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On the Ontological Status of Some Cosmological and Physical Theories

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This study investigates the ontological status of some physical and cosmological theories that are not based on empirical observation and probably cannot be tested empirically. It is suggested that these theories exist only in our consciousness and are no more than Kantian ideas. Indeed, these theories imply paradoxes as was predicted by Kant regarding ideas of pure reason.

Keywords: Kantian ideas, bubble theory, many worlds theory, string theory

Our knowledge about physical phenomena is based primarily on input that we obtain through our senses. However, raw sensory input does not arrive directly to our consciousness. There are several stages of neural processing and censorship (Treisman and Schmidt, 1982) leading to the creation of an image of the world and of the phenomena pertaining to it in our consciousness. Therefore, these images are not necessarily what Kant called "the things as they are in themselves" that emit the raw sensory input, which is processed to become the images. Another source of these images of the world is the mathematical model created by physicists. The existence of a consistent mathematical model of the world does not necessarily mean that the entity described by the model exists in some external real world (Fidelman, 2009). Moreover, physical phenomena may be described by more than one possible model.

Some criteria have been developed for choosing the best model. One is "Occam's razor," according to which we choose the simplest of all the possible explanations. Another criterion was suggested by Popper (1934), according to which a scientific theory cannot be proved empirically. It can only be falsified

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by empirical methods. Each scientific theory is merely a candidate for falsification. A theory for which there is no possibility for an empirical falsification is not defined as scientific.

Nevertheless, cosmological and physical literature is infested with theories that are neither simple nor falsifiable empirically. The only justification for these theories is that they have beautiful and very complicated mathematical models. It seems that some theoretical physicists have forgotten that their discipline is based on empirical facts and have turned physics into a branch of pure mathematics. Here, I will investigate the ontological status of some of these cosmological and physical theories.

The Hemispheric Model of the Brain's Functioning

There is a functional difference between the two cerebral hemispheres. According to Ben-Dov and Carmon (1976), the left hemisphere is more specialized than the right one in the analysis of individual items. After the analysis these individual items are transferred to the right hemisphere, which is specialized to some degree in the integration of several individual items into a comprehensive new whole. This new whole is transferred back to the left hemisphere where it is treated as a new individual item and it is processed analytically by the left hemisphere, and so on. Thus, more and more complex cognitive structures are constructed.

However, the two hemispheric mechanisms don't always operate in harmony. Below we will see that sometimes the two mechanisms oppose and inhibit each other. When this happens the outcome is cognitive conflict. The first example for such a conflict is the antinomies related to Kant's ideas of pure reason.

Kant's Ideas of Pure Reason

According to Kant there are three levels of consciousness. The first level is perception, that is, the awareness of the sensory input. Perception produces images, or, rather, phenomena. These phenomena must be perceived within a framework of the spatial and temporal modes of perception. The second level of consciousness is understanding, that applies Kant's transcendental logic to classify the phenomena into two sorts. The first sort is of phenomena that comply with logic, which are accepted as "experience" or, rather, physical experience. The second sort is of phenomena that do not comply with Kant's transcendental logic and are rejected as illusions. The individual is aware of both kinds of phenomena, but understanding causes the person to feel that the illogical phenomena should be regarded as illusions and be ignored.

The third level of consciousness is pure reason. Pure reason produces Kantian ideas (that are different from Platonic ideas), which are not part of experience, but are related to experience. These ideas of pure reason include the entirety of all phenomena of experience (which is not part of experience). This kind of idea is called "a cosmological idea." Another kind of Kantian idea of pure reason is an explanation for the existence of experience. An idea of this kind is called "a theological idea." For example, there is empirical evidence for the "Big Bang" and it may be thus considered to be "Kantian experience." However, at our present state of knowledge a reason for the "Big Bang" is a "Kantian theological idea" and there is no empirical evidence for the existence of any of the reasons suggested for it. Since Kantian ideas are not part of experience they may not comply with logic, and may involve paradoxes (or antinomies), and vice versa: if a theory implies a paradox it cannot be experience, since it is rejected by understanding. If this theory is not based on empirical observations it cannot be defined as illusion, and the only remaining possibility is that it is a Kantian idea of pure reason.

Cosmological and Physical Structures as Kantian Ideas

According to Kant, the entire cosmos is an idea. This follows Kant's argument that the cosmos is neither finite nor infinite, therefore it can be only a subjective idea. Thus Kant's argument applies also to Einstein's closed and finite cosmos, which is integrated by the right hemisphere from all the individual phenomena which have been analyzed by the left hemisphere. If the cosmos is finite we cannot avoid the question "What is beyond the end of the cosmos?" Linde (1983a, 1983b) suggested an answer to this question. He introduced to cosmology the many "bubbles concept," each bubble of which is an entire "Einsteinian cosmos," similar to our cosmos and external to it. However, according to Einstein, the cosmos is closed. This means that no information from outside the cosmos can penetrate it, and the existence of these external cosmoses has not been proved empirically without alternative explanations to the relevant phenomena. Thus the entirety of phenomena is a Kantian idea, and it is created by the right hemisphere. If all these supposed bubbles are limited in a finite space then this finite space becomes a cluster of bubbles, or a super bubble. Then we must continue to ask: "What exists outside this finite space?" And so on. We obtain a potentially infinite series of larger and larger clusters of super bubbles. This series cannot be limited by some finite border, because the space limited by this border becomes itself a new super cluster of bubbles, and the process is not terminated by this limiting. The assumption that the cosmos is finite leads to a paradox.

Suppose that this potentially infinite series of clusters of bubbles is integrated by the right hemispheric mechanism of our consciousness into a new comprehensive whole, thus integrating an actually infinite cosmos. Kant negated the infinite cosmos by an argument similar to Zeno's paradoxes of the runner and Achilles and the tortoise: the potentially infinite process of obtaining horizon beyond horizon without a last stage never ends and therefore it cannot be terminated by the integration of a comprehensive entity. The assumption of the existence of an actually infinite cosmos again implies a paradox. This paradox is caused by the objection of the left cerebral mechanism that creates the potentially infinite process to the attempts of the right cerebral mechanism to terminate this process by integration. Thus neurological and cognitive conflict is created. This issue is discussed by Fidelman (1988, 2004).

Another approach that introduced "Kantian ideas" into cosmology is the parallel worlds theory of Everett (1957). According to Everett, when an event concerning a microscopic particle has two options of unfolding (for example, when a single particle has a certain probability to be an electron and another probability of being a positron and its wave function collapses) then the world splits into two parallel worlds, in each of which one of these two options is realized. This effect is repeated and many parallel worlds emerge and exist simultaneously. However, no information can be transferred between these worlds and we cannot obtain any empirical evidence that worlds parallel to our world do exist. Since these additional cosmoses are not part of experience they can be only ideas of pure reason. Thus we extend the term Kantian idea to include widening of the empirical world (or experience) into larger domains. Since additional worlds are no more than Kantian ideas, the same is true regarding "worm holes," passages between our world and these additional worlds, that exist according to some cosmological theories: if the worlds parallel to our own world have no real existence, the same must be true regarding passages to these worlds.

Indeed, Everett's theory involves paradoxes, as may be expected from Kantian ideas. This theory is implied by the collapse of the wave function that is a Kantian antinomy, as well as the existence of additional worlds that is inferred from it. According to Fidelman (2002, 2004, 2005), this confusing antinomy and the collapse of the wave function is related to the transfer of our cognizing of the physical phenomenon from the right hemispheric mechanism (that cognizes the wave function) to the left hemispheric mechanism (that cognizes the appearing of the concrete object or particle). This means that the Kantians ideas and the paradoxes (or antinomies) related to them exist in our consciousness (i.e., they are subjective) and are related to a conflict between the two hemispheric mechanisms that produce two alternative presentations of the raw sensory input: a wave and a particle, rather than to the real physical world. This conflict explains the paradox of the duality in physics: the particles and waves are two different interpretations of the same raw sensory input.

In addition to cosmologists, theoretical physicists sometimes introduce into physics beautiful mathematical structures that have no relation to empirical facts. For example, string theory introduced into physics, in addition to the known three spatial axes, more spatial axes that cannot be seen (thus widening the experiential world into a larger domain). Therefore, physicists assume that these axes are folded into curled loops that are so small that they cannot be detected empirically. Instead of empirical proof for this theory, string theorists provide conjecture that in the future, technology will be more advanced and the problem of obtaining empirical proof to the existence of these folded spatial axes will be solved. Let us examine this possibility.

One purpose of string theory is to unify electromagnetic and gravitational forces. Popper's (1934) demand that a scientific theory should be subjected to empirical falsification is not fulfilled by string theory. The success of this theory to construct a beautiful mathematical structure that seems to solve the important problem of unifying the two forces cannot turn this theory into a scientific one. Meanwhile, we may suspect that string theory, as well as the previously discussed cosmological theories, may be no more than Kantian ideas. If string theory is an idea of pure reason then it is liable to imply paradoxes. If we can discover such a paradox this will be in line with our suspicion that it is a Kantian idea.

The Direction of Particles in Time

According to Feynman (1985), a positron is an electron that moves backwards in time. Assume that this is correct. The inversion of the direction of time inverts also the order of the events occurring during time. Therefore, if an electron inverts its temporal direction and travels towards the past, the electrostatic force of repulsion that operates between it and an ordinary electron is inverted and becomes a force of attraction. That is, the inversion of the direction of time of an electron is equivalent to the inversion of the sign of its electrostatic charge from negative to positive. Indeed, the electrostatic force between a positron and an electron is attraction. This means that the empirical observations are as expected by Feynman's suggestion, and we may call it a theory rather than a suggestion or a hypothesis.

In addition to the electrostatic force there is also a weak gravitational force that operates between these two particles. The gravitational force depends only on the mass of the two particles (and the distance between them). Suppose that the direction of the gravitational force too is inverted in an electron that moves backwards in time. Since this force is determined only by the mass of the particle, its inversion means the sign of the mass of the electron that moves backwards in time is inverted and the mass should be negative. However, negative mass has not been detected empirically and may, in fact, not exist. In order to save Feynman's theory, Fidelman (2002, 2006, 2009) proposed that this apparent contradiction may be resolved by the suggestion that there are at least two independent temporal axes. The electrostatic force operates along one of them while the gravitational force operates along the second. Usually such independent axes are represented graphically by two perpendicular lines in space. The projection of each force on the temporal direction of the other force is zero.

Unified Field Theories

In order to unify two force fields into one field, a physicist has to describe, using mathematical equations, the mutual influences of the two fields on each other while time changes. This is how Maxwell unified the electric and magnetic force fields into one field: the electromagnetic force field. Einstein believed that such unification can be achieved also for electromagnetic and gravitational forces. However, neither Einstein, nor others, succeeded in this endeavor. The above suggestion — that time comprises at least two independent axes along one of which operates Maxwell's electromagnetic force (that, according to Maxwell, includes electrostatic force) and along the other one of which operates the gravitational force — implies that changes in the force operating along one of these temporal axes does not influence the force operating along the second temporal axis. This means that no unification of the gravitational and the electromagnetic forces is possible. This observation may explain the failure of Einstein and others to achieve this unification.

More recently, string theorists achieved a unification of these two force fields. This was done by adding several spatial dimensions to the three existing spatial dimensions. This observation apparently contradicts the outcome of the previous discussion according to which no unification of the electromagnetic and gravitational force is possible and seems to contradict string theory.

In order to remove this contradiction one must determine whether there is a difference between spatial and temporal dimensions. Since Descartes, time is considered to be a spatial axis, additional to the three ordinary axes. It is well known to physicists that inverting the direction of time, the sign of the electrical charge, and the direction of the spatial axes do not change Maxwell's equations that describe the electromagnetic force. Such transformations are known as "CTP [Charge, Time, Parity] transformations," and they can interchange spatial and temporal axes. Thus, temporal axes may be transformed into — or be disguised as — spatial axes. That is, temporal axes disguised as spatial axes have been introduced into physics by string theorists — obtaining a unified field theory.

In order to decide between the theory of multidimensional time and string theory, Occam's razor may be helpful. Accepting temporal axes is simpler than accepting the bizarre folded spatial axes that string theory has introduced to physics in order to explain why the additional spatial axes are not observable. Thus, the theory of multidimensional time is preferred over string theory in its original form of adding spatial axes, but not temporal axes, to physics, according to the principle of Occam's razor.

Contradiction between String Theory and Feynman's Theory

It is observed that cosmology and physics include several theories that have no relation to empirical facts. It has been shown that the additional cosmological structures, both Linde's (1983a, 1983b) "bubbles" and Everett's (1957) "many worlds," are Kantian ideas and not physical experience. Indeed, these "cosmoses" involve paradoxes — the first of the kind that is implied by the Kantian idea of the cosmos and the second of the kind that is related to the collapse of the wave function.

String theory, too, is of the same nature. Indeed, there is no empirical evidence for the existence of additional spatial dimensions, in particular of folded dimensions, and at no foreseeable future can any attempt to test their existence possibly be imagined. Therefore, string theory is immune to any attempt at falsification, and according to Popper, it cannot be considered to be a scientific theory related to Kantian experience. Moreover, string theory involves antimony, thus the structure created by it is, apparently, a Kantian idea rather than a physical reality. This means that all the efforts to test this theory experimentally cannot lead to any result. It follows that this theory in its original form (with the addition of spatial dimensions but not temporal dimensions), as well as the above-mentioned cosmological theories, do not help us to understand the experiential world. Alternatively, it may be that string theory is valid and then Feynman's positron theory is not valid. These theories are mutually exclusive.

Reconciliation of String Theory with Feynman's Theory

In order to prevent contradictions in theoretical physics, one has to choose between the two theories: string theory and Feynman's theory of positrons. Feynman's theory is in line with an empirical observation: the direction of the electrostatic force between an electron and a positron is the opposite of that of the force between this electron and another electron, and this is the only difference between an electron and a positron. This observation may be explained by Feynman's theory. On the other hand, there is no justification for the introduction of additional folded spatial dimensions. The fact that this introduction enables string theory physicists to obtain unification of the electromagnetic and the gravitational fields does not mean that the mathematical structures created by string theory, that are not supported by empirical evidence, have any real physical meaning. Certainly their existence in not subject to empirical falsification. Therefore, according to Popper's principle we should prefer Feynman's theory.

Feynman's theory also causes us to introduce mutually independent temporal axes to the spatial-temporal frame of the world. Since a temporal dimension cannot be observed, there is no need to fold these temporal dimensions in order to explain their being undetectable empirically. Thus, replacing some spatial axes by temporal axes camouflaged as spatial axes (the existence of which is derived from Feynman's theory) simplifies the original string theory considerably. Also, the unification of gravitational and electromagnetic forces may become possible by describing the changing of each of them along one of the two independent temporal axes. Thus, after updating string theory, a reconciliation of these two theories occurs.

Identifying Physical Structures as Ideas of Pure Reason

Previously it was suggested that contradictory empirical findings in physics, like the duality of light, may be explained by the existence of two different hemispheric neural mechanisms that present to our consciousness two different interpretations of the raw sensory data and there is neural and cognitive conflict between these two interpretations. The antinomies related to Kantian ideas are also related to similar inter-hemispheric conflicts.

In this article a method is suggested by which we may determine whether a non-usual theoretical physical structure, which is an extension of our daily experience, should be defined as Kantian experience or as a Kantian idea of pure reason. This method comprises attempting to find paradoxes related to this structure. We have found a paradox related to the existence of the spatial multi-dimensional structure of string theory. This means that the rules of logic do not apply to the structure of additional spatial dimensions and this structure cannot be defined as a Kantian experience but rather as a Kantian idea or as an illusion. Since the existence of these dimensions cannot be tested empirically, they are not phenomena and they cannot be defined as illusions. Thus, we obtain that the additional spatial dimensions that are constructed by string theory can be only the new kind of Kantian ideas of pure reason suggested above: the widening of the experiential world into a larger domain.

The difference between the paradoxical duality between waves and particles in physics and string theory is that the duality follows from empirical phenomena. The paradoxes that follow from this duality were imposed on physics but were not really understood logically by the physicists who were compelled by the empirical evidence to live with them. There is no logical explanation within physics for these paradoxes. These paradoxes can be understood only within a higher level of science, neuropsychology, which is the meta-language of physics (Fidelman, 2009). The hemispheric theory, which is part of neuropsychology, can give a logical explanation to this duality in physics. On the other hand, string theory is not based on any findings and the paradoxes related to it may imply that such empirical findings will not be found.

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