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On Elitzur's Discussion of the Impact of Consciousness on the Physical World

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Elitzur (1989) maintains that in quantum mechanical measurement consciousness does not have a significant impact on the physical world. His thesis is refuted through an elaboration of Schrödinger's gedankenexperiment called the cat paradox. The generally conservative tone of Elitzur's article as regards the involvement of consciousness in the physical world is discussed. Through discussing the conservation of energy and the second law of thermodynamics much differently than did Elitzur, it is shown how the involvement of human cognition in the functioning of the physical world can be found in the structure of physical theory itself. Elitzur's major argument concerning a demonstration of a non-material basis for consciousness is shown to be inadequate.

A number of points in Elitzur's (1989) article, entitled "Consciousness and the Incompleteness of the Physical Explanation of Behavior," require discussion. Foremost among these points is Elitzur's position that quantum mechanical measurement does not involve human consciousness, and by implication human congition. Another point concerns the conservative nature of the general tenor of his arguments concerning the role of consciousness in the physical world as this world is described by physical theory. Finally, the inadequacy of Elitzur's own fundamentally philosophical argument concerning the non-material nature of consciousness will be demonstrated.

Quantum Mechanical Measurement and Consciousness

In his recent article, Elitzur argues that in quantum mechanics consciousness does not have a demonstrable impact on the physical world. This thesis can be shown to be incorrect. Essentially, Elitzur maintains, as do other physical scientists, that a non-human measuring apparatus can just as well be respon-

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sible for a measurement as the human who finally realizes the results of the measurement. If this is the case, the consequences resulting from human observations of some physical phenomenon should be the same regardless of the time at which they are made. As Elitzur states:

> The difficulty in testing the hypothesis concerning the influence of consciousness [in quantum mechanics] lies in the fact that, according to the theory, the influence of consciousness on the observed system can be exerted even at a later time. The instrument may thus remain in a superposition, together with the event measured, until someone reads it. Now, since all physicists possess consciousness, this hypothesis lies entirely beyond proof or disproof and hence is metaphysical rather than scientific. (p. 4)

First, and fundamentally, a human observer's being aware of some physical event predicted by some physical theory does not constitute an invalidation of the theory. Instead it is a validation. In that the prediction is verified for all human observers, the theory is the more valid. Because all physicists are conscious, in Elitzur's terms, they can thus contribute to the validation of the theory.

Elitzur seems to be looking for a differential effect of consciousness on the physical world. This effect can be provided in an elaboration of Schrödinger's gedankenexperiment called the cat paradox (Schrödinger, 1935/1983). In a recent article (Snyder, 1989b), Schrödinger's gedankenexperiment and an extension of this argument were used to posit that in quantum mechanical measurement human observation is important to the structure and function of the physical world. In his gedankenexperiment, Schrödinger (1935/1983) proposed:

> A cat is penned up in a steel chamber, along with the following diabolical device (which must be secured against direct interference by the cat): in a Geiger counter there is a tiny bit of radioactive substance, *so*, that *perhaps* in the course of one hour one of the atoms decays, but also, with equal probability, perhaps none; if it happens, the counter tube discharges and through a relay releases a hammer which shatters a small flask of hydrocyanic acid. If one has left this entire system to itself for an hour, one would say that the cat still lives *if* meanwhile no atom has decayed. The first atomic decay would have poisoned it. The ψ-function of the entire system would express this by having in it the living and the dead cat (pardon the expression) mixed or smeared out in equal parts.
>
> It is typical of these cases [of which the foregoing example is one] that an indeterminancy originally restricted to the atomic domain becomes transformed into macroscopic indeterminancy, which can then be *resolved* by direct observation. (p. 157)

In my proposed extension, two options were noted. Both assumed that the toxic substance is removed from the box after one hour whether or not an observation is made.

Option 1. A person (O) looks in the chamber after one hour at the time t_0 and finds either that the cat is dead or that the cat is alive. After O looks in the chamber and finds that the cat is alive or dead, a subsequent observation will certainly yield the same result.

Option 2. O does not look in the chamber at the time t_0. The probability that the cat will be found dead when O looks at a future time is 1/2 and the probability that the cat will be found alive when O looks at a future time is 1/2.

A potential observer O's knowledge concerning whether or not the cat is alive or dead after one hour depends on whether or not O (or someone else who communicates the results of his or her own observation to O) looked into the chamber after one hour. This is not especially surprising except that this experimental scenario, reflecting quantum mechanical principles, does not allow that there is some independently existing reality behind a person's perceptions and deductions in which the cat is actually alive or dead. What O knows is all that, for O, characterizes the world. Further, because of the personal nature of O's knowledge concerning whether the cat is dead or alive, it is reasonable to surmise that O's observation and knowledge of the aliveness of the cat are conscious experiences. If another potential observer P does not observe the cat after one hour and is not told by an observer who has observed the cat (such as O) whether the cat is alive or dead, then for P the aliveness of the cat is expressed by the ψ-function in which, in Schrödinger's words, "the living and dead cat [after one hour] . . . is mixed . . . in equal parts" (p. 157).

Some physicists argue that the non-human measuring apparatus may indeed be responsible for the change in the status of the aliveness of the cat after one hour. In this case, one can apply the above analysis involving O and P with a minor modification. Here O would be a machine consisting of the Geiger counter, the hammer, the flask of hydrocyanic acid, and the cat. Then, for P (where P is the human observer), whether the cat is alive or dead depends essentially on whether O "tells" P that a measurement has been made and the results of the measurement. In either case, P's predictions, based on P's knowledge, will be correct.

Consider the following alteration of Schrödinger's gedankenexperiment in which a bomb with a detonator is eventually set off if the hammer strikes the flask with hydrocyanic acid. Allow that there is a sophisticated timing mechanism attached to the bomb that will set off the bomb an hour and five minutes after the steel chamber is initially closed if the radioactive material decays. The human observer is not told that a bomb has been enclosed in the chamber. But if the radioactive material decays, the sophisticated timing mechanism will display the message: "This is a bomb set to go off in five minutes." If a human observer opens the chamber and looks at the cat after one hour and sees the cat is dead, the observer will also notice the message on the timing mechanism and will likely get as far away from the box as quickly as possible. The human observer will thus be saved from the bomb. If, on the other hand, the human observer does not look at the cat after one hour, but instead plans to look in the box after one hour and ten minutes have elapsed since the box was closed up, the experimenter has only a fifty-fifty chance of being alive at the end of one hour and five minutes. Whether he will get a chance to make an observation that the cat is dead if the radioactive material has decayed is open to debate, but it will only occur as he is exploding.

So if Elitzur, like other physical scientists, continues to assert that human observation, and specifically consciousness, does not impact the physical world, I ask Elitzur: Which position would he rather be in? Would he prefer to observe the aliveness of the cat after one hour, or would he prefer to wait for one hour and ten minutes and perhaps find the time of the observation pushed up to one hour and five minutes?

Elitzur quotes Peres (1986) that quantum mechanical measurement is "not a supernatural event. It is a physical process, involving ordinary matter, and whatever happens ought to be explained by the ordinary physical laws" (p. 688). Elitzur's dislike for metaphysical positions should have allowed him to see that Peres' statement at the beginning of his (i.e., Peres') article is a metaphysical position. Peres' subsequent argument concerning the solely physical nature of quantum mechanical measurement has been questioned (Snyder, 1989a).

The Conservative Nature of Elitzur's Arguments

In general, Elitzur's article is a very conservative one in terms of physical theory. He does not question the validity of the great majority of physical theory, particularly its widely accepted materialist interpretation. Considering the change in physical theory needed to allow for a psychological influence, Elitzur states: "Which of the existing basic notions of physics is to be revised? Naturally, we would wish it not to be a too basic one" (p. 15). Where he raises the possibility of changes (i.e., concerning the principle of the conservation of energy and the second law of thermodynamics), he raises significant arguments against an alteration of these principles and basically leaves it at that. He does note that "a sharper thorn in the side of physicalism" (p. 16) could come from the second law of thermodynamics.

One statement of the second law of thermodynamics is that when two isolated physical systems composed of many particles are allowed to interact, the result in general is an increase in the disorder characterizing the interacting systems (Kittel, 1969). Essentially, this is due to statistics and more fundamentally to the random character of certain individual processes found in the systems. Elitzur notes that something like Maxwell's demon (originally conceived by James Clerk Maxwell) might attempt to restore order to these individual processes. But Maxwell's demon, according to Elitzur, is necessarily a part of the physical world. Thus even though it may restore order in certain systems, through its own interactions in the world, it increases disorder in accord with the second law. Elitzur does not pursue a change in the second law further in a substantive way.

In looking at how cognition and consciousness might influence the physical world, the initial exploration should not be so much directed to finding the change in the principles governing the physical world resulting from the discovery of a psychological influence. Rather, it should be in exploring whether the processes of the physical world themselves have a significant cognitive component.

Quantum mechanical measurement has already been addressed. Consider the conservation of energy. Instead of arguing whether or not a conscious influence on the physical world disrupts the conservation of energy, attention should be directed to the fact that the conservation of energy in its fundamental structure has a cognitive component. That is, the conservation of energy is fundamentally a definition of potential energy. The conservation of energy may be stated thus: for an isolated physical system, the energy of the system is constant (Resnick and Halliday, 1960/1977). The energy of the isolated system is the sum of the kinetic energy and the potential energy. The kinetic energy can be determined independently of the total energy of the system. But the fundamental nature of the potential energy of the system is such that it allows the total energy of the system to remain constant. It does not have an independent basis for its determination as does the kinetic energy. It is the case, for example, that the zero point of the scale used to measure the potential energy of an isolated physical system can be arbitrarily chosen by an experimenter.

Or, concerning the second law of thermodynamics, Elitzur does not note that the randomness underlying this law may itself be intrinsically tied to cognition. For example, how is it that the normal distribution can both describe the distribution of intelligence among humans (as measured by psychometric instruments) and be most elegantly developed on the basis of random processes (Snyder, 1986)? Perhaps the ability to find order in experience, a characteristic of human intellect, and randomness are not as fundamentally distinct as they are traditionally considered to be. Perhaps a human acting as Maxwell's demon can bring order to a physical system without contradicting the random character of the individual processes making up the physical systems of concern.

The Inadequacy of Elitzur's Argument Concerning the Non-Material Basis of Consciousness

Elitzur's major argument that one can demonstrate a non-materialist basis for consciousness through noting that being bewildered by one's own consciousness cannot have a materialist nature is inadequate. Basically, Elitzur maintains that a person can escape the material by placing the material in question. In computer programming, it is not difficult to write a program that takes some level of program code and implements this code under various contingencies that are themselves part of the program code. I do not see why Elitzur's contingency is so special as to not be amenable to this kind of coding. The higher level of code could be assigned the non-material property Elitzur reserves for consciousness.

Conclusion

In developing a position concerning the non-material nature of consciousness from a primarily philosophical position divorced from physical theory, Elitzur implicitly validated the contemporary interpretation of physical theory as basically materialist in nature. He took away the strongest foundation on which to explore the role of consciousness in the physical world and instead chose the much weaker philosophical approach. Elitzur's argument does not stand up to the elementary capabilities of computer programs. The exploration of physical theory itself, directed toward the possibility of a conscious (and cognitive) component in the functioning of the physical world, is the likeliest way to demonstrate such a contribution. Contrary to Elitzur's (1989) statement regarding the impact of consciousness on the physical world in quantum mechanical measurement, this path does not lead "to a dead end" (p. 3).

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