Letter to the Editor

Reply to Mathematical Error in "Incompatibility between Quantum theory and Consciousness"'

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In (Georgiev, 2008), Georgiev claims to have spotted a critical mathematical error in the paper (Song, 2008) showing the incompatibility between quantum theory and consciousness. This note's goal is to show that Georgiev's claim comes from a simple misunderstanding of the paper.

The whole point of (Song, 2008) was to show that quantum theory's existing standard axioms cannot consistently describe the phenomenon presented as **(N2)**, which describes a case where an observer in the mental reference frame $\hat{e}$ is observing his own reference frame's unitary evolution. This phenomenon can be pictured as follows: consider a closed system with an observer and a qubit. The observer can choose or change the measurement basis for the given qubit. Moreover, the observer can still have or change this basis choice $\hat{e}$ even when the closed system contains no qubit. Philosophy literature widely discusses self-observation, i.e., the observer observing his own mental state, which is also known as reflexive self-consciousness or simply reflexive consciousness (for example, see (Halliday, 1989; Velmans, 2008)). **(N2)** considers a case when subject and the object being observed are identical, i.e., both correspond to a single vector, $\hat{e}$, rather than two vectors pointing in the same direction.

Let us now discuss the fallacy in Georgiev's argument (Georgiev, 2008). Vectors $\hat{e}$ and $\hat{v}$ are not just any two vectors; they represent an observable and a state vector, respectively. The axioms of quantum theory say that, in the Schrödinger picture, the state vector evolves under *U*. In the Heisenberg picture, the observable evolves under U^{+}. In the two picture formulation, not only are the probability outcomes the same in both pictures, so is the observation of unitary evolution (Song, 2008). All of the four types of cases that Georgiev, suggests in sect. 3 of (Georgiev, 2008) are irrelevant for describing **(N2)** because **(N2)** does not deal with measurement. **(N2)** does not mention the measurement process because having or changing the basis choice, as written in **(N2)**, requires no measurement. Instead, **(N2)** requires the equivalence of observing unitary evolutions in both pictures. In these two pictures, however, the same vector evolves in two different directions, which do not provide the same unitary evolution observation described in **(N2)**. There is no mathematical error as Georgiev claims and the result in (Song, 2008) remains correct.

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References

Georgiev D. Mathematical error in "Incompatibility between quantum theory and consciousness" by Daegene Song. NeuroQuantology 2008.

Halliday E. Reflexive Self-Consciousness, The Melchisedec Press,1989.

Song D. Incompatibility between Quantum theory and Consciousness. NeuroQuantology 2008;6: 46-52.

Velman, M. Reflexive monism. Journal of Consciousness Studies 2008; 15: 5-50.