Roger Penrose Physics and consciousness wiki

http://en.wikipedia.org/wiki/Roger_Penrose

Penrose has written books on the connection between fundamental physics and human (or animal) consciousness. In The Emperor's New Mind (1989), he argues that known laws of physics are inadequate to explain the phenomenon of consciousness. Penrose proposes the characteristics this new physics may have and specifies the requirements for a bridge between classical and quantum mechanics (what he calls correct quantum gravity). Penrose uses a variant of Turing's halting theorem to demonstrate that a system can be deterministic without being algorithmic. (E.g., imagine a system with only two states, ON and OFF. If the system's state is ON if a given Turing machine halts, and OFF if the Turing machine does not halt, then the system's state is completely determined by the Turing machine, however there is no algorithmic way to determine whether the Turing machine stops.)

Penrose believes that such deterministic yet non-algorithmic processes may come in play in the quantum mechanical wave function reduction, and may be harnessed by the brain. He argues that the present computer is unable to have intelligence because it is an algorithmically deterministic system. He argues against the viewpoint that the rational processes of the mind are completely algorithmic and can thus be duplicated by a sufficiently complex computer. This contrasts with supporters of strong artificial intelligence, who contend that thought can be simulated algorithmically. He bases this on claims that consciousness transcends formal logic because things such as the insolubility of the halting problem and Gödel's incompleteness theorem prevent an algorithmically based system of logic from reproducing such traits of human intelligence as mathematical insight. These claims were originally espoused by the philosopher John Lucas of Merton College, Oxford.

The Penrose/Lucas argument about the implications of Gödel's incompleteness theorem for computational theories of human intelligence has been widely criticized by mathematicians, computer scientists and philosophers, and the consensus among experts in these fields seems to be that the argument fails, though different authors may choose different aspects of the argument to attack.[16] Marvin Minsky, a leading proponent of artificial intelligence, was particularly critical, stating that Penrose "tries to show, in chapter after chapter, that human thought cannot be based on any known scientific principle." Minsky's position is exactly the opposite - he believes that humans are, in fact, machines, whose functioning, although complex, is fully explainable by current physics. Minsky maintains that "one can carry that quest [for scientific explanation] too far by only seeking new basic principles instead of attacking the real detail. This is what I see in Penrose's quest for a new basic principle of physics that will account for consciousness."[17]

Penrose responded to criticism of The Emperor's New Mind with his follow up 1994 book Shadows of the Mind, and in 1997 with The Large, the Small and the Human Mind. In those works, he also combined his observations with that of anesthesiologist Stuart Hameroff.

Penrose and Hameroff have argued that consciousness is the result of quantum gravity effects in microtubules, which they dubbed Orch-OR (orchestrated objective reduction). Max Tegmark, in a paper in Physical Review E,[18] calculated that the time scale of neuron firing and excitations in microtubules is slower than the decoherence time by a factor of at least 10,000,000,000. The reception of the paper is summed up by this statement in Tegmark's support: "Physicists outside the fray, such as IBM's John A. Smolin, say the calculations confirm what they had suspected all along. 'We're not working with a brain that's near absolute zero. It's reasonably unlikely that the brain evolved quantum behavior'".[19] Tegmark's paper has been widely cited by critics of the Penrose–Hameroff position.

In their reply to Tegmark's paper, also published in Physical Review E, the physicists Scott Hagan, Jack Tuszynski and Hameroff[20][21] claimed that Tegmark did not address the Orch-OR model, but instead a model of his own construction. This involved superpositions of quanta separated by 24 nm rather than the much smaller separations stipulated for Orch-OR. As a result, Hameroff's group claimed a decoherence time seven orders of magnitude greater than Tegmark's, but still well short of the 25 ms required if the quantum processing in the theory was to be linked to the 40 Hz gamma synchrony, as Orch-OR suggested. To bridge this gap, the group made a series of proposals. It was supposed that the interiors of neurons could alternate between liquid and gel states. In the gel state, it was further hypothesized that the water electrical dipoles are oriented in the same direction, along the outer edge of the microtubule tubulin subunits. Hameroff et al. proposed that this ordered water could screen any quantum coherence within the tubulin of the microtubules from the environment of the rest of the brain. Each tubulin also has a tail extending out from the microtubules, which is negatively charged, and therefore attracts positively charged ions. It is suggested that this could provide further screening. Further to this, there was a suggestion that the microtubules could be pumped into a coherent state by biochemical energy.

Finally, it is suggested that the configuration of the microtubule lattice might be suitable for quantum error correction, a means of holding together quantum coherence in the face of environmental interaction. In the last decade, some researchers who are sympathetic to Penrose's ideas have proposed an alternative scheme for quantum processing in microtubules based on the interaction of tubulin tails with microtubule-associated proteins, motor proteins and presynaptic scaffold proteins. These proposed alternative processes have the advantage of taking place within Tegmark's time to decoherence.

In 2011 W. Christensen [22] argued that the universe can be shown to be conscious via a cosmological model based on Maxwell's demon and information theory.

Hameroff, in a lecture in part of a Google Tech talks series exploring quantum biology, gave an overview of current research in the area, and responded to subsequent criticisms of the Orch-OR model.[23] In addition to this, a recent 2011 paper by Roger Penrose and Stuart Hameroff gives an updated model of their Orch-OR theory, in light of criticisms, and discusses the place of consciousness within the universe.[24]

Phillip Tetlow, although himself supportive of Penrose's views, acknowledges that Penrose's ideas about the human thought process are at present a minority view in scientific circles, citing Minsky's criticisms and quoting science journalist Charles Seife's description of Penrose as "one of a handful of scientists" who believe that the nature of consciousness suggests a quantum process.[19]

Religious views

Penrose does not hold to any religious doctrine,[25] and refers to himself as an atheist.[26] In the film A Brief History of Time, he said, "I think I would say that the universe has a purpose, it's not somehow just there by chance ... some people, I think, take the view that the universe is just there and it runs along – it's a bit like it just sort of computes, and we happen somehow by accident to find ourselves in this thing. But I don't think that's a very fruitful or helpful way of looking at the universe, I think that there is something much deeper about it."[27] Penrose is a Distinguished Supporter of the British Humanist Association.

16 ^ Criticism of the Lucas/Penrose argument that intelligence can not be entirely algorithmic:

* MindPapers: 6.1b. Godelian arguments

* References for Criticisms of the Gödelian Argument*

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* Feferman, Solomon (1996). "Penrose's Gödelian argument". PSYCHE 2: 21–32. CiteSeerX: 10.1.1.130.7027.

* Krajewski, Stanislaw 2007. On Gödel's Theorem and Mechanism: Inconsistency or Unsoundness is Unavoidable in any Attempt to 'Out-Gödel' the Mechanist. Fundamenta Informaticae 81, 173–181. Reprinted in Topics in Logic, Philosophy and Foundations of Mathematics and Computer Science:In Recognition of Professor Andrzej Grzegorczyk (2008), p. 173

* LaForte, Geoffrey, Patrick J. Hayes, and Kenneth M. Ford 1998. Why Gödel's Theorem Cannot Refute Computationalism. Artificial Intelligence, 104:265–286.

* Lewis, David K. 1969. Lucas against mechanism. Philosophy 44 231–233.

* Putnam, Hilary 1995. Review of Shadows of the Mind. In Bulletin of the American Mathematical Society 32, 370–373 (also see Putnam's less technical criticisms in his New York Times review.

17 ^ Marvin Minsky. "Conscious Machines." Machinery of Consciousness, Proceedings, National Research Council of Canada, 75th Anniversary Symposium on Science in Society, June 1991.

18 ^ Tegmark, Max. 2000. "The importance of quantum decoherence in brain processes". Physical Review E. vol 61. pp. 4194–4206.

19 ^ a b Tetlow, Philip (2007). The Web's Awake: An Introduction to the Field of Web Science and the Concept of Web Life. Hoboken, NJ: John Wiley & Sons. p. 166. ISBN 978-0-470-13794-9. http://books.google.com/?id=3mPI9rUuhJ8C&printsec=frontcover&dq=penrose+%22thought+process%22&q=penrose%20.

20 ^ Hagan, S., Hameroff, S., and Tuszyński, J. (2002). "Quantum Computation in Brain Microtubules? Decoherence and Biological Feasibility". Physical Review E 65: 061901. arXiv:quant-ph/0005025. Bibcode 2002PhRvE..65f1901H. doi:10.1103/PhysRevE.65.061901.

21 ^ Hameroff, S. (2006). "Consciousness, Neurobiology and Quantum Mechanics". In Tuszynski, Jack. The Emerging Physics of Consciousness. Springer. pp. 193–253

22 ^ Sir Roger Penrose & Dr. Stuart Hameroff (2011). "Consciousness and the Universe: Quantum Physics, Evolution, Brain and Mind," Chapter XIV Does the Universe have Cosmological Memory? If so does this imply Cosmic Consciousness?. Oxford University Press.

23 ^ "Clarifying the Tubulin bit/qubit - Defending the Penrose-Hameroff Orch OR Model (Quantum Biology)". YouTube. 2010-10-22. http://www.youtube.com/watch?v=LXFFbxoHp3s. Retrieved 2012-08-13.

24 ^ Journal of Cosmology.com (1992-07-04). "Journal of Cosmology". Quantumconsciousness.org. http://www.quantumconsciousness.org/Cosmology160.html. Retrieved 2012-08-13.