Consciousness and Everett's Many-Mind Interpretation

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Abstract

The original approach to the decision of a mind-body problem which basis on philosophically rethought of Hugh Everett’s "multiworld" interpretation of quantum mechanics and Marvin Mensky’s idea about identity of consciousness with process of selection of quantum alternatives is offered. The explanation of visible psychophysical interaction and processes of a reduction of wave function in the quantum mechanics is offered.

Key Words: consciousness, mind-body problem, quantum physics

In this article the original development of M.B. Mensky’s ideas, stated in the article “Concept of consciousness in context of quantum mechanics” (Mensky, 2005), is offered. Mensky’s concept is based on many-world interpretation of quantum mechanics invented as early as 50-th by the American physicist Hugh Everett (Everett, 1957) as means of conceptual difficulties’ overcoming in the foundations of quantum mechanics, arising in connection with the postulate of wave function reduction.

The paradoxically of the reduction procedure consists in the fact that it by no means can be obtained because of Schrödinger evolution of the state vector both of the initial system and of the complex system consisting of the quantum system and the measuring instrument. Measurement from the physical point of view is interaction of the quantum system with the measuring instrument and as that it, of course, can be described by means of Schrödinger equation. Let the instrument be in the quantum state before measurement \(|P\rangle\), and the measurable quantum system is in the superposition state

\[ |\Phi\rangle = c_1 |\phi_1\rangle + c_2 |\phi_2\rangle \]

where \(|\phi_1\rangle\) and \(|\phi_2\rangle\) - are eigenfunctions of the operator of the measured value. Then the state of the complex system “quantum object + instrument” before measurement is represented as:

\[ |P\rangle |\Phi\rangle = |c_1 |\phi_1\rangle + c_2 |\phi_2\rangle |P\rangle. \]

After interaction, owing to linearity of Schrödinger evolution, we will get the superposition describing the state of the quantum system and the instrument:

\[ |G\rangle = c_1 |\phi_1\rangle |p_1\rangle + c_2 |\phi_2\rangle |p_2\rangle, \]
where $|p_1>$ and $|p_2>$ - are states of the instrument after measurement, meaning accordingly: “the instrument has shown value $p_1$” and “the instrument has shown value $p_2$”. Thereby, after interaction with the quantum system the instrument also passes in the superposition state that contradicts that obvious fact, that having looked at indications of the given instrument we always find it in a certain state: either $|p_1>$, or $|p_2>$. The situation does not vary also in case if we try to consider interaction of the system “object + instrument” with the person-observer who reads out indications of the given instrument. The quantum-mechanical analysis shows, that as soon as the observer sees an instrument reading, he also passes in the superposition state and, hence, he is not able to define in which of two alternative states the instrument is. All these things obviously contradict common sense and demand explanation.

The original solution of the measurement problem in quantum mechanics is given by the many-world interpretation of Everett. As a matter of fact, it is based on the literal interpretation of quantum-mechanical description of interaction of the quantum system, the instruments and the observer. The result of this process is the superposition state of such a kind:

$$c_1|\phi_1> |p_1> |f_1> + c_2|\phi_2> |p_2> |f_2>$$

where $|f_1>$ and $|f_2>$ - alternative states of the observer) which literally means that the subject with probability $|c_1|^2$ observes value $p_1$ characterizing the state of the instrument after measurement and with probability $|c_2|^2$ – value $p_2$.

Owing to linearity of Schrödinger equation, no physical process is capable to destroy instantly one of the superposition components having left the second one invariable. Hence, if we consider quantum mechanics as the full and closed theory, we should admit, that both components of the superposition continue to exist after measurement. Everett interprets this situation as follows: no reduction of wave function in the measurement process occurs, but it occurs Universe “splitting” in two copies which are identical in every respect, except for the readings of the instrument, read out by the subject, registering the result of the given experiment. In the Universe$_1$ he sees value $p_1$ and in the Universe$_2$ - value $p_2$. It means that the subject-observer “is split” in two copies (“twins”) which are identical in every respect except that the first “twin” finds out himself in the Universe$_1$ and observes value $p_1$ and the second “twin” finds out himself in the Universe$_2$ and, accordingly, observes $p_2$.

Already in the Everett theory, consciousness appears to be closely connected with the process of quantum superposition elements’ selection. Exactly consciousness splitting leads to visible effect of wave function “reduction”: we see a quite certain result of measurement just because our consciousness was split together with the Universe and it is capable to see only one of the components of the initial superposition. However, in the theory it is not clear what consciousness of itself is. Mensky (Mensky, 2005) makes the following quite logical step and postulates that consciousness is none other than “the process of division of the quantum state in components” itself. Particularly, he writes: “Ability of a person (and any breather), called consciousness, - is the same phenomenon which in the quantum theory of measurements is called state reduction or alternative selection, and in Everett concept it appears as division of the uniform quantum world into classical alternatives” (Mensky, 2005).

As a whole, accepting this idea about connection of consciousness with the process of “alternatives selection” in general, we, nevertheless, believe, that there is no necessity to connect it with Everett Universe splitting in “equally real” duplicates and the more so with splitting of the subject in great number of “equally real” twins. Both these positions are not only unnecessary, but also entail a number of difficulties, from which, however, it is possible to get easily rid of, if we represent the process of “alternatives selection” a little bit differently.

At the beginning let us note obvious lacks of Everett interpretations of the measurement process. We will begin with the thesis about the Universe “splitting” in great number of “duplicates”, each of which corresponds to one of the members of the
state superposition of the investigated quantum system. First, the idea itself, that the Universe as a whole is split in great number of “equally real” duplicates only because of the fact that I have made some experiments with instruments and micro objects, seems fantastic. How could my so insignificant actions make so grandiose result? This lack is marked, in particular, by Mensky (Mensky, 2005). Still bigger problems are generated by the idea of the subject-observer “splitting” in great number of twins, each of which finds out himself in one of “the parallel Universes”. In this situation, we should either recognize the absurd idea of possibility of “dual personality” existence - possibility of existence of two individuals not connected with each other by relation of consciousness unity, having the same “Ego”, or admit that the slightest change in my perception is capable to destroy self-identity of my “Ego”. Both ideas seem contra intuitive. Thus, we should abandon admission of existence both of great number of Universes (multiverse), and “the multiple personality”, i.e. we should admit that “in fact” there is only one Universe and each person exists only in the form of the unique personality.

How could this conclusion be combined with the idea that consciousness function coincides with the function of “alternative selection” in quantum measurement? It is clear, that alternatives selection is inseparably connected with sensual perception of these alternatives. Consciousness chooses exactly what we sensually perceive. Moreover, vise versa, what our consciousness chooses in the process of alternatives selection is just what we perceive. Hence, it is natural to draw a conclusion that the choice of alternative and sensual perception is in fact the same thing. Where do other alternatives, which we do not perceive, disappear in this case? They do not disappear anywhere, and nothing occurs to them. They remain there where they were – in initial superposition.

Here it is appropriate to recollect classical Born “probabilistic” interpretation of the vector state. According to literal understanding of this interpretation the quantum state before measurement describes only probability distribution to obtain these or those results of measurement of the certain physical value. There are no grounds to think that this value exists in fact as something definite before we have made measurement. Moreover, such assumption leads to the contradiction with formalism of quantum mechanics. Hence, before measurement the quantum system exists only in the form of collection of “real possibilities” (potentialities) and only measurement transfers one of these possibilities in the real actual state.

Actualization is connected with observation, and observation is always associated with sensual perception. Therefore, we can assume quite legally that actualization and sensual perception is in fact the same thing. Perception transfers one of the superposition components into the act, whereas all the rest (inconceivable) components of the superposition are still there where they were - in the sphere of potential being. At that, perception (actualization) does not have any physical influence on the state vector, including the component, which it actualizes. Actualization (i.e. “sensual recognition”) just simply “marks” one of a superposition component that does not influence in anyway physical state of the quantum system, evolution of its quantum state, but, however, influences the subsequent actualizations. Everything looks as if at calculations we simply “mark” with a marker one of a superposition component that would not influence in any way the further calculations, but would essentially influence the subsequent marks done by us.

To obtain the realistic theory of quantum measurements, we should impose on the processes of actualization (“marking”), at least, two conditions: self-consistency and inter subjectivity. The self-consistency condition demands that each subsequent actualization be conformed to the results of the previous actualizations. For example, if in the first measurement (of the same quantum system) actualization “signed” (“marked”) component \(\phi_1\) (that in our example corresponds to perception of \(p_1\)) and, respectively, “did not mark” component \(\phi_2\), then in the following measurement it can “be marked” only that component of the new superposition which evolutionally descends from the “marked”
state $\psi_1$ but it will never be “marked” any component which descends from the earlier “not marked” state $\psi_2$ though its “descendants” do not disappear anywhere and on equal rights with “descendants” of $\psi_1$ are present in the final superposition. Actually, exactly this condition of self-consistency generates illusion of the state vector “reduction”: as the “not marked” components of the superposition never give “marked” “descendants”, then the corresponding components and their “descendants” never become the object of perception and, hence, they can be simply neglected.

The condition of inter subjectivity demands the results of different subjects’ perception be mutually coordinated. That is, if I in the quantum measurement have seen that the instrument shows value $p_1$ (and, hence, state $\psi_1$ was actualized) my friend, who observes my experiments will also see the same thing. Thus, all actualizations of quantum Universe states are mutually coordinated, and it creates the general for everybody inter subjective “visible world”.

Our concept, thereby, essentially differs from the Multiverse theory. First, in our model nothing is split: either the Universe, or the observer. Secondly, in the Multiverse concept each observation “singles out” a certain “classical alternative”, describing the Universe state as a whole. In our model as actualization coincides with sensual perception, it is enough only transition of the physical state of that part of brain which is responsible for sensual perception (“sensorium”) in “the actual plan of being”. Hence, each measurement fixes not “the Universe state”, but only particular, attached to the certain subject “the Universe perception state” represented in “sensorium”. It should be also noticed that if no observation is made, there is no reason in describing the quantum state in the form of any superposition. The superposition states make sense only in relation to any kinds of measurements - as a result of the given quantum state decomposition on eigenvectors of the operator of the measured value. Thereby instead of Multiverse (set of the parallel universes), we have simply the Universe quantum state describable by a state vector. If we imagine that this Universe quantum state is defined at every moment of time then the corresponding “all-time” state vector will describe all possible (physically permissible) results of any possible measurements carried out at any moments of time (the Universe of physically possible).

As this “all-time” Universe state vector represents a certain self-identical stationary structure, it can be represented as a “crystal” in which any possible “perceptions of the Universe” are initially “written down”. We will call this structure “the quantum crystal”. It is possible to represent the process of actualization (perception), in this case, as a certain “excitation wave” which extends inside the quantum crystal along the time vector and it moves as an aggregate of “points” (each of which represents individual consciousness) which move not chaotically but along certain self-consistent and mutually coordinated trajectories and at that do not have any influence on the quantum crystal itself.

It is clear that the consciousness should execute some work useful to its carrier, realize some important functions. Intuitively it seems obvious that consciousness is that in me, what perceives, thinks, understands and made the behavioral decisions based on understanding and comprehension of the apprehended things. However earlier we, after Mensky, connected function of consciousness exclusively with actualization of the quantum alternatives. At that function of consciousness is only a selection of the quantum superposition elements of the human brain state, singling out (“marking”) of one of this superposition elements and its actualization (perception). Under the self-consistency requirement, the subsequent actualizations depend on previous ones, and that creates illusion of “state reduction”. Thereby function of consciousness is a state reduction. But reduction, according to the principles of quantum mechanics, is implemented in a random way (taking into account the weight factors attributed to the members of the superposition). Then it turns out that consciousness function, figuratively speaking, comes to “throwing of dice” and, then, “marking” of the element of the superposition chosen in a random way. It is clear that it is not enough to assert that
consciousness “comprehends something”, “understands” or “makes a decision”. Of course, even such primitive function as “random selection of the superposition components and reduction of other members» as Mensky (Mensky, 2005) noticed, is also rather useful for a living organism, as it (under the conditions of self-consistency and inter subjectivity) leads to stabilization and continuity of the visual environment picture.

If consciousness is really the subject of comprehension, understanding and decision-making then it should not simply “throw dice” and “mark” the chosen state (transferring it into sensually perceivable state), but it should also be capable to implement state selection deliberately, reasonably and expediently. If we attribute such reasonable and expedient selections to the process of sensual perception of visual environment, we come to rather a fantastic hypothesis, that consciousness is able to influence the choice of surrounding reality purposefully.

Nevertheless, consciousness function, obviously, does not reduce to perception function. Consciousness does not only perceive, but also understands the apprehended things and on the basis of this understanding makes the deliberate behavioral decision. It is natural to assume, that if in the act of sensual perception of the outer world the selection of the superposition member is implemented purely randomly (in conformity with predictions of quantum physics) then in the course of perception of own behavioral decision the selection of the actualizable superposition component occurs already “deliberately”, i.e. reasonably, expediently, considering possible consequences of the given selection etc. The selection is implemented on the basis of understanding of the perceivable information and estimation of supposed action importance.

The understanding act assumes correlation of the percept with all possible contexts. Set of all possible contexts forms “a semantic field” which is substantially identical to “a set of all possible worlds», i.e. to expanded Multiverse, including, besides physically possible worlds, physically impossible ones as well. Meaning of any thing is its relation to all conceivable real and possible things, i.e. its relation to “a semantic field” as a whole (Ivanov, 2007). “The Quantum crystal” can be considered, in that case, as a certain area “inside” “the semantic field” which is distinguished by the fact that only in this area actualizations are possible. At that probability of actualization (perception) of any superposition components, obviously, will not be entirely defined by predictions of quantum mechanics (as alternatives selection in this case is implemented intelligently and expediently - with correlation of each alternative with all “semantic field” as a whole, but not in a random way). Mechanism of “the accepted decisions” perception (unlike the mechanism of the external world perception) will, thereby, create illusion of physics laws’ violation which the observer can interpret as a result of influence on the brain of a certain extraneous “force” essentially changing probability distribution ordered by quantum mechanics. It should be underlined that this “probabilities shifting” will occur only in the subject’s perception (and in perception of other subjects - under the condition of inter subjectivity), but will not have any influence on real physical processes.

It turns out that every our action which seems to us deliberate and reasonable (produced just by our “Ego” and not by corporeal automatics) is such only in our perception. Purely physically, our body “implements” (in the potential plan, of course) all actions at once (both reasonable and unreasonable) which are ordered to it by the laws of quantum physics. For example, if a stone flies at me and I deliberately avoid collision with it then this action purely physically exists as a part of superposition with other possible actions, a part of which are less reasonable and lead to damage of my organism. However, my consciousness perceives only that action which seems to me the most intelligent and expedient. Under the condition of self-consistency, only this action will be fixed in memory, and under the condition of inter subjectivity it will be fixed in perception and memory of other subjects.

The proposed concept of “consciousnesses in the quantum world”
resolves the basic conceptual problems, which arise both in connections with the analysis of the mind-body problem and in connection with the measurement problem in quantum mechanics. The analysis of the measurement problem leads to two conclusions contradicting each other: 1. Consciousness (of the observer) should inevitably be considered in the physical picture of the world. 2. Consciousness cannot be described and explained by means of the mathematical apparatus of the quantum theory.

The analysis of the mind-body relation also leads to the similar paradox. Here we also obtain the contradiction: 1. Consciousness should operate in the physical world. 2. The physical world is causally closed and, hence, consciousness influence on physical processes is impossible.

Both these contradictions in our model are easily resolved. Consciousness is not described by physical formalism, but it should be considered at the analysis of sensual perception of physical reality. Consciousness does not influence physical processes, but selectively influencing the process of physical reality's perception, it creates illusion of psychophysical interaction. Every action of consciousness in the world is only a selection and actualization (perception) of those components of “the Quantum crystal” (“the Universe of physically possible”) in which this action is already physically (potentially) implemented. For example, my consciousness does not influence my hand typing this text, but only actualizes that part of the Universe of possible in which I have already been “depicted” typing this text. Consciousness simply selects for perception that part of the reality in which my body implements action wished by me.

References
http://ivanem.chat.ru/ontology1.htm