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Correlation Between Mental Processes and External Random Events*

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Abstract—The report reviews the author's early work on the precognition of quantum processes, including changes introduced as safeguards against errors.

Introduction

The basis for the experiments to be discussed was laid in the last century when scientists performed controlled experiments in telepathy (Koestler, 1972). Initially, telepathy seemed intellectually acceptable because one could imagine it in terms of some conceptual model, of a "mental radio" using either the recently discovered radio waves or some other signal wave. But then Charles Richet (1888), the famous French physiologist, shocked the scientific community by reporting that "telepathy" also worked without a human sender. In Richet's experiments, a human subject was able to guess (with above chance accuracy) randomly drawn playing cards even, if no sender looked at the cards. This effect, termed clairvoyance, could not be conceptualized in terms of a mental radio or any other plausible mechanism.

When later J. B. Rhine in the United States extended Richet's work, there appeared in the laboratory two more phenomena without a plausible mechanism. One was precognition, an ability of some people to predict (with above chance accuracy) the order in which cards would appear after shuffling. The other was psychokinesis, a mental effect on the outcome of random dice falls.

The work of Rhine and of other preceding workers has been much criticized, rightly or wrongly. Nevertheless, this work provided a challenge and a starting point for many of the current researchers in parapsychology. (I am using the word parapsychology here as a label for a serious scientific discipline, not in the sense in which it is used by bookstores as heading of their occult section).

This report will summarize some of my earlier work in this direction, aimed at precognition, with the basic questions in mind: Do the claimed

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effects really exist? If yes, what can we find out about the underlying mechanism?

Precognition of Quantum Jumps

From the physics viewpoint, the ultimate test for precognition is an experiment in which people try to predict the outcome of quantum jumps which, according to current quantum theory, are in principle unpredictable.

For such an experiment, one might want to shoot photons at a semitransparent mirror and let the subject guess whether a photon will pass through or be reflected. This conceptually neat experiment is not very practical, however. What we need is some more rugged test device, easily built and handled.

For this purpose, I built a quantum based random number generator (Schmidt, 1970) that could generate the numbers 0, 1, 2, and 3 in a random sequence. The principle is very simple (Figure 1). A 1-Mhz oscillator drives a modulo-4 counter so that the counter advances rapidly in the sequence 0, 1, 2, 3, 0, 1, 2, ... The counting is stopped when a radioactive decay particle is registered by a Geiger Tube. And since the timing of radioactive decays is truly random, the stopping position of the counter 0, 1, 2, or 3 is truly random and unpredictable in the quantum mechanical sense. If quantum theory is correct, then nobody should be able to predict the stopping position with more than 25% accuracy.

I built this device into a box with four colored lamps and four push buttons. Initially the lamps are dark and the internal modulo-4 counter advances rapidly. When a button is pressed, nothing happens until the next signal arrives at the Geiger Tube. At this moment the counter stops and the stopping position is indicated by the lighting of one of the four lamps.

The subject tried repeatedly to predict the next light and registered the prediction by pressing the corresponding button (which, in turn, triggered the next event). A pair of electro-mechanical reset-counters registered the numbers of trials and hits. For added security against errors, a corresponding pair of nonreset counters was mounted at the back of the machine. In addition, the full sequence of events, the buttons pushed, and the random numbers generated were automatically recorded on paper punch tape. Note that this was in 1968, when home computers and small recording memories were not yet available. On the other hand, one could already buy integrated circuits, which greatly simplified the construction of the circuitry.

To test the randomness of the machine in the absence of a subject, one button was actuated automatically many times. The resulting random numbers were recorded on paper punch tape and subsequently evaluated on a mainframe computer. Thinking of possible malfunctions in the electronics, one is particularly interested in the relative frequencies of the four events as well as the correlations between two subsequent events. Considering the

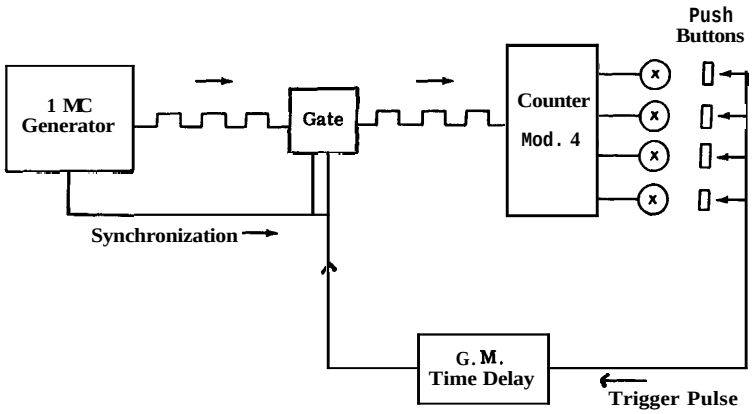

Fig. 1. Principle of the random number generator.

simple structure of the random generator, one would not expect highly complex nonrandom patterns which the subject might detect and utilize. None of the randomness tests did show any anomalies. I continued these randomness tests during the experiments with human subjects to be described.

The First Tests with Human Subjects

The vast majority of the first 100 people tested seemed to produce merely chance result, about 25% success rate. One interesting exception was a physicist who reported having frequent precognitive dreams. After some initial tests, this man obtained an average scoring rate of 27.2% over 7,600 trials. This result, 4.38 standard deviations above the chance level, would have been produced by mere luck only once in about 100,000 such experiments so that chance as an explanation could practically be ruled out. Unfortunately the physicist left for a sabbatical and I had to start searching for new performers to reconfirm the existence of the effect.

Among a group of professional psychics and their friends, I finally located some unusual performers with abilities similar to the physicist's. In a first experiment of 63,000 trials, I used three pretested subjects. One of these scored near chance ($z = 1.6$) but each of the other two scored more than 4 standard deviations above the chance level ($z = 4.4$ and 4.6 respectively). The average scoring rate of the three subjects was 26.1% hits over the 63,000 trials. In this experiment, the number of trials was prespecified only within the limits of between 55,000 and 70,000 trials to be made. The probability for chance producing the observed or a higher score deviation anywhere in this interval is less than 2×10^{-9} (Schmidt, 1969a).

For a final experiment, I used a new test machine which was built not by myself, but by technicians of the Boeing Company where these experiments were performed. I did, however, personally recheck the circuitry (the same as

used in the previous machine) and the electronic performance. Randomness tests, again, showed no anomalies.

In this experiment of exactly 20,000 trials, the subjects could choose either to aim for a high or a low score. In the latter case the subject tried to push a button next to any lamp that would not light. The choice was made before a test sessions by the setting of a switch whose position was automatically recorded on the punch tape, so that the evaluating computer could distinguish the two situations. Figure 2 plots the cumulative number of hits (light-button coincidences) above the chance level. Only the subject JB worked with both options, while OC aimed always at a large and SC always at a small number of coincidences. Under all conditions the scores deviated from chance in the desired direction. The average deviation (from the 25% chance hit rate) in the desired direction was 1.8%, corresponding to 6.5 standard deviations, with odds against chance of ten billion to one.

From an intuitive viewpoint, one might try to interpret the results in terms of two mechanisms: It might have been precognition in the sense that the subject predicted the outcome of the future random event. But it might also have been psychokinesis: The subject might have selected any button and then mentally forced the random generator to produce the matching number. In that case, the subject would not have to look into the future, but the mechanism would equally violate current quantum theory. Later experiments suggested that psychokinesis and precognition are so intricately related that a distinction between different "mechanisms" becomes meaningless. Therefore a new term psi has been introduced to describe all psychic phenomena. For the same reason I have used in the title the neutral term "anomalous correlation," to not imply any intuitively suggestive but misleading concept of a particular mechanism.

Even with the help of many critics, I haven't been able to find anything wrong with the experiments. It seems that human subjects can beat quantum theory: the theory is not correct when applied to systems containing a human subject. That result is certainly worrisome and you ask yourself: could there, in spite of all care taken, be some terrible error in the experiment? The best way to approach this is to make changes and see if the effect persists. Let me mention two such changes:

Changed Test Arrangements Confirm the Effects

First, I replaced my quantum based random number generator by a different source of randomness. The RAND random number tables (published by the RAND Corporation) had been tested by mathematicians extensively. From these tables, which were available on computer tape, I had the mainframe computer of the Boeing Company prepare a long paper tape with a random sequence of the numbers 0, 1, 2, and 3. I put this paper tape into an enclosed tape reader and connected the system to my display box. When

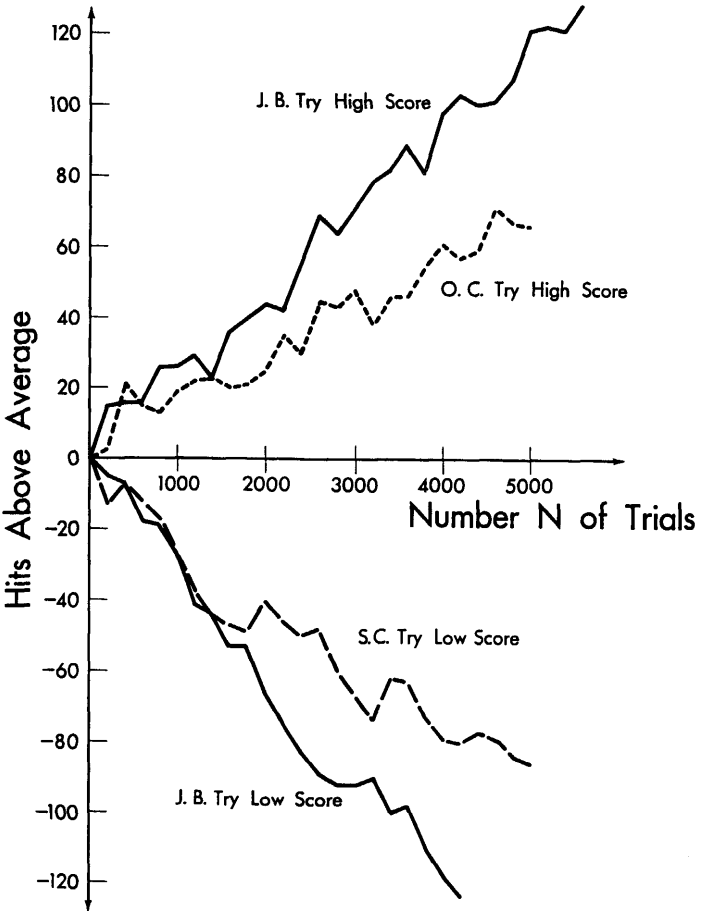

Fig. 2. Results of the precognition experiment with 20,000 trials. The cumulative score deviation from chance is plotted after each block of 200 trials. In all four cases, the subjects obtained deviations in the desired direction.

now the subject pressed a button, the next light was determined by the next number on the paper tape, hidden inside the tape reader.

In this setting, a subject with precognitive ability should again be able to succeed. Certainly, this setting lacks the particular challenge of predicting quantum events, but the task of guessing the sequence of holes in a hidden paper tape seemed physically nearly equally impossible.

For the experiment of 15,000 trials (Schmidt, 1969b), I used several preselected subjects, most of which had participated in previous studies. The result was comparable to the earlier results: an average deviation of 1.3% from the chance level, with odds against chance of a million to one ($z = 5.0$).

Using for a moment the viewpoint of the older, naive terminology, the first experiments could be interpreted in terms of precognition or psychokinesis.

In the last experiment, psychokinesis seemed ruled out, but clairvoyance appeared as a new alternative. Based on the naive viewpoint, I had initially expected that the clairvoyance option might rnake the task easier and produce higher scores. This was not the case, however, and the following experiment as well as later experiments (Schmidt, 1986) enphasized that internal physical differences in the test arrangement have little effect on the operation of psi.

For a second change (Schmidt & Pantas, 1972), I kept my original internal random generator, but in a different role. My idea was to make the task more psychokinesis oriented, without the subjects noticing the difference.

In the previous arrangement, let me call this the "precognition-oriented" arrangement, a generated 0, 1, 2, or 3 made the corresponding lamp (numbered 0, 1, 2, or 3) light up. In the new, "psychokinesis oriented" arrangement the generated number, however, determined the displacement of the light with respect to the pushed button. If the generator had produced a 0, then always the lamp next to the button was lit, while a 1, 2, 3 lit the lamp shifted by 1, 2, or 3 steps to the right (in cyclical order). To the subject, the new system looked the same: pressing a button caused randomly one of the lamps to light. But now an above number of hits meant that the machine had generated an excess of 0's. We had channeled the subject's effort into the psychokinesis task of unbalancing the random generator. I did a special experiment to compare success on the machine under the two types of circuitry. The results showed no difference, significant scoring under both conditions.

The results obtained in the psychokinesis-oriented mode provide one more argument against hidden patterns in the random generator permitting the subject to succeed. Let me briefly review these arguments.

First the simple construction of the random generator suggested that any malfunctions leading to nonrandomness should show up already in the simple randomness tests for the frequencies of the individual events and their next-neighbor correlations.

Second, the tests with random numbers from the RAND tables would have required a discernible hidden pattern in these numbers, which appears extremely unlikely.

Third, success in the psychokinesis oriented mode appeared as an increased generation rate of 0's during the test sessions. It was an elementary matter to check, by extended tests in the intervals between the test sessions, that there appeared no such bias in the absence of the subjects.

You might argue that it doesn't require a particular psychokinesis mechanism to unbalance the random generator. A subject with precognitive abilities could have waited until the time felt right for obtaining a "0" from the random generator, and then pressed a button. One could challenge this interpretation, however, because the internal counter advances at a megacycle rate, above the limits of muscular response times. These arguments can be

avoided by assuming the viewpoint that psychokinesis and precognition do not represent distinct mechanisms. If I, nevertheless, use the terms precognition and psychokinesis it is merely to characterize the experimental setup rather than the underlying mechanism.

Part of the last experiment was interesting from a practical and psychological viewpoint in so far as it used unselected subjects in an emotionally slightly stressful setting. The underlying ideas (already pointed out by Rhine) were, first, that very many people can produce psi effects if only they get emotionally involved in the experiment and, second, that these effects can work against the subject's wish if the subject feels uncomfortable, apprehensive or fearful.

The subjects were provided by visiting groups, ranging from elementary school children over Girl Scouts to science teachers, with typically ten persons in a group.

To get the subjects into a slightly apprehensive state, they had to step individually to the test machine in front of the group. Their assigned task was to avoid the light: "See how many safe steps you can make before stepping on the light. When this accident happens imagine you have stepped on a bomb or you got an electric shock, be extremely careful."

The group watched closely, and when the "accident" occurred, this was greeted by laughter. Then the subject had to step down, and it was the next person's turn. **A** pilot test with three groups showed that the feared accidents, the light-button coincidences happened with increased frequency.

Then I decided on a formal experiment of 1,000 trials, which took 15 groups to complete. Note that this was a very slow experiment, with much emotion spent on every trial. Each subject had only one or two turns and took each trial very seriously.

The total result was a significant increase of the feared hits (the "accidents") from the 25% chance level to 30.6%. With 4.1 standard deviations from the expected average, the odds against chance are about 10,000 to 1. Figure 3 gives the cumulative number of hits above the chance level, plotted after each group.

The psychological setting of this experiment may be similar to many real-life situations. We have one person in charge (the current subject) trying to avoid an accident, and we have a number of onlookers, waiting (like press reporters) for something to happen. Under these conditions the accident rate was increased above its expectation value. For every five accidents expected by chance, there actually happened about six. In the experiment, we had on purpose provided some accident-producing random process.

In a real-life situation, such as for example the launching of a satellite, we will try to reduce such accident producing chance factors to a minimum. By increased quality control we can lower the base rate for accidents to a much smaller value than the 25% in our experiment. But as long as there is any room for chance accidents, there might enter an accident-enhancing psycho-

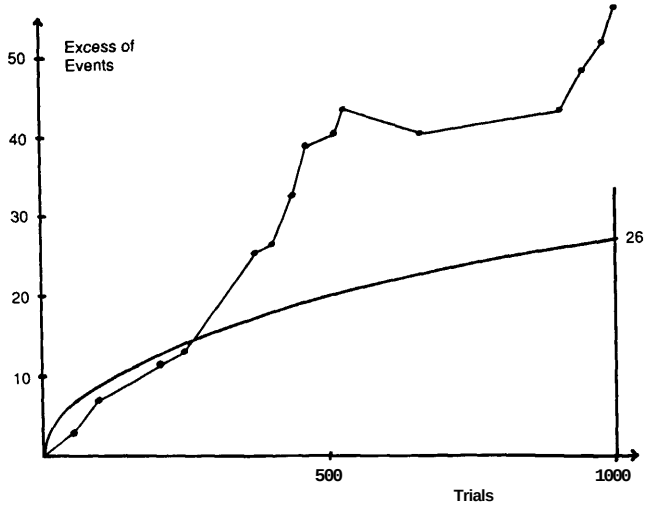

Fig. 3. In an experiment of only 1,000 trials, 15 groups contributed varying numbers of trials. The cumulative score deviation is plotted after completion of each group. Under slightly stressful conditions, the unwanted events, the "accidents" occurred with significantly increased frequency. Only one of the 15 groups scored opposite to this expected direction.

kinetic effect. If the psychological conditions were similar to our experiment, we might predict that, again, for every five accidents expected by pure chance, there could occur rather six accidents.

Should one take that seriously? A simple, inexpensive way to find out would be to replicate the experiment, perhaps 10 times, with different experimenters and different groups. And if the effect should continue to appear rather regularly, it might not be too difficult to find psychological counter measures.

In closing, let me return to the more fundamental questions about the underlying mechanism. In later experiments (Schmidt, 1986), I used more psychokinesis-oriented arrangements. The most simple example is given by a binary random number generator that activates a red and a green lamp in random sequence, once per second. The subject doesn't even touch the equipment but is instructed to mentally try to have the red lamp lit most of the time. One finds that some subjects can affect the random generator under these conditions, and the effect has been confirmed by a large number of different experimenters. The size of the effects is comparable to the results from the earlier precognition oriented tests. The psychokinesis arrangement is experimentally very convenient and suggests new questions to explore: How does the effect depend on the distance between random generator and subject? How is it affected by the random generation speed, and how does

the score depend on the internal structure of the random generator? These questions may already have been answered (Schmidt, 1986), but many more are still to be answered before we may have enough building blocks for some future theory of the effects.

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