Schrödinger's Mechanical Cat *

An example of what I have previously termed a "cardinal sin of Philosophy," is "Causal inference from *a priori* reasoning without direct substantiation in … experience." In that essay, [1] I quoted the philosopher David Hume, who "…warned against assuming that our ability to associate different ideas and memories doesn't ensure that the result of said association is necessarily true and scientifically sound." I also added as a corollary, a definition of "Superstition as an erroneous association of two or more ideas."

In order to illustrate this particular cardinal sin, I will use the example of the evolution of the word "quantum." First of all, what is the etymology of "quantum"? The word comes from the Latin *quantum* meaning "as much as, so much as;" or, in the interrogative mode "How much?... How far?... How great an extent?" The word was introduced into physics by Max Planck in 1900 to illustrate the notion of the… "minimum amount of a quantity which can exist." [2] Until that date, the word "quantum" had only been used for physical objects no smaller than microbes. [3]

Before the 1920s, theoretical physicists took it for granted that physical objects possess definite properties that suitable observations can reveal. Their use of the word "quantum" to describe the behavior of subatomic "particles" also took it for granted that these phenomena behave more-or-less as supra-atomic objects do. Again, some of the words used by physicists were also borrowed from existing technical and/or mathematical terminology (e.g., mechanics, locality, event, fluid, charge, orbit, etc.) without proof that they are applicable to the subatomic realm. So, according to quantum mechanics, a measurement of some property –say a particle's momentum– can yield a range of possible results with varying degrees of probability. [3]

"Quantum mechanics" was considered revolutionary because it upended how the atomic-level world was to be described. Gone were the simple certainties of Newton's physics, replaced with only probabilities of this outcome or that. In the Copenhagen interpretation of quantum mechanics, spearheaded by Niels Bohr, properties such as the momentum of a quantum particle have no definite value until a measurement is made. Emblematic of this idea is Werner Heisenberg's famous "uncertainty principle" of 1927, which said that measurement of a particle's momentum limits the ability to find out its position, and vice versa. Many other pairs of observable quantities are also governed by the uncertainty principle. [3]

Albert Einstein never really liked quantum mechanics. He railed in particular at the notion of "quantum entanglement," whereby two particles seem intimately linked. In a letter to Niels Bohr, he called it *spukhafte Fernwirkung* ("spooky remote effect" or "spooky action at a distance.") A subatomic particle is neither here nor there –the theory suggested– until you measure it, it is both. That looked to Einstein like information moving instantaneously (i.e., faster than light), which his own special theory of relativity said was a universally erroneous. In 1935, Einstein showed that quantum theory was incomplete. Einstein's reasoning was unequivocally good: The flaw is that quantum mechanics has an element of "non-locality"–a subtle connection between particles that persists even after they separate. Bohr also did not accept non-locality, whose

implications for our understanding of the fundamental nature of the physical world remain obscure. [4]

As can be seen by the above-underlined words and phrases (i.e., more or less, probability, without proof, possible, uncertainty and obscure), the aporia at the birth of Quantum mechanics opened the door to confusion and even to "Quantum mysticism" –a set of metaphysical beliefs and associated practices that sought to relate consciousness, intelligence, spirituality or mystical worldviews to the ideas of quantum mechanics. Before the 1970s, the term Quantum mysticism was usually used in reference to the von Neumann–Wigner interpretation of Quantum mechanics. In this interpretation, consciousness is postulated to be necessary for the completion of the process of quantum measurement. In his 1932 book *The Mathematical Foundations of Quantum Mechanics*, John von Neumann argued that the mathematics of quantum mechanics allows the collapse of the wave function to be placed at any position in the causal chain from the measurement device to the "subjective perception" of the human observer. [5]

Undoubtedly, many scientists believe that Quantum mechanics has been demonstrated to hold true for complex molecules with thousands of atoms. Predictions of quantum mechanics have been verified experimentally to an extremely high degree of accuracy; but its application to human beings raises philosophical problems, such as "Wigner's friend;" ** and its application to the universe as a whole remains speculative. [6]

In conclusion, I present to you my resultant thesis: That the attempt to elaborate a new method of mechanics to observe and measure subatomic phenomena, using techniques and mathematics appropriate for supra-atomic objects, can never precisely determine their true position and behavior in the space/time continuum. And that labelling it "Quantum" adds nothing to its scientific precision.

However, this discussion must necessarily lead us to attempt a clearer philosophical definition of the word "Science" –but that will have to wait for another day.

* Written by © Pascual Delgado, July 24th 2024.

[1] See my essay *The Seven Cardinal Sins of Philosophy* (July 27th 2016) on this same website.
[2] https://www.etymonline.com/word/quantum
[3] *What's Wrong with Quantum Mechanics?* by David Lindley, September 23, 2005, Physical Review Journal, Focus No. 16, pg.10, American Physical Society.
https://physics.aps.org/story/v16/st10
[4] *What Is Einstein's Spooky Action at A Distance?* –The Economist, March 19th, 2017.
--Published by Principia Scientific International.
https://principia-scientific.com/einsteins-spooky-action-distance/
[5] https://en.wikipedia.org/wiki/Quantum_mysticism
[6] https://en.wikipedia.org/wiki/Quantum_mechanics
** (*Wigner's friend* is a thought experiment in theoretical quantum physics, first published by the Hungarian-American physicist Eugene Wigner in 1961. It is directly linked to the measurement problem in quantum mechanics, with its famous "Schrödinger's cat" paradox.)