Editorial

On Probabilistic Quantum Thinking

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Professor Elio Conte is a theoretical physicist, a scientist who is active from many years in the fields of the basic foundations of quantum mechanics and in the application of such quantum theory to the dynamics of living matter and its cognitive functions in humans. In detail, his research fields are on derivation of quantum mechanics by Clifford algebra, and on applications of his Clifford quantum mechanical formulations to the analysis of perceptive and cognitive functions in humans. Rather recently he has formulated some very innovative quantum theories based on Clifford algebra and with co-authors as Prof. Joseph P. Zbilut, Orlando Todarello, Andrei Yuri Khrennikov, Antonio Federici at the Department of Pharmacology and Human Physiology and Department of Neurological and Psychiatric Sciences - University of Bari (Italy), he has also obtained experimental results that are of basic significance. His theoretical and experimental results point out profound implications in the fields of neuroscience and of psychology. This is the reason because the Editorial Staff of NeuroQuantology deliberated to dedicate a Special Issue to such scientist.

The special issue is arranged in the following manner. After article of the Editor in Chief-Dr. Sultan Tarlacı, it contains a target article of Professor Elio Conte in which he gives a wide and excellent review of his results. This paper is followed from the contributions of other eights scientists that are the professors Jerome Busemeyer, Reinhard Blutner,Riccardo Franco, Huping Hu, Andrei Yuri Khrennikov, Dean Radin, Lance Strom, Patrizio Tressoldi.

The Editorial staff of NeuroQuantology remains profoundly indebted with all such authors for the excellent level of the texts and for the high standard of the scientific profile that such special issue has consequently reached.

The formation of scientific method started in 16th-century Europe, and after that went through a huge revolution. The universe ceased to be mysterious and beyond human understanding, and started to be understood as having a mechanical quality. In the wake of Copernicus' theory, the Sun and the Earth and Man were no longer seen as the centre of the universe, but as only one planet of many at the edge of the Galaxy, orbiting in a very unremarkable area. The human-centred universe had disappeared, and this caused great disillusionment. But today's physics has placed man right back at the centre of the universe. For many years it was accepted that an experiment with the same starting conditions would always give the same result, that the experimenter has no role to play in this, and that the physical world had a physical reality independent from the human observer. However, quantum mechanics (QM), which was developed in the 1900s, has a completely opposite view in this regard. It has very different things to say about the ordinary and common place.

For years, quantum physics was seen as the physics of non-living matter. Thus, when biological living things were discussed, this sequence always came to the fore: biology → organism → organs → tissue → biochemistry → physics → classical mechanics + quantum mechanics. It can be seen that there was a reduction to the lower

structures, and that at the base one reaches the level of particles such as atoms and molecules. But when the physico-chemical level is reached, it can be seen that many quantum mechanical events are taking place in living things, and that in fact these are quite normal reactions.

Quantum physics is not only the physics of non-living matter. In our biological makeup, a large number of events, millions even, are taking place that involve quantum physics. The simple examples given above are taking place not in the cold of Siberia but in the warmth of the human body. Even though we do not at present have very strong evidence, there is great likelihood that in the nervous system, some higher cognitive functions such as consciousness, mind and learning are related to this kind of quantum neurobiological process, only more complicated.

Everywhere we can check the correctness of the laws of physics and chemistry; we see that these laws must be valid for living things too. If we accept that living organisms are physical and chemical systems, we can expect that they will behave in accordance with these laws. Such important physicists as Niels Bohr, Erwin Schrödinger, Walter Heitler and Max Delbrück proposed that biological processes could only be described according to the quantum theory model. However, this view did not win any supporters in the field of biology (Matsuno, 2000). Whatever laws of physics and chemistry the atoms in the stars obeyed, the same laws would apply to the atoms in our brains. Our bodies and nervous systems are derived from stardust, and are not subject to different laws. Minerals, plants and animals are all made of the same material and obey the same rules. Biologists try to relate everything they know about life to chemistry, the theories behind chemistry, quantum theory and electrodynamics. Quantum theory, since it can explain all of chemistry and the various characteristics of objects, is accepted as very successful (Feynman, 1988).

There are natural events which cannot be explained by the theories which began with Kepler's classical physics, continued with classical statistical mechanics and reached their final form with Maxwell's equations and classical electromagnetic theory; but they can be explained by QM. Not stopping there, it has been the harbinger and source of a good many new developments. QM has been proved a 'correct' theory by later experiments and observations. In addition to its being correct, it is a theory with internal consistency. That is, it is not possible to make two propositions from this theory which contradict each other.

With the rise of quantum mechanics in the 1900s, the search in physics for a place for "something else" alongside matter began, and unfortunately, the searchers were physicists and not neuroscientists. Consciousness, which at first entered into the philosophical interpretations of quantum mechanics, was eventually incorporated into the equations. Classical physics contradicts the idea of free will, and connections were sought with quantum mechanics, which made random choices (Tarlacı, 2010).

Quantum mechanics is not the final stage in the science of physics. At worst, quantum mechanics may have nothing to do with the workings of the brain. Even then, using the characteristics of quantum mechanics as a metaphor for consciousness and other brain functions can at least provide us with new viewpoints and new ways of thinking (Tarlacı, 2010).

When the descriptions of what constitutes reality get more and more complex, you start to doubt your own reality. Pinching yourself to be aware of reality, you want to reach the conclusion that 'I am real'. But QM is real. There is no doubt that it is based on solid foundations. May be that one day a better viewpoint, but one still derived from today's basic structure of QM, will refine further the role of probability. This will be less controversial and will reach more certain interpretations.

Time and new scientific approach will give us the best proof of this.

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