Review of: "The Case for Conscious Experience Being in Individual Neurons"

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My expertise is in cellular and molecular biology. Yet, in spite of this I have been asked to review this paper by Edwards & Somov on a rather esoteric subject (at least for me): where is the seat of consciousness? In the West, since the time of Descartes it began a tradition linking the brain with consciousness. However, Cartesian dualism posed the problem of how it was possible that a non-material entity (the mind) could, through the brain, elicit actions in a material body. This metaphysical, ghost in the machine, problem has been apparently tackled by current reductionist materialism (physicalism). Thus, given that perturbation of brain activity leads to altered conscious states or even to temporary or permanent loss of consciousness, it has been assumed that consciousness is nothing but the result of normal wakeful brain activity, stimulated either by external or endogenous inputs. Yet, contrary to a mainstream that considers consciousness as an epiphenomenon of whole or at least regional brain activity, this paper argues that it is in individual neurons and their associated dendritic trees where conscious experience takes place.

The present manuscript is the latest in a series of papers where the authors have introduced and developed such cellular-consciousness hypothesis. For them, the so-called “phenomenal binding problem” (how to get many signal supposedly encoding an experience, coming together) is not soluble at the whole brain cortex level, as they see no way that patterns of firing across the cortex can be selectively bound. For the authors consciousness is not a field but it is something affected by a field (which they assume is the electromagnetic field) and so the question is what is experiencing that field. The answer for them is that the “aerial” able to sense spatial patterns (many electromagnetic potentials at a time) is the dendritic tree of a given cortical neuron. Thus consciousness belongs to individual cells, the neuron itself is the seat of consciousness as sensory inputs correspond to signals that converge onto “computational events” that occur in individual neuron dendritic tress. For the authors this means that binding of signals only occurs in such individual dendritic trees. They also claim, on the one hand, that it is a fallacy the notion of the need of a single conscious “control agent” in a mind in order to prevent chaos, and on the other hand, that the phenomenological singularity of our beings is just an illusion. Thus, for the authors a “multiple subjectivity” that might be deduced from their proposal is not a problem. Indeed, potentially serious philosophical issues raised by their proposal are dealt in a rather cavalier fashion by simply acknowledging that their theory is “anarchic”. Curiously (and rather contradictorily with their own theory), the authors reject that a single neuron may have its own memory and suggest that memory is a collective property of sets of neurons.

More than hundred years ago William James agreed that there is correlation between brain activity and consciousness, but he also suggested that such activity might be “permissive” or “transmissive” rather than “productive”. Although the

authors think of individual neuron dendritic tress as “aerials” one gets the felling that their overall view concurs with the “productive” perspective; hence, consciousness is an epiphenomenon of individual neuronal activity. The problem then is how to test experimentally such a proposal. The authors quote the work of Craddock et al. (2017) for supporting their suggestion that the cytoskeleton might be involved in sensing the complex pattern of electromagnetic potentials that according to them “provide information about the world”. However, the piece of research by Craddock et al., is more about discovering how anesthetics may work, since anesthesia (as well as consciousness) remains an unexplained phenomenon. They conclude that anesthetics may work through their effects on microtubules thus affecting the stability of the cytoskeleton, but provided that such structure has something to do with neural response to synaptic activity. Moreover, Craddock et al., also acknowledge that theories that relate microtubule processes directly to neural coherence and consciousness are controversial and lack experimental support. Indeed, the mainstream claims that the exploration of brain function during general anesthesia allows a better understanding of the neural correlates of consciousness, since changes in functional and effective between-region brain connectivity and spatio-temporal dynamics of between-region interactions have been evidenced during anesthesia. Yet, it is also acknowledged that the exact identification of the “neural substrate” of consciousness remains an unsolved problem (Bonhomme et al, 2019. Front. Syst. Neurosci. 13:36). Thus it seems obvious that anesthesia would be rather useless for testing the single-neuron consciousness hypothesis.

Once inside the realm of experimentally-untestable hypotheses we may shift towards the speculative analysis of speculative proposals. This paper displays the standard jargon of physicalist reductionism, including the now fashionable “computational events”. It is amusing that the brain is always analogous to the latest technology for human communication. Thus it has passed from being a telegraphic system, to a telephonic network, then a computer and now a quantum computer of some sort. However, it is interesting that in ancient times the brain was considered as a secondary organ. Indeed, for Aristotle the brain purpose was to function as a cooling device for the heart, that in those times was considered as the seat of emotions and thoughts. Therefore, we can appreciate the seat of consciousness has been a point of controversy through the ages. Currently there is a minority that concurs with Wittgenstein in that one of the most dangerous ideas is “that we think with our heads or in our heads” (*Zettel*, 605). Thus, for some the research program addressed to causally link either the brain or individual neuronal activity with consciousness, is equivalent to searching for the last show of “The Sopranos” within the circuitry of a TV set or thinking that the soccer match currently on TV, is nothing but the result of the activity of the TV set or at least from some particular microchip within.

Coming back to the Edwards & Somov paper, I find flimsy their justification for suggesting that conscious experiences are quantum-level events. It is quite unconvincing their claim that quantum physics deals with individual/indivisible units and that such indivisibles at the cellular scale are the physical correlates (or source, according to them) of conscious experiences. In contrast, starting form a deep knowledge of quantum physics, one of the foremost physicists of the twenty century derived the “unbroken wholeness of the totality of existence” and then developed a theory of consciousness. In his theory the mind enfolds matter in general and therefore the body in particular. Similarly, the body (as a whole) enfolds not only the mind but also the entire material universe (D. Bohm, 1980, Wholeness and the implicate order, chapter 7. Routledge and Kegan Paul, London). Thus Bohm’s perspective on consciousness is at loggerheads with the one presented in this paper. Interestingly, Kurt Gödel, another clever mind, suggested that the widespread notion that “there is

no mind separate from matter", is just a prejudice of our time and it will be disproved scientifically (quoted in H. Wang, 1974, From mathematics to philosophy, Routledge and Kegan Paul, London, p. 326).

Hence, papers like the present one are worth reading but provided that the reader already belongs to the brain/neuron consciousness faith, but for those sympathizing with alternative faiths (on the issue of consciousness) the experience could be like a trip into the vacuum.