable. A 4-dimensional manifold is thus obtained which is homogeneous in a single parameter, time. Once particles and their relative motions are defined from that single parameter, you wind up with a velocity limit for those motions. So the limiting velocity is entailed by the reduction to time, and no axiom is required for postulating a velocity limit. That is the logical advantage of the event ontology over Einstein's formulation of dual-parameter "space-time."

The fewer the assumptions the better. With forking-and-converging temporal sequence forming a causal web, and with spatial distance replaced in principle by degree of causal isolation, we can proceed with confidence in navigating the 3-dimensional space-like world at the pace we are used to. The theoretical particles we never saw before can now be replaced by repetitious causal sequences, which will likewise never be seen. One model of invisible entities is replaced by another. The particle-like sequences are enmeshed in the wide range of frequencies that constitute our system of temporal succession. The scheme is as simple as the concept of an arrow diagram-- "the arrow diagram of the universe." The persistence through time of matter and matter-arrangements in a 3-D spatial world, is described instead as massive time systems of high frequency, propagating in parallel in the 4-D manifold. Such re-creation of pattern, via sheer temporal succession, is too quick for the slow pace of human perception or reaction. We can feel all the more secure about the 3-D Newtonian space of practical life, as a convenient fiction for slow beings, that is well explained by a simple ontology of individuals engaged in temporal succession.

The particle constructions that I've made, and the structural definition of energy in terms of relative frequencies, cause me to believe that all moments (all occasions) of this universe are consistently ordered into one specific structure of temporal succession which obeys chronology protection. Temporal succession is an accretion of new moments onto accumulated past moments. The primitive fact of temporal succession is the connection of one moment to another by a substantial step of time, or step of causal influence. In developing the physics, the interpretation of the hypothetical primitives-- the moments plus the ordering links that connect them-- can be deferred and consigned to subsequent metaphysical analysis. In that case, it is only the restricted topic of the structure of time-ordered generic individuals that concerns the physicist as physicist. That accounts for the formal nature of the physics, for which the notation of an ordered pairing denotes the primitive fact of physics,

and the rest of theoretical physics is confined to the combinatorics of ordered pairs, in order to model entities and account for the empirical data of experimental physics.

Without going into Whitehead's distinction between pure and hybrid physical prehensions, let me sidestep such thoughts and use the term "inheritance" as a way to combine pure and hybrid into one category. Any of my arrow diagrams can be called an "inheritance map," supposing that each arrow depicts an inheritance by the later occasion of something belonging to, and passed on by, the earlier occasion. To me, there is nothing "physical" to be passed from one occasion to another, since the physics is already exhausted by the bare inheritance map itself. There is only the "feeling content"--phenomenal data-- to be passed.

I will add a point about "action at a distance" as it applies to this theory. All distance in my theory is temporal distance, just as the light-year is a span of time. And the primitive action in my theory is the quantum of action. Each quantum has a relative time span with respect to any other-- a time span which is, in every case, non-zero. Thus, every action is "action at a distance," since the action is between two moments that have a time span, or temporal distance, between them. The time span may be a pico-second or it may be a light-year. The causal link, or quantum, while connecting one occasion to another, logically implies their separation too, as distinct occasions. So the closest possible connection in my theory, the quantum of action, which defines the contiguity of two occasions, represents, ironically, action at a distance.

Most people still believe in, and think in terms of, a space-time continuum supporting calculus and differentiable smoothness. That makes it hard, for the layman at least, to understand what dimensionality is. Secondly, it's difficult with a dimensional continuum to not envisage the whole continuum as one inviolable "rubber sheet" of uniform dimensionality. When further dimensions were needed to model the nucleus, we heard that these extra 6 or 7 dimensions were "curled up" within individual locations of the 4-D continuum. I doubt whether Whitehead would have tolerated that any better than he liked Einstein's "curved space." I have a philosophical intuition-- no more than that-- about mathematics and its use of infinity. I think that any area of mathematics that employs infinity has, at its core, a finite version on which it is based. So with dimensionality, I think it must be understood in terms of a finite case, and understood well, before one can hope to understand what the dimensionality of a continuum might mean.

My theory has no continuum. I constructed an extendable 4-D time lattice using arrows, such that each location in the lattice is at the intersection of four time axes. So that, I say, represents a discrete 4-D manifold. The ordering relation of the manifold is the temporal successor pairing-relation. The relata of the pairing relations are momentary events (or just plain "moments") which I conceive as actual entities, or occasions of experience. In itself, an occasion has no dimensionality. As point-like primitives of temporal structure, occasions do anchor relations that form four-dimensional regions.

There is no extension, either spatial or temporal, to a single occasion. The 4-D patterns of temporal succession do have finite extension (strictly temporal extension,) and they are extendable further without limit, but it's not the occasions that have any extension or dimensionality of their own. Dimensionality is a structural feature, and an occasion is like a dimensionless point, pinioned between its incoming and outgoing causal relations, in the context of a 4-D manifold. Thus any occasion has specific location in a 4-D region, but zero extent in that region, like a momentary point in time.

Descartes was resistant to the idea that mental experience, or the mind, could have spatial extent, and he used that intuition to demarcate the mental from the physical. When Whitehead bestows 4-dimensional extent upon his occasions, that strikes me as the application of a physical attribute to what is otherwise a purely mental entity, the occasion. I fear that Whitehead is "cheating" here, in the sense that Descartes did not cheat, in sorting out mental from physical. I took my theory from a passage in *Adventures of Ideas*, where Whitehead lays out an alternative to his earlier "extensive abstraction." With the later approach, occasions can be conceived as purely mental entities, having no intrinsic physical attributes whatever. That, to me, is the antidote to "dualism all the way down," and a true reduction of the physical to the mental-- a true panpsychism.

The 4-D time lattice I propose has space-like relations among contemporary moments, relations which are compounded of primitive time-ordering relations. The space-like relations afford pseudo-geometry. The pseudo-geometry accounts for Newtonian physics, which is subsumed by the foundation of sheer temporal succession.

Differences between the old and new physics

The absence of any spatial states in the theory means that there is no "collapse to a state" as there is in mainstream theory, which is based on instantaneous spatial relations. Besides that, there are no continuous waveforms in the new theory that need collapsing. (Frequency and wavelength values are obtained from discrete causal set constructions.) Symmetry, as the only organizational principle that applies to causal sets, assumes the role that "forces" have conventionally played in physics. Laws are regularities of structure, typified by the impressive longevity of a proton as a good example of law-like behavior. Finally, quantum behavior is thoroughly orderly, as Einstein insisted, rather than chaotic. The uncertainty principle arises from asking the wrong questions of Nature. That is to say, parameter values such as "mass" are features defined by structural arrangements of multiple quanta, so it makes no sense to expect such values to be localized any more tightly than to the extended region of the pertinent quanta arrangement that suffices to define the parameter value.

Arithmetic applied to the causal set constructions is used to derive basic constants such as 137 and 1836. Higher mathematics, often the starting point in mainstream theory, is too general to obtain such constants.

