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Comment

The face of freedom
Comment on "Consciousness in the universe. A review of the 'Orch OR' theory" by Stuart Hameroff and Roger Penrose

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Professors Stuart Hameroff and Roger Penrose have been led by two routes to take freedom seriously, considering it not only from the outside, but also from the point of view of those who decide what to do, the face they have in exercising it.

The low road to freedom is by quantum mechanics. Quantum mechanics has proved Laplacian determinism to be false. Throughout the physical world new things happen which could not have been predicted with certainty. Many are of no consequence, and are smoothed away as we concentrate on the big picture of the general course of events. But some indeterminacies can signify. The human eye is sensitive to only a few quanta of light, and the brain is similarly sensitive to small fluctuations which may make all the difference to subsequent behaviour.

The high road is by Gödel's theorem, which shows that minds cannot be explained by any computational system and must derive from some effect that cannot be characterized algorithmically. Other authors have been led by the two routes to similar conclusions. What distinguishes Hameroff's and Penrose's approach is that they offer an account that integrates the two approaches into a single theory.

Hameroff and Penrose locate their position by contrasting it with currently held ones. Theirs is anti-epiphenomenalist and anti-dualist.

Most scientists adopt the former, shutting their eyes to crucial facts. Descartes and many religious thinkers are dualists, thereby taking consciousness outside the range of scientific enquiry. A scientific, non-reductive explanation is called for as the only one faithful to the facts and worthy of a scientist.

The one put forward by Hameroff and Penrose has three components: Objective Reduction, Orchestration, and a quantum-mechanical re-interpretation of neurophysiology leading to Quantum Computing in the Brain.

Contemporary physicists have not been able to marry Einstein's General Theory with quantum mechanics to produce grand unified theory of everything. Hameroff and Penrose try to make the match, explaining (though not algorithmically) quantum-mechanical fluctuations as due to small alterations in the gravitational field. "Surprising as it may seem, however, such tiny differences in space–time structure can have large effects, for they entail subtle but fundamental influences on the very rules of quantum mechanics." Objective Reduction occurs when quantum superpositions between slightly differing space–times take place, differing from one another by a minuscule space–time factor – a 4-volume Planck measure, involving both time and space, where the time measure would be particularly small when the space-difference measure is relatively large.

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Orchestration occurs as a result of a beat phenomenon whereby axonal firings come to be integrated and coherent. But they may be not fundamental. Rather, they are preceded and caused by synchronized dendritic/somatic integrations. It is these, not axonal firings, that generate gamma synchrony electro-encephalographic correlates of consciousness.

The work of Anirban Bandyopadhyay and others suggests that quantum effects occur in microtubules at biological temperatures. Electronic conductance along microtubules, normally extremely good insulators, becomes exceedingly high, approaching quantum conductance, at certain specific resonance frequencies of applied alternating current stimulation. Electron quantum conductance may function in tubulin and microtubules. Moreover, quantum mechanics itself yields strange possibilities when looked at closely. Many reductionists argue that consciousness must be epiphenomenal, because encephalographic scans show that decisions are made before we are consciously making up our minds. But backward causation is possible at the quantum level. A quantum-mechanical account of the brain could accommodate the reductionists contentions, while still giving a plausible account of what really goes on.

Is a neurophysiological instantiation of Orchestrate Objective Reduction too good to be true? Many would say Yes. It is difficult to see how gravitational effects could explain quantum-mechanical fluctuations without being algorithmic. Temporal Non-locality seems a dodgy defence of Free Will. Hameroff and Penrose admit that much of their case is speculative, and that "the actual mechanisms underlying the production of consciousness in a human brain will be very much more sophisticated than any that we can put forward at the present time, and would be likely to differ in many important respects from any that we would be in a position to anticipate in our current proposals". They report many of the objections that have been made, and give their own counters to them. They could be right. Even if they turn out to be wrong, we need to remember the lesson of the Einstein–Podolsky–Rosen argument, which turned out to be mistaken, but through its very mistakenness paved the way for a much deeper understanding of quantum mechanics.