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FOREIGN TECHNOLOGY DIVISION

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by

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A TELEPATHETIC EXPERIMENT: NECESSARY REQUIREMENTS

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...Telepathy. How different are the reactions which this word causes among different people. Some believe that there is no telepathy and cannot be any since it contridicts the basic laws of physics. Others say that they believe in telepathy and if it violates laws of physics, then so much the better. Still others believe that there is nothing surprising in telepathy: bio-currents exist in the brain, currents cause radio waves, and radio waves are received by another brain.

Just why is the puzzle which has interested mankind for thousands of years not yet been solved? Why, despite the fact that now hundreds of people in many countries are occupied by telepathy (some as a hobby, others as professionals) do we not know if telepathy exists? Let us try to examine this.

Let us begin with the question of what is sensibly called telepathy. For we are inclined to call few of the methods for transferring thoughts from one person to another telepathy. A person can transmit his thoughts using speach, mimicry, a dance, nature of behavior, and so forth. No one considers any of these methods telepathy. (Let us note in passing that by these methods a person sometimes transmits his thoughts apart from and even in

spite of his will. How many people have given themselves away by the direction of a glance, a change in the respiratory breathing, or movements of the hand!)

Obviously, in the cases when we succeed in tracing the effect on the sensory organs of the "receiver of a thought," the effect being the carrier of information, we do not recognize such transmission as telepathy. Telepathy is the transmission of information without an effect on the sensory organs. Sometimes they even say: extrasensory (or supersensory) transmission of a thought.

What is the source of the very idea of the possibility of telepathy? Most likely, from numerous observations of daily phenomena. For example, a friend expresses some thought literally within several instants after it came into your head. Or he begins to whistle a tune which just has been haunting you for a half an hour already. And, of course, the insight of people that are close to you and who, when you have not even managed to enter the house, are already asking: "What happened at work!" on those very days when something actually happened.

And how many cases are known where a person felt that some misfortune occurred to his relative located at a great distance! Can't these and similar phenomena be considered proof of the existence of telepathy? They cannot, in which regard for many reasons.

The first is that thoughts arise in a person's head not without reason. A person saw something, heard something, he must solve certain problems - all this "prehistory" affects the course of his thought. Therefore, if two friends thought about the very same thing simultaneously, this may also occur without any telepathy: for you see, they have a common set of impressions to some degree and if one and the same stimulus acts on them, it is extremely probable that both will think about the same thing.

Thus, one should not confuse the transmission of a thought with the simultaneous appearance of this thought in two people under the effect of the very same factors.

The degree of the identical cause for the thinking of different people due to external reasons (stereotype) is well demonstrated by the following experiment: we give a person an assignment which requires some attention, for example, let him call out the even numbers in order - 2, 4, 6 etc. We ask him to answer assigned questions, interrupting the counting only for the time of the answer. More than 90% of those being tested under these conditions will answer in response to the question: "Name a part of the face" - will name: Nose;" to the request "Name a Russian poet" - they answer: "Pushkin;" "Name a domestic fowl" - "Chicken", etc. If two people being tested are sitting side by side, it may appear that one of them is transferring thoughts to the other.[1]

It is not at all mandatory that the external influences which caused one thought or another reach the consciousness and be memorized. And if a friend began to whistle a tune which is spinning around in your head, it most likely that this tune was heard an hour ago on the radio in an adjacent apartment. Distracted by a conversation, you and your friend did not even pay attention to it and then you remembered it "absolutely independently."

The second reason why common observations cannot be used to prove the presence of telepathy is the already mentioned variety of "sensual" methods for the exchange of thoughts. You have not yet said anything about the incident at work. But it has disturbed you and you placed the key in the keyhole somewhat

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[1]Of course, the reader understands that this test cannot be conducted with a testee who knows what he is waiting for.

differently, your walk has changed ever so slightly, your smile has become strained, and so forth. People who know you well sense all this. They may not notice which deviations from the norm gave away the unusual nature of your condition. And then the case of the "unexplained insight" will remain in their memory and in yours.

The third reason. People usually do not remember and do not consider those cases where an error occurred when guessing a thought, when a foreboding deceived us, and so forth. But you see, only a full consideration of successful and erroneous predictions permits us to estimate the probability that successful predictions were not chance coincidences.

And, finally, one more very serious circumstance. Science is basically interested in reproducible phenomena. Phenomena for which a list of conditions exists so that if we reproduce all the conditions on this list the phenomenon must also be reproduced (or is reproduced with a very high probability). Despite this requirement, not one description of cases of "everyday telepathy" contains instructions on the method to reproduce the transmission of thought.

Thus, everyday observations, even those which are very numerous, cannot satisfy us.

Specially organized tests are necessary. And, of course, these tests should be organized by taking into account all the considerations mentioned above. Naturally, tests in which the possibility remained to confuse with telepathy the stereotyping of thought, or the perception of information using the sensory organs, or chance coincidences and so forth cannot prove the existence of telepathy.

Recently, such tests have been organized rather widely but, as far as is known to the authors of the article, they are always organized with serious methodological errors. It is these very errors which forced us to state in fact: science does not know whether or not telepathy exist. We will try to analyze the errors in the telepathy tests.

We will describe tests containing a great variety of errors at once. This will help to explain the nature of the possible errors and methods for their elimination.

Obviously, in any test on telepathy someone who is transmitting thoughts and someone who is receiving them should participate. For brevity, we will call them: "sender" and "receiver."

Thus, we are present at a telepathy seance. The sender and receiver are sitting at a table in the apartment of the receiver. They agreed that the sender will think about some objects.

"I am ready," said the receiver. The sender began to look about the room in search of a suitable object. Then, finally, the object was found and the sender says: "I thought of something." A pause sets in. The receiver looks at the sender fixedly. He takes in the room with a glance. He rises from behind the table and walks about the room several times, glancing at the sender from time to time. "The mirror," says the receiver. "Correct," answers the sender, glancing once again at a mirror hanging on the wall. They repeat the test. This time a cup was thought of and the receiver said: "Saucer." "Very close," shout those who are present, "Also white, round, and of china!" On the third, fourth, and fifth tests even the enthusiasts who are present do not see anything common between what has been thought of and what has been perceived. "But, you see, they must be tired," a voice is heard, "We have to stop the tests, such a straining of thought is no laughing matter. But then how precisely it was transmitted the first time!" And everyone is convinced that he was present during

the "extrasensory transmission of thought."

One is struck by the thought that although we are talking about a specially organized test, it causes the same basic objections as "telepathy in everyday life." We recall how easy it is to force two people to think simultaneously and "absolutely arbitrarily": "Nose." Not lips, not cheeks, not brow, but namely the nose. The selection of the object which the sender thinks about in our test is determined to some degree by external circumstances (although it also seems to him that he is selecting it absolutely freely). The same circumstances also affect the selection of the receiver. Where is the guarantee that identical circumstances do not lead to the identical selection even without telepathy?

Several scientists conducted the following test: they asked a person to write an absolutely random series of zero's and one's. The person wrote something like this:

1001011010010111010100101100101 (A)

Then these zeroes and ones were presented to a computer under one sign. The computer predicted what the next number in the series thought up by a person would be. If a person could actually think up zeroes and ones with absolutely equal probability and absolutely independent of the figures which he had thought up earlier, the computer would guess about 50% of the figures. The tests showed, however, that even extremely simple programs systematically guess more than 50% of the figures. The reason for this, of course, is not in the telepathic capabilities of the electronic computers but in the fact that man is not able to select completely randomly. (Such tests were accomplished with several different programs.)

Thus, man cannot be entrusted with the selection of a report which must be transmitted mentally. This selection must

be performed with the aid of chance (tossing a coin or throwing dice, pulling cards from a deck, and so forth). The result of the chances should also determine what the sender will think. Naturally, the casting of lots should be performed secretly from the receiver. Such a procedure should also be accomplished in those cases where the receiver and the sender are located in different rooms and even in different cities.

Let us now examine the test described above where a cup was transmitted and a saucer was received. Is it or is it not valid to consider that in this case something similar was received? Obviously not, since if we did not stipulate ahead of time which signs of objects affect similarity and which do not, any answer can be interpreted both as similar and as dissimilar. For example, if a mirror was thought of and a tray was received it can be said that this is "similar" since both have a rectangular form, and it can be said that they are "dissimilar," since the mirror is made of glass and the tray is metal. The same signs lead to opposite conclusions if the mirror was thought of and a glass was received. And what should we consider - successful or unsuccessful - if eye glasses were thought of and a bicycle was received?

In order to eliminate chance in the interpretation of the results of a test, it is necessary to stipulate prior to the test that set of reports from which a selection can be accomplished by casting lots. The receiver must know this set. Any noncoincidence between what has been thought and received is considered an error. This procedure is also needed for one more reason. It alone provides the opportunity to evaluate the probability of obtaining a given result simply as a consequence of chance coincidence after the tests. And you see, only such an estimate interests us if we want to prove that it was telepathy which served as the reason for a given test result.

Since the goal of the tests is an estimate of certain probabilities, the arbitrary classification of the results into those which will be considered and those which will not be considered for some reason ("they were tired!") is absolutely impermissible. For it is always possible to find reasons to reject unsuccessful (or, conversely, successful) results. The rules of the game should be stipulated prior to the tests and all results obtained in conformance with these rules should be considered. For example, it can be stipulated ahead of time that to avoid extreme fatigue two tests per day will be made. Or it can be agreed that prior to any test both the sender and receiver have the right to say: "Tired." The tests stop but all the tests conducted prior to this are considered in the statistical processing.

Let us move on to the next fundamental error of the telepathy seance described above. Normal channels of communication between the sender and the receiver were not eliminated.

"But, you see, the sender only thought and said nothing," the reader may object. "About what channels of communication can we talk?" Of course, the sender was silent during the test. But did he really not look for the object of thought with his glance? And really, did not the receiver have the opportunity to follow his glance? And you see, this is also a channel of communication! We have already said there are many such channels. Furthermore, it can be asserted with confidence that we still do not know all such channels. It was disclosed comparatively recently, for example, that some information can be transmitted by light which falls on the skin rather than in the eye. Therefore, in tests on telepathy it is absolutely necessary to interrupt any physical possibility for contact between the sender and receiver.

But is it absolutely necessary to be concerned about two-way isolation? Perhaps, it is sufficient merely to interrupt the communication channels which go from the sender to the receiver. For it would seem that the reverse channels cannot interfere.

This would be correct if we could be confident that absolutely all direct channels were interrupted. If, due to some oversight (or an insufficiency of knowledge) some "very weak" direct channel of communication remained (with a very small capacity), the result of the test would be very heavily dependent on whether or not we had eliminated all reverse channels.

Let us place the sender in the dark corner of a room. Assume that it is so dark in this corner that the receiver does not see the sender. The sender, however, sees the receiver. The receiver walks about the room. He approaches various objects and touches them with his hands. If we study the condition of the sender at this time, it turns out that a whole series of indicators - blood pressure, pupil diameter, amount of saliva released, temperature and moisture of the skin, frequency and depth of respiration, and so forth - changes when the receiver approaches close to or touches the object which has been thought of. These changes can be recorded by the receiver. The receiver may not even realize the channel over which he receives the information on the condition of the sender - whether he perceives a change in the heat which he radiates, whether he heard a change in respiration or discovered a change in the odor of the skin. He simply feels that the sender is thinking: "Mirror."

This occurs because we did not break all direct channels. But these communication channels which we did not note and therefor were preserved could not have interfered with the experiment if we had broken the reverse channel. If the sender did not see what the receiver is doing.

Are these fears excessively devised? Is the necessity to eliminate reverse channels just as thoroughly as direct ones confirmed?

The psychological tests of the magnificently working stage actor V. Messing are widely known. Messing accomplishes a variety of tasks which are thought up by one of the viewers. For example, the following: "Go to a certain person, remove his watch from his left hand, set it to 0915 hours, and put it on the same person's right hand." The viewer who thought up this sequence of action says nothing to Messing but he either holds Messing by the hand or is simply located close to him so the Messing sees him, hears him, and so forth. Thus, during the test some direct channels of sensory communication are maintained. And reverse channels are maintained - the viewer sees Messing.

And what if we eliminate the reverse channel? For example, blindfold the viewer? In this case, are there enough direct communication channels for the transmission of the necessary information? One day, one of the authors of this article, in accomplishing the role of sender, proposed that V. Messing conduct the following experiment. Messing refused. Then the sender, without being blindfolded simply tried not to see what Messing did. He held Messing by the hand and diligently thought about those actions which Messing should accomplish. It turned out that under these conditions Messing stopped receiving thoughts. Vibration of the hand and a change in the senders breathing could not transmit to Messing, for example, the thought "0915 hours." At the same time, it was clear that the vibration of the hand would have been sufficient to transmit the thought "stop," if the sender had seen the position of the hands on the watch. The viewers in the vicinity said that Messing had accomplished at least four turns of the watch hand but did not know where to stop. Messing also had similar difficulties when searching for a required person and when searching for an object with which he was to work, and so forth.

For the test to continue, it was necessary to look at what Messing was doing from time to time ("turn on the reverse channel") and thereby provide the opportunity to move on to the next action.

and thereby provide the opportunity to move onto the next action.[1]

Thus, when organizing tests on telepathy it is necessary to eliminate both the channels which are able to transmit information from the sender to the receiver and channels which are able to accomplish the reverse transmission of information.

Now let us assume that we have organized tests with consideration of all the requirements which were formulated above. The sender and receiver are in buildings located on different streets (of course, from the windows of one house the other cannot be seen). They synchronized their watches and agreed that mental reports will be transmitted in five-minutes seances, with five-minute interruptions, and that altogether 10 reports will be transmitted. "Zero" and "One" will be selected as the objects of the report.

At the time agreed upon the sender tossed a coin - it came up "tails." Since he had decided ahead of time that "Heads" would signify "One" and "Tails" - "Zero," the sender began to think intensely: "Zero, zero... zero." At the sametime the receiver tried to sense just what the sender is suggesting to him. After five minutes, the sender wrote in his record "Zero." The receiver decided that most likely he transmitted zero and wrote this in his record. After the intermission the sender again flipped the coin, the receiver again concentrated, and new entries appeared in the records. And the transmission of ten reports proceeded in this manner. When the reports were compared after the experiment, it turned out that of the ten reports six were received correctly and there was a mistake in four cases.

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[1]Everything that V. Messing ever demonstrated is not telepathy. Messing himself states that he can also perceive thoughts under conditions of a pure experiment. However, all attempts by scientist to conduct such tests remained without results. Agreeing in principle to experiments under pure conditions V. Messing thus far cannot find any time for them.

How can this result be interpreted? On the one hand, more than half the reports were received correctly. On the other hand, such a result could also be obtained by chance with a rather high probability. As a matter of fact if, for example, a coin was tossed 10 times it is not at all mandatory that it come up "Heads" five times and "Tails" five times. If we accomplish many series of ten tosses, there will be comparatively frequent cases of 6:4. Somewhat more rarely but nevertheless not too rarely - 7:3. And approximately once out of 1000 series there will even be cases of ten "Heads" in a row.

In many works on telepathy, attempts are made to avoid the caprices of chance by increasing the number of reports being sent. If 60 reports out of 100 have been correctly received, the probability that this occurred by chance is much less than if there were six correct cases out of 10. And the probability that 600 reports out of 1000 will coincide by chance is already quite small (less than 10^{-6}). Therefore, when they do not succeed in obtaining a high percentage of correctly received reports, many scientists begin to increase the number of reports until the laws of statistics begin to guarantee with great reliability that the deviation from 50%[1] which is present was not obtained by chance. There are works in which about 25,000 reports have been transmitted for this purpose!

Is this way correct? With a frequency of correct guesses of 52%, having made 10,000 tests is it possible to prove the existence of telepathy? The answer to this question sounds as follows: this way would be more reliable if we were confident that we know exactly the initial uncertainty of the report. Putting it simply, if we

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[1]We take 50% as the initial level since in our example there are two possible reports. In those works where a selection is made, for example, from five possible reports 20% is taken as the initial level and so forth.

were confident that there is no method to guess the reports with a probability greater than 0.5, without a communication channel at all. However, we have never had such confidence and, apparently, in principle it cannot be.

Let us explain what has been said by means of examples. Let us assume that the sender is using a slightly bent coin. As a result, "Heads" and "Tails" do not turn up with the same frequency. For example, "Heads" - with a probability of 0.6 and "Tails" - with a probability of 0.4. Now, even without any telepathy the receiver has the possibility of guessing more than 50% of the reports. For this, it is sufficient for him to record several more ones in the record than zeros. For example, if he writes 60% ones and 40% zeros, then on the average he will guess 52% of the reports. Ten thousand such tests - and the existence of telepathy is "Proven."

We began with the simplist case where zeros and ones appear with the same probability. Obviously, such a primitive law is easily noticed and after this the entire series of tests is rejected. However, the matter is complicated by the fact that this is far from the only type of law which can change the initial indefiniteness (entropy) of the report. For example, the sequence of zeros and ones (A) presented on page 6 contains them equally and, it would appear, in an absolutely random order. At the same time, a method exists to guess the next figure in this sequence step by step in more than 50% of the cases. As a matter of fact, in it the transitions from zeros to ones and back are encountered noticeably more often than should be with their random distribution.[1] Therefore, if we act in accordance with the principle:

[1]Such a regular law is usually obtained if a person tries to think up a "random" sequence in his head.

the first time, name what turned up, learn if you made a mistake or not, name a figure which does not agree with the one which turned up in the first place, learn whether or not you made a mistake... and continue on in this manner, then for sequence (A) only seven or eight mistakes are obtained out of 30 reports.

Let us note that in order to use this regular law, it is not at all mandatory for the receiver to understand it. He will simply call that which "Comes to mind," but (just as for the one who thought up the sequence) after a zero a one comes to mind most often and after one zero.

There also exist laws for the use of which it is not necessary to obtain information whether or not there was an error the preceding time.

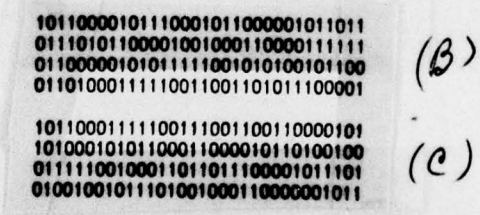
How can this be?

Is there any method of obtaining an absolutely random sequence "with a guarantee?"

Strictly speaking, such a desire is an internal contradicition. In fact, to the extent to which a certain method for constructing a sequence can be indicated, it turns out not to be random. Our only hope may be that, indicating the method for obtaining a sequence, we "will forget" to stipulate certain parameters which substantially influence the result of the selection. Here, we must also hope that the scatter of these "forgotten" parameters which we do not check do not contain regular laws themselves. Let us examine as an example the selection of zeros and ones using the flipping of a coin. Obviously, if we include with sufficient accuracy in the description of this method an indication of the initial velocity of the coin's center of gravity, the initial angular velocity, the initial position of the coin, air pressure and temperature, and so forth the coin will always come up the same.

Chance in an actual case is obtained because the method of tossing the coin is not determined and precise instructions as to how to toss the coin are "forgotten." A person spins the coin now more strongly, now more weakly. But where is the guarantee that he is doing this randomly? It will change little if the coin is tossed by some mechanical device.

Let us try to approach the problem from a different aspect. Assume that we can guarantee that some procedure will engender a random sequence. Can we not check experimentally that the sequence created by this procedure will be suitable for experiments in telepathy? For example, take a sequence of zeros and ones which is obtained by the repeated tossing of a coin and be convinced that it contains no regular law? Alas, this is unrealistic. In order to feel the nature of the difficulties which arise in this case let us try to find the regular law in sequences (B) and (C).



At first, the desire to check the number of zeros and ones arises. We satisfy ourselves that they are approximately equal in (B) and (C). We check to see if there is a correlation between the terms in the sequence separated by 2, 3, ..., 10 terms; it turns out that there is none. We check to see if the terms of the sequence are not signs of an expansion into a binary fraction of some "significant" number (e, π, $\sqrt{2}$, etc.). Nothing could be fitted. The reader, probably, is thinking up another set of hypothesis concerning the possible nature of a regularity. Each hypothesis can be checked. If a check confirms the hypothesis, then everything is ended: we were convinced that this sequence can also be guessed without telepathy. And what if all the checked hypotheses were not confirmed? This, you see, does not mean that

there are no regularities. Actually, sequence (B) was obtained by tossing a coin. But sequence (C) was constructed in accordance with some law (a comparatively simple one). Using this law, we can guess the next number in the sequence in approximately 75% of the cases. However, it is not so simple to discover this law.

The authors are not able to find a regularity in (B), but they are not confident that they would be able to discover it in (C). Therefore, we cannot guarantee that no one is able to guess, for example, 50% of the terms in sequence (B) without possessing telepathic capabilities in this case.[1] (We have already mentioned several times that in order to use a regularity it is not at all mandatory that it be realized. The brain solves the most difficult problems without "conducting" them through our consciousness.)

Thus, we never know precisely the initial indefinateness of a sequence of reports. Therefore, a small (even extremely reliably discovered) deviation in the percentage of correct guesses from 50% cannot serve as proof of the presence of any communication channel between the sender and the receiver.

The situation here recalls the situation with the necessity to eliminate the reverse communication channels. If we were absolutely confident that all direct channels have been eliminated, it would not have been necessary to pay attention to the reverse channels. Similar to this, if we are confident that it is impossible to guess more than half the reports, we could be satisfied with as small an excess above 50% as desired. A realistic estimate of the limited nature of our capabilities when searching for direct channels and when searching for regularities in

[1]In the sequences obtained when tossing a coin by several of those being tested, the regularity was discovered.

random[1] sequences leads to the necessity to eliminate reverse channels and requires a high percentage (close to 100) of correctly received reports.

True, the following objection may be put forth against the latter requirement.

It is known that due to interference in a communication channel a signal which has been sent cannot always been received without error. And suddenly, is there also strong interference in a telepathic communication channel? By requiring a high reliability of reception, do we not close the opportunity to discover telepathy?

To combat interference, we can draw on those methods which are used when transmitting reports over channels with noise. The simplest is the repetition of a signal many times. Let us assume that we correctly receive each signal with a probability of 0.8 and assume that they transmit the very same report to us 10 times in a row. Then, it is most probable that we receive the signal correctly 8 times and incorrectly 2 times. We will solve the problem of which report was transmitted to us by voting (for example, if the zeros were greater than the ones, we consider a zero). Clearly, the results from voting will deceive us extremely rarely (in less than 4% of the cases). If it is necessary for us to increase the reliability of the voting even more strongly, we can transmit one report by sending 20 signals, 30 signals, etc. With any probability of the correct reception of a signal different from 1/2, by using a sufficiently large number of signals we can obtain a probability of correct results in voting as close to 1 as desired.

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[1]We adhere to the point of view which can be roughly formulated as follows: "What is too difficult for me seems to me to be random." Obviously, it should be remembered that what is difficult for me may prove to be accessible (not random) for someone else.

Now, a method is outlined with which it is possible to reconcile the desire to prove the existence of telepathy if it exists and the desire to avoid the erroneous identification of regularities in "random" events with telepathy. After the sender cast his lot, he transmits the same signal many times.[1] Having received the signals, the receiver votes and makes one final decision concerning which report was transmitted. Then everything is repeated. To prove the existence of telepathy, a coincidence of results of the casting of lots of close to 100% with the decisions made at the receiving end is necessary.

Voting is only one of the possible ways to extract a signal from beneath the noise. The organizers of the experiment are correct in using any procedures: to record the temperature of the receiver and then to average it or record the diameter of his pupil or the biocurrents of the muscles, and so forth. All methods are permissible under the condition that at the receiving end of the telepathic channel a report is entered in the record which almost always agrees with the result of the casting of lots on the transmitting end. Anyone at all can perform the processing, for example, of the biocurrent records; it is not at all mandatory that it be the person whose biocurrents have been recorded but, of course, all those participating in this processing (decoding of the report) must not know the result of the casting of lots (of what was transmitted).

Now we can formulate the conditions the observance of which is necessary in tests on telepathy.

1. The test should be organized in the form of a transmission of some sequence of reports from one point to another. For

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[1]How many signals are needed for one report is explained in the preliminary tests by the one who is working out the procedure.

simplicity and specificity, we will consider that a set of possible reports consists of two reports (zero and one). For actual tests, it is not mandatory that the set contain exactly two reports. It is only necessary that they be at least two and that they all be precisely stipulated prior to the test.

2. The selection of the next report in the sequence should be accomplished using a good physical generator of random values (for example, an automatic device which tosses a coin so that it accomplishes many revolutions in flight and, after landing, can neither roll nor jump). An experimental check of the generator's quality is necessary. If it is discovered that, in the sequence obtained during the test, there is a regularity which is simultaneously both briefly formulated and highly improbable, the entire series is rejected.

3. With the transmission of "Zero" and "One", all physical processes on the transmitting end of the channel should coincide where possible.[1] Only those systematic differences which are unquestionably necessary for transmission are permitted. For example, differences in the biocurrents of the sender's brain are permissible when he is thinking "Zero" or "One," but he must not be located in different points of the room in these cases.

4. A report which is transmitted over a telepathic channel must be decoded (a decision concerning which report was translated must be made) on the receiving end. The success or failure of the transmission of a given report is judged from the agreement of the decoded report with the initial one (the result of the casting of lots).

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[1]This does not mean that all parameters must be recorded. It is only necessary that the laws of distribution of all parameters with the transmission of "Zero" and the transmission of "One" be identical (including the distribution and combination of parameters).

5. For the time of transmission of the report (from the moment when the lots are cast to the moment of final decoding) all mental communication channels between the receiving and transmitting points must be broken with the greatest possible thoroughness. In particular, any contact should be unconditionally forbidden (including contact on questions which do not pertain to the test) between persons who know the results of the lots and with persons participating in the decoding. This also pertains to contact through third persons (even those who know nothing about the experiment), the sending of objects, observing one another over a television set, and so forth.

It is extremely desirable to break communication between the receiving and transmitting points for the time of a long series of reports.

6. To discriminate the signal from the noise, the transmission of a report with the aid of a repeated sending of the very same signal is permitted. Any form of processing of the received signals is permitted. After processing, the entire aggregate of received signals should be decoded as one report.

To prevent the accumulation of an information leak, all requirements in paragraph 5 operate in this case in precisely the same manner from the moment of the casting of the lots (it is accomplished once for the entire set of signals) to the moment of final decoding.

7. When calculating the frequency of successful transmissions, all reports without exception should be considered. Abandonment of the test (fatigue or a different reason) may be accomplished only prior to the casting of lots.

8. In order to prove the existence of telepathic communication, a high frequency of agreements of results of decoding with the results of the lots is necessary. With an increase in the

number of signals in the report (in accordance with paragraph 6) this frequency should strive toward one.

If it is discovered that with an increase in the number of signals in the report the frequency of agreements strives asymptotically not toward one but toward a lesser value, this should be interpreted as a result of a terminal leak of information for each report or the existence of a regularity in the sequence of signals being transmitted. Here, it should be considered that no telepathy was discovered in the test data.

The reader is correct in proposing: "From the many thousands of tests on telepathy which have already been done by various people, let us select those which satisfy all the requirements of this article's authors. The results of these selected tests will also tell us whether or not there is telepathy."

The majority of the tests which are known to the article's authors immediately err in several points. For example, in the tests on the "Transmission of thought" of Moscow - Novosibirsk and Moscow - Leningrad which was recently reported in "Komsomol'skaya Pravda," "Moskovskaya Pravda," and by television paragraph 1 (the selection of a report from a certain set) was violated as were paragraph 2 (selection with the use of lots), paragraph 4 (success - this is the complete agreement of the transmitted and received), paragraph 7 (the requirement to consider all tests), and paragraph 8 (frequency of successful reports close to unity). The authors of the article are familiar with only some of the works on telepathy but among the hundreds of studies known to them there is not one which would satisfy immediately all the listed requirements. This is why the authors of the article do not know whether or not telepathy exists...

Thus, the one who wants to discover telepathy should set up some new tests. As always, prior to the start of new work it makes

sense to think whether it is worthwhile undertaking this work. Here, two groups of circumstances are usually taken into consideration: does the work promise interesting results in case of success and what is the probability that success will be achieved? An estimate of the prospects for the work in regard to these parameters, of course, is subjective. In particular, the authors of the article agree with each other in everything which was stated earlier but hold to different points of view on this question. One of us believes that science should not overlook such a phenomenon as telepathy if it exists. Therefore, tests in telepathy are needed. If they prove to be unsuccessful, then science loses little: the expenditures on these tests will comprise a small fraction of the expenditures for unsuccessful tests in other fields. Success, however, will entail important shifts in physiology, psychology, physics, and even, perhaps in our impression of what this causality is.

And now, several words about why the discovery of telepathy may lead to a change in our opinions in the field of physics.

For a minute, let us forget about all the errors in the tests on the transmission of a thought over a distance. We will take the word of the advocators of telepathy in everything. What picture do we form as a result of the summation of their statements? It turns out that no distances (within the limits of Earth, of course) are an obstacle for telepathic communication. (The transmission of a thought from Moscow to Novosibirsk, across the Atlantic Ocean, and so forth has been recorded.) Furthermore, a transmission over great distances proceeds just as successfully as over short distances. Apparently, a telepathic signal does not scatter at all. No obstacle to it has been found - neither thick walls nor metal barrels are able to weaken this signal to any noticeable extent.

It is not by chance that from time to time the most fantastic hypotheses are published concerning the physical nature of a signal with such unusual properties. For example, one can encounter the statement that telepathy uses gravitational waves. Or that it is accomplished using a neutrino flux. There is no need to be a physics specialist to understand the groundlessness of such hypotheses. Changes in the gravitational field may be caused only by the displacements of some masses. Obviously, displacements in the head of the sender located in Moscow will cause much smaller disturbances of the gravitational field in the area of the receiver's head, for example in Novosibirsk, than the work of numerous motors or simply the running of children about a kindergarten in Novosibirsk itself. By the way, the gravitational field attenuates with distance.

The neutrino theory of telepathy appeared to explain the fact that there are no screens for telepathy. For you see, a neutrino flux possesses namely the property where even in a screen with the thickness of the Earth only an infinitesimally small portion of the flux is absorbed. But, you see, an even more infinitesimal portion is absorbed in the receiver's head! If we make the most optimistic assumptions on the quantity of neutrinos which are radiated by the sender's brain, it turns out that during the time of all the experiments which have been conducted until today it is most probable that not one neutrino has been absorbed in the heads of all the receivers.

And what about the electromagnetic theory of telepathy?

Alternating currents flow in the human brain which, in principle, may cause the radiation of electromagnetic waves. However, the nerve fibers in which these currents arise are constructed in the manner of a coaxial cable. The very same coaxial cable which is used in technology when it is necessary that there be no radiation of radio waves. Of course, a nerve fiber is not an ideal cable and some radiation is possible nevertheless. The total

current able to cause the radiation of radio waves can be estimated by the direct measurement of the difference in potentials which arises between the various parts of the head. It turns out to be 10^{-12}-10^{-11} amperes. But, you see, in Novosibirsk itself there are sources of currents (of the same frequencies so that it is impossible to "tune them out") of dozens of amperes! In addition, it can be added to this that biocurrents have a comparatively low frequency: 10-1000 Herz. The length of radio waves even at a frequency of 1000 Herz is 300 kilometers. It is known that for the successful operation of an antenna the transmitter should be comparable for dimensions with the wavelength in the medium to which the wave is radiated. Obviously, in the case where the antenna is the sender's head, this condition is far from satisfied. Therefore, those currents which circulate in the head are used for radiation only to an infintitesimal degree. Power is clearly insufficient.

Thus, it should be realized conclusively that contemporary physics cannot explain telepathy. The difficulties are aggravated by one more circumstance. Parapsychology (as the science which is interested in telepathy is usually called) is concerned not only with the transmission of thought. It also studies the guessing of the contents of a sealed envelope and the guessing of the results of lots which have not yet been cast (clairvoyance). And, if we can believe the parapsychologists (and, you see, we decided to gain access to them for a while with complete confidence), the possibility for clairvoyance has been proven just as well experimentally as the existence of telepathy. Therefore, a physicist who believes parapsychologists should be ready to explain not only telepathy but also clairvoyance and telekinesis.

So these are the grounds which force the other author of this article to consider it extremely improbable that pure experiments will confirm the existence of telepathy (just as clairvoyance and telekinesis). It should be remembered that up to now, outside the field of parapsychology not one case has been discovered where the

laws of physics which have been found in a study of inorganic nature would prove to be inoperative for living nature. If people thought in ancient times that an animal can shift his center of gravity due to internal forces or today some people assume that the second law of thermodynamics is violated in the living then, you see, this is only a naive lack of understanding of mechanics or thermodynamics. From the viewpoint of physics, the living is not remarkable in any way (amazing properties begin at the level of biochemistry and in the field of information relationships). Therefore, there are no grounds to expect the discovery of new physical laws in the study of living systems.

As you see, the authors evaluate the expediency of searches for telepathic phenomena differently. However, they again believe absolutely unanimously that if searches are undertaken, they should be organized competently and with consideration of those special features of the subject which may lead to errors. Unfortunately, with a superficial familiarity the impression arises among many that there is no need to know anything or to be able to do anything for pursuits in telepathy. They sat down with a friend in adjacent rooms, one thought of something, the other guessed what had been thought - and there you have it, a great discovery. Only by such an attitude is it possible to explain the large number of poorly organized tests. Actually, this field requires experimental art in the highest meaning of these words. An understanding of what conclusions can be drawn and what cannot be drawn from various tests is required. The ability for the simultaneous consideration of many circumstances which at first glance are absolutely unimportant is required. And when an incomprehensible result is obtained, the ability to so modify the tests as to separate the essential circumstances from secondary circumstances is required.

It should be noted that even very high qualifications in some scientific field (zoology, medicine, radio engineering, etc.) frequently does not protect a person from elementary errors when he is setting up or checking tests on telepathy. Reports have

appeared in the press where professor-so-and-so or doctor of sciences so-and-so witnessed the telepathic (clairvoyancy) abilities of so-and-so. On checking, it repeatedly turned out that these people, worthy specialists in their field, were misled due to poor familiarity with the specific nature of parapsychology. We can recall that an entire group of scientists who considered themselves specialists in parapsychology investigated the unusual abilities of a certain N. K. for a long time and only slowly did they come to understand that all this is talented mystification.

If scientists often make mistakes, neither are journalists protected against errors. Therefore, one should have a very cautious attitude toward earth-shaking reports about telepathy and clairvoyance (they often are diffidently called "Biocommunication," "Biotelecommunication," "Animal radio communication," etc.).

And the final question: why has the interest of many people in telepathy increased recently? Here, we can state several assumtions. It is simplest to assume that now many facts about telepathy have now been accumulated - this is what one of us thinks. But other assumptions may also be put forth.

Is not the enthusiasm for telepathy a mass reaction to the contridiction between the dream of an important discovery and the difficulties which must be overcome before hope appears for such a discovery in any field except telepathy? For, with a superficial approach to the task the impression is created that telepathy contains the hope to turn science over, placing tests on the level of school laboratory work. And one of the goals which the authors of the article set for themselves was to show the groundlessness of such hopes.

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