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

André Fiala[1]

1 University of Göttingen

Potential competing interests: No potential competing interests to declare.

The search for neural correlates of consciousness is a widely investigated topic across several scientific disciplines, but none of the current theories has so far provided convincing strategies to solve the fundamental problem of how consciousness actually arises. This is partially due to unclear definitions (e.g., what is actually meant by “consciousness” as an unambigous, operational definition), and it is due to category mistakes (e.g., a conscious person is a different category than a circuit or a neuron).

Current theories about how consciousness (e.g., phenomenological experiences or self-awareness) might mechanistically arise from brain activity include, e.g., processing of neuronal activity as higher-order representations, “integrated information theory” or “global workspace theory”. The present article highlights one out of several dozen or so theories on neuronal correlates of consciousness, i.e., the “single-neuron theory”. Several authors have formulated this theory before, including one of the authors of the present article. The article does not offer many new considerations, but it might serve to disseminate the idea to a broader readership. In short, it is speculated that consciousness (that is not precisely defined here) requires binding (i.e., integration) of many input channels of information. This binding or integration of large amounts of information the authors assign, because of theoretical considerations, to the dendritic trees of neurons. They state that the dendrites of neurons are the places where multiple individual pieces of consciousness are generated (through so far unknown mechanisms that might involve, according to the authors, physical phenomena at the quantum level), and not at higher levels of integration such as neuronal circuits, larger networks or synchronized neuronal activity. The theory denies potential “emergent properties” of brains or neuronal networks that might give rise to conscious experiences.

The problematic points of the concept are obvious. If individual neurons have conscious experiences (as stated), and not only entire humans and animals, it is unclear what then the definition of consciousness actually is. In addition, if our experiences of consciousness are multiple and distributed across neurons (as stated by the hypothesis), it remains unclear whether all neurons of the many types that exist contribute equally to it, or whether some neurons are more important. Whereas it is clear that dendritic trees of neurons can integrate and process information from many input neurons in rather complex ways, the question how this should be mechanistically related to the experience of “being a neuron” - and what stating that such “neuronal experiences” exist actually means - remains elusive. Why the process should involve “indivisible” units such as “quantum-level events” is also not clear to me.

An intrinsic feature of many theories of neuronal correlates of consciousness is that they are often difficult to be experimentally tested. This is often due to a lack of proper, operational definitions of the terminology, and the confusion of

categories. However, it shoud be noted that in recent years much progress has been made in formulating operational definitions of aspects of what is subsumed under the more general term consciousness, and experimental approaches to detect at least neuronal correlates. In the present article, the term “consciousness” is only superficially defined as “there is something it is like to be in a world”. This concept is of course not amenable to scientific tests.

However, the article is an interesting read. As a comparison, the search for neuronal correlates of learning and memory storage has started also with collecting ideas, such as hypotheses of encoding memories in protein or RNA sequences or in reverberating circuits, and finally has let to current concepts of synaptic plasticity underlying learning and memory formation. This process of collecting ideas, testing them and discarding/accepting specific ones required proper operational definitions of the terminology, and it required keeping different categories apart. The search for neuronal correlates of consciousness is still in the state of collecting ideas, and any contribution to it should be appreciated. However, proper definitions (what is actually consciousness and which aspect of it do we investigate) and disentangling categories (humans and animals, brains, neurons, etc.) seems absolutely necessary.