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Mentality: a childish enquiry

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A question asked by most children but avoided by adults is "Why am I me?". It seems obvious and important when one is young but, to a grown-up, is too difficult and perhaps meaningless. Questions of this sort often have culturally sanctioned answers. For instance, "How did the world begin?" could have been answered (somehow) by any educated adult in any period of which we have records, and now the cosmologists are adding their own gloss to the replies.

The puzzle that I want to discuss takes slightly different forms according to the age of the enquirer. A six-year-old might ask, "What *makes* me me?"; a 12-year-old, "Daddy, you are some sort of doctor and are always talking about mental this, that and the other: what does mental mean?". From a troubled teenager it might be, "Why do I have to be conscious, and what is it anyway?". Until recently the reply would have been assured; – "The essence of you is your soul and awareness is an attribute of it". There might then have been elaborations dependent on the sophistication of Daddy's views on spirit, animal soul, subconscious mind and the like, but few would have disagreed with the basic reply.

A different paradigm has now grown as a consequence of the "scientific" world view greatly enhanced by analogies taken from computer technology. It is that awareness, the very essence of any person, is due to information processing within certain functionally defined systems of the brain and might in principle be an attribute of any sufficiently elaborate information processing machinery whether made of neurones or silicon chips. In this simple form there are obvious problems with the idea. For instance, could a room thermostat be said to possess that most primitive form of mentality since it "knows" if the room is too hot or too cold? What is the difference, and surely there is one, between information processing and understanding? Searle (1990) has clearly shown that the former does not entail the latter by necessity. Most difficult of all, the so-called "qualia" problem of philosophers; when I look at the sky, how do the trains of neuronal discharges in my visual cortex translate into my experience of blueness?

The best answer to these difficulties from within the same paradigm is that awareness is a new, emergent property of sufficiently complex, self-reflective information processing. This view has been expressed with marvellous wit and erudition by Hofstadter (1979, 1986). His "ant fugue" in the 1979 book is a *tour de force* which one feels deserves to be true as a valid analogy for the physical basis of mind. Neurological flesh has been put on the bones of this approach by many authors, most convincingly perhaps by Edelman (1989), and of course there is a vast literature on artificial intelligence much of which assumes that the intelligent computer will have some sort of awareness (or that, provided the computer can pass the Turing test, asking whether it is aware would be no more useful than asking the same about one's neighbour). Nevertheless, when all is said and done, the qualia problem and much else seems to have been sidestepped rather than answered by this set of ideas. The whole truth may not be in them.

Quantum physicists have for years commented on the links that may exist between mind and matter. One of the most thoroughgoing in this direction (Bohm, 1983) regards both as manifestations of an underlying whole called by him the "implicate order" which also includes all the unmanifest possibilities familiar (at least to physicists) in the Schrödinger wave function. The philosopher Lockwood (1989) argued in his closely reasoned book that awareness is likely to be a consequence of the strange properties of matter revealed by quantum theory. He pointed out that the holism entailed by their theory may provide the beginnings of an answer to the qualia problem since the object of awareness and the brain activity subserving awareness from a correlated whole in quantum mechanical terms. Interestingly enough, St Thomas Aquinas (1274: 1991 translation), following Aristotle, took a similar view in that he regarded human awareness as due to an internalisation of the "forms" of external objects.

Penrose's literally wonderful book *The Emperor's New Mind* (1989) popularised the idea that the brain might depend on quantum mechanical principles for its higher functions. He skirted around talking about consciousness in the book, although he has done so

elsewhere (Penrose, 1987), but appears to regard it as one of the higher functions in question. His basic argument is that mathematicians can ascertain truths which could never be reached by computers since the latter are all Turing machines dependent on algorithms and subject to inherent limitations due to Gödel's theorem. Therefore the brains of mathematicians, and presumably other people too, must operate on principles additional to those known to classical physics. The argument is impressive but does not amount to proof as Hofstadter had previously stated that, although the abilities of computers are limited by Gödel's theorem, sufficiently ingenious programming should allow them to escape the consequences of this up to a level of sophistication at which humans would no longer be able to discern the limitations. If the human brain computer has such programming, people could equally not be expected to discern Gödel limitations in each other.

These ideas and arguments have become of practical concern since Marshall (1989) and Zohar (1990) suggested that a phenomenon first postulated to occur in biological systems by Frohlich (1968) might form the physical basis of consciousness. It is the phenomenon termed Bose-Einstein condensation which is responsible for laser light and superconductivity. In theory, mathematically similar condensations might occur in the brain producing widespread fields with the properties (e.g. unity, non-locality in some circumstances, uncertainty about which of a range of possibilities will become manifest) of single quantum objects. The original idea was that vibrating molecules in nerve cell membranes might provide the basis for the condensate, but there are other possibilities.

The "quantum consciousness" idea has thus become precise enough to be open to experimental refutation. If awareness is a Bose-Einstein condensate, it ought to show the holism and non-locality characteristic of quantum systems in a manner which would clearly distinguish it from the consequences of ordinary information processing, however complex or self-reflective. There are two main impediments to devising practical experiments. First, no one knows what consciousness actually does; indeed, it might just be but have no effect on measurable behaviour. If it is wholly epiphenomenal direct experimentation is impossible, but there are quite strong evolutionary and other arguments for supposing that it may do something. All the same, would-be experimenters need to keep very open minds about what influence it might have on their experiment. Second, physicists remain uncertain about what causes collapse of the Schrödinger wave function – i.e. what converts the range of possibilities relating to a quantum object into an actuality. Some ideas about wave function collapse, if true, would make experimentation very difficult and perhaps impossible.

All the same a pilot experiment, designed to work if consciousness does affect behaviour and if one of several theories about wave function collapse is correct, has been run in Southampton. It suggests that awareness has one of the properties (a type of holism) expected of a quantum object. If it is confirmed, psychiatrists may soon be having the following conversation:

> "Mummy, what do you do all day at work?"
> "I investigate and treat the pathology of Bose-Einstein condensates".

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