Review of: "Neural Quantum Superposition and the Change of Mind"

Kang Wang[1]

1 University of California, Los Angeles

Potential competing interests: No potential competing interests to declare.

In this paper, the author employed the quantum mechanical formalism to elucidate the double slit experiment and present a novel model, Neural Quantum Superposition, to describe its psychological counterpart in the human mind. Furthermore, he thoroughly examines the concepts of time evolution and perturbation, which play crucial roles in this cognitive framework. But there are something needs to be thought through. One concern lies in the testability of the proposed analogy. As the paper rightly points out, the analogy to a quantum mechanical system cannot be definitively proven or falsified. It is essential to recognize that any future work building upon this analogy would require careful consideration of experimental design and novel methodologies to address this issue effectively. The existence of a more plausible molecular mechanism involving neurotransmitter competition within the human brain has also been mentioned in some previous papers and consider to be the “classical explanation of the microscopic mechanism. This mechanism appears to be distinct from quantum mechanics and is not directly linked to the proposed Neural Quantum Superposition model. system. It is vital for the author to explain the approach of the Neural Quantum Superposition model with a critical mindset. While it introduces a unique perspective, researchers must remain vigilant in exploring other viable explanations and conducting empirical investigations to verify its validity. The manuscript provokes an idea of considering the neural thought process in decision as quantum mechanical. The mathematical description of wave nature as in the Schrodinger equation seems consistent but so is the classical description as given by Edward Nelson (PHYSICAL REVIEW VO. 150, No 4, 1966) in Derivation of the Schrodinger Equation from Newtonian Mechanics. In short, the paper describes a thought process and a mathematical model without a justification of quantization. Thus, it is not quantum mechanical. There is no proven entanglement of nonlocality as in quantum mechanics. Specifically, • Conventional wisdom: Imaginary numbers are an essential ingredient in the formulation of quantum mechanics; without them, the theory would lose its predictive power. In the standard formulation of quantum theory (e.g., Schrödinger’s equation), the state of a physical system is represented by a vector of complex numbers called the wave function. • The author’s (Marsili) underlying approach is to use the double slit experiment to model the psychological experience of selecting an option of between two choices A or B. The neurological network consists of two ensembles of neurons [f(NA) and f(NB)] that are activated in a specific region of the brain. He then equates the f(NA) and f(NB) to quantum mechanical state functions and . • The author then defines the superposition state = + ; followed by = = (+)(+) = (2 + 2 + 2). The issue here is that the , , , are not complex quantities! Therefore, how can this development be called a quantum formulation of psychological choice (decision making) of the human brain (the author refers to this as “Neural Quantum Superposition”) given that complex numbers are not involved? • It is not obvious to this reviewer how this author’s

development can be considered an isomorphism between quantum mechanics and human psychological decision making.

• There is a lot of literature related to understanding brain function in terms of quantum theory (attached are just two) that may prove beneficial to the author. References: Abninder Litt et al, Cognitive Science 30 (2006) 593–603 Stuart R. Hameroff, Cognitive Science 31 (2007) 1035–1045