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

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I read the article “Neural Quantum Superposition and the Change of Mind” by M. Marsili with great attention.

The article introduces the interesting concept of decision-making capacity as the breaking of an entangled state between two equally probable positions. Initially I look at a red or blue T-shirt and I don't know which one to buy: I am therefore faced with a decision. Deciding means, in the physical sense, measuring the entangled state, then breaking it, opting for one state or the other.

This position is absolutely acceptable and offers important food for thought.

However, the article does not solve the fundamental problem of how the decision is made. In fact, there is a logical leap in the article between the initial entangled state and the "decided" state, without explaining how the decision takes place.

In particular, the author should make an effort to introduce, either as an operator or as another state, the prior consciousness/knowledge of the person which, by interacting with the entangled state, allows breaking the symmetry and making the superimposed state evolve towards one or the other other of the contained substates.

I found some errors/inaccuracies that I would like to highlight:

Page 5 penultimate line: “*the point is the existence of a nonlinear term in eq.3, manifest as gamma in eq.5*.” As everyone knows, the double slit experiment shows an interference pattern only when both slits are open. Mathematically this is described by the interference term represented by the gamma term in the article. Having interference does not mean having a "nonlinear" behavior, but still "linear" or if you want "deterministic" in the strict sense (even if obviously the field/intensity oscillations have a simple sinusoidal or quadratic trend). Having a nonlinearity in the interaction point means it allows the system to "make a decision": instead the double slit always returns the same interference mapping, i.e. it does not decide. To make a decision it is necessary that at the point of interaction of the fields there is a true "nonlinear system" that allows decision making. In one of my recent papers (classical, non-quantum) it is shown how the presence of a nonlinearity (in that case photorefractive one) at the junction point between two interacting channels allows to decide whether to make the system evolve towards one or the other state (A. Bile, F. Moratti, H. Tari, E. Fazio, Supervised and unsupervised learning using a fully-plastic all-optical unit of artificial intelligence based on solitonic waveguides, Neural Comput. & Applic. 33, 17071-17079 (2021)).

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Page 6: The fundamental role in the decision is given by the functions f(NA) and f(NB) which precisely describe the asymmetry introduced by conscience. It should be better specified who these functions f(Ni) are because they describe the ability of the single person, based on personal experience, to make a decision.

Page 7: In the definition of the entangled state the coefficients ALPHA and BETA for the overlap are introduced. For simple entagled states (e.g. photon entanglement) these parameters are real. However, I am not sure that, having to describe the evolution of the decision-making state over time, ALPHA and BETA should continue to be real: I think it is more correct and general to consider them complex.

In particular, following the initial definition (eq.2) of the PHI function, the square modulus of the entangled function SIGMA should always be considered (i.e. the product of SIGMA by its complex conjugate) while throughout the article (except in eq .2) the simple square is taken. The calculations from eq.13 onwards should contain the square modulus of the SIGMA function.

PAG:10 caption of figure 3: "causes the modulating of GAMMAmax over time" the term GAMMAmax cannot vary over time since it defines the normalization or, if you prefer, the conservation of energy. What varies is GAMMAtau and, consequently, ALPHA^2+BETA^2.

I really appreciated the introduction of OMEGA frequencies in relation to the energy of the states. I find it very interesting and opens up many food for thought. I would add to correlate the energy to the lifetime of the states: a high energy state is a stable state that does not decay; a low energy state is a state with a short life time, which therefore decays quickly (I forget or replace it with a stronger one).

In conclusion, the article is very interesting and offers many food for thought. It is certainly an important starting point for understanding the decision-making process even if the formulation of how a choice is made is really missing in the general description.