

13. Overview.

The message of this book is that von Neumann's Process 1, which was introduced to order create a mathematically well defined physical theory, injects causally efficacious and non-redundant mind into the causal workings of nature. Consequently, quantum theory, by virtue of its logical structure, entails a connection between mind and brain that is radically different from what emerges from the conception of nature that defined science at the end of the nineteenth century. In this final chapter I shall compare this quantum view with some contemporary main streams of thought on the subject.

A tremendous burgeoning of interest in the problem of consciousness has occurred during the last few years. The grip of the behaviorists who sought to banish consciousness from science has finally been broken. This shift is ratified by the recent appearance of a special issue of Scientific American entitled "The Hidden Mind." The lead article, written by Antonio Damasio, begins with the assertion: "At the start of the new millennium, it is apparent that one question towers above all others in the life sciences: How does the set of processes we call mind emerge from the activity of the organ we call brain?" He notes that some thinkers "believe the question to be unanswerable in principle" while "For others, the relentless and exponential increase in knowledge may give rise to the vertiginous feeling that no problem can resist the assault of science if *only the science is right* and the techniques are powerful enough." (My emphasis.) He notes that "The naysayers argue that exhaustive compilation of all these data (of neuroscience) adds up to *correlates* of mental states but to nothing resembling *an actual mental state*." (His emphasis.) He adds that: "In fact, the explanation of the physics related to biological events is still incomplete" and states that "the finest level of description of mind ... might require explanation at the quantum level." Damasio makes his own position clear: "I contend that the biological processes now presumed to correspond to mind in fact *are* mind processes and will be seen to be so when understood in sufficient detail."

With "biological processes" understood to be quantum processes, as contrasted to classically describable processes, I agree that mind processes are biological brain processes. The point is that biological brain processes demand, for the reasons described in Chapter 10,

the application of quantum physics, and that makes feelings, for the reasons explained in Chapters 11 and 12, critical components of brain dynamics.

The possibility that quantum physics might be relevant to the connection between conscious process and brain process was raised also by Dave Chalmers, in his article *The Puzzle of Consciousness*. However, he effectively tied that possibility to a proposal put forth by Roger Penrose, and, faulting that particular approach, rejected the general idea.

The deficiency of Penrose's approach identified by Chalmers is that it fails to bring in consciousness: it is about certain brain processes that may be related to consciousness, but "...the theory is silent about how these processes might give rise to conscious experience. Indeed, the same problem arises with any theory of consciousness based only on physical processing." That negative conclusion is based, however, on the presumption that brain processes can be described in a way that leaves out feelings and other experiential-type realities. But, according to the present view, Process I plays a crucial dynamical role of physical processing, and hence the brain dynamics of an alert agent cannot be described without taking experiential-type realities explicitly into account.

Chalmers goes on to expound upon the "explanatory gap" between theoretical understanding of the behavioral and functional aspects of brain process and an explanation of how and why the performance of those functions should be accompanied by conscious experience. However, the notion that such a "gap" exists depends upon the presumption that a valid understanding or conception of brain behavior and functioning can be divorced from the associated conscious experiences. The whole notion that such a separation is possible arises only from the fundamentally false and incorrigibly inadequate classical model.

The confounding of reality itself with the caricature of it suggested by the work of Descartes and Newton has blighted the philosophy of science, the philosophy of mind, moral philosophy, and aesthetics for more than three centuries, and it still retains its blinding effect on the views of even those philosophers who absolutely reject that dualistic

view. For example, Daniel Dennett, one of the most out-spoken critics of Cartesian dualism, says that his own thinking rested on the idea that “a brain was always going to do what it was caused to do by current, local, mechanical circumstances.” By making that judgment he tied his thinking to the physical half of Cartesian/Newtonian dualism, or its child, classical physics, and thus was forced in his book “Explaining Consciousness” to leave consciousness out, as he himself admits, but tries to justify, at the end. By thus accepting the fundamentally erroneous classical-physics understanding of brain processes, instead of the view offered by modern science, Dennett cut himself off from any possibility of explaining consciousness.

Many important features of the von Neumann approach being described here can be brought out by contrasting them with the contrary properties of Penrose’s proposal. The first key difference is that Penrose does not introduce the von Neumann Process I, which is essential to von Neumann quantum theory. Penrose uses instead the Process III: State Vector Reduction, which he calls R. This difference is crucial! State Vector Reduction, which Penrose *does* use, brings in the unnecessary global non-locality, whereas Process I, which he *does not* use, accounts for the causal effect of mind on brain.

A second essential difference between the present proposal and that of Penrose, and his collaborator Stuart Hameroff, is that their theory depends on establishing macroscopic quantum coherence over an extended portion of the brain, whereas the theory being described here does not. Most physicists deem it highly unlikely that such large-scale coherence could be sustained in a warm, wet, living brain.

A third difference is that their theory depends on the complex question of quantum gravity, which is currently not under good theoretical control, whereas the theoretical ideas that are the basis of the present approach are the fundamental mathematical principles of quantum theory, which, thanks to the work of John von Neumann, are under much better control.

The fourth difference is that the justification that Penrose gives for believing that quantum theory has something to do with human consciousness is a very much disputed argument that claims to

deduce from (1), the fact that mathematicians construct proofs that they believe to be valid, and (2), some deep mathematical results due to Kurt Godel, the conclusion that conscious thought must involve quantum theory. But in the von Neumann approach the relevance of consciousness arises from its connection to Process I, which is a basic feature of orthodox quantum theory.

The fifth difference is the fact, already emphasized by Chalmers, that Penrose's theory of consciousness turns out to be about a conceivable neural correlate of consciousness, but is silent about how that brain activity might give rise to conscious experiences, whereas the present work is directly about the relationship of brain processes to conscious experiences.

Francis Crick and Christof Koch begin their essay *The Problem of Consciousness* with the assertion: "The overwhelming question in neurobiology today is the relationship between the mind and the brain." But after a brief survey of the difficulties in getting an answer they conclude that "Radically new concepts may indeed be needed---recall the modifications in scientific thinking forced on us by quantum mechanics. The only sensible approach is to press the experimental attack until we are confronted with dilemmas that call for new ways of thinking."

However, the two cases are extremely dissimilar. The switch to quantum theory was forced upon us by the fact that we had a very simple system, consisting of one proton and one electron, that was so simple that it could be exactly solved by the methods of classical physics, but the calculated answer did not agree with the empirical results. There was no conceptual problem. It was rather that precise computations were possible, but gave wrong answers. Here the problem is reversed: precise calculations of the dynamical processes associated with conscious experiences are not yet do-able, and hence have not revealed any mismatch between theory and experiment, but the *concepts of classical physics* that most neurobiologists want to use are clearly inadequate: they lack the conceptual ingredients needed to account for conscious experience. Dave Chalmers recognizes this conceptual difficulty, and concludes that experimental work by neurobiologists is not by itself sufficient to resolve of *The Puzzle of Conscious Experience*: also needed are

better concepts. He suggests that the stuff of the universe might information, but then rejects the replacement of classical physical theory, which is based on material substance, by quantum theory, which builds (its conception of) nature out of a non-substantive stuff that can be characterized as information imbedded in a mathematical structure.

John Searle is perhaps the strongest contemporary voice calling for a forthright acknowledgement of both the existence of the subjective realities that *are* the experiential qualities, and also the need to explain them, rather than trying to explain them away. His views mesh well with the quantum approach developed here.

I shall use as my source Searle's article in the Journal of Consciousness Studies, which is based on his talk at the Tucson 2000 conference on Consciousness. This presentation seems to me to represent his best effort to come to grips with the problem.

Searle reiterates his longtime themes:

1. Consciousness is a real biological phenomenon.
2. It consists of inner, qualitative, subjective, unified states of sentience, awareness, thoughts and feelings.
3. This unified field of conscious subjective awareness is not reducible to any third-person phenomena.
4. All of our conscious states are caused by lower-level neuronal processes in the brain.
5. All of our conscious states are themselves features of the brain.

If one were to accept the classical-physics conception of the brain then there would appear to be a conflict between claims 3 and 5. For if a brain were a conglomeration of particles, which, as the objective elements of nature are third-person entities, and conscious states are features of these conglomerations, then consciousness seems to be reduced to third-person phenomena. However, if one accepts the quantum idea that the states of consciousness characterized in properties 1, 2, and 3, above, are first-person subjective features of the brain, which is an informational structure that combines distinct first-person and third-person informational features, then this conflict is resolved.

Later on, Searle introduces “psychological processes” by observing that people sometimes give ‘reasons’ for acting as they do. But he notes that these ‘reasons’ are not always conclusive, or sufficient to entail the actions they promote. He wishes to consider the possibility that although the psychological processes may be indeterministic, the underlying “neurobiological process” is deterministic. He then says that psychological indeterminism with neurobiological determinism---

“is intellectually unsatisfying because it is a modified form of epiphenomenalism. It says that the psychological processes of decision making really do not matter. The entire process is deterministic at the bottom level, and the idea that the top level has an element of freedom is simply a systematic illusion. ... The bodily movements would be exactly the same regardless of how these processes occurred.

“Maybe that is how it will turn out, but if so the hypothesis seems to me to run against everything we know about evolution. It would have the consequence that the incredibly elaborate, complex, sensitive and ---above all---biologically expensive system of human and animal conscious rational decision-making would actually make no difference whatever to the life and survival of the organism. Epiphenomenalism is a possible thesis, but it is absolutely incredible, and if we seriously accept it, it would make a change in our world view, that is, in our conception of our relations to the world, more radical than any previous change, including the Copernican Revolution, Einsteinian relativity theory and quantum theory.”

The sort of epiphenomenal consciousness that Searle is considering, and finds incredible, is what naturally arises from a classical-physics conception of the brain. But quantum theory gives consciousness a causal power that is outside the control of the bottom-level local deterministic laws that are the quantum counterparts of the classical laws of motion. The causal power of consciousness arises from the way that consciousness fills a *causal gap* in those bottom-level laws. This lacuna is filled in a natural way by causal agents, who supply the logically needed elements of definiteness.

The description of nature's process given in earlier chapters is perhaps overly formal and austere. I shall give now a more intuitive account, focusing on the question of how conscious process can be seen as a feature of brain process.

The evolving state of the universe is a giant mass of conflicting potentialities. Within this huge space there can occasionally appear an island of stability. Because the potentialities are 'potentialities for feelings to actualize', these islands of stability will have associated "potential feels," which are characterizations of their internal harmony. The potential feel of a possible state is presumably connected to mathematically describable features of that state in specified ways, but the potential feels themselves are taken to be ontological primitives, probably of a genus more primitive than the quantum state, and containing the elements out of which the quantum state is constructed. Von Neumann's Process I is a boot-strapping action in which the potential feel actualizes itself by lifting the island of stability with which it is associated out of the mass in which it is imbedded, creating a separation of the total state into two branches. I believe it is not profitable at this point in the development of science to try to specify in detail exactly how the feel of the actualized state is connected to the mathematical structure of the state, presumably via the elements out of which the state itself is constructed. Because I am trying to sticking closely to von Neumann's ideas, with minimal speculation, I will be content to characterize the feel of an actualized state as an aesthetic evaluation of a quality of coherent organization of that state.

The purpose of this work is to provide understanding. The idea that science could or should provide understanding was very much out of favor in the first half of the twentieth century, due partly to the Kantian thesis that the thing-in-itself is unknowable, and partly to the influence of the logical positivists. But while certainty about the exact nature of the world in which our thoughts are imbedded is unattainable, partial contemporary understandings based on the best available data, and on efforts to construct theories that rationally and coherently account for that data, is a hallmark of contemporary science. It is essential to strive to produce improved science-based understandings because otherwise ignorance-based understandings will come to rule the world by default, with likely disastrous consequences.

