Human Perception of Physical Experiments and the Simplex Interpretation of Quantum Physics

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In this paper it is argued that knowledge dividing the usual, unusual, transient and transcendental depends on human perception of the world (macro or micro) and depends too on the inclusion of human consciousness in the system. For the analysis of this problem the idea of "Schrödinger's cat" is employed. Transient and transcendental knowledge of the state of Schrödinger's cat corresponds to the case when the observer's consciousness is included in the system. Here it is possible to speak about the latent parameters of the sub quantum world of which Einstein was convinced. Knowledge of the unusual state of Schrödinger's cat, simultaneously alive and dead, corresponds to a case of the open micro world. The usual knowledge of the state of Schrödinger's cat (alive or dead) corresponds to a case of the open macrocosm. Each world separately divides the objective and illusory.

1 Introduction

Scientific cognition frequently avoids the question of interaction of our consciousness with the external world. However, the celebrated known physicist Wigner [1] maintains that separation of our perception from the laws of a nature is no more than simplification and although we are convinced that it has a harmless character, to nevertheless merely forget about it does not follow.

Purposeful perception is sensation and in order to understand more deeply that sensation it is necessary, in the beginning, to be able to distinguish sensation in a macrocosm (spontaneously) from sensation in a microcosm (through the device). Many scientists believe that information recorded with the help of devices can be equally considered with sentient data. Their belief, harmless at first sight would, should not result in the serious misunderstanding. But actually it is not so.

Sensation in a macrocosm, for example, that of a sunrise, and sensation in a microcosm, for example, some number displayed on an ammeter, are not the same. Perception, by definition, is complete subjective reflection: the phenomena are events resulting from direct influence on sense organs, and in a macrocosm it certainly does not depend on the level of our knowledge. Nobody will argue that a sunrise and other such phenomena, events in a macrocosm, are perceived by all people equally. But in a microcosm this is not so. Perception of the invisible world of electrons is not whole or complete and therefore depends on the level of our scientific knowledge. But that knowledge is connected to our consciousness. It becomes clear then why the consciousness of the observer finds itself a place in quantum physics.

The problematic interpretation of quantum mechanics has been a controversial topic of discussion for more than 80 years. The most important upshot of this for physicists is that this problem is related to the problem of consciousness — an interdisciplinary problem concerning not only physicists, but also philosophers, psychologists, physiologists and biologists. Its solution will result in deeper scientific knowledge. As many scientists have argued, the path to such knowledge should not consider separately the physical phenomena and the phenomena accompanying our thinking. By adhering to this position it is reasonable to conclude that the correct interpretation of the quantum mechanics comprises such knowledge.

Really, the problem of quantum physics, as a choice of one alternative at quantum measurement and a problem of philosophy as to how consciousness functions, is deeply connected with relations between these two. It is quite possible that in solving these two problems, it is likely that experiments in the quantum mechanics will include workings of a brain and consciousness, and it will then be possible to present a new basis for the theory of consciousness

2 Dependence of physical experiment on the state of consciousness

During sensation our brain accepts data and information from an external world. On the basis of these data, during thinking, knowledge is formed. The biological substratum of thinking is the brain. Therefore, knowledge is a product of the brain.

Consciousness, as it is known, is a property of the brain and therefore already concerns the origin of knowledge. Clearly, this relation is either active, i.e. influencing the origin of knowledge, or passive. If active as well as passive, we ask: Does consciousness influence the origin of knowledge? It is possible to answer this because it is known that there are different kinds and levels of consciousness and scientific knowledge which represent various forms and levels of reflection. Considering the definition of knowledge in that it is a reflection of objective characteristics of reality in the consciousness of a person, we are interested with a question:

When and what reflection — passive or active, unequivocal or multiple-valued — takes place?

Passivity or activity of reflection depends on passivity or activity of the consciousness of the observer. Clearly, consciousness is passive if it is not included in the system, being in this case an open system. Consciousness can be active if it is included in the system, being in this case a closed system. Activity or passivity of consciousness is expressed in its ability to influence reflection on reality, i.e. on knowledge. With the contention that active consciousness may influence reflection on reality it is possible to imply that this influence can be directed onto reality as well. Whether or not this is so is however difficult to say. But we know that a closed system should differ from an open one. The difference is expressed in the activity of consciousness, which influences reflection and knowledge.

The unambiguous or the multi-valence nature of reflection does not depend on the activity or passivity of consciousness; it depends on perception, i.e. from integrity of perception. The perception of a macrocosm is complete, but the perception of a microcosm is not complete. Therefore it is clear that reflection on reality in a macrocosm will be unequivocal, but in a microcosm, multiple-valued.

Multiple-valued reflection does not influence knowledge, but, nevertheless, makes knowledge multiple-valued, unclear, and uncertain. It now becomes clear why knowledge of a microcosm results in uncertainties, including the well-known Heisenberg Uncertainties. It is possible that these uncertainties are effects of consciousness, dependent not on the activity of consciousness, but on the impossibility to completely perceive the cognizable world by consciousness.

Thus, in a closed system, reflection is active. In an open system reflection is passive. In a macrocosm it is unequivocal but in a microcosm it is multiple-valued.

For elucidation we shall imagine a mirror; a usual mirror, i.e. a mirror with which we are commonly familiar. Let's assume that this mirror is our consciousness. The mirror is passive, because reflection of objects in it does not depend on itself. Similarly, consciousness is passive, if reflection of reality in it does not depend on itself. Clearly, the passive consciousness appropriate for this mirror is consciousness in an open system, because only in this case is consciousness similar to a mirror that can be counter-posed to a being. If around the mirror there is a bright light, for example, sunlight, the reflection of objects in it will be unequivocal. Perception of these objects will be complete. This case of bright light around of a mirror corresponds to a case of the macrocosm. Really, the macrocosm is our visible world. But now we shall imagine that the mirror is in darkness. Images are absent in the mirror. This case of darkness around the mirror corresponds to a case of the microcosm. The microcosm is our invisible world. Let's now imagine that we want to receive some image from the mirror. For this purpose we artificially illuminate an object. This action corresponds to how we investigate a microcosm with the help of devices. Artificial illumination is not ideal; therefore reflection of objects in the mirror will be multiple-valued. Clearly, perception will not be complete either. Already, as a result, knowledge cannot be unequivocal. The Heisenberg Uncertainties of a microcosm are the proof. Knowledge from these uncertainties is multiple-valued because it is impossible to determine exactly the localization and speed of a micro-particle. So the usual mirror corresponds to passive consciousness. But what mirror will correspond to active consciousness? In this case the system is closed and the mirror should be unusual; the reflection of objects in it depends on itself. Such a mirror includes a mirror, or more exactly, many mirrors; a mirror in a mirror in a mirror.

So consciousness includes consciousness; it is consciousness in consciousness. One could say that such mirror is a distorting mirror, although a word "distorting" is perhaps not the best description. It is a mirror of unusual reflection. Depending on the mirror, reflection in it varies up to the unrecognisable. To make a distorting mirror a person performs an act — alters a usual mirror. To effect this action he must be included in the system — he cannot simply take a usual mirror in his hands. Similar to this action of the person, consciousness is included in the system, can change consciousness, and reflection of reality will depend on it. Therefore knowledge, being this reflection, will depend on consciousness. In this case, consciousness influences processes in the origin of knowledge. Phenomenologically speaking, reflection of objective reality will already be an actual stream of consciousness.

After we have found out in what case some reflection takes place, we shall be able to answer the aforementioned question: Does consciousness influence the origin of knowledge or not?

Passive consciousness can be excluded from being, from what takes place in an open system. In this case, being is determined according to materialist philosophy. In an open system, passive reflection takes place, and consequently knowledge is defined as passive reflection of reality in the consciousness of a person. As remarked above, passive reflection is unequivocal in a macrocosm, and it is multiple-valued in a microcosm. Therefore, in the case of an open system, in a macrocosm, knowledge is passive and unequivocal. In a microcosm it is passive too, but it is multiple-valued. We shall call this knowledge, accordingly, *usual* and *unusual* knowledge respectively — the unusual because knowledge of the microcosm, including the Heisenberg Uncertainties, is for us, unusual.

Thus, in unusual knowledge there is an affection of consciousness. Hence, it is necessary to consider ontological problems in physics. Many physicists adhere to a definition of being according to materialism. Therefore, constructed by them with the help of theories, physical reality characterizes the world, and excludes the consciousness of the observer

from consideration. We shall call such a concept of physical reality *usual*. Building on it, the physicists do not take into account questions connected with perception and consciousness, so it is possible to act only in the case of a macrocosm.

For a microcosm, physical reality, as constructed by the physicists, should be entirely different; unusual. We shall call physical reality describing a microcosm, as an open system, *ontological*. In this case, effects of consciousness take place, but the effects are connected not with the activity of consciousness, but with reflection or integrity of perception of the cognizable world.

Answering "yes" to the question: Does consciousness influence the origin of knowledge or not? it is evident that consciousness is active and therefore cannot be excluded from the being participating in the closed system. As we have already seen, in the closed system active reflection takes place, so knowledge is active reflection of reality in the consciousness of a person. In this knowledge there is a place for the effects of consciousness, but they are connected not with perception of the cognizable world, as in case of unusual knowledge, but with the activity of the consciousness of the observer.

Can active consciousness of the observer be consciousness of the person? Certainly not! The system, having captured the consciousness of one person, is not closed, because outside it there is the consciousness of another person in which reality can be reflected. Thus, when we speak of consciousness of the observer in the closed system, i.e. about active consciousness, we mean that it cannot be consciousness of the person. The consciousness of the person is a passive consciousness, i.e. this consciousness of the observer in an open system. Knowledge which takes place in this case is *a simple* knowledge of passive consciousness — the person. Accordingly, this knowledge is *usual* (in case of a macrocosm), or *unusual* (in case of a microcosm).

Knowledge, which takes place in the case when the system is closed, is knowledge of active consciousness. This knowledge is absolute knowledge.

Let's consider absolute knowledge in the case when the closed system is a macrocosm. In this case knowledge is active and unequivocal reflection. We shall call such knowledge *transcendental*. Such a name is justified because transcendental knowledge can be understood by passive consciousness. Clearly, such analysis is possible in a macrocosm because in this case we learn of our world, which, in contrast with the microcosm, is visible, audible, and otherwise sentient. *Transcendental* knowledge concerns scientific knowledge.

In the case of a closed system as a microcosm, knowledge is active, but multiple-valued reflection and so gives rise to latent uncertainties which are not Heisenberg Uncertainties. The paradoxes concerning the laws of the quantum world were explained by Albert Einstein as properties of an unobservable, deeper sub-quantum world; hidden variables. With the help of Bell's inequalities it was proved that latent parameters (hidden variables) do not exist. However, if Heisenberg Uncertainties are open to passive consciousness, i.e. to the consciousness of a person, then the latent parameters are open only to active consciousness. Therefore we also cannot open them. We shall call such knowledge *transient*. Such a name is justified in that it cannot be understood.

Thus, for open systems, knowledge is passive and unequivocal in a macrocosm, passive and multiple-valued in a microcosm. For the closed systems the knowledge is active and unequivocal in a macrocosm, active and multiple-valued in a microcosm. Accordingly, knowledge is divided into the *usual*, *unusual*, *transcendental* and *transient*. Physical reality for these cases are, philosophically speaking, usual, ontological and active.

3 The "Schrödinger cat" experiment

It is known that in a macrocosm a body can be in only one state. Clearly, this knowledge is usual. In a microcosm an elementary particle can be simultaneously in two states. Of course, such knowledge is *unusual*.

However, it has been established that in the result of intensification the superposition of two micro-states turns into superposition of two macro-states. Therefore in a macrocosm there is unusual knowledge. This paradox has been amplified by E. Schrödinger in his mental experiment, known as Schrödinger's cat.

In the paradox of Schrödinger's cat the state of a cat (alive or dead) depends on the act of looking inside the box containing the cat, i.e. depends on the consciousness of the observer. Thus, consciousness becomes an object of quantum physics. We mentioned above that in an open system the consciousness of an observer, being passive, is the consciousness of a person. In an open macrocosm perceived by us unequivocally, the open microcosm is perceived by us as multiple-valued. Frequently it is asked: Where is the border between the macrocosm and the microcosm It is possible to answer that this border is the perception of a person. The state of Schrödinger's cat simultaneously both alive and dead corresponds to an open microcosm. Although we talk about a macro object — a cat — it is connected to a microcosm; it is a microcosm when a person doesn't open the box and look at the cat. As soon as a person looks at the cat in the box, i.e. completely and unequivocally perceive it, the state of the cat is determined, for example, the cat is alive. This state of the cat corresponds to an open macrocosm — to the world which we live.

The state of Schrödinger's cat — simultaneously alive and dead — is the entangled state. In an open system the paradox of Schrödinger's cat is described with the help of the decoherence phenomenon [2]. The open system differs from the closed. In an open system there are some degrees of freedom, including a brain and the consciousness of the observer that by our measurements can give us information. We open the box and find out that the cat is actually alive — it is the deco-

herence. With a statistical ensemble of Schrödinger cats, we can use probability theory and statistical forecast.

What will be Schrödinger's cat in a closed system? The most interesting theory here is the many-world interpretation of quantum mechanics of Everett and Wheeler [3]. The closed system is the whole world, including the observer. Every component of superposition describes the whole world, and none of them has any advantage. The question here is not: What will be the result of measurement? The question here is not: In what world, of many worlds, does the observer appear? In the Everett-Wheeler theory it depends on the consciousness of the observer. In the terminology of Wheeler such consciousness is called active. Knowledge in this case is knowledge of active consciousness and called by us the transcendental (in a macrocosm) and the transient (in a microcosm).

Recall Einstein's objection to Bohr's probabilistic interpretation of the quantum mechanics: "I do not believe that God plays dice". M. B. Menskii [4] writes "Yes, God does not play dice. He equally accepts all possibilities. In dice plays the consciousness of each observer". The author means, that the consciousness of the person, his mind, builds the forecasts, based on concepts of probability theory. Let's agree that the world, about which Einstein speaks, in which God does not play dice, is a real world. The world in which the person plays dice is a sentient world.

Besides these two worlds there exists, according to Max Plank [5], a third — the world of physical science or the physical picture of world. This world is a bridge for us, and with its help we learn of those worlds. It concerns the aforementioned physical reality. Descriptions of the real and sentient worlds in the world of physical science are the quantum and classical worlds, accordingly.

In physics the classical world is very frequently interpreted as the objective world. The quantum world exists as some mathematical image — a state vector, i.e. the wave function. Therefore it is objectively non-existent, an illusion. Such an interpretation, warns Plank, can result in the opinion that there is only a sentient world. Such an outlook cannot be denied logically, because logic itself cannot pluck anyone from his own sentient world. Plank held that besides logic there is also common sense, which tells us that although we may not directly see some world, that world may still exist. From such a point of view, interpretation of the mutual relations between the worlds will be very different — the quantum world is objective, the classical world is an illusion.

It is possible to interpret these worlds from the new point of view. As we saw above for Schrödinger's cat, the border between quantum and classical worlds is erased. Therefore the real world is both the objective quantum world and objective classical world. Furthermore, the sentient world is both an illusion of the quantum world and an illusion of the classical world. Thus, the quantum and classical world each consist of components — objective and illusory components.

Are there an objective classical world and an illusion of the quantum world in our understanding? The classical world is the world of macroscopic objects and our consciousness sees and perceives this world. For us it should be sentient. Illusion of the classical world satisfies this condition. The quantum world is the world of microscopic objects. This world is invisible to us and so cannot be the sentient world. The objective quantum world satisfies this condition. Thus, although there is an objective classical world and an illusion of the quantum world, these worlds are outside the ambit of our consciousness. It becomes clear now why classical and quantum physics essentially and qualitatively differ from each other. Classical physics studies a physical picture of an illusion of the classical world. Quantum physics studies the physical picture of the objective quantum world.

Thus, our consciousness comprehends the objective quantum world. Following Menskii [4], it can be represented symbolically as some complex volumetric figure, and the illusion of the classical world is only one of the projections of this figure. It will be expedient to present this complex volumetric figure, as a simplex.

4 Simplex interpretation of quantum physics

From functional analysis [6] it is known that a point is zero-dimensional, a line is one-dimensional, a triangle is bi-dimensional, a tetrahedron a three-dimensional simplex. The three-dimensional simplex, a tetrahedron has 4 bi-dimensional sides (triangles), 6 one-dimensional sides (lines) and 4 zero-dimensional sides (points), giving a total of 14 sides.

It is impossible to imagine a four-dimensional simplex in our three-dimensional space.

The parallelepiped or cube is not a simplex because for this purpose it is necessary that all 8 points were in six-measured space. Thus, formed from more than four points, is a complex volumetric figure.

Let's assume in experiment with 100 Schrödinger cats, 80 cats are alive and 20 are dead. Points 20 and 80 are two ends of a simplex. At other moment of time or in another experiment let's assume from 100 cats that 60 are alive and 40 are dead. These two points are also ends of a simplex. We can continue our tests, but we shall stop with these two, and thus, we consider a three-dimensional simplex — a tetrahedron. The ribs of our tetrahedron indicate various probabilities. For example, the rib linking the points 80 live cats and 40 dead cats give $80/120 = 2/3$ of probability of the case in which a cat is alive. In the case 60 live and 20 dead cats, the rib of the simplex shows that the probability is $60/80 = 3/4$, etc. The rib linking the points 20 dead and 40 dead cats and the rib linking the points 80 live and 60 live cats each give a probability of 1. Let's consider the faces of the simplex. In the case of a live cat on one of them the probability changes from 2/3 to 0.8; on another face, from 3/4 to 0.6; on third face, from 2/3 to 0.6; on fourth, from 3/4 to 0.8 etc. As to points of a tetrahedron

they specify determinism of an event. For example, the point of 80 live cats specifies that in fact all 80 cats are alive.

We could construct the simplex with various probabilistic ribs and sides because we are observers from outside. In this case we built a physical picture of the real world. Only in this world is the probabilistic interpretation of the quantum mechanics given by Bohr true.

In a physical picture of the sentient world, we cannot construct a simplex. We can only perceptions as projections, i.e. sides of a simplex. After that, classical probability is applied, but it is applied, we shall repeat, not for a whole simplex, but only for one of its sides. This side, perceived by us as the sentient world, is an illusion because it not unique: there exists a set of worlds alternative to it. With a physical picture of the world, we can even count the number of parallel worlds. As our world is three-dimensional and our consciousness exists in it we can count only sides of a three-dimensional simplex — a tetrahedron, which, as shown above, has only 14 sides.

Returning now to the dispute between Einstein and Bohr, in the real and sentient worlds, of course Einstein was right — really, God does not play dice. However, in the physical picture of the world, Bohr had the right to apply probability and statistics.

Usually in a game of dice we mean only the act of throwing dice. However, dice consists of acts before (we build forecasts) and after (realization of one forecast from possible results). This situation can be likened to a court case; there is a hearing of a case, a verdict and a process after the verdict. In the physical picture of the real world, a game of dice by consciousness is a game up to the act of throwing the dice. Our consciousness can only imagine all sides of a three-dimensional simplex, i.e. all alternative results. But the choice of one of them depends on "active" consciousness. In our sentient world, in the act of throwing the dice, we shall see this choice. In the physical picture of the sentient world, a game of dice by consciousness is a game after the act of throwing the dice. Having these outcomes allow us to statistically forecast.

Thus, uncertainty of the real world qualitatively differs from uncertainty of the sentient world. Thus, uncertainty of the sentient world is not present and, as a matter of fact, the finding of the probability of some casual event has no connexion with uncertainty because this probability exists beforehand, a priori, and by doing a series of tests we simply find it. It becomes clear then why quantum statistics essentially differs from the classical.

This simplex, with various probabilistic ribs and sides, we could construct with the help of epistemological analysis. Knowledge which was analyzed in this case is knowledge of active consciousness. In the case when the simplex from a volumetric figure is converted into one of its projections, we see only one of its sides (a point, a line, a triangle). Knowledge appropriate to this case is knowledge of passive consciousness. In a simplex the lines (80, 20) and (60, 40) where points 80, 60 are live, and 20, 40 are dead cats, correspond to *usual* knowledge. In this case we use classical statistics (after we have looked in the box, Schrödinger's cats became simple cats, and we already have data, for example, from 100 cats in one case 80 alive, and in the other case 6, etc.). With the help of this date we find an average and dispersion of a random variable.

But when the ensemble consists not of simple cats, but Schrödinger cats we deal with a microcosm, with a world, the perception of which, is multiple-valued. In this case, for example, the point 80 is already fixed simultaneously and with the point 20, and with the point 40. Therefore the triangle (20, 80, 40) is examined. Similarly, the triangle (40, 60, 20) is also considered. These triangles correspond to *unusual* knowledge. In this case we cannot apply classical statistics. Therefore we use quantum statistics.

There is a question: But what in a simplex will correspond to *transcendental* and *transient* knowledge? We can answer that transcendental knowledge is knowledge of active consciousness in the case of a macrocosm, and corresponds to the entire simplex. Transcendental knowledge can be acquired by us a priori (because we could construct the simplex), but for transient knowledge this is not possible. Knowledge of active consciousness appropriate to transition from a microcosm to macrocosm, i.e. to our world, will be transcendental, and from a microcosm to a microcosm it will be transient. There is no sharp border between macro-world and microcosms, but in fact there is a sharp border between knowledge about them.

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