Bell inequality violation in the framework of a Darwinian approach to quantum mechanics

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A fundamental particle in physical space subject to conservation of momentum and energy, and characterized by its average mass and its position is methodologically supplemented with an information processor – a classical Turing machine – and a randomizer both defined on an information space. In this way the particle can be considered a generalized Darwinian system on which natural selection acts steering the evolution on the information space of the algorithm that governs the behaviour of the particle. Assuming as starting point for every system the blank state, i.e. no information, an initial random behaviour would plausibly give rise to an emergent quantum behaviour, as discussed in previous preliminary studies [1, 2]. This theory is applied to an EPR-Bohm experiment for electrons in order to analyze Bell inequality violation [3]. A model for the entanglement of two particles has been considered. The model includes shared randomness – by means of a randomizer shared by both particles – and the mutual transfer of their algorithms – sharing programs – that contain their respective anticipation modules. This fact enables every particle to anticipate not only the possible future configurations of its surrounding systems, but also those of the surrounding systems of its entangled particle, bringing about information nonlocality, but only in the information space. Thus, locality would be preserved in the physical space. The theory is realist in a minimalist sense, since the state of the particle includes its position at any time as part of its characterization, as in the de Broglie-Bohm theory. Finally, in this theory randomness is fundamental and irreducible, although the weight of randomness – versus causality – would presumably decrease with time as the complexity of the algorithm increased, up to reaching the quantum equilibrium.

[1] C. Baladrón, in Quantum Foundations and Open Quantum systems edited by T. Nieuwenhuizen et al. (World Scientific, Singapore, 2014), Chap.13.

[2] C. Baladrón and A. Khrennikov, BioSystems 150 (2016) 13.

[3] A. Khrennikov, Fortschr. Phys. doi:10.1002/prop.201600044 (2016).