Review of: "The Quantum Character of Perception: The Probabilistic and Reversible Thermodynamic Cycle can Produce Spin-like Attitudes, Thinking, and Behavior"

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Potential competing interests: No potential competing interests to declare.

The work seems interesting, albeit debatable. The application of the language of physics (quantum mechanics in particular) to the description of the cognitive processes (thinking and awareness) is quite natural since all material processes obey the laws of physics. However, the transfer of terms and concepts of quantum mechanics to the process of consciousness seems here to be too mechanistic and literal. For example, the concept “thought = quantum of consciousness” is simply not true since thought is a more complex and time-consuming object. A quantum is the minimum possible amount of something, while any thought, being formulated, requires a certain (often considerable) number of words. One could say that the ‘word’ is a quantum of consciousness, but this is not true either, since consciousness appears before a person acquires the language (words). In general, the problem of revealing a ‘quantum’ (an elementary, indivisible amount of something) already represents a challenge.

In our works, we employ a close approach based on brain biochemistry/biophysics, neuro computing (Hopfield-like and Grossberg-like neuro-processors) and Dynamic Theory of Information (developed by Prigogine, Haken, and Chernavsky). By the way, it is worth noting that the formal Hopfield’s neuron, i.e., an element that can be in two states, active (plus) and passive (minus), already represents a direct analog of a fermion. The main points and references to early seminal works can be found in

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Emotions represent a very interesting and topical issue. Let us emphasize that it is just the reproduction\ interpretation\ imbedding emotions that is a challenge when creating a human-like\identical robot, while modelling the logical thinking does not present any particular difficulties. Emotions, of course, should support homeostasis, but in general, all human life-support systems are aimed at the same goal, while emotions relate just to the brain and consciousness (Brain and Mind). In our model, emotions does not regulate the entire homeostasis, but only the redistribution of the activity of cognitive processes between two subsystems, one of which is responsible for the perception and generation of information, while the other one -- for the processing and storage of information. The well-known psycho-physiologist

Goldberg believes that the first subsystem is associated with right hemisphere, and the second (storage) -- with the left one. The transfer of activity between them (associated with *corpus callosum*) is represented by a directed arrow, i.e., may have a plus or minus sign (just like in the given article), and it is emotions that control this sign. Thus, the use of fermionic ideology (i.e., up\down states) is close to us.

The “wave-particle” dualism is a very capacious concept, and it is intuitively apparent that it could (and should) be related to the cognitive process. In our model, a ‘wave’ could be correlated with the ‘image’ of a phenomenon, while a ‘particle’ relates to its symbol (and it is the symbol that could be considered as a “quantum of consciousness= quantum of Mind”).

On the other hand, the application of thermodynamics (in particular, the Carnot cycle) to the cognitive process is controversial since thermodynamics describes processes in closed systems well, while as Brain, as well as the Mind, represent open systems (exchanging by energy and information with the environment).

It seems to me that the most vulnerable point in the author’s is the following. The human mental process is very rarely accompanied by one bright ‘pure’ emotion - like joy at the presentation of an award or grief at the death of a loved one. Much more often emotions are mixed and vague: there is joy, disappointment, and doubt. Therefore, Carnot cycles, which the authors consider as stable units of thinking associated with a certain sign of emotion, in fact should be mixed, that could lead to chaotization of all processes. Our understanding of the role of emotion as a regulator of the activity of the ‘hemispheres’ is free from this problem.

It should be noted that the term “social temperature” does not seem to be very successful, because it is perceived as the temperature of public consciousness. I believe that it's better to use the term "emotional temperature".

In general, it would be interesting to suggest any specific experiment that could confirm or disprove the authors' hypothesis.

I am personally very interested in clarifying what exactly the authors identify or associate with the ‘subconsciousness’.