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Non-Causality as the Earmark of Psi*

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The Physicist's Approach to Psi

As a student of physics, one grows up in a climate of optimism. One experiences how Nature can be described in terms of mathematically simple laws which the human mind is able to comprehend. In quantum theory one finds an elegant and powerful tool which—one feels—may well be the final theory for all there is to know on this earth, ranging from atoms to living organisms.

Quantum theory, apart from its practical success, has raised profound and puzzling questions on the nature of physical reality and the role of the human observer, but these questions have remained on the periphery because they seemed of no practical relevance.

Through the results of psi research it became apparent that quantum theory has flaws in a very practical sense. Applied to a systems that include human subjects the predictions of quantum theory were seen to be sometimes incorrect. This finding may well touch upon the open problems of the role of the observer in quantum theory, the nature of reality, and perhaps even on the problem of consciousness.

For our present discussion we will put these profound problems aside and look at psi from the view of an optimistic and practical minded physicist. We will consider the psi effects as a challenge to either modify the quantum formalism or to look for other novel mechanisms.

The Causality Principle

A most striking feature of psi effects is the violation of the causality principle. Causality, in the meaning in which I am using this term, concerns the time order between cause and effect, with the cause always preceding the effect. From early childhood we get used to the principle of causality. If the milk is spilled, somebody must have tipped the cup, and there is no way to undo the accident by changing the past. Causality has become so much an integral part of our common sense feelings that a non-causal world appears almost unthinkable. And even though theorists with little regard for naive common sense feel-

*Prize Lecture: Eleventh Annual Meeting of SSE, Princeton Univ., June 11–13, 1992 ings have occasionally toyed with non-causal models (Wheeler and Feynman, 1945, Schmidt, 1966, and many others), all experimental evidence from the physics laboratory has so far supported the causality principle.

Does Precognition Violate the Causality Principle?

A first hint of non-causality came from reported cases of precognition. If a person can predict some future chance event, then this future event seems to affect the person's present mental state, with the cause producing an earlier effect, acting backward in time. J. B. Rhine brought precognition into the laboratory. He reported that subjects could predict the order in which cards would appear after shuffling.

From the pre-quantum viewpoint of a deterministic world, with the atoms moving like planets in deterministic orbits, precognition might have appeared as a strange ability to mentally calculate the future. Quantum theory, however, told us that some processes are in principle indeterministic and unpredictable. This raised the questions whether some persons could still predict those "in principle unpredictable" events.

In order to generate such events (Schmidt, 1969), I used a combination of a fast computer clock and a Geiger counter to build a random number generator that could produce the numbers 1, 2, 3, and 4 in truly random sequence, so that—according to very basic axioms of quantum theory—nobody should be able to guess the next number with more than the 25% chance accuracy.

As it turned out, selected subjects were still able to predict the numbers to be generated at success rates between 26% and 27%, significantly above the chance success level. This showed that quantum theory—when applied to system that include human subjects—is not always correct. This in itself is certainly a most exciting finding. But does it indicate a causality violation?

Psychokinesis

There seemed to be one way out to still save causality, based on Rhine's reports (Rhine, 1943) on psychokinesis (PK). These reports suggested that some people could mentally affect the outcome of chance events such as dice falls. Subjects in precognition experiments therefore might have succeeded not by looking into the future, but by offering a wild guess and then using PK to make the final outcome match the prediction.

It wasn't easy for me to take the possibility of PK seriously. And when I finally had built some PK test equipment I gave up after a few half-hearted attempts. Only much later could J. B. Rhine persuade me make a systematic effort to find good performers. In the end, success in PK tests seemed not more difficult than success in precognition tests, and the scoring rates in both cases were comparable.

For practical convenience most PK tests use a binary random generator, an "electronic coin-flipper" which the subjects tries mentally to unbalance such as to, say, produce an excess of "heads". In my first experiments (Schmidt,

1971) the binary random generator was automatically activated once per second and the generated heads and tails were displayed by clockwise or counter-clockwise motion of a light in a circle of 12 lamps. The subject aimed at having the light move primarily in the clockwise direction.

With the help of digital electronics it was easy to arrange very reliable PK tests so that, I think, even the early tests left no room for error. Later when small computers became available many researchers were able to start reliable experiments and confirm the existence of PK effects. Some researchers, including myself, have tried to work with particularly successful individuals, and some workers, such as Dean Radin and Charles Honorton, have used themselves as the most available and most motivated subjects. Many others, such as Robert Jahn and his group, have worked with largely unselected subjects.

All these approaches have produced significant PK effects but nevertheless we have not yet reached the stage where we can reproduce the effects reliably on demand. This may be partly due to the subtle psychological factors involved in PK success, but there may be also more basic obstacles to reproducibility introduced by the non-causal features of the underlying mechanism.

The Goal Orientation of PK

Imagine a typical PK experiment in which a binary random number generator (RNG) is connected to a display device. The random decisions which the subject tries to affect are made in the RNG, and are displayed shortly afterwards to the subject. Contrary to what one might expect, the subject need not know anything about the random generator, but succeeds with a goal oriented attitude, focusing only on the final outcome shown by the display device rather than on the necessary preliminary steps leading up to this outcome.

The first suggestion that this goal orientation is more than a matter of psychology comes from experiments with different kinds of random generators which indicate that the nature of the random generator, such as its degree of internal complexity, do not affect the PK success rate.

More explicitly emphasized is the goal-oriented feature and its associated element of non-causality by experiments which introduce a time delay between the generation of the random events and the subsequent mental effort of the subjects (Schmidt, 1987).

In such a typical experiment we first activate a random generator many times and store the produced binary random sequence on computer disk or in permanent computer memory. At this time nobody looks at the generated events, but we usually make copies of the data and even computer printouts which are immediately sealed to preclude human observation.

At a later time, usually weeks or months later, we use the stored binary events, the random sequence of "heads" and "tails", to activate some display device while the subject is instructed to aim for an increased number of heads or tails.

The results of these PK experiments have produced highly significant effects, and there is no indication that the time delay makes PK success more or less difficult. If copies of the pre-recorded data were made at the generation time, these copies still agree at the end. In all practical respects it seems that the subject's mental effort during the test session had an effect on the decisions made by the random generator weeks or months earlier: we have a non-causal action of the present into the past in a quite pragmatic sense in that we can experiment with the non-causal effects. This action into the past should not be understood in the sense that my present action would *change* the past. Rather, the past chance events happen as if they could sense what I will do later, and adjust their outcome accordingly.

Psi and Quantum Theory

Since the inception of quantum theory there has been an ongoing controversy on whether or not the theory could adequately describe the human observer himself. The discussion, however, was based mainly on philosophical arguments and on matters of personal taste on what should be considered a satisfactory theory. The mentioned psi experiments provide, I think, the first clear experimental evidence that quantum theory is not quite correct when applied to a system that includes a human subject.

The relevance of psi effects for quantum theory is emphasized by the finding that the effects we observe in the laboratory act only on chance processes. Formulated more specifically, this led to idea that PK violates conventional physics only in a weak sense: It leaves the conservation laws for energy, momentum, symmetry etc. untouched and only affects the outcome of not pre-determined chance processes. Thus PK can affect only outcomes about which the physicist is not certain, and it does nothing that is impossible according to conventional physics; it merely changes the probabilities for possible outcomes.

This weak violation hypothesis links psi in a quite specific manner to quantum theory and implies already some non-causal element. To see this remember that quantum theory can lead to quantum correlations between happenings at distant locations. For example, one can generate a correlated pair of photons flying in opposite directions, so that both photons are polarized in the same direction while nature has no yet decided which this direction is. When one photon at A meets a polarizer it is a matter of chance whether the photon passes or gets reflected. Due to the quantum correlation, the other photon at B meeting a similar polarizer must make exactly the same decision as if it knew which decision the photon at A had made. While this quantum correlation is puzzling and a topic of much discussion we cannot talk about a "telepathic" link between A and B because the coupling cannot be used to transmit information from A to B. We can only passively watch and see how the two distant photons make identical decisions.

Things change if we assume a PK subject at A able to affect the photon's quantum decision. Imagine a continuous stream of photon pairs. If then the subject succeeds to have an excess of photons transmitted at A, the same must happen at B. Thus an experimenter at B notices instantly the PK effort made at A: we have an instant telegraph. And if relativity theory is right this should enable us to send signals into the past. I will not go into practical details because the PK experiments with pre-recorded random events provide an easier way to study non-causality experimentally.

While the present formalism of quantum theory is causal and inconsistent with psi, one might try to change the formalism slightly to make room for the observed effects. Physicists had already tried to change quantum theory for other reasons. In an attempt to make quantum theory more intuitively appealing they tried to introduce "hidden variables" which might give a deterministic underpinning to the formalism. As it turns out, such models lead necessarily to non-causal or non-local effects in the sense that changes of a hidden variable at one location may imply an instantaneous change of the corresponding variable at a distant location. In the conventional hidden variable models these non-local effects are not observable because the hidden variable cannot he observed or changed at will. If the brain had some access to the hidden variables, however, one might see this as the source of some basic psi mechanism. Several writers have proposed modifications of quantum theory to accommodate psi (Walker, 1979, Mattuck and Walker, 1997, Schmidt, 1982), but unfortunately all modifications of quantum theory attempted so far appear to me rather clumsy and arbitrary when compared to the beautiful and simple original quantum formalism. As soon as a larger number of clever theorists become aware of the existence of psi and its quite real challenge to current physics, the outlook may brighten.

Non-Causal Lawfulness

One might be inclined to argue that a retroactive effect of a subject's present mental effort on a previous random event must lead to logical inconsistencies. The situation may remind us of a science fiction scenario where a person can travel back in time and interact with his parents while they were still children. This would lead to problems if the person had a nasty streak and would cause a fatal accident to his father walking to elementary school. Science fiction writers have to avoid or to talk their way out of such interventions which would lead to "impossible" scenarios.

One can counter this argument against retroactive PK by presenting detailed models which are logically self consistent and nevertheless show retroactive or non-causal effects. Indeed, we can see such effects in motion pictures. Suppose that the director has decided that the hero must throw two sixes in a game of dice or accomplish some other unlikely feat. Then the director simply takes many recordings of the scene, repeated over and over, until the desired to sixes have come up. While all recordings made represent possible histories, the director discards all but the lucky one with the two sixes.

This selection procedure leaves us with a film that shows happenings that are physically possible, but rather unlikely and goal oriented: the appearance of the two sixes sets a goal or a future boundary condition to which the preceding events must lead up to.

One class of non-causal models whose internal consistency becomes easily evident, is obtained by replacing the movie director by some mathematical selection principle. According to quantum theory the future depends on chance, i.e. we have many possible future world histories from which the real one is selected by chance. We could imagine now a law that — like the movie director-introduces a bias towards certain histories that satisfy some teleological criterion so that what happens now is not only determined by the past but also by the future. The resulting history is then clearly self consistent because it was selected from among many physically possible histories.

Speculations in this direction have not been restricted to science fiction writers. Considering the evolution of biological species, for example, biologists have wondered whether the few billion years available were enough to get such marvelous results by mere chance mutations or whether there must have been some additional "master plan" or "life force" to direct the chance mutations. Perhaps further progress in molecular biology may some day lead to an answer.

I would imagine such a possible master plan not in terms of "divine intervention" but in the form of some mathematically simple law. Imagine for example that one could formulate some simple mathematical measure for the "complexity" of a biological system. Then the master plan may specify that such mutations are more likely to occur which, a million years in the future, lead to more complex systems. Such a master plan would change the statistics of mutations, favoring the development of complex biological systems such as human brains. To ask for the "plausible mechanism" for such changes in the mutation rates might miss the point because the master plan could be one of those basic physical laws that cannot be reduced to other more familiar laws of nature.

One kind of goal oriented world history which does not require any novel laws of nature has been discussed under the label of the "anthropic principle". Assume that the universe contains an virtually unlimited number of earth-like planets. Then some of these should by mere chance — no matter how unlikely this occurrence is — have led to the present world with its highly developed brains including myself with my own consciousness and my ability to observe the world around me. That would explain why all observers in the universe see very complex, statistically unlikely life forms, because planets without such life forms do not breed conscious observers. In such systems, however, the unlikely apparently non-random processes that led to the present state and to my existence are a matter of the past; from now on I see nothing unusual happen and the future mutations are ruled exclusively by chance. Such an anthropic principle therefore could not account for the observed psi effects.

From the view-point of the practicing psi researcher, one might see psi as some goal oriented principle that favors histories which will in the future lead to happiness or some form of satisfaction on the part of the subject or the experimenter. The pre-recorded event turns out as a head rather than a tail because the appearance of a head will—later in the test session—give satisfaction to the subject, or even because it will contribute to a successful experiment which will, in the end, make the experimenter happy. Some researchers think that the result of an experiment can be affected even by the mental attitude of the readers who study the final published report. Such a situation would make it very difficult to reliably control the test conditions, but this is typical for non-causal systems in general.

The Loss of Isolated Systems

Nature has been generally friendly to physicist in allowing them to study fundamental laws on hand of practically "isolated systems". Newton could find the laws of planetary motion because he could study one planet at a time in its orbit around the sun. If the sky had been teeming with planets, all strongly interacting with each other, it might have taken a long time to recognize the simple laws at the bottom of the apparent confusion. Similarly physicist could study elementary particles, one or two at a time, while disregarding the rest of the universe. By preparing a systems in the laboratory one can often provide a desired initial condition and then study what happens next without any unwanted interference from the outside. In a causal world the behavior of the system depends only on the past, on the manner in which we prepared the system.

In the presence of non-causal interactions, however, the present behavior of a system may depend on its future history which is beyond our control. If we prepare two systems identically, they may show different behaviors if they will be exposed to different conditions in the future. Thus the results of seemingly well controlled experiments may appear erratic and irreproducible, unless we fully understand the non-causal mechanism and can control the future of the systems accordingly.

Conclusion

From the view of the optimistic physicist psi should be explainable in terms of some yet unrecognized law of nature applicable to animate and inanimate nature alike. The basic structure of this law should be mathematically simple so that the observed complexities result from a combination of basically simple laws and a practically very complex brain structure. The psi experiments indicate that the new law must be non-causal, which makes the psi effects so intuitively implausible and inconsistent with current physical theory. One might hope to find the origin of this non-causality in some modified form of quantum theory, and the reports on psi effects should provide a mayor stimulus for physicists to review the experimental and conceptual basis of the quantum formalism. Even if the microscopic origin of the non-causality were known, however, there is still the practical questions of the global implications. These global features may even be studied independent of the microscopic mechanism with the help of phenomenological models in the same way one can study water waves phenomenologically without having to go into the underlying molecular structure of water. Indeed, the development of new phenomenological models or improvement of old ones (Schmidt, 1975) may be the most efficient thing to do at this time, in giving us a better feeling for non-causal systems in general and helping us to design meaningful experiments.

References

Mattuck, R. D. and Walker, E. H. (1979). The action of consciousness on matter, a quantum mechanical theory of psychokinesis. *The Iceland Papers,* Editor Puharich, *A.* Essentia Research Associates, Amherst, 1997, pg. 111-159.

Rhine L. E. and Rhine, J. B. (1943). The psychokinetic effect. *Journal of Parapsychology,* 7, 20-43.

Schmidt, H. (1966). Model of an oscillating cosmos which rejuvenates during contraction. *J. Math. Phys.* 7,494-509.

Schmidt, *H.* (1969). Quantum processes predicted? *New Scientist,* October 1969, 114-115.

Schmidt, H. (1971). Mental influence on random events. *New Scientist and Science Journal,* June 1971,757-758.

Schmidt, H. (1975). Toward a mathematical theory of psi. *Journal of the American Society for Psychical Research,* 69,301-319.

Schmidt, H. (1982). Collapse of the state vector and psychokinetic effect. *Foundations of Physics* 12,565-581.

Schmidt, H. (1987). The strange properties of Psychokinesis. *Journal Scientific Exploration,* 1, 103-118.

Wheeler, J. **A.** and Feynman, R. P. (1945). Interaction with the absorber as the mechanism of radiation. *Rev. Mod. Phys.* 7, 157.

Walker, E. H. (1979). The quantum theory of psi phenomena. *Psychoenergetic Systems,* **3,** 259-299.