Whiteheadian Physics: Its Implications for Time, Consciousness, and Freedom

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There have been countless discussions of the implications of modern physics, especially quantum physics, for various issues of importance to philosophy of religion and theology. These issues have included problems involving time, consciousness, and freedom.

With regard to time, it has been widely argued that modern physics shows time as we experience it---with its distinctions between the past, the future, and the present---to be ultimately unreal.

With regard to consciousness, it is widely thought that any philosophy of mind, to be compatible with modern physics, must regard conscious experience as a nonefficacious byproduct of the brain's subatomic particles.

With regard to freedom, it is widely thought that any understanding of reality based on modern physics must rule out the possibility that our decisions could really involve self-determination.[1]

In the light of these supposed implications of modern physics, it is widely assumed that a worldview that takes physics seriously is necessarily a worldview that contravenes the worldviews presupposed by the world's religions in general and the biblically based religions in particular.

In reality, however, none of these implications follows from physics as such. Rather, in every attempt to derive philosophical and religious implications from physics, the "physics" in question is not "pure physics," in the sense of ideas that have been experimentally verified. Rather, the physics is always *physics as interpreted from some particular philosophical perspective*. Accordingly, physics as interpreted from a *different* philosophical perspective might have radically different implications. The point of the present lecture is to show that physics as interpreted in terms of Whitehead's philosophy rejects all three of the so-called implications of physics just mentioned.

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[1] This statement may be surprising in light of the fact that quantum indeterminacy has been widely hailed in popular thought as opening the way for a reaffirmation of human freedom and hence moral responsibility. The dominant understanding among philosophers of mind, however, is that quantum physics, properly understood, implies determinism at the human level as fully as did classical physics.

The basic reason for these radically different conclusions is that Whiteheadian physics replaces the materialistic view of nature, which has been presupposed in conventional discussions of the implications of quantum physics,[2] with a panexperientialist view.

According to the materialistic view, the ultimate constituents of nature are devoid of at least five characteristics that characterize our own experience: temporality, experience, intrinsic value, internal relations, and even the slightest capacity for self-determination.

According to Whitehead's a panexperientialist worldview, the ultimate units of nature are experiential, value-realizing, internally related, partially self-determining events.

In the remainder of this lecture, I will explain how Whiteheadian physics leads to conclusions about time, consciousness, and freedom that differ radically from the implications that have widely but falsely been thought to follow from physics as such.

1. Physics and Time

I will begin by explaining why physics, interpreted in terms of a materialist view of nature, has been thought to support the ultimate unreality of time.

Three Features of Experienced Time

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[2] *This "materialistic view of nature" does not necessarily imply a materialistic view of the world as a whole or of human beings in particular. Many thinkers with a materialistic view of nature have a* dualistic *view of human beings, according to which the human mind or soul is a reality different in kind from the material stuff comprising nature and hence the human body. Many of these thinkers, moreover, extend this dualistic view at least part way down the animal kingdom. But these dualists share with materialists the view that at least the lowest level of the world---the level studied by physics, chemistry, and at least most of biology---is to be understood in purely materialistic terms.*

In speaking of time, I am referring to *experienced* time, which can be characterized in terms of three features: asymmetry, constant becoming, and irreversibility in principle.

Asymmetry means that the relation of the present to the past is different in kind from the relation of the present to the future. We express this difference by saying that whereas we *anticipate* the future, we *remember* the past. The past, we take for granted, is completely settled: If something happened, nothing we do now can change that fact. We presuppose, by contrast, that the future can still be shaped by present decisions. Whereas the past is settled actuality, the future involves potentiality to be settled. The present---the "now" between the past and the future---is the time in which potentialities are being settled.

The statement that time involves *constant becoming* refers to the fact that this "now" does not stand still. Rather, it always divides a different set of events into past and future.

To say that time is *irreversible in principle* means that a series of events could not conceivably turn around and go in the opposite direction. Events in my past could not be in my future.

Time as we experience it clearly involves asymmetry, constant becoming, and irreversibility.

These Features as Undetected by Physics

However, it has widely been agreed, time characterized by these three features is not detected by physics.[3]

It is often said, to be sure, that time is provided by thermodynamics, with its law of entropy, according to which organized systems gradually increase their entropy---that is, become more disordered. The differences in the entropy of successive states means that the order of events when read off in one direction will be distinguishable from the order when read off in the other direction. The result is a kind of time called

[3] I am ignoring a couple possible exceptions to this claim. For one such exception, see P. Weiss, "Time Proves Not Reversible at Deepest Level," *Science News* 154 (October 31, 1998): 277. I ignore these exceptions because they have not significantly affected the consensus that physics does not provide a basis for asymmetrical, irreversible time.

"anisotropic," which simply means "not isotropic," because the direction of measurement makes a difference.

However, although thermodynamic entropy is widely said to provide "time's arrow," the time in question has virtually nothing in common with experienced time, because it involves no distinction in kind between "past" and "future." The order of events as measured by increasing entropy does *in fact* go from the past to the future. But the order of the events, it is said, could in principle go in the opposite direction, so that the entropy would *decrease* with time. Thermodynamics does not, therefore, provide any categorical distinction between past and future. As Kenneth Denbigh puts it: "although thermodynamics finds the two directions of time to be distinguishable, it does not display the one direction as being in any sense "more real" than the reverse direction."[4]

If one direction is not more real, moreover, it would seem that it would be possible for things to go in the other direction. Richard Feynman, in fact, wrote that "irreversibility is caused by the general accidents of life. . . . Things are irreversible only in a sense that going one way is likely, but going the other way . . . is possible . . . according to the laws of physics."[5]

Time in this reversible sense is different in kind from time as we experience it. This point is brought out by Denbigh's statement that "[m]ental processes display irreversibility of a kind not shown by physical processes--that is, in the sense that it is not conceivable that they could ever occur in the reverse temporal sequence."[6]

Besides not being characterized by asymmetry and irreversibility, moreover, the time of physics is also devoid of the constant becoming that characterizes time as consciously experienced. "[P]hysics," says Paul Davies, "has shifted the moving present

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[4]Kenneth G. Denbigh, *Three Concepts of Time* (New York: Springer, 1981), 167. Denbigh's statement continues: ". . . The question, 'Which direction along the *t*-coordinate is the real direction?' just doesn't arise in physical science."

[5]Richard Feynman, *The Character of Physical Law* (Cambridge: MIT Press, 1965), 112.

[6]Kenneth G. Denbigh, *An Inventive Universe* (New York: Braziller, 1975), 39. P.J. Zwart has likewise said: "One thing is quite inconceivable: that we could perceive a later event before an earlier one. . . . This kind of proposition is self-contradictory, that is to say, time reversal in this sense is *logically* impossible. Reversal of the entropic ordering is not logically impossible, however" ("The Flow of Time," in Patrick Suppes, ed., *Space, Time, and Geometry* [Dordrecht, Holland: Reidel, 1973], 131-56, at 144.

out from the superstructure of the universe, into the minds of human beings, where it belongs."[7]

Time as Unreal for the Entities Studied by Physics

As Davies' statement suggests, the failure of physics to detect time as we experience it has led to the conclusion that time in this sense simply does not exist for the entities studied by physics. And since time characterized by asymmetry, constant becoming, and irreversibility is what we mean by "time," this conclusion really means that time simply does not exist for the entities studied by physics.

But if that be the case, where does time exist? Davies says that it exists in "the minds of human beings." But what does that mean?

The Dualistic View

One possible meaning is that ours is a dualistic world, one part for which time is real, another part for which it is unreal.[8] This idea, however, creates at least three serious problems.

One problem is how these two parts of the world could interact. We know that our minds do interact with the world studied by physics, because the molecules constituting the brain both influence, and are influenced by, our thoughts, feelings, and decisions. But how could things for which time does not exist interact with things for which time is real?[9]

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[7] Paul C. W. Davies, *The Physics of Time Asymmetry* (Berkeley: University of California Press, 1976), 2.

[8]One possible answer to the question of how such a world could have come about would be to say that God simply created the world this way, with minds, for which time exists, and matter, for which it does not. Now that scientists accept an evolutionary account of our world, however, dualists about time generally consider it an *emergent* reality, which arose at some point in the evolutionary process. This latter position has been articulated most fully by J. T. Fraser in *The Genesis and Evolution of Time: A Critique of Interpretation in Physics* (Amherst: University of Massachusetts Press, 1982).

[9]It was partly Henri Bergson's later realization that his first book, *Time and Free Will* (1889), contained this insoluble problem that led to his new view of matter in *Matter and Memory* (1896), which overcame his earlier stark contrast between matter and mind. This development in Bergson's thought influenced the later thought of William James (see Milic Capek, *The New Aspects of Time: Its Continuity and Novelties: Selected Papers in the Contemporary Philosophy of Science*, ed. Robert S. Cohen [Dordrecht/Boston: Kluwer Academic Publishers, 1991]). Then Whitehead was influenced on this point by James as well as directly by Bergson. Accordingly, Bergson's move in *Matter and Memory* to what Capek calls

A second problem is how things for which time is real could have emerged out of things that are completely timeless.

A third problem is that the very idea that time emerged in the evolutionary process is self-contradictory, because the notion of evolution itself presupposes time.[10]

Time as an Illusion

More popular than this dualistic view, at least among well-known thinkers, has been the inference that if time does not exist for physics, it does not exist period. This inference has been expressed by Henry Mehlberg's book *Time, Causality, and Quantum Theory,* in which we read: "[I]t would be either a miracle or an unbelievable coincidence if all the major scientific theories . . . somehow managed to co-operate with each other so as to conceal time's arrow from us. There would be neither a miracle nor an unbelievable coincidence in the concealment of time's arrow from us only if there were nothing to conceal--that is, if time had no arrow."[11]

According to this view, the statement that time exists only in our minds means that it is an illusion.[12] This view was endorsed by Einstein, who said, famously: "For us believing physicists, the distinction between past, present and future is only an illusion, even if a stubborn one."[13]

One of the best-known statements of this position was provided by physicist Louis de Broglie, who said: "In space-time, everything which for each of us constitutes the past, the present, and the future is given in block . . . . Each observer, as his time passes, discovers, so to speak, new slices of space-time which appear to him as

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"temporalism" can be considered a crucial step in the trajectory that led to process philosophy in the Whiteheadian sense.

[10]As Fraser himself admits, "there is no noncontradictory way in which to state that time evolved in time." See J. T. Fraser, "Out of Plato's Cave: The Natural History of Time," *Kenyon Review* 2 (Winter 1980), 143-62, at 147.

[11]Henry Mehlberg, *Time, Causality, and the Quantum Theory I: Essay on the Causal Theory of Time,* ed. Robert S. Cohen (Dordrecht: Reidel, 1980), 207.

[12]Davies endorses this view in speaking of "the apparently illusory forward flow of psychological time," *The Physics of Time Asymmetry*, 22.

[13]Quoted in Banesh Hoffman (with Helen Dukas), *Albert Einstein: Creator and Rebel* (New York: Viking Press, 1972), 258.

successive aspects of the material world, though in reality the ensemble of events constituting space-time exist prior to his knowledge of them."[14]

This position has led some interpreters to argue that the Western, biblically-based worldview, which regards time and thereby the historical process as ultimately real, is undermined by modern physics, which instead supports certain Eastern worldviews. In *The Tao of Physics*, Fritjof Capra argued that modern physics, with its complete symmetry between past and future, teaches the same lessen as Hua-Yen and Zen Buddhism, which speak of the mutual interfusion of past, present, and future.[15] Essentially the same message is conveyed by Gary Zukav in *The Dancing Wu Li Masters*, who like Capra quotes de Broglie to support the idea that time is an illusion.[16]

This view, that we in the present moment are related to the future and the past in a symmetrical way, has some startling implications. One of these is that we should be able to remember the future. Lewis Carroll expressed this view whimsically by having the White Queen say to Alice: "It is a poor memory that remembers only backwards." Bertrand Russell echoed this idea---evidently *without* tongue in cheek---by saying: "It is a mere accident that we have no memory of the future."[17]

Another counter-intuitive implication is that the idea of making free decisions, through which we bring about a future different from what might have been, is an illusion. We should neither be praised nor criticized for our actions. We have all simply done what it has been true from all eternity that we were to do.

Is Another Solution Possible?

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[14]Louis De Broglie, "A General Survey of the Scientific Work of Albert Einstein," in P. A. Schilpp, ed., *Albert Einstein: Philosopher-Scientist* (La Salle: Open Court, 1949), 107-27, at 113.

[15]Fritjof Capra, *The Tao of Physics: An Exploration of the Parallels between Modern Physics and Eastern Mysticism* (Boulder: Shambhala, 1975), 179. For an excellent comparison of Hua-Yen Buddhism with Whitehead's philosophy on precisely this point, see Steve Odin, *Process Metaphysics and Hua-yen Buddhism: A Critical Study of Cumulative Penetration vs. Interpenetration* (Albany: State University of New York Press, 1982).

[16]Gary Zukav, *The Dancing Wu Li Masters: An Overview of the New Physics* (London: Rider/Hutchinson, 1979), 236, 237, 238.

[17]Bertrand Russell, *Our Knowledge of the External World* (London: Allen & Unwin, 1921), 23.

Given the radically counter-intuitive implications of this position, we should hope the problem of the relation of physics to time has a better solution. And it does. Instead of trying to assimilate experienced time to the limited kind of time provided by physics, we could reinterpret the world of molecules, atoms, and subatomic particles in light of time as we experience it. This reinterpretation could be justified, in part, by saying that physics, as a discipline, abstracts from the full nature of the entities it studies.

This solution was suggested in a 1937 book, *Time and Its Importance in Modern Thought*, by Mary Cleugh.[18] Remarking that "[a] fundamental feature of time as experienced is its irreversibility," she pointed out that the physicist's variable "t" abstracts from this irreversibility.[19] She then added that although this "t" is a legitimate abstraction when it is restricted to the purpose of physics, which merely concerns measurement, it becomes a falsifying abstraction when it is taken to be a metaphysical truth about the very nature of time, with which physics has no concern.[20]

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[18]Mary F. Cleugh, *Time and Its Importance in Modern Thought* (London: Methuen, 1937), 49-51.

[19]In explaining the extent of the abstraction involved, Cleugh quoted A. A. Merrill's statement that "*t,* while created originally from our direct experience with real time, is subsequently handled in a way that has no relation to real time at all" (quoting A. A. Merrill, "The *t* of Physics," *Journal of Philosophy* 19/9 [April 1922]: 238-41, at 240).

[20]More recently, Nathaniel Lawrence, who was influenced by Whitehead, made the same point. Pointing out that physics is concerned exclusively with measurement, he says that it is perfectly legitimate, for this purpose, for physicists to abstract from time's passage, its cumulative character, and its absolute difference from spatiality, and thereby to represent time as space. However, Lawrence added, this abstraction, while legitimate for the purpose of measurement, has become dangerous, due to the great success of physics: "The great danger in . . . restricted enterprises is success. Success in one's own particular practice convinces him that he has got his hands on the primary reality. And therefore the more he will argue that other visions of reality are best tested by one's own particular discipline." But, Lawrence argued, "measurement is almost as hopelessly partial as an approach to reality [as a whole] as is the marketing of peas." See "Time Represented as Space," in Eugene Freeman and Wilfrid Sellars, ed., *Basic Issues in the Philosophy of Time* (La Salle: Open Court, 1971), 123-32, at 123-24, 129. From the perspective of Cleugh and Lawrence, then, the fact that physics does not detect asymmetrical, irreversible, constantly becoming time is simply irrelevant to the question of whether time in this full sense is real for the entities studied by physicists. This suggestion would, of course, be rejected by positivists, who believe that science, especially physics, provides the only route to truth. Hans Reichenbach, for example, said: "There is no other way to solve the problem of time than the way through physics. . . . If time is objective the physicist must have discovered the fact. If there is Becoming, the physicist must know it. . . . If there is a solution to the philosophical problem of time, it is written down in the equations of mathematical physics" (Hans Reichenbach, *The Direction of Time* [Berkeley: University of California Press, 1956], 16). Reichenbach's statement, however, ignores Cleugh's and Lawrence's point, which is that physicists may, for their limited purposes, have abstracted from certain features of atoms and subatomic entities that make time real for them.

It was this approach that was taken by Whitehead. The idea that time is unreal for what we call the physical world results from what he called "the fallacy of misplaced concreteness," which involves the "error of mistaking the abstract for the concrete" (SMW 51).

Panexperientialism and Pantemporalism

The primary example of this fallacy is the idea that the things studied by physicists are "vacuous actualities," meaning entities that are fully actual and yet "void of subjective experience" (PR 167).

It is this idea that leads to the idea that time, besides being undetected by physicists, is in fact unreal for the entities studied by them. If electrons and atoms are simply bits of matter, with nothing even remotely analogous to our experience, then they have nothing even remotely analogous to our memory and anticipation, through which we distinguish the present "now" from the past and the future. Accordingly, for electrons and atoms there would be nothing remotely analogous to our experience of constant becoming, with its ever-changing "now." Also, the only relations that could exist between vacuous actualities are purely external relations, so that interactions between them would involve nothing analogous to our memory, in which our present experience is internally qualified by prior events. There would, therefore, be nothing to make the succession of events irreversible.

But if electrons and atoms consist of experiential, internally related events, then the situation is entirely different. According to Whitehead's panexperientialism, an enduring individual, such as an electron or an atom, is not a single actual entity enduring through time. It is a temporally ordered *society* of actual entities. These actual entities are events, called "actual occasions." Each actual occasion is an "occasion of experience." Each occasion of experience, whether electronic, atomic, or human, begins by "prehending" prior events, which means taking aspects of them into itself. Each occasion ends with an anticipation of causally influencing subsequent events.

Accordingly, time's asymmetry, which is based on memory and anticipation, exists for electrons and atoms as well as for dogs and human beings. Likewise, our experience of constant becoming, in which the present "now" always divides a different

set of events into past and future, would not be completely absent for electrons and atoms. And finally, the fact that the past occasions, in exerting causal influence on the present occasions, are prehended into those occasions makes the temporal process irreversible. In Whitehead's words: "This passage of the cause into the effect is the cumulative character of time. The irreversibility of time depends on this character" (PR 237). Accordingly, just as it is inconceivable that the temporal order of our experience could be reversed, so that past events could be in our future, such reversal is also inconceivable for the entities studied by physics.[21]

It is important to realize that physics as such neither affirms nor denies panexperientialism. In Whitehead's words: "In physics there is abstraction. The science ignores what anything is in itself. Its entities are merely considered in respect to their extrinsic reality" (SMW 153). It is only when physics, based on this abstraction, is turned into metaphysics, by means of the fallacy of misplaced concreteness, that we get the idea that the entities studied by physics are vacuous actualities. To commit this fallacy is to ignore the truism, stated by Whitehead, that "an abstraction is nothing else than the omission of part of the truth" (MT 138).

The truth in relation to this issue, Whitehead maintained, is that experience goes all the way down, to the ultimate units of which our world is composed. And if that is the case, then so does time. Panexperientialism implies pantemporalism. We need not, therefore, waste time on the insoluble problems created by the assumption that time does not exist for the level of nature studied by physicists.

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[21] *According to the conventional view, time does not exist for individual electrons or atoms because, given the materialistic view of nature, those entities have no relations within or between themselves that would establish asymmetry and irreversibility. Insofar as there is something even analogous to time---namely, anisotropy---it exists only by virtue of complex systems subject to entropy. As Paul Davies has put it: "Nothing yet discovered in nature requires individual atoms to experience time [anisotropy], the very essence of which is the collective quality of complex systems" (*The Physics of Time Asymmetry*, 4). Although Davies referred in this passage to "time asymmetry," he used this term here and throughout his book for what most others call mere "anisotropy."*

2. Physics and Consciousness

I turn now to the problem of consciousness, which can be stated as the question of how the existence of our conscious experience is compatible with the world as revealed by the physical sciences. The main presupposition behind this problem, called both "the mind-body problem" and "the problem of consciousness," is the assumption that the body is composed of matter that is insentient, meaning wholly devoid of experience. In a book entitled *The Problem of Consciousness*, for example, Colin McGinn says that the problem is how "the aggregation of millions of individually insentient neurons [constituting the brain could] generate subjective awareness."[22]

The Failures of Dualism and Materialism

Given that assumption about our bodily components, there are two possible positions: materialism and dualism. Philosophers representing these two options have been working on the problem since Thomas Hobbes and René Descartes---representing materialism and dualism, respectively---struggled with it in the 17th century.

Contemporary materialists and dualists are, however, no closer to a solution. McGinn, writing from a materialist standpoint, has said that the problem of the rise of consciousness is not merely a problem; rather, it is a mystery, which "we cannot resolve."[23] Geoffrey Madell, a contemporary dualist, admits that "the appearance of consciousness in the course of evolution must appear for the dualist to be an utterly inexplicable emergence."[24]

The reason this problem is insoluble in principle, as McGinn points out, has been stated classically by Thomas Nagel. Using the French term *en soi* for a being that exists merely "in itself" and *pour soi* for one that exists "for itself," Nagel wrote: "One cannot derive a *pour soi* from an *en soi*. . . . This gap is logically unbridgeable. . . . [A]

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[22]Colin McGinn, *The Problem of Consciousness: Essays Toward a Resolution* (Oxford: Basil Blackwell, 1991), 1.

[23] Ibid., viii; see also 19, 85, 45, 213.

[24] Geoffrey Madell, *Mind and Materialism* (Edinburgh: The University Press, 1988), 140-41.

conscious being . . . [cannot be created] by combining together in organic form a lot of particles with none but physical properties."[25]

Some scientists and philosophers have thought otherwise, arguing that the emergence of experience out of nonexperiencing entities is simply one more example of the not uncommon phenomenon of emergence, in which the combination of two things, each of which is devoid of a certain property, results in the emergence of something *with* that property. For example, neither hydrogen nor oxygen has the property of liquidity or solidity. When they are combined into H_20 molecules, however, liquidity emerges, and when this water is frozen, solidity emerges. "Consciousness is a higher-level or emergent property of the brain," argues John Searle, "in the . . . [same] sense."[26]

However, as some of Searle's fellow materialists have pointed out, his analogy is invalid, because the examples are actually different in kind.[27] One way to state this difference is to point out that liquidity and solidity are features of things *as they exist for our sensory perception*, whereas experience is a feature of things *as they exist for themselves*. In other words, the emergence of liquidity or solidity is the emergence of a new kind of experienced property. It is hence different in kind from the alleged emergence of an experiencing entity out of entities wholly devoid of experience. The latter kind of alleged emergence---of subjects, with an inside, from mere objects, with nothing but outsides--hence remains absolutely unique, with no analogy.

We are left, therefore, with the fact, acknowledged by Nagel, McGinn, and Madell, that if we accept the assumption that the ultimate units of nature are vacuous actualities, wholly devoid of experience, the emergence of conscious experience is inexplicable.

The seriousness of this problem is illustrated by McGinn's statement that the transition from insentient matter to things with "an inner aspect" could be effected only by a supernatural deity. In McGinn's words, "only a kind of miracle could produce *this*

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[25] Thomas Nagel, *Mortal Questions* (London: Cambridge University Press, 1979), 188-89.

[26] John R. Searle, *The Rediscovery of the Mind* (Cambridge: MIT Press, 1992), 14.

[27] McGinn, *The Problem of Consciousness,* 79n.; William Seager, *Metaphysics of Consciousness* (London & New York: Routledge, 1991), 179.

from *that*. It would take a supernatural magician to extract consciousness from matter, even living matter."[28] But McGinn holds that any appeal to a supernatural agent is unacceptable.[29] Whitehead agreed, rejecting any "appeal to a deus ex machina . . . capable of rising superior to the difficulties of metaphysics" (SMW 156).

Panexperientialism and Consciousness

If we agree that an answer, to be philosophically and scientifically acceptable, must not presuppose supernatural intervention, then there is only one way to dissolve the mind-body problem. We must abolish the idea of vacuous actuality, on which both dualism and materialism are based, in favor of panexperientialism.[30]

Panexperientialism makes the emergence of consciousness conceivable because what needs to be explained is not the emergence of experience out of nonexperiencing entities but merely the emergence of conscious experience out of nonconscious experience.

As that statement implies, Whitehead did not equate consciousness and experience. Rather, he famously said, "consciousness presupposes experience, and not experience consciousness" (PR 53). Most experience is, in fact, not conscious, because consciousness is a very high-level type of experience.[31]

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[28]McGinn, *The Problem of Consciousness*, 45. Richard Swinburne has, in fact, based an argument for a supernatural deity on this basis, saying: "[S]cience cannot explain the evolution of a mental life. That is to say, . . . there is nothing in the nature of certain physical events . . . to give rise to connections to [mental events]. . . . God, being omnipotent, would have the power to produce a soul" (*The Evolution of the Soul* (Oxford: Clarendon, 1986), 198-99).

[29] McGinn, *The Problem of Consciousness*, 47.

[30]Indeed, even McGinn agrees, saying that it would be "easy enough to see how neurons could generate consciousness" if we could suppose them to have "proto-conscious states" (ibid., 28n.). McGinn even quotes (81) a passage showing that Kant realized that panexperientialism, which he knew in its Leibnizian-Wolffian form, could overcome the chief difficulty in understanding the communion of body and soul. "The difficulty peculiar to the problem consists," suggested Kant, "in the assumed heterogeneity of the object of inner sense (the soul) and the objects of the outer senses. . . . But if we consider that the two kinds of objects thus differ from each other, not inwardly but only in so far as one appears outwardly to another, and that what, as thing in itself, underlies the appearances of matter, perhaps after all may not be so heterogeneous in character, this difficulty vanishes" (Immanuel Kant, *Critique of Pure Reason,* trans. Norman Kemp Smith [New York: St. Martin's, 1965], 381 [B428]).

[31] "[C]onsciousness is the crown of experience, only occasionally attained" (PR 267). Consciousness is to be equated not with experience as such but only with experience that involves knowing (SMW 144, 151). Put otherwise, consciousness involves an awareness of what *is* in contrast with what *is not* (PR 161, 243).

The task, therefore, is to explain how conscious experience could have evolved out of subatomic entities that must, by comparison, have only a very low level of experience.

The Emergence of Consciousness

Many discussions of this problem, often under the heading of "the physics of consciousness," assume that the task of explaining the rise of conscious experience is a task for the physicist as such. These discussions are extremely reductionistic, presupposing that conscious experience somehow emerged directly out of subatomic particles, perhaps as organized into atoms and ordinary molecules. This presupposition is embodied in the program known as Hard AI (Artificial Intelligence), which holds that there is no reason in principle why computers built out of ordinary molecules could not be conscious.

According to Whiteheadian panexperientialism, by contrast, conscious experience presupposes a long evolutionary development, during which many levels of actualities emerged, paving the way for the emergence of very high-level actualities with the capacity for conscious experiences.

This notion of various levels of actualities involves a distinction between two different ways in which temporally-ordered societies can be spatially ordered. They can, on the one hand, be organized so as to produce an aggregational society, which can neither experience nor act as a whole. Sticks and stones are obvious examples. Although each of a stone's individual molecules has experience, the billions of molecular experiences do not give rise to a higher-level experience. The stone as such has no experience.

On the other hand, the various temporally-ordered societies can be organized so as to result in the emergence of higher-level experiences, thereby producing a compound individual.[32] To say that this compound entity is an individual means that it, in each moment, can experience and act as a unit.[33]

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[32] See Charles Hartshorne, "The Compound Individual," in Otis H. Lee, ed., *Philosophical Essays for Alfred North Whitehead* (New York: Longmans Green, 1936), 193-220; reprinted in Charles Hartshorne, *Whitehead's Philosophy: Selected Essays 1935-1970* (Lincoln: University of Nebraska Press, 1972), 41-61.

From this perspective, even some extremely low-level entities would be compound individuals. For example, electrons, protons, and neutrons would seem to be compound individuals, arising out of quarks. This notion is fully consistent with quantum physics, according to philosopher William Seager, who says: "Quantum wholes are not just the sum of their parts."[34] Higher examples would be atoms, molecules, and macromolecules. Still higher-level examples would be bacteria and other prokaryotic cells, in which the new level of actuality consists of "living occasions." Higher yet would be eucaryotic cells and then multicellular animals, in which the dominant occasions belong to that temporally ordered society that we call the animal's mind. It is only the experiences of these dominant occasions, belonging to the mind, that sometimes enjoy conscious experience.

In this view consciousness is a type of experience enjoyed by the mind, not the brain. The materialist view, according to which the mind is identical with the brain, renders entirely mysterious our experienced unity of conscious experience.[35] The identist view is reflected in Daniel Dennett's assertion that the human head contains billions of "miniagents and microagents (with no single Boss)" and "that's all that going on."[36] But if that is all that is "going on" in the human head, we cannot explain the unity of our

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[33] It is important to note that the production of a compound individual involves the emergence of a higher-level *actuality*. All occasions of experience are, by definition, actual entities. The higher-level occasions of experience are as fully actual as the lower-level ones. The highest-level occasions of experience in a compound individual are, in fact, called "regnant" or "dominant" occasions, because they exert a dominating influence, giving the compound individual a unity of action. That point will be especially important when we come to the question of freedom of action. For now, the main point is that by virtue of its regnant occasions of experience, a compound individual as a whole enjoys experiences that are at a higher level than the experiences of any of its parts.

[34] William Seager, "Consciousness, Information, and Panpsychism," *Journal of Consciousness Studies* 2/3 (1995): 272-88, at 284.

[35] I have dealt with the problems common to dualism in *Unsnarling the World-Knot: Consciousness, Freedom, and the Mind-Body Problem* (Berkeley & Los Angeles: University of California Press, 1998), 52-60, and in *Religion and Scientific Naturalism: Overcoming the Conflicts* (Albany: State University of New York Press, 2000), 151-64.

[36] Daniel E. Dennett, *Consciousness Explained* (Boston: Little, Brown & Co., 1991), 458, 459.

conscious experience. As Thomas Nagel says, "the unity of consciousness . . . poses a problem for the theory that mental states are states of something as complex as a brain."[37]

Dualists, by virtue of saying that the mind is a full-fledged actuality, numerically distinct from the brain, do not have this problem. John Eccles, for example, said that "the unity of conscious experience is provided by the self-conscious mind, not by the neural machinery."[38] But dualists, of course, have the insoluble problems of explaining how experience could have emerged out of nonexperiencing entities and how it can influence them in return.

Whitehead panexperientialism avoids these problems of dualism while being able to say, with it, that the unity of our conscious experience reflects the unity of the mind. The mind in each moment, rather than being somehow identical with the billions of cells constituting the brain, is a higher-level occasion of experience that synthesizes data from the brain cells into a unified experience.[39]

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[37] Thomas Nagel, *The View from Nowhere* (New York: Oxford University Press, 1986), 50. John Searle agrees. After pointing out that "unity" is one of the "structures of consciousness," he says, candidly: "We have little understanding of how the brain achieves this unity" (*The Rediscovery of the Mind*, 130).

[38] John C. Eccles, *How the Self Controls Its Brain* (Berlin, Heidelberg, & New York: Springer-Verlag, 1994), 22.

[39] *This relation between the mind and the brain is simply a high-level example of Whitehead's most fundamental metaphysical principle, according to which "[t]he many become one, and are increased by one." Whitehead explains this principle in these words: "The ultimate metaphysical principle is the advance from disjunction to conjunction, creating a novel entity other than the entities given in disjunction. The novel entity is at once the togetherness of the 'many' which it finds, and also it is one among the disjunctive 'many' which it leaves; it is a novel entity, disjunctively among the many entities which it synthesizes. The many become one, and are increased by one" (PR 21). Whitehead's view here agrees with a position developed by William James, for which James gave the following argument: "Take a sentence of a dozen words, and take twelve men and tell to each one world. Then . . . jam them in a bunch, and let each think of his word as intently as he will; nowhere will there be a consciousness of the whole sentence. . . . Where the elemental units are supposed to be feelings, the case is in no wise altered. Take a hundred of them . . . and pack them as close together as you can . . . ; still each remains the same feeling it always was . . . , ignorant of what the other feelings are and mean. There would be a hundred-and-first feeling there, if . . . a consciousness* belonging to the group as such *should emerge. And the 101st feeling would be a totally new fact; the 100 original feelings might . . . be a signal for its* creation*, when they came together; but they would have no substantial identity with it, nor it with them" (*Principles of Psychology*, Vol. 1 [New York:*

Compound Individuals and Internal Relations

Panexperientialism, besides allowing for an a view of the mind-brain relation that does justice to our experience, can also show how consciousness could have emerged out of nonconscious experiences.

As we have seen, there are at least six major levels of actuality between the lowest level of nature and the level at which consciousness can emerge--- namely, subatomic entities, atoms, molecules, macromolecules, prokaryotic cells, and eucaryotic cells. To understand why these various levels of compound individuals are necessary, we must understand why compound individuals presuppose Whiteheadian panexperientialism, according to which actual entities are experiential, internally related events.

To return to the mind-brain relation: The brain is composed of billions of brain cells, or neurons, each of which has its own living occasions of experience. The mind is temporally ordered society of still higher-level, dominant occasions of experience. Each dominant occasions arises out of, and synthesizes, the experiences contributed by these billions of neurons. It is because of the variety, richness, and intensity of the experiences provided by the brain cells that dominant occasions, with the capacity for conscious experience, were able to emerge. The experiences enjoyed by each neuron are quite trivial compared with the experiences of the dominant occasions. However, in comparison with the experiences of quarks, electrons, and atoms, the experiences enjoyed by neurons are extremely rich. The experiences of entities at the level of quarks, electrons, and atoms could not have directly provided the wherewithal for the emergence of occasions of experience with the capacity for consciousness. In Whitehead's words:

Henry Holt, 1890], 160). As Whitehead's agreement with James shows, it is not sufficient to refer to his position as simply panexperientialism, because there is, in addition to Whitehead's type of panexperientialism, also an identist *type. According to this identist panexperientialism, the many feelings constituting the brain do have "substantial identity" with the higher-level feeling that, emerging out of the group, attains consciousness. Whitehead, like James, insists that this higher-level experience is a "novel entity," a "totally new fact," that is created out of the brain's feelings rather than being somehow identical with them. He thereby allows for* interaction *between the mind and the brain.*

"Apart from life a high grade of mentality in individual occasions seems to be impossible" (AI 208).

Nor could any of the intermediate steps have been skipped. The experiences of atoms, by virtue of synthesizing experiences from their subatomic parts, are richer than the experiences of those parts. As such, they have more to contribute. Likewise, the experiences of macromolecules, by virtue of being internally constituted by their appropriation of experiences from the many ordinary molecules making them up, are far richer than those of the ordinary molecules themselves. They are, accordingly, able to contribute experiences out of which living cells, dominated by living occasions of experience, can emerge. It is, finally, only these cells that, when organized into brains, can give birth to the high-level experiences constituting an animal soul. In Whitehead's words: "The whole body is organized, so that a general coordination of mentality is finally poured into the successive occasions of [the dominant] personal society" (AI 211). The body in this process acts as a "complex amplifier," in which the experiences of the various parts of the body are enhanced *en route* to the central occasions of experience (PR 119).

The main point of this discussion is that without the assumption that the entities making up our world are events that are internally related to previous events, thereby being partially constituted by data received from them, the idea of progressive evolution, in which more complex, higher-level actualities emerge, would be impossible to conceive. Whitehead made this point explicitly, saying that the materialistic view of nature, which rules out internal relations, cannot account for evolution. As he put it:

> The aboriginal stuff, or material, from which a materialistic philosophy starts is incapable of evolution. . . . Evolution, on the materialistic theory, is reduced to the role of being another word for the description of the changes of the external relations between portions of matter. There is nothing to evolve, because one set of external relations is as good as any other set of external relations. There can merely be change, purposeless and unprogressive. (SMW 107)

One can get an intuitive idea of Whitehead's meaning by trying to imagine how a bunch of billiard balls, even if arranged in a very complex pattern, could give rise to a higher-level individual. Only if we understand the actual entities of the world to have experience and hence internal relations, Whitehead pointed out, can we do justice to the basic idea of

the evolutionary worldview, namely, "the evolution of the complex organisms from antecedent states of less complex organisms" (SMW 107).

From Physical Purposes to Intellectual Feelings

Whitehead's explanation of the evolution of organisms complex enough to enjoy conscious experience involves his notion that every occasion of experience has three or four phases, the highest of which is not realized in low-grade occasions.

All occasions have the first three phases, which are: (1) the physical phase, in which data from prior actual entities are prehended; (2) the conceptual phase, in which possibilities (eternal objects) in the actualities prehended in the physical phase, are felt; and (3) an elementary comparative stage, in which the data from the first two phases are synthesized. In very low-grade occasions, this synthesis results in mere "physical purposes," in which the possible forms are not felt *as* possibilities but are simply reaffirmed (PR 267, 276). Each low-grade occasion, terminating with this phase, thereby simply repeats its predecessors. Electrons, protons, and atoms can hence remain virtually unchanged century after century.

In higher-grade occasions, however, the third phase may involve "propositional feelings," in which the possibilities are lifted out from the prior occasions in which they were embodied and felt *qua* possibilities. That phase hence provides the basis for a further phase, in which the propositions are compared with the data received in the first phase. It is in relation to these higher comparative feelings, called "intellectual feelings," that consciousness arises.

It is not necessary, for present purposes, that the details of this explanation be understood. It is essential only to understand two points. One of these is the idea that consciousness, rather than being synonymous with experience, is a very high-level, rare form of experience, which is evoked into being only in very high-level occasions of experience. Conscious experience involves the capacity to be aware not only of what *is* but also of what is *not* but *might* have been. Consciousness, therefore, can arise only in beings capable of entertaining this affirmation-negation contrast.

The second essential idea is that Whitehead's position explains how consciousness could have emerged in a purely naturalistic way. A canine or human

occasion of experience in which some of the ingredients are illuminated by consciousness is not essentially different from a protonic, atomic, or molecular occasion of experience. It simply actualizes possibilities that, while possible in principle all along, were not *really* possible until the evolutionary process had brought forth beings with dominant occasions having sufficient richness of experience to stage the affirmation-negation contrast.

Accordingly, given the idea of evolution as involving increasingly complex compound individuals, which can provide their dominant occasions with increasingly complex data, we can get a glimpse of how experiences with consciousness, even self-consciousness, could have arisen, through an incremental process, out of extremely trivial experiences.

This same set of ideas can also be used to solve the long-standing problem of how to reconcile science and human freedom.

3. Physics and Freedom:

The Problem of Freedom and Determinism

For science-based intellectuals in the modern world, the question of what to say about human freedom has been one of the most difficult problems. Philosopher Thomas Nagel has said, for example, that he changes his mind about the problem of freedom every time he thinks about it.[40] John Searle, spelling out why the problem is so difficult, says: "On the one hand, a set of very powerful arguments force us to the conclusion that free will has no place in the universe. On the other hand, a series of powerful arguments based on facts of our own experience inclines us to the conclusion that there must be some freedom of the will because we all experience it all the time."[41]

This "philosophical conundrum," as Searle calls it, existed already in the nineteenth century, which Whitehead called "a perplexed century" because of a "radical inconsistency" in the thought of the century's leading intellectuals: "A scientific realism,

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[40] Nagel, *The View from Nowhere*, 112.

[41] John R. Searle, *Minds, Brains, and Science: The 1984 Reith Lectures* (London: British Broadcasting Corporation, 1984), 88.

based on mechanism, is conjoined with an unwavering belief in the world of men and of the higher animals as being composed of self-determining organisms" (SMW 82, 76).

In that century, it was almost universally assumed that the entities studied by physics interacted in a wholly deterministic way. It was widely assumed, therefore, that unless one was willing to accept dualism, in spite of its insoluble mind-body problem, one had to accept a completely deterministic understanding of human behavior.

Given the unattractiveness of both options, the emergence of quantum physics, with its doctrine of indeterminacy, was widely hailed as a godsend, because it seemed to provide a scientific basis for affirming human freedom.

Three Objections to the Relevance of Quantum Indeterminacy

The dominant position among philosophers, however, is that quantum indeterminacy is irrelevant to the question of human freedom. This position has been based on three arguments. Whitehead's panexperientialism, however, provides an answer to these three arguments.

One argument is that the indeterminacy of which quantum physics speaks is not necessarily ontic; it may be purely epistemic. That is, it may exist only because of the difficulty of measuring what is going on at that level. What is going on may be, in itself, fully deterministic.

However, the main reason for suspecting the interactions to be fully deterministic is the belief that the entities at that level are devoid of experience, so that nothing analogous to human freedom of choice could possibly exist. But according to Whitehead's panexperientialism, every actual occasion, after beginning with a physical pole, in which prior actualities are prehended, has a mental pole, in which *possibilities* are prehended. Mentality hence signifies at least some slight capacity for self-determination.[42]

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[42] Although it may be thought that this notion, while helpful metaphysically, is not empirically warranted, philosopher William Seager says that quantum physics "asserts that there is no explanation of certain processes since these involve an entirely random 'choice' amongst alternative possibilities." He adds, moreover, that various considerations, such as the two-slit experiment, suggest that the most elementary units respond to *information*. Although this information is of a very elemental sort, it is "not just the bit capacity of classical information theory but something more like semantically significant information," which is "a notion of information more akin to mentality" (Seager, "Consciousness, Information, and Panpsychism," 283). The same idea is present in the interpretation of quantum theory provided by David

The second argument against the relevance of quantum indeterminacy is that even if the indeterminacy at the quantum level is ontic, reflecting something that can be called a "decision," it must be such a trivial sort of decision that it does not even begin to account for the extremely complex decision-making process involved in Hamlet's question, "To be or not to be?"

A Whiteheadian response to this objection would begin by agreeing that the "freedom" at the quantum level must indeed be extremely trivial, so that it could not directly account for human freedom. However, by virtue of the way in which the human body, as a compound individual, functions as an amplifier, the trivial freedom that exists at the quantum level can be amplified so as to provide the basis for the kind of freedom enjoyed by the human mind. So, although quantum indeterminacy does not provide a *sufficient* condition for human freedom, it does provide a *necessary* condition. It is, accordingly, far from irrelevant.

A third argument is that any ontic indeterminacy that exists at the quantum level, far from being amplified within the human body, would be entirely canceled out. I will treat this third argument, which is quite widespread, at greater length.

The Argument that Quantum Indeterminacy is Canceled Out

Two philosophers who articulate this argument are John Searle and William Lycan. Searle, who says that science "allows no place for freedom of the will,"[43] says that the fact of quantum indeterminacy does not change this fact. "[T]he statistical indeterminacy at the level of particles," he argues, "does not show any indeterminacy at the level of the objects that matter to us---human bodies, for example."[44] Lycan, seeking to explain why, says that the nondeterministic quantum phenomena "cancel each other out" so that "at the macrolevel determinism still holds as near as matters."[45] Their twofold point is that the

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Bohm and B. J. Hiley, according to which all elementary units are influenced by what they call "active information," leading them to say that "even an electron has at least a rudimentary mental pole, as well as a physical pole" (*The Undivided Universe: An Ontological Interpretation of Quantum Theory* [London and New York: Routledge, 1993], 387).

[43] Searle, *Minds, Brains, and Science*, 92.

[44] Ibid., 87.

[45] William G. Lycan in *Consciousness* (Cambridge: MIT Press, 1987), 113-14.

indeterminacy that exists at the micro-level is canceled out at the macro-level, in accordance with the law of large numbers, and that this law applies not only to nonliving objects such as billiard balls but also to human beings.

Lying behind this conclusion is the materialistic view of nature held by these two philosophers. From that perspective, as we have seen, there is no basis for thinking in terms of compound individuals. This means that all visible objects, be they billiard balls, toasters, or human beings, exemplify the same part-whole relation. In each case, the whole is no more than the sum of its parts and their relations to each other. The whole is never a higher-level actuality with the power to act as a unit, so it has no power to act back on its parts.[46]

From Whitehead's panexperientialist point of view, by contrast, a billiard ball and a human being are structurally different in kind. Whereas a billiard ball is an aggregational society of billions of molecules, a human being is a compound individual, in which the ordinary molecules are within macromolecules, which in turn are within living cells, and these living cells, especially those in the brain, support a mind composed of dominant occasions of experience. Accordingly, although panexperientialism rules out *ontological dualism*, it does allow for an *organizational duality*. This duality is crucial for the question of freedom, because "diverse modes of organization," says Whitehead, can produce "diverse modes of functioning" (MT 157).

The organization of an inorganic aggregational society, such as rock, is such that the kind of analysis given by Searle and Lycan is, from Whitehead's perspective, largely accurate. The parts, such as the atoms and molecules, can make spontaneous choices, but these "flashes of selection (if any) are sporadic and ineffective" because there is no dominant member to coordinate them. As a result, Whitehead said, "these functionings thwart each other, and average out so as to produce a negligible total effect" (MT 27; AI

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[46] These convictions are clearly expressed in Searle's statement that "nature consists of particles and their relations with each other" and "everything can be accounted for in terms of those particles and their relations" (*Minds, Brains, and Science*, 86). These "relations" are, of course, entirely external relations, so they cannot give rise to higher-level actualities, such as living cells and minds, which can act. Human behavior is to be explained, therefore, in terms of the human body's most elementary constituents (93, 98). The fact that Searle explicitly denies the existence of a mind, understood as distinct from the physical brain, is shown by his statement, referring to the human head, that "the brain is the only thing in there" (Searle, *The Rediscovery of the Mind*, 248).

207). The behavior of a stone is, therefore, "a mere aggregation of effects" (SMW 110). As a result, its behavior is describable, even predictable, in terms of the "laws of inorganic matter," which are "mainly the statistical averages resulting from confused aggregates" (SMW 110).

It would be a category mistake, however, to assume that this kind of causal analysis is applicable to compound individuals, in which there is a dominant member that can coordinate the various spontaneities in line with its aims. In societies of this type, especially human beings, an adequate causal analysis must take into account the final causation, the purposes, of the dominant member, which through its dominance guides the person's movements bodily (MT 28-29).

If we do not accept this distinction between compound individuals and aggregational societies, however, we are led into absurdities. According to the materialist analysis, Whitehead pointed out, a person's bodily actions must be thought to be "purely governed by the physical laws which lead a stone to roll down a slope and water to boil. . . . The very idea is ridiculous" (FR 14). Searle, interestingly, agrees that none of us can actually live as if we believed this idea, because "we can't act otherwise than on the assumption of freedom, no matter how much we learn about how the world works as a determined physical system.[47] Searle concluded, accordingly, that he simply had to live with a contradiction between theory and practice.

To his credit, Searle adds that this unsatisfactory outcome makes him confident "that in our entire philosophical tradition we are making some fundamental mistake . . . in the whole discussion of the free will problem."[48] Several decades earlier, Whitehead had identified that fundamental mistake as the fallacy of misplaced concreteness, which leads to the idea that the fundamental units of nature are vacuous actualities. By replacing this materialist view with panexperientialism, Whitehead's philosophy shows not only how the indeterminacy discovered by quantum physics can be real but also how it provides a necessary condition for human freedom.

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[47]Searle, *Minds, Brains, and Science*, 97.

[48] Ibid., 145.

Symbols for Whitehead's Works

AI *Adventures of Ideas* (1933). New York: Free Press, 1967.

FR *The Function of Reason* (1929). Boston: Beacon, 1958.

MT *Modes of Thought* (1938). New York: Free Press, 1968.

PR *Process and Reality* (1929), corrected edition, edited by David Ray Griffin and Donald W. Sherburne. New York: Free Press, 1978.

SMW *Science and the Modern World* (1925). New York: Free Press, 1967.