

Quantum Mechanics and Subjective Experience

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ABSTRACT: There is a deep analogy between quantum reality and subjective experience. Such subjective properties as wholeness, temporal nonlocality, actual-potential structure of subjective being, qualia, individuality have analogues in quantum world.

INTRODUCTION

A subject of the paper is a search for analogy between properties of human subjectivity and quantum reality. Hypothesis of a consciousness quantum nature is widely discussed now (Walker (1970), Bohm (1983), Penrose (1989), Stapp (1993), Globus (1996), Hameroff & Penrose (1996), Sarfatti (1996)).

The early attempts to explain consciousness on the basis of the quantum theory often have two drawbacks. As a rule, there is no philosophical substantiation of the possibility of physical and subjective collation and, besides, the authors try to explain complex, high level forms of consciousness directly from the first quantum theory principles. But even the human (to say nothing

about the quantum particle) is not always capable of thinking, perceiving, remembering, understanding the environment keeping what we name "internal world" or "subjectivity" (for example, in dream, at pathology of a brain etc.). If there is an analogy between fundamental quantum properties of matter and subjective sphere, it relates only to most general, formal, invariant to a level of complexity human subjectivity properties. (Though, certainly, it is necessary also to show that having achieved the certain organization level the quantum systems will be able, in principle, to implement complex mental functions).

The term "subjectivity" will be used further as a generic notion for designation of any phenomena of the internal world, irrespective of their complexity level.

From this point of view the consciousness should be considered as only one of the subjective organization forms, described by such attributes as reflectivity, usage of high-level abstractions, self-regulation, social-dependence of subjective contents and the ways of mind functioning. But unconscious subjective contents, having no listed attributes of consciousness also exist.

In this light, we see that it is reasonable firstly to search for the analogy between quantum and subjective, instead of quantum and consciousness, that means to take the subjective phenomenon into account, abstracting from specific human content. The relations between "formal" (invariant) properties of human subjectivity and fundamental physical objects properties are the main problem of this paper.

1.DOUBLE-ASPECT SOLUTION OF MIND-BODY PROBLEM

First of all, let us consider philosophical basis of the very possibility of physical reality and subjective experience collation. As I understand it, the double-aspect theory can serve as such base. This theory was suggested in initial form in the second half of 19th century by G.T. Fechner.

In compressed form the main idea of the double-aspect theory may be expressed as follows. It is confirmed, that subjectivity and at least some part of the brain is one and the same thing. It is supposed that only subjectivity is an authentic reality, that exists "in itself", while matter - is only the "image" or "projection" of some other (not my) subjectivity. What exists in itself as subjective experience, appears as the matter (stuff) in external observer's subjectivity.

The fact, that having opened skull we do not find out in brain the "internal model" of the environment, which is directly given to us in our subjective experience, is explained in double-aspect theory by representative character of sensual perception. It is supposed, that the sensory images are absolutely not similar to the objects, as these objects exist "in itself", but between an image and an object there is a relation which is close to isomorphism (one-to-one structural correspondence). The latter guarantees adequacy of sensual perception of the external world and ensures the possibility to act successfully in the external world on the basis of a sensual image qualitatively distinct from this world.

According to this point of view, a brain, as I see it, is not identical to a real brain, as it exists "in itself" and, therefore, it is quite admitted to assume, that some part of a brain is really my subjectivity as it exists in itself.

In initial variant (for example at Fechner) double-aspect approach was a variant of the panpsychism. But we can avoid panpsychism if we assume, that the matter beyond a brain, considered from its internal side, is similar to human subjectivity only from the point of view of its formal properties, but is not similar by contents or function. It means, that the matter outside brain has neither

thinking, nor perception or memory, at least in some highly advanced form (as we do not always think, perceive, remember, but that does not deprive us of subjectivity). There is no necessity to attribute human mental property to some material objects beyond brain, even if they possess their internal world similar to our internal world by their formal properties.

It is possible to assume, that the specific mental properties of human subjectivity are not immanent properties, but are only emergent effect of its external organization, induced by other brain structures, which are localized beyond "my" subjective world.

The main problems of double-aspect theory appear in an effort of its concretization, when we really try to present physical matter as external manifestation of subjectivity. If matter (in its own existence) is something like our subjectivity, then though it must not possess consciousness or thinking (since we are not always conscious or thinking), at least it must possess such essential "formal" characteristics of subjective experience, as wholeness, temporary depth (non-locality), qualitative heterogeneity and specific dual "actual-potential" being form which we find in our own subjectivity. Exactly these four particularities of subjectivity are the main obstacles in our attempts to consider subjective experience as "internal" of the matter. The brain matter is presented as something actual, disintegrating into separate, comparatively autonomous elements (atoms), local in time and qualitatively homogeneous.

However, all this is correct only in case, if we take the conceptions of classical physics as the basis. Situation greatly changes if we take into account understanding of matter which quantum mechanics gives. Here we find a deep analogy of physical reality and subjective experience.

Before the investigation of this analogy, we must study in more detail above mentioned main formal characteristics of subjectivity.

2. STRUCTURE AND MAIN PROPERTIES OF SUBJECTIVITY

2.1. "Actual" and "potential" subjective phenomena

The subjective phenomena may be separated into three groups. The first group is "actual" (sensual) subjective phenomena. The second group is volition and emotions. And the third group is the meanings.

The actual phenomena are sensations, sensual images and mental images or representations (memories, fantasies imaginations). The sensations and sensual images are obvious, qualitatively certain, located more or less precisely in subjective space and time contents of subjective experience. Mental images may not have any part of qualities and not have exact spatial and temporal localization. The actual phenomena can be described as a temporal "stream" of subjective events.

Meanings are given as tacit, uncertain, non-actual, non-spatial, timeless and non-qualitative content of our subjectivity. The specificity of meaning is that it simultaneously exists and not exists, is given and is not given to the subject, is experienced and not experienced. We can not assert that meanings do not exist at all, but we can not identify them with some certain content of our experience. The meanings can not be identified neither with sensations, sensual or mental images, nor with relations between actual sensations or images. The meanings amongst desires, intentions or values are "supersensible" or "ideal" contents of our consciousness.

Though the meanings do not show themselves in a certain form at the moment of their experience, we can, if necessary, display some meaning (for example the meaning of the word) in a sequence of mental images or use other words, also having meaning, retrospectively.

If we investigate these displays, we can conclude, that the meaning occurs when any actual experience comes into correlation with some part of our past experience. However actually, in the obvious form this correlation or displaying of meaning at the moment of its experience is not realized.

Subjectively we experience the meanings, for example meanings of the word, directly, not using some images, fantasies or verbal descriptions.

We consider it to be possible to interpret nature of meaning using Aristotelian categories "potential" and "actual" (or "possible" and "real"). If sensations, images are actual, real contents of subjectivity, the meanings that subjectivity contain as "pure potency" devoid an actual existence. The potential being can be considered as something intermediate between actual existence and nonexistence (existent nonexistence).

The meaning as we have described it above, may be also described as some sort of "existing nonexistence" - it simultaneously is present and is not present, is experienced and is not experienced. For this reason we can explain the form of being of meanings as ontologically available being of potency.

Every potency is a possibility of transition from one (available) actual being to the other (possible) being (that can be transformed into actual form in future). Thus, the meanings exist as a set of possibilities of transition from available sensual or mental experiences to possible ones.

From this point of view, the experience of some actual subjective element's meaning is the experience of possibility of appearance of other (connected with this actual element) actual experiences as well as experience of possibility of other possibilities, as these other experiences also can have a meaning.

We have defined earlier that the meaning of some actual subjective element can be understood as a result of collation of this element to the past experience. The direct experience of meaning is, thus, an experience of a very possibility of such collation, that is experience of a possibility of "scanning" some fragments of past experience and comparison of the given actual element and these fragments.

It is clear, that the potential form of access to the past experience gives a huge advantage to the consciousness, because the potential access to the information, against actual access, allows "virtually" to look over through unlimited information files for short time. Due to this the consciousness has

ability to parallel "virtual" processing of huge information contents and this ability explains surprising efficiency of human mentality.

Above we have noted that the meaning is the experience of a very possibility of other experiences and as these other experiences also have a meaning, it's the experience of possibility of other possibilities. It means, that each concrete meaning receives the defined contents through the relations to all other meanings. But these other meanings also receive the certain contents through the relations to the third meanings and so on. Thus, the meaning finds its non-sensual definiteness inside the network or "field" of other meanings (semantic field). This semantic field is a system of all interconnected meanings and this system can be understood as human's cumulative knowledge about itself and about the external world.

As the meaning exists as something certain only inside an integral semantic field, the changes of meanings cannot be considered as a "stream" of isolated meanings in which one collection of meanings replaces the other. The meaning's dynamics can be considered only as modification of semantic field as a whole.

However, the meaning's dynamics, nevertheless, can be presented in certain relation as consecutive replacement of different "semantic states". Indeed the meanings can differ from each other at definite moments of time by their readiness to actualization. Some meanings can be actualized at once, without any additional conditions. These meanings form a "current semantic state". Other meanings require the additional conditions for actualization. They form a "semantic background". These "background meanings" can become a current semantic state when some certain conditions will be executed.

Let's emphasize that we directly experience not only "surface" (current) semantic state, but also all "deep" background semantic "layers". All contents of semantic field as a whole are given to us every moment. Otherwise "surface" meanings would lose their certain content.

2.2. Wholeness

We have established that our subjectivity contains two ontologically different components in itself - actual and potential. Thus, we can define the form of subjective being as "actual-potential".

Other important quality of subjectivity is wholeness. Our subjective sphere is not a mechanical sum of independent parts or isolated areas. Just the opposite, it exists as "integrated unity" in which it is only conditionally possible to select some parts or divisions.

The wholeness of a sensual component of subjective experience can be described as "Gestalt" properties of sensual images. The sensations, sensual qualities are experienced not isolated from each other, but on the contrary, they create a special whole form (image) in which sensations are experienced with relations between them.

The sensual images also exist not isolated from each other, but form an integrated polymodal phenomenal "field of actual sensual experiences" (so-called, perceptive field).

In semantic sphere we have a higher form of wholeness, than in sensual sphere. It is partly explained by absence in semantic sphere of sensual space and time, which in sensual sphere divide being into separate elements. The single meaning is no more than abstraction. Only holistic semantic field is a unique authentic reality. Each meaning receives the definiteness inside this field only through the relations with all other meanings or, figuratively speaking, through the "place" that it occupies in semantic field. Meanings penetrate each other and mutually cause one another. (All is present in all, but, as Proclus said, in everyone in a specific manner). Each meaning contains in itself or of necessity supposes system of meanings as a whole.

Wholeness exists not only inside sensual and semantic spheres separately, but these two ontologically different components of subjectivity also form

"integrated unity". The unity of sensual perception and meanings manifest itself empirically, as direct meaningfulness of sensual images. As a rule, the meanings are present in the images initially and directly. We find out ourselves inside some semantic situation at once. Only in specific extreme conditions (presence of interference, etc.), a perception partly splitting into pure sense datum and meanings, secondary joined to it, is possible.

On the other hand, the meanings cannot exist "in itself", but only as meanings of some sensual phenomena. Such close connection of sensual phenomena and meanings follows from the given above explanation of meanings as "pure potencies". As potency is a possibility of transition from one actual element to another, the meanings can be defined as the "communications" between various sensual phenomena, which are localized in different temporal layers of subjective being.

It is possible to explain a unity of sensual phenomena and meanings in a different way.

Let's notice that the actual experiences and meanings are essentially two various forms of knowledge or information. The meaning is the information that exists as "pure knowledge", deprived of some qualitative, spatial and temporal form of its representation. The sensual experience is the information having the form that sensual qualities, subjective space and time are constitute. The content of the information does not depend on this form, because the same information can be represented in various sensual forms. From this point of view sensual images are meanings embodied in sensual form, and as meanings they are integrated in a homogeneous semantic field.

If meanings are pure information, and sensual images are information having qualitative, spatial and temporal form, mental images (memories, fantasies) are something intermediate between meanings and sensual images. Mental images are information only partially embodied in sensual (qualitative, spatial and temporal) form.

2.3. Self

The most common form of unity and interrelation of sensations, sensual images, mental images and meanings manifest itself as the belonging to unitary "self" or "subject". From this point of view self is the factor providing unity of subjective sphere. To explain the nature of self is the same as to explain, what connects different single experiences in unitary whole, particularly, that creates a supertemporal wholeness of sequential in time sensual states of our consciousness.

Two different theories of a self nature exist (and accordingly two ways of understanding nature of the factor creating unity of consciousness). According to one of them ("transcendent" theory), self is something, that exists outside consciousness, but by some not clear way it unites various sensual and supersensible phenomena and, thus, creates wholeness of consciousness. Here, the unity of consciousness is a result of "belonging" of various subjective phenomena to this "transcendent" self. In this case self is a "pure look", in front of which all various content of our internal life is displayed. As "transcendent" self is not present directly in our internal mental life, it displays itself only indirectly, as a condition making possible our knowledge by creating a unity of our mental life.

However, some difficulties arise when we admit, that self is outside subjective sphere. As self is only abstract "bearer" of subjective phenomena, totally distinct from these phenomena, this self is absolutely uncognizable. I can know that my self exist, but I can't know what is my self and how I am capable to know about existence of my self. Let's note that absence of direct experience of own self makes impossible to indicate any criteria of self-identity in time. As self has no any observable properties, the replacement of "I" /"non-I" is non-observable in principle, i.e. the loss of self-identity do not lead to any observable

consequences. Thus, the given theory comes to a conclusion, that the existence of self and its identity in time can be only a subject of irrational belief and can not be either proved or justified.

According to another ("immanent") theory, self and the subjective sphere is just the same. My self is my subjective sphere taken in aspect of its integrity, selfexistence, self-perception, self-experience, self-representation. My own self istotality of all my own experiences. If I experience some image - it means that I am this image. From this point of view we can have at least partial (aware,reflective) knowledge about own self, because all knowledge about own subjective phenomenon is, from this point of view, knowledge about own self.

We noticed above, that both considered components of subjectivity - sensual phenomena and meanings can be considered as two different forms of knowledge(or information) existence. The meanings are a "pure knowledge" and images are knowledge having the sensual form. If self is identical to subjective sphere, it may be identified with a total knowledge constituting our subjectivity. (Of course, we have not complete awareness of this knowledge, it's a mainly non-reflective or "non-conscious itself" knowledge). Since a "transcendent" self is denied, this knowledge (identical to the self) is "knowledge which knows itself" (in irreflective form, of course). It is a knowledge which is identical to its subject and to "I" possessing this knowledge.

The "immanent" theory has obvious advantages, as I think, and I will follow it further. In particular, this theory allows to solve a problem of temporal self-identity. But at first we should investigate temporary properties of subjectivity in general.

2.4. Temporal nonlocality

The holistic being of subjective phenomena possesses a defenite certain "temporal depth". Our actual experiences exist not as infinitely thin "temporal layer" of being, but as a holistic formation, located within extensive temporal

area, in which sequential in time sensations and images coexist in united experience. This temporal area is the "extended present".

The temporary depth of our "subjective present" allows us to perceive the environment in dynamics, to perceive movement directly and other changes in time as a directly given experienced reality. For direct experiencing movement it is necessary to grasp in the unitary experience the present, past and future of a moving object. It is possible only if our subjective "now" is something extended.

If temporal depth of actual (sensual) experience is relatively not big (no more than some seconds), the meanings have much more area of temporal nonlocality or even considered as possessing unlimited temporal nonlocality.

Empirically supertemporal nature of meanings shows itself as ability to grasp meaning of events, temporal extension of which outstands far the limits of the sensually experienced present. For example, I am capable of grasping the meaning of a movie or a book as a whole in the unitary act of my consciousness experience.

From the theoretical point of view supertemporality of meanings is a consequence of the described above wholeness of a semantic field, which is not decomposed on isolated semantic units. As any meaning exists only in a context of the whole complete system of individual meanings, it is possible only conditionally to speak about current experience of meaning. In each actual state of consciousness all individual meanings are presented as a "semantic horizon" (semantic background), though at each moment in the specific "semantic perspective". The meanings do not replace one another arising and destroying, but only their actualization readiness is changed depending on a current state of sensual experiences.

Let's notice that the idea of supertemporal character of some deepest components of a human soul is widely presented in various philosophical systems of the past. According to the Plotinos doctrine, the fundamental components of our soul are located "in Eternity" and identical to the World Mind. Kant also

assumed the existence of both temporal and supertemporal components of our subjective life.

According to Kant, the subject, as a "thing in itself", is located outside the phenomenal world, only to which temporal form is applicable, as a priori form of contemplation. According to A. Bergson, the human memory is direct access to the past "through the time", instead of storage of traces of the past in the present. The idea of supertemporal nature of our self was admitted widely in Russian philosophy (L.M. Lopatin, N.O. Lossky, S.L. Frank).

The problem of temporal nonlocality of subjectivity is closely connected with a problem of self-identity in time. Indeed, the unique method to be convinced that my own self at present is the same as it was a year ago, is the direct moving to the past for comparison of past and present self. Hence, if our intuitive belief in identity of own self in time has any real basis, our subjectivity should have ability of direct (through time) access to own past states, that is it has unlimited temporal nonlocality. The "immanent" theory of self induces us to search for a source of this nonlocality inside subjective sphere. It is necessary to find out such non-local in time elements of our subjectivity that would provide consecutive temporal states of our consciousness with real comparability. As the sensations, images, volition, emotions are obviously located in time, only meanings can have such unlimited temporal nonlocality. The meanings in this case should be understood as the supertemporal relations between the present, past and future sensual experiences. We must understand the comparison of actual experience to the past experience, that is the mechanism of meaning occurring, just as the direct access to the original past sensual states of consciousness, that is a travel through time to the own subjective past, instead of trivial comparison of actual experience with actual traces of the past events. The meaning, from this point of view, is the past present in the "now". The effect of comprehension is simply an effect of supertemporal unity of the subjective sphere. These supertemporal semantic communications connect ("stick together") consecutive in time sensual states of

consciousness and, thus, create what we name "identity of our self in time". Both "actual" (in given moment of the time) and temporal integrity of self is a semantic integrity - unity of meaning which penetrates consecutive in time sensual states of consciousness.

From this point of view self is a subjective sphere considered in aspect of its supertemporal unity. Our self does not correspond to the current present state of consciousness, but it corresponds to the whole temporal sequence of such states, connected by integral meaning. It's incorrect to speak about self as about something existing "now" or to speak about the current state of self. Self is beyond of "time stream", it is something "time-embracing" and it includes subjective "now" only as an element.

Integral meaning connecting consecutive states of consciousness is possible to define as the real "person". This means that self and person are the same. Identification of self and real (empirical) person derives, however, the hard problem. On the one hand, my self is something constant, identical in time, but, on the other hand, as identical to the person, my self should be changed, develop. The solving of this problem, as I believe, is an identification of self with a certain "abstract idea". This means that my self is not only real, empirical person, but also is all possible (virtual) persons, which should arise on the basis of given self under various circumstances. Indeed, if I had not written this article, I should have gone for a walk or read the book and it would result in some change of my person. But the identity of my self, apparently, will not be lost. Hence, the identity of self is compatible with different (but not by everything) variations of the person. If we, taking it into account, want to save understanding of self as quite certain information contents, we must admit that all these allowable variations of the person are initially included in structure of my self. They are located in my self in any implicit form. Thus, we draw a conclusion, that self is identical not to the empirical person, but to, probably infinite, stationary structure - to a "bunch" of the "virtual persons". This "bunch of the virtual person" may be

understood as an abstract idea of a given concrete and indefinitely various in its possible embodiments, spiritual individuality. Thus, our self exists mainly in the "world of possibilities" (the world of potencies) and only a small part is present in the actual, sensual, spatial and temporal world. For this reason we continue to exist as a same person after coma, sleeping without dreams and other states of subjective non-existence. In these states we have no any actual life, but we continue to exist as a pure potency, as a pure spiritual entity capable to new actualizations.

2.5. Qualia

One of the most important formal properties of subjective sphere is a qualitative character of distinctions between sensual modalities and sensual experiences inside modality. Let's note, that qualitiveness, (the qualitative heterogeneity) is only a property of sensual experiences. The meanings are deprived of qualia. The idea of "red" is not red and the idea of "cold" is not cold, etc.. The volition and emotional phenomena also, I believe, are deprived of qualia.

If the meanings are qualitativeless, they can differ from each other obviously only quantitatively. Hence it is possible to conclude that the semantic structures can be adequately described as mathematical structures and that semantic universe (the world of "pure meanings") is the mathematical universe. This hypothesis, as I believe, is confirmed by a successful computer modeling of semantics.

3. WILL AND EMOTIONS

Such phenomena as acts of will, desire, aspiration, intention, evaluations, emotional experiences (such as fear, anger, love etc.), ethical and aesthetic experiences, such mental states as confidence and other similar phenomena as well as sensations, images and meanings are components of our subjective being. What ontological status has these phenomena? How do they correspond with other phenomena of subjective sphere? What is their specificity? It is clear, that neither the volition, nor the emotional phenomena are identical to any sensations or images, though they can be accompanied by any specific sensual experiences. Even pain is not identical to pure pain sensation. It is known that patients with disfunction of the frontal lobes can feel pain, but even strong pain does not cause them anxiety or suffering. It is obvious, that something supersensible joins to pure sensation of pain, when pain become an emotional experience. The same is possible to assert concerning other emotions as well as will phenomena. For example, intention can be accompanied with planned actions image. However, these actions can be imagined without any real intention to carry out them. Fear is not identical to specific sensations in legs, stomach and other parts of a body. Thus, the emotions and volition (as well as evaluations, confidence etc.) are the supersensible phenomena. Can we identify them with meanings? Or can we assert that it is a pain meaning that joining to sensation of pain makes it emotional experience?

We have defined meanings as "pure knowledge" (or information). Obviously to know what pain is and to suffer from pain is not the same. It's not the same to love and to know what love is, to fear and to know what fear is. Thus, if love, fear, suffering, desire are meanings, they are highly specific meanings. They express not only knowledge about any situation (the potencies that this situation has), but also subject's attitudes to the situation. These attitudes can be identified with subject's readiness to act in this situation in a certain way. A real will act is realization of this readiness. Love, fear, desire, rage etc. are distinct

from "pure knowledge" by experience of certain potential readiness to act in situations which correspond to these mental states in a specific way. This readiness, however, may be delayed on an indefinite period until some circumstance take place. Therefore, I can get a fright, i.e. to experience the readiness to run away, but actually not to run. Some readiness to act may not be realized at all if it is blocked by some other readiness.

The meanings, into which some readiness to act in a certain way is integrated, may be named as "personal meanings". My personal meaning of a situation has to change if I change my readiness to act in a specific way in this situation. But impersonal, "objective" meaning of situations may include a big set of alternative allowable behavioural directions. These possible behavioural lines are important part of "objective" meaning of the situation. The "objective" meaning becomes the "personal" one, when a person makes a choice of a certain behavioural direction. The subject may be aware of this choice and may control it and in this case we have volition. If this choice is not aware and controlled by the person - we deal with emotion. Thus, the existence of volition and emotions demands the reduction of "objective" behavioural potencies set to some single potency. This reduction (or choice) is of great importance for a proper understanding not only of will and emotions, but for understanding of individuality nature.

The choice realize depends on our individuality (self), and, on the contrary, we may say, that our individuality is nothing but the complete system of such choices, related to endless set of all possible situations. Indeed, if you and I have equal external and internal situations (equal states of external world and our bodies) and, in spite of this, we make different choices, it is only our self that may create this difference. If self and subjectivity are the same, then our individuality must be determined wholly by specific actual and potential content of our subjectivity. But this content depends on real and potential choices that we make, or might make, or will be able to make. Infinite set of choices potencies of a

"behavioural line" in all of possible external and internal situations are the authentic "source" of our self, that creates a unique "bunch of virtual person". Thus, will and emotions are the only "channel" through which our unique individuality can display itself.

4. QUANTUM AND SUBJECTIVE WHOLENESS

Let's return to the analogy of quantum reality and subjective experience. First of all, we should note that this analogy follows already from the very basis of the double-aspect theory. Indeed, the double-aspect theory defines subjectivity as "thing-in-itself", i.e. as a "substratum" of matter or its authentic being, beyond which there is no other reality, visibility or external manifestation of which would be our subjective sphere. Hence, if we want to find out physical analogues of the basic properties of subjective sphere, we should concentrate at the most fundamental level of matter description, i.e. at such level, "beyond" which there is no any "deeper", more fundamental reality.

Quantum physics and quantum mechanics just pretend to such status of fundamental description of matter. It is supposed, that classical physics gives us only "rough", not exact description of reality, and, thus, it cannot be correlated with subjectivity directly.

However, can we be sure, that quantum theory really gives us "final", exact and exhaustive picture of reality? I believe that we have important proofs that here we really reach such a final description. First of all, the failures of numerous attempts to give fuller and more exact description of physical reality using "hidden variables" can be such an argument. "Hidden variables" are such latent "mechanisms", which, as it is believed, could explain the observable quantum behaviour, from the point of view of "deeper" level of reality.

As J. von Neumann showed, the impossibility of "hidden variables" introduction into quantum theory has a character of basic principle. It is

impossible to introduce any "deeper" determinants of quantum behaviour into quantum mechanics without destroying its mathematical structure and without conflicting with the observable facts. Recent researches, connected with Bell-inequalities verification, have confirmed this point of view by excluding, at least, existence of so-called "local" "hidden variables".

It is clear that the impossibility of "hidden variables" introduction does not prove "final" character of the quantum description, because there is an opportunity of the quantum theory replacement by any other theory, based wholly on different principles. However, if we assume that the "final" theory is created, obviously, it, should exclude an opportunity of introduction of any sort of "hidden variables". The quantum mechanics has such property. It is possible naturally to explain many strange peculiarities of quantum mechanics (absence of "quantum jumps" "mechanisms", spontaneous of quantum objects behaviour and other) supposing the "final" character of quantum description, otherwise we have not any explanation of this peculiarities.

However, the "final" character of quantum description does not mean its absolute completeness. As we shall see further, the quantum mechanics is not complete, in some sense, because reality is not exhausted by that "layer of being", which the quantum mechanics directly describes. "Finality" in such case means only that, at first, the "gaps", which exist in the quantum description, cannot be filled, or their filling requires outstanding the limits of applicability of purely quantitative, mathematical methods of the reality description. This means that the quantum mechanics is neither complete, nor is "the theory of everything" and it cannot be made complete with help of traditional ways. We cannot hope, that by substitution for the Schrodinger's equation or its analogues for more complex, for example, nonlinear, equation, we should receive the best approximation of reality. Von Neumann's results show, that the layer, which quantum mechanics directly describes, is described with maximum completeness. It means that we must exclude any "hidden mechanisms" or any "depth",

"beyond" that reality which the mathematical formulas of quantum mechanics directly represents.

Thus, the quantum mechanics, as I believe, describes reality with utmost completeness, but outside this description yet some irrational "the rest" remains, which, however, it is impossible to consider as "mechanism" or as "hidden essence" of quantum objects.

Here we can point out the first analogy of quantum and subjective reality - we find out in both cases the absence of any "depth" or "mechanisms" which are beyond the observable phenomena. (The basic methodological principle, to that W. Heisenberg was guided, when he created "matrix mechanics", was the requirement to exclude all non-observable entities from the theory). Like processes in our consciousness, the quantum processes proceed "spontaneously", i.e. without any internal "mechanisms".

The idea of existence of a "fundamental" level of the description often is rejected proceeding from a potency of creation of more fundamental description of a reality by means of unlimited increasing of sensibility of measurements. By means of sensibility increasing of measurements, we consecutively "open" more and more deep "layers" of reality and only necessity of extremely large energy use to consider small details of matter's structure can put an end to this progress. It is important, that "opening" of new "layer" of reality, as a rule, requires essential theory correction.

This circumstance results in the following paradox: on the one hand, we know that our brain "actually" consists of quarks and leptons and, hence, if the double-aspect theory is right, we must admit that when we describe our consciousness experience we simultaneously describe authentic being of these quarks and leptons. However, on the other hand, we know, that, for example, quark's structure of matter may be displayed only in high-energy interactions, which, obviously, are inaccessible to biological systems. Hence, when we describe properties of our subjective phenomenon - we describe such properties

of brain's matter, which we, as being the biological systems, are not capable to find out without complex physical devices.

It is possible to solve this paradox, if we take into account dependence of the existence form of quantum objects on character of measurements. According to classical (M. Bohr's) interpretation of quantum state, a quantum object has not any certain actual being out of measurement, and it exists in this case only as set of "pure potencies", i.e. as possibilities of detection some certain observable properties in appropriate measurement. We can not attribute to quantum object certain (let's even unknown) spin, impulse or coordinate - until appropriate measurement will be performed. The measurement not simply reveals preexist characteristics of quantum object, but, on the contrary, it creates them at the moment of measuring interaction.

Thus, the quark's properties of matter do not show themselves in our actual experiences, because "measurements" inside brain are such, that do not reveal these properties and, hence, according to the quantum mechanics ideology, we must admit that these properties, until appropriate measurement is performed, are not simply "latent" , but they have not any actual existence at all. They exist only as "pure potencies" - until the measurement with energy-suitable parameters will be carried out.

Taking into account this specific quantum principle of "nonexistence (or existence only as "pure potency") of non-observable" (in particular, the nonobservable properties of quantum objects), it is possible also to explain the subjective sphere wholeness. From the double-aspect theory follows paradoxical character of "integrated unity " of subjectivity. Indeed, if physical is only an "external manifestation" of subjective experience, and if subjectivity has such form of unity, that it can not be represented as mechanical sum of any independent parts, it is absolutely incomprehensible how the "grain" (atomic) structure of the part of our brain, which corresponds to our subjective sphere, arises. It is possible to explain the absence of matter-like "granularity" in

subjective sphere using conception of "quantum holism" or "individuality" (term of N. Bohr) of quantum many-particle systems. According to this conception, the complex (compound) quantum system (such as atom, the molecule and etc.) shows itself as a unit in all cases, until it come into interaction with such measuring apparatus that is capable to distinguish its separate elements and individual properties of these elements.

If such measurements are performed, the quantum many-particle object passes from "integrated" state to a state "composed of parts" and these states can have highly different properties. Thus, it is possible, to speak about some sort of complementarity of the "system-like" and "unit-like" states of quantum objects.

If we accept the principle of "nonexistence of non-observable", we must also admit that if "measurement" which is carried out inside a brain, is performed in such a manner, that separate particles, which constitute ("in potentia") the hypothetical material substratum of subjectivity, do not manifest themselves ("in actu") as actually separated entities, these substratum (in itself) really does not exist as "having any parts", but it exists as real wholeness. For this reason we don't "feel" any atomic "granularity" in our actual subjective experience.

We can suppose that matter substratum of consciousness is a many-particle quantum system. But if different particles are not observed as really separated from each other objects, we can not affirm that these particles really exist as individual, self-identical objects. Thus, "measurement" in a brain must be performed in such a manner that, though it may reveal complex space-time or energy structures of a hypothetical quantum substratum of subjective, it must not identify the contribution of each individual particle to a result of this "measurement".

Apparently, a sufficient condition of quantum wholeness "disintegration" is such character of measurement with which an opportunity to identify each particle (or any sub-set of particles) as separated, self-identical object, which may interact with external world irrespectively of other particles, arise.

5. QUANTUM ANALOGUE OF ACTUAL-POTENTIAL STRUCTURE OF SUBJECTIVITY

Sufficiently clear analogy is tracked between described above "actual-potential" structure of subjectivity and "actual-potential" being of quantum objects. The latter reveals itself in dualism of quantum states (which are interpreted as a set of "pure potencies") and quantum observables (which are possible to understand as actualized potencies).

As far as we have ascertained above the possibility to interpret meanings as "pure potencies", it would be natural to compare semantic dimension of subjectivity with quantum states before the measurement (or with non-observed part of quantum system), while "actual" (sensual) subjective experiences are naturally correlated with the results of process of actualization of quantum states in measuring interactions.

Thus, duality of actual experience and meanings corresponds to duality of quantum observables and quantum states. Quantum observables are congenial to actual experiences (sensuality) as both exist in a form of "stream of events" and have certain spatial and temporal properties.

From this point of view wave function (state-vector), as a representation of quantum potencies, describes supersensible entities congenial to Plato's "ideas" by its nature. (It describes not only potencies, but also their "readiness to actualization"). Plato's "ideas" are, in essence, "pure knowledge" existing without any material substratum. Quantum potencies, as I think, have the same ontological status. These potencies are identical to our knowledge about quantum object states. However, this knowledge exists not only in our mind, but also beyond it, as "objective reality".

The main difference of our approach from traditional Platonism is that we don't accept "naive" version of this theory, i.e. we don't consider such "ideas" like Plato's "tableness", "chairness" or "horseness" as objective reality. But we suppose objective existence of "non-naive" (hidden, non-anthropomorphic) "ideas" which can be "grasped", as I think, only in scientific (mathematical) knowledge.

As we shall see further, these "ideas" can be identified with the senses of mathematical formulas of contemporary physical theories. The role of such "non-naive" "ideas" matches most quantum "waves of probability" described by wave function. Indeed, "quantum waves" are really something "supersensible" (it's impossible to "see" or directly register them), these waves, as we shall see further, are not localized in space and time and they appear only as theoretical constructions (i.e. they exist as "noumenal" reality). Nevertheless, quantum waves are not only our mental constructions. They exist in external world as something real, ontologically available.

6. QUANTUM AND SUBJECTIVE TEMPORAL NON-LOCALITY

The important property of subjectivity is temporal non-locality of subjective being. This property is often considered as the reason for refusal from any comparisons of matter and subjective experience. Indeed, we may describe changing of atomic states taking into account such time intervals as 10^{-23} sec. (for processes inside atomic nucleus). On the contrary, in our sensual subjective experience the minimal time interval, which we yet are able to "feel" directly - is about 10⁻¹ sec. If subjective experience is "internal being" of matter, and if matter can have real dynamics on time intervals, much less than these we are able to distinguish, the question arises: why don't we "feel" micro-time dynamics of our subjective states? If matter is only "external manifestation" of subjective being, the micro-time dynamics of physical states of our brain (or such part of brain that directly corresponds to subjectivity) can exist only as "projection" or

"manifestation" of micro-time dynamics of subjective states. But we don't experience such dynamics. Thus, we should draw a conclusion that our subjectivity and matter exist in different temporal scales and, thus, we can not acknowledge matter should be considered as "external manifestation" of subjectivity.

We can solve this paradox without refusing of double-aspect theory, taking into account the above offered interpretation of actual subjective experiences as observable part of some quantum system. If actual (sensual) experiences correspond to results of measurements, the properties of these experiences should correspond to some parameters of measurement procedure, i.e. these properties should depend on what and with what preciseness quantum objects are measured. Taking this into account, it is possible to draw a conclusion that if we do not get any information about changing of quantum object states, we can not assert that some real changing or "current of events" in this object takes place.

We can get any information about changing of quantum state only if we perform the measurement. Therefore, it would be natural to assume that if measurement is not performed at all, the internal "current of time" (states dynamics) is completely absent. If the measurement is carried out with period T , this period determines such temporal interval, inside which all successive subjective events are experienced simultaneously. Thus, this interval sets the scale of subjective "now". It means that an interval doesn't exist for a subject, if it is smaller than T . In general, we may correspond to the scale of subjective "now" the preciseness of time interval's measurements (resolution time), which are performed in our brain. If our brain can not distinguish time intervals smaller than T , we won't be able to any experience temporal intervals of such kind.

If preciseness of time intervals measurement in our brain is changed, the temporal scale of our subjective experience should be changed too. Thus, this model allows us to explain such subjective phenomenon as difference in scale of

subjective "now" in different sensual modalities or varying of subjective "time current" speed (that occur in pathology).

Someone may object to me and note that quantum mechanics allows us to describe changes of quantum states on infinitesimal time intervals without any reference to measurements, since state-vector continuously depends on time variable.

If we accept, that wave function describes only "pure potencies", i.e. probabilities to get some results of measurement in a certain moment of time, if the measurement is really performed at this moment, we should also accept that time dynamics of wave function is not a real process of changing of any actual entities, but only redistribution of potencies, which have existence only relative to measurement. This redistribution does not "occur" at certain moments of time and it can not be localized in space and time continuums. As we shall see further, time variable "t", on which wave function depends, describes not the time that we directly experience in our consciousness as "stream of events", but it describes non-temporal entity that philosophers name "Eternity" - fixed, space-like, dispossessed of becoming, supersensible "prototype" of subjective "flowing" time. "Eternity" is quasi-temporal modus of being in which meanings dwell. As some quantum experiments show (Costa de Beauregard (1977)), the "internal" time of quantum objects (temporal extent between measurements) radically differs from "external" time in which quantum object shows itself in observer's subjective experience.

In particular, as experiments with "delayed choice" show us, quantum particles may have "pre-cognition" concerning the character of a future measurement and change its behaviour beforehand according to this "pre-cognition". We can explain these results if we accept that there are no any actual "changing of states" in time intervals between measurements. Non-observed quantum object has not any temporal dynamics that we may imagine as irreversible replacement of each actual state by the following one. Consecutive

states coexist, "feel" each other and are capable to influence each other both in direct and in the reverse temporal order. For this quantum object there are not divisions of temporal extent on the past, the present and the future. Only the extended the present exists, which embraces everything taking place between measurements.

Thus, we may accept that unobservable quantum "processes" which take place between preparation of initial quantum state and measurement have only imaginary character. There is no any real movement, even of potencies, in this interval. That actually takes place is direct supertemporal communication between observable events connected with both the preparation of a initial state and the measurement of a final state.

These conclusions confirm our thesis that meanings, being correlates of an unobservable part of quantum system, exist as supertemporal communications between the present, the past and the future subjective events (which correspond to results of measurement). From this follows that it is possible to identify human memory content with "quantum information" which quantum states can store in potential form.

7. QUANTUM DESCRIPTION AND QUALIA

One more subjective property which apparently distinguishes subjective being from matter is a qualia. Let's emphasize, that only sensual phenomenon (such assensations, images) has qualia. Representations can be deprived of some part of qualia. The meanings are utterly deprived of qualia. Above we connected the distinctions between sensual experience and meanings with measurement.

Measurement "transform" supersensible meanings into sensual form connecting "pure" information with sensual qualia and giving them certain spatial and temporal properties.

Taking this into account, now we can give an answer to the question: why is matter represented as something unqualitative ("pure extent", according to

Descartes) from the physical point of view, whereas in our subjective experience matter (of brain), on the contrary, demonstrates diversity of modal specific sensual qualia (according to double-aspect solution of mind-body problem).

In quantum case, unqualitativeness of matter manifests in that the basic equation of quantum mechanics - Schrodinger equation, as well as its relativistic analogs, comprises the minimum of qualitatively heterogeneous parameters (spatial coordinates, time, the mass). The implementation of program of reducing physics to geometry, can reduce these parameters only to special and temporal coordinates. But even if it will not happen, it is obvious, that physical "qualia" known now are not sufficient to explain all the spectrum of sensual qualia.

Let's notice further, that the Schrodinger equation describes only state-vector evolution and, therefore, it describes only evolution of "pure potencies", i.e. according to our conception, in brain's case, it describes only semantic component of our subjectivity, which is also unqualitative and can be interpreted as "pure information" deprived of any sensual, spatial and temporal properties. Only actual (sensual) components of subjective experience have qualia. But these components we have connected with the process of measurement, which not described by Schrodinger equation (as von Neumann has shown).

Thus, unqualitativeness of physical description is possible to explain proceeding from the fact that physics can "grasp" only "supersensible" (semantic, potential) components of being, and doesn't provide us with any description on that unique process (actualization, measurement) which just creates qualia and other forms of sensual representation of information.

According to this, it becomes clear why all attempts to create the mathematical description of measurement in quantum mechanics were so unsuccessful. It is impossible to do in principle - by virtue of qualitative, irreducible to pure quantitative description nature of actualization and actual being. Hence, the description of the world can not be completely mathematized,

i.e. reduced to some fundamental set of equations. Next question arises: what are "physical correlates" of distinctions between sensual modalities and sensual qualia inside sensual modalities. As we correspond sensual experience to measurement, it is natural to suppose that intermodal and intramodal qualitative distinctions depend on distinction in methods of measurement implementation.

At least, it is clear, that a close connection between qualia and parameters of measurement should exist: qualia should correspond to "classification states" of measuring device (in our brain). (If qualia do not correspond to such "classification states", it is obvious, that we could not just speak about qualia - because any information about our subjective states can be accessible for external observers only by means of measurements, which our brain performs at quantumsubstratum of consciousness). We can suppose that qualia arise in our brain when measurement gives information about distinctions between states of this quantum substratum, but it can not give quantitative characteristic of these distinctions. This means that qualitative character of experience corresponds to the loss in the process of measurement information about quantitative distinctions of quantum states of hypothetical physical substratum of our consciousness. Indeed, if there are no quantitative distinctions, we inevitably get qualitative distinctions. According to principle of "non-existing of non-observable", if quantitative distinctions do not display themselves in measurement, they don't exist at all (in actual being), but, nevertheless, qualitative distinctions can exist.

CONCLUSION

The main distinction of our approach to the "quantum foundations of consciousness" from other similar theories is its "monistic" character. Quantum models of consciousness offered by such authors as D. Bohm, H. P. Stapp, R. Penrose, E.H. Walker and many other similar models are founded on dualistic ontological basis. These authors try to use quantum theory for proving the idea, that consciousness is a necessary component of physical reality, another

component of which is a non-animated matter. The idea prevails, that consciousness comes into material world only through "quantum jumps" between different quantum histories (i.e. it corresponds to state-vector collapses). For example, according Stapp (1993, 1996), the inner or mental aspects of mind/brain system correlate with actual events (quantum jumps between high-level (macroscopic or classical) branches of brain quantum state), and material aspect of mind/brain system correlate with the "objective tendencies" (quantum potencies), i.e. consciousness corresponds to quantum events, and matter (of brain) corresponds to quantum states. Thus, only actual being has dual mental-material structure. ("The physical and mental events can be regarded as two aspects of the same event-like reality" (Stapp (1996)). Potential being has not any mental property. According to this theory, we may conclude that single function of consciousness is a free choice between different high-level brain quantum states that may correspond to different states of mind or to different behaviour directions.

The main lack of this theory is its "mystical" character. It requires goes beyond standard scientific methods for searching of consciousness. Indeed, we have no scientific methods for explanation of "quantum jumps" and, if the latter corresponds to consciousness, we have not any explanation of conscious functions too. (According to Penrose (1993) , consciousness corresponds to quantum noncomputable dynamics in human brain. That means that we can not use methods of computer science for searching of function of our consciousness). According to our approach, matter, as something quite different from subjectivity, is completely eliminated. There are not only quantum events that may correlate with "actual" subjective states. Quantum potencies have subjective correlates too. They correspond both to personal (if they are connected to other subjective phenomena) meanings and to transsubjective ones (beyond this connection). Third group of subjective phenomena - will and emotions, correspond to the very "mechanism" of actualization which bridges actual (sensual) and potential

("noetic") components of being. Our unique "selfhood" may correspond to "hidden reasons" which are determinants of unique (noncomputable) choices between different possible quantum histories. The greatest advantage of this approach is that it allows us to search consciousness in framework of contemporary science methods. We may, for example, propose that consciousness corresponds to the some sort of quantum computer, that is localized in our brain. This proposition allows us to use theory of quantum computations for explanation of the huge computational power of our brain and, besides, we can try to use analogy with quantum computer for explanation of some peculiarities of our subjective experience.

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