DISCUSSION

THE EXPERIMENTAL ESTABLISHMENT OF TELEPATHIC PRECOGNITION

DURING the last four years two papers have been published in the *Proceedings of the Society for Psychical Research* by Dr. S. G. Soal which demand the most careful attention of psychologists and philosophers. These papers record the methods and results of two admirably planned and executed series of experiments on card-guessing, and they provide evidence which is statistically overwhelming for the occurrence, not only of *telepathy*, but of *precognition*. There was already a considerable mass of quite good experimental evidence for telepathy, e.g. in the work of Dr. Rhine and his colleagues at Duke University, but Dr. Soal's results are outstanding in at least the following three respects. (1) The precautions taken to prevent deliberate fraud or the unwitting conveyance of information by normal means are described in great detail, and seem to be absolutely water-tight. (2) The results are susceptible of a perfectly simple and straightforward statistical treatment, and the odds against chance-coincidence have steadily grown during the experiments until they are now astronomical. (3) The conditions have been varied, and, probably for the first time in the history of the subject, correlations have been found between variations in certain of the conditions and variations in the phenomena under investigation.

The two papers are entitled *Fresh Light on Card Guessing* and *Experiments in Precognitive Telepathy*. The former is published in Vol. XLVI, Part 162. of the *Proceedings* of the S.P.R. and the latter in Vol. XLVII, Part 167. I shall describe them in turn, but I shall devote more attention to the second than to the first.

FIRST SERIES OF EXPERIMENTS. (1) *General Account.* The history of this first series has a certain dramatic interest. By November 1939 Dr. Soal had been working for five years, had tested 160 persons in card-guessing, and had accumulated 128,350 guesses. To all appearance the results were not significantly different from those which would have arisen if all the guesses had been quite literally shots in the dark and no paranormal cognition had been in operation. But another member of the S.P.R., Mr. Whately Carington, had been experimenting in Cambridge by exposing drawings night after night in a locked room and getting people to sit down each night in their own rooms and draw what came into their heads when they tried to guess what picture had been exposed on that night. He had found that what was drawn on the *n*-th night in any one such series did *not* show a significant amount of agreement with the picture exposed *on that night*. But he found that, when he conducted several such series, each separated from the others by a considerable interval, the drawings made in any one such series *taken as a whole* resembled the originals exposed in that series *taken as a whole* to a significantly greater extent than they resembled the originals exposed in other series. (These important experiments are described in Vol. XLVI, Part 162, of the S.P.R. *Proceedings* under the title *Experiments on the Paranormal Cognition of Drawings*.) On being told of this by Mr. Whately Carington, Dr. Soal re-examined his results in order to see whether the guesses made

by his subjects coincided to a significant extent, *not* with the card at which the guess was aimed, but with its *immediate predecessor* or its *immediate successor*. In the case of two and only two of his subjects he found that this happened to an extent which seems completely to rule out chance-coincidence.

(2) *Experimental Details.* (i) *The Cards and their Randomization.* Dr. Soal used the special cards called "Zener Cards" which were first used by Dr. Rhine in his experiments at Duke University. Each Zener card has on it one or other of five simple figures, viz., a cross, a circle, a star, a rectangle, and a pair of wavy lines like the Zodiacal symbol for the sign Aquarius.

Dr. Soal had his packs of Zener cards made for him by a firm of playing card manufacturers. Many experiments on ostensibly paranormal cognition are vitiated by grave doubts whether the backs of the cards do not provide slight sensory clues to the guessers. Even with a pack of cards made by a professional there may be small specks or other oddities on the backs of certain cards. Suppose that the same pack is used again and again with the same guesser, and suppose that he is allowed to see the back of a card before he guesses it and the front of it after it has been turned up to verify or refute his guess. Then he may come to associate minute peculiarities of the back with the figure on the front, and thus by quite normal means score successes which are significantly above chance expectation. This source of error was completely ruled out in Dr. Soal's experiments by the following two precautions. (*a*) The guesser was never allowed to see the back of any card that he was guessing. In every case it was either covered by a rectangle of white cardboard, or completely hidden by a screen, or sealed in an opaque envelope. (*b*) The same pack was never used twice on the same day with the same guesser.

Instead of trusting to shuffling in order to secure a random sequence of cards in the packs which he was using, Dr. Soal deliberately randomized them in the following way. He had in all 1,200 cards, viz., 240 of each of the five kinds. With each figure he associated a number, e.g., 1 with cross, 2 with circle, and so on up to 5 with wave. He then wrote down, from a table of seven-figure logarithms, the last digit of the logarithms of a series of five-figure numbers at intervals of 100, e.g., the logarithms of 10,078, 10,178, 10,278, and so on. If the digit happened to be one of the integers from 1 to 5 inclusive, the corresponding card-symbol was entered beside it in the list. If the digit happened to be 0 or one of the digits above 5, it was rejected. The 1,200 cards were then arranged in order in the sequence of the symbols taken from the list so constructed. Dr. Soal then took the first 1,000 cards of this sequence and divided them into 40 packs consisting of the first 25, the second 25, and so on. (Of course each such pack would *not* contain exactly five of each kind of card, and the whole 40 packs would not necessarily contain between them exactly 200 cards of each kind.) Each pack was then put into an envelope, and the envelopes were numbered 1 to 40. In the experiments a different pack was used on each successive occasion until the whole 40 had been used.

After this the 40 envelopes were shuffled so that they came in a different order, and the experiments were continued with the packs in the order in which they now stood. At this stage the pack in each envelope was taken out and shuffled, out of sight of the guesser, before being used.

So far the packs had remained in their original envelopes, though the order of the envelopes had been altered by shuffling and the pack in each envelope had been shuffled. But at the beginning of each week a further precaution was taken in order to prevent any association arising in the mind of a guesser between a particular envelope and a particular pack. The packs were at this

stage taken out of their envelopes, the empty envelopes were shuffled, and the packs were put back into different envelopes. Lastly, a completely fresh random distribution of 1,000 cards was made on the average after each 4,000 guesses.

(ii) *Presentation, Guessing, and Recording.* The experiments fell into two main divisions. (*a*) Those in which no one had any normal knowledge of the nature of the card at which the guess was aimed until some time after the guess had been made and recorded. In such experiments, if there was paranormal cognition of the card at which the guess was aimed, it must have consisted either of pure clairvoyance or of precognition, viz., fore-knowledge by the guesser of what would be seen by himself or by the experimenter when the card should afterwards be turned up to test the correctness of the guess. What is ruled out here is *simultaneous* telepathy. We can therefore describe these experiments for short as N.S-T. experiments. (*b*) Those in which one at least of the persons taking part in the experiments was aware of the nature of the card aimed at before and during the making of the guess. Any paranormal cognition of the card aimed at in such experiments might consist either of clairvoyant perception of the card, or of simultaneous telepathic knowledge of what was already present in the experimenter's mind. Such experiments are described as "undifferentiated" and may be called U.D. experiments for short.

In the N.S-T. experiments three different methods were adopted. As no significant results were got in these experiments, either on the card aimed at or on its immediate predecessor or successor, I shall not describe these methods in detail. What is worth mentioning about them is this. In the first method the guesses were checked against the actual cards after every *fifth* guess in *presence* of the guesser; in the other two they were checked after every *twenty-fifth* guess in *absence* of the guesser. Now suppose that significant results had been got, and that they had not been due to clairvoyant perception by the guesser of the card aimed at. Then the precognition must have extended to quite an appreciable distance in the future; for the actual cards were not seen by anyone until after the fifth guess in the first method and after the twenty-fifth guess in the other two. In the first method, if precognition were operating, it might be either non-telepathic or telepathic. For the guesser might be foreseeing his own future knowledge of the actual cards or the experimenter's future knowledge of them. In the other two methods, if precognition were operating, it would have to be telepathic. For only the experimenter, and not the guesser, will see the cards after they shall have been turned up.

I pass now to the arrangements for the U.D. experiments. In them it is of course even more important than in the N.S-T. experiments to guard against the possibility of normal clues being given to the guesser. In the N.S-T.'s no one is in a position to give a clue voluntarily or involuntarily to the guesser; for no one knows the value of the card at which the guess is being aimed until after that guess has been made and recorded. But it is an essential point of the U.D. experiments that someone shall know the value of the card at which the guess is being aimed before and during the period when the guess is being made, for we are trying to find out whether the guesser can telepathically cognize this knowledge.

I will premise by saying that in U.D. experiments the person who has normal knowledge of the objects to be guessed is called the "Agent," because, if simultaneous telepathy takes place, the information which the guesser (who is now called the "Percipient") acquires telepathically must have emanated from him.

The guesser and the agent sit at opposite ends of a table 5 feet long, and they are separated by a lateral screen which crosses the table in the middle and rests upon it. This screen is 2 feet 6 inches high. There is also a lateral screen beneath the table, which makes it impossible for the guesser to see or to touch the feet or legs of the agent and thus prevents clues being conveyed in accordance with a code by slight movements of the agent's feet. The experimenter, who was generally Dr. Soal himself, sits at the side of the table on the side of the screen away from the guesser and near to the agent. The guesser is provided with a scoring-sheet, and records his guesses on it as he makes them. The experimenter has a similar scoring-sheet, and is also provided with an ink-pad and five rubber-stamps each of which has one of the five card-symbols on it. The scoring-sheets are divided vertically into two halves headed (*a*) and (*b*). Each half is divided into two columns, of which the one on the left is headed G (i.e. column for recording *guesses*) and the one on the right is headed A (i.e., column for recording the *actual* card at which the guess was being aimed). Each column is divided into 25 rows, numbered 1 to 25.

The procedure is as follows. The pack, consisting of 25 cards randomized in the way described above, lies face downwards in the middle of the table on the agent's side of the screen. The experimenter shuts his eyes, lifts off the top card, holds it up (concealed by the screen from the guesser) with its face to the agent, who concentrates his attention upon it. Still keeping his eyes shut, so that no one but the agent has normal knowledge of the card, the experimenter calls out "First!" or "Next," as the case may be. Thereupon the guesser makes his guess and records it in the G column of his sheet. Meanwhile, the experimenter opens his eyes and notes the nature of the card exposed and then records it with the appropriate rubber stamp in the A column of *his* sheet. Neither the agent nor the guesser is allowed to speak during the experiment. When the guesser has recorded his guess he taps twice on the table with his pencil to tell the experimenter that he is ready for the next card to be exposed. Each card, after it has been exposed, is placed face downwards on the table in the order in which it has been drawn from the pack. When twenty-five guesses have been completed the guesser hands his sheet to the experimenter, who copies the entries in the G column of it on to the corresponding lines in the G column of his own sheet. This copying is checked by the agent, who now acts as a witness. The reason for the experimenter using the rubber stamps to record the actual cards exposed is that, if he were to draw the symbol with his pencil, the sound made might give away to the guesser that it was a circle or an oblong or some other symbol.

I think it is certain that Dr. Soal eliminated by these devices all possibility of the guesser receiving information by any known normal means about the nature of the card at which he was aiming his guess.

(3) *Statistical Treatment.*—The simplest way of considering the statistics of the experiments is the following. Let the probability that a cross will be guessed on the r-th occasion be p_1; let the probability that a circle will be guessed be p_2; and so on for the other three symbols. Then, since one or other of these five alternatives must be guessed, we have $p_1 + p_2 + \ldots . p_5 = 1$. Since the cards have been randomized, the chance of the actual card being of any of the five kinds is the same, viz., 1/5. If nothing but chance is operating, the probability of the compound event of guessing a cross and of the card actually being a cross is $p_1 \times 1/5$. Similarly, the probability of guessing a circle and of the actual card being a circle is $p_2 \times 1/5$, if the two events are independent of each other. And so on for the three remaining

alternatives. Now to guess rightly on the r-th occasion is either to guess a cross and for a cross to be the actual card, or to guess a circle and for a circle to be the actual card, or so on for the three remaining alternatives. Therefore, if agreement between guesses and cards aimed at is purely a matter of chance, the probability of guessing rightly on the r-th occasion is the probability of the disjunctive event composed of these five alternatives. Its value is 1/5, since $p_1 + p_2 + \ldots . p_5 = 1$. It is plain then that, if nothing but chance is operating, the most probable number of correct guesses in a set of n shots is $n/5$. The question therefore is whether the actual number of correct guesses differs from the number which would be most likely on the hypothesis of chance coincidence by so much as to render that hypothesis incredible

The test for this is to calculate the *standard deviation*; to find the ratio of the actual deviation to this; and then to find out from tables of the Error Function what is the probability that so great a multiple of the standard deviation would occur by chance. In our experiments the standard deviation, calculated from the usual formula, is 2/5 of the square-root of n. If the actual deviation exceeds $2\frac{1}{2}$ times the standard deviation, the hypothesis of chance coincidence begins to be highly improbable. Suppose that the actual deviation were found to be as much as 4 times the standard deviation. It would be found from the tables that, on the average, only one in ten thousand series of n trials would have so high a deviation as this if only chance were operating.

There is a somewhat more delicate method of calculating the expected frequency and the standard deviation, which has been worked out by the statistician Mr. W. L. Stevens. This makes use of the actual frequencies with which each kind of card is guessed and with which each kind of card actually occurs. Dr. Soal in fact made use of this, but he shows that the numerical results differ very little from those given by the cruder and simpler method described above.

(4) *Results.*—We will now consider the results of the 128,350 guesses made by Dr. Soal's 160 guessers. In order to do this I shall begin by distinguishing what I will call "direct" and "deflected" hits. If the r-th guess in a series coincides with the actual value of the r-th card in that series, i.e., with the one at which it was aimed, it will be called a "direct hit." If it coincides with one that was exposed earlier or later in the series, it will be called a "deflected hit." A deflected hit may be deflected either forwards or backwards, i.e., on to a card which had not yet been exposed when the guess was made or on to one that had already been exposed and aimed at by an earlier guess. So a deflected hit is either a "fore-hit" or a "back-hit." Suppose that the $(r - p)$-th guess in a series agrees with the r-th actual card in that series. Then I shall call it a "minus-p fore-hit." Suppose that the $(r + p)$-th guess in a series coincides with the r-th actual card in that series. Then I shall call it a "plus-p back-hit."[1]

(i) *Direct Hits.*—When Dr. Soal did these experiments he naturally thought at first only of direct hits, and when he first worked out the results he considered only such hits. The results were quite consistent with the hypothesis that nothing but chance was operating. This is so whether they are taken all together, or whether the N.S-T. results and the U.D. results are taken separately, or whether the scores made by individual guessers are taken

[1] The reader should note that Dr. Soal has altered his signs between his first and his second paper. He now gives + signs to *fore*-hits and − signs to *back*-hits. I have kept to the convention of the first paper throughout.

separately. There is nothing to suggest that paranormal cognition is taking place. I will give the relevant figures.

(*a*) *N.S-T. Results.*—70,900 guesses were made by 108 guessers. The number of direct hits was 201 *less* than the most probable number on the hypothesis of chance. The standard deviation is 89·51. So the actual deviation is 2·24 times this. This is below the level of significance. It might be expected to happen in about 2·4 % of a very large number of random series each of 70,900 guesses.

(*b*) *U.D. Results.*—57,450 guesses were made by 84 guessers. The number of direct hits was 51 *more* than the most probable number on the hypothesis of chance. The standard deviation is 96. So the ratio of the actual to the standard deviation is 0·531. This is quite insignificant. It might be expected to happen in about 60 % of a very large number of random series each of 57,450 guesses.

(*c*) *An Individual Result.*—I shall give one of the few impressive individual results, both because it is interesting in itself and because it led to startling conclusions when it was later investigated for deflected hits.

A lady called Mrs. S. did two sets of 1,000 guesses in the U.D. experiments. In her first 1,000 she scored 238 direct hits. This is a positive deviation of about 3 times the standard deviation, which, taken in isolation, is fairly impressive. It might be expected to happen in no more than 0·27 % of a very great number of random series each of 1,000 guesses. But it would be quite misleading to take it in isolation. At the time when Mrs. S. scored this result 43,000 other guesses had already been made. So her 1,000 guesses must in fairness be regarded as simply an outstanding set in 44 sets of 1,000. Since 0·27 % of these might be expected, on the hypothesis of chance, to give at least as good results as hers, the probability of getting at least one such set out of 44 is $1 - (1 - 0{\cdot}0027)^{44}$, which is approximately 44 times 0·0027, i.e., about 0·118. So that her score, when taken against the background of the rest of the experiment, is not surprising enough to cast doubt on the hypothesis of chance. It should be added that Mrs. S. scored only 209 direct hits in her second series of 1,000 guesses. This deviation of only 9 is quite insignificant. It was only when Dr. Soal was stimulated by Mr. Whately Carington's work to re-examine the results for deflected hits that he discovered what a remarkable performance Mrs. S. had accomplished.

(ii) *Deflected Hits.*—I will first state the statistical theory, and then give the results.

In a run of 25 guesses and 25 actual cards let us denote the r-th actual card by A_r and the $(r - p)$-th guess by G_{r-p}. Then for forecasts at a distance p cards ahead we have pairs of the form $G_{r-p}A_r$. The number of such pairs is found by letting r range from $p + 1$ to 25. It is therefore $25-p$. The probability of any such pair being a hit is 1/5 on the hypothesis of chance coincidence. In N sets of 25 there are $N(25-p)$ such pairs. Therefore, on the hypothesis of chance, the most probable number of minus-p fore-hits is $N(25-p)/5$. The standard deviation is 2/5 times the square-root of $N(25-p)$. The expressions will be exactly similar for plus-p back-hits.

Now suppose that we take together direct guesses, minus-1 forecasts, and plus-1 backcasts. We get the three types of pair G_rA_r, $G_{r-1}A_r$, and $G_{r+}A_r$. A set of 25 guesses will give rise to 25 pairs of the first kind, 24 of the second, and 24 of the third, i.e., to 73 in all. The probability of any of these being a hit is the same, viz., 1/5. In N sets of 25 there will be $73N$ such pairs. Therefore the most probable number of hits of these three kinds in N sets of 25 guesses is $73N/5$, and the standard deviation is 2/5 of the square-root of $73N$.

DISCUSSION

When these considerations are applied to Mrs. S.'s results the following conclusions emerge:—

HITS IN FIRST 1,000 *GUESSES*

	Back-Hits + 1	*Direct*	*Fore-Hits* − 1	*All three*
Actual number . .	221	238	225	684
Most probable number	192	200	192	584
Actual deviation . .	+ 29	+ 38	+ 33	+ 100
Standard deviation .	12·4	12·66	12·4	21·6
Ratio Actual: Standard	+ 2·34	+ 3·02	+ 2·66	+ 4·62
Probability of so great a deviation on the hypothesis of chance	0·019	0·003	0·008	$< 10^{-5}$

HITS IN SECOND 1,000 *GUESSES*

Actual number . .	221	209	232	662
Most probable number	192	200	192	584
Actual deviation . .	+ 29	+ 9	+ 40	+ 78
Standard deviation .	12·4	12·66	12·4	21·6
Ratio	+ 2·34	+ 0·711	+ 3·22	+ 3·6
Probability . . .	0·019	0·478	0·0013	0·00032

HITS IN THE WHOLE 2,000 *GUESSES*

Actual number . .	442	447	457	1,346
Most probable number	384	400	384	1,168
Actual deviation . .	+ 58	+ 47	+ 73	+ 178
Standard deviation .	17·6	17·9	17·6	30.6
Ratio	+ 3·3	+ 2·63	+ 4·15	+ 5·82
Probability . . .	0·00097	0·0086	0·000035	10^{-6}

In order to avoid overestimating the significance of these results we must take this set of 2,000 guesses against the background of the whole number of 128,350 guesses which were made in this series of experiments. This can be regarded as consisting of 64 sets of 2,000 guesses. We must then ask ourselves the following question. On the hypothesis that nothing but chance coincidence is operating what is the probability that in at least one of these 64 sets the deviations would be at least as great as they were in this set of Mrs. S.'s? The answer is found by multiplying each of the probabilities in the last line of the third table by 64. The results are 0·062, 0·550, 0·0022, and 0·000064. There is therefore no good reason to think that Mrs. S.'s direct hits were due to anything but chance coincidence. But there is some reason for thinking that her back-hits on the card which immediately preceded that at which she was aiming were *not* wholly due to chance coincidence. And there is overwhelming evidence against the hypothesis of chance coincidence in the case of her fore-hits on the card which immediately followed that at which she was aiming. Finally, if we take together the cluster of three cards which consists of that at which she was aiming and its immediate predecessor and successor, the odds against her hits on these being due to chance coincidence are of astronomical dimensions.

On going over the results of the other guessers who had taken part in the U.D. experiments Dr. Soal found one and only one of them who had scored significantly in deflected hits. This was a Mr. B. S. He had done 800 U.D.

guesses. His score of direct hits was quite insignificant. In this he differed from Mrs. S., in her first 1,000 guesses, but resembled her in her second 1,000. But he resembled her in scoring significant positive deviations in his + 1 back-hits and his − 1 fore-hits. The results may be summarized as follows:

HITS IN 800 GUESSES

	Back-Hits + 1	*Direct*	*Fore-Hits* − 1	*All three*
Ratio Actual: Standard	+ 3·74	+ 0·44	+ 3·65	+ 4·49
Probability . . .	0·0003	0·66	0·0005	10^{-5}

Now the whole 128,350 guesses can be divided into 160 sets of 800 and Mr. B. S.'s 800 can be regarded as one of these. Accordingly we must multiply the probabilities by 160 in order to find the probability that at least one set of 800 guesses will have at least as great a divergence from the expected number of successes as Mr. B. S.'s 800 had. The resulting probabilities are 0·048 for + 1 back-hits, 0·08 for − 1 fore-hits, and 0.0016 for the three central places taken together. It seems plain, then, that the hypothesis of random coincidence must be rejected here also for both + 1 back-hits and − 1 fore-hits.

(5) *Summary of Results of the First Series of Experiments.*—The following conclusions, negative and positive, emerge from the first series of experiments. (i) Two and only two of the 160 persons tested showed signs of possessing powers of paranormal cognition. (ii) Even in these two cases these powers were not displayed so long as attention was confined to *direct* hits. (iii) It was only in those experiments in which the possibility of simultaneous telepathy is *not* excluded that any sign of paranormal cognition, whether direct or deflected, was shown. (iv) In the two cases of Mrs. S. and Mr. B. S., there is very strong evidence for paranormal cognition in the + 1 back-hits and the − 1 fore-hits.

SECOND SERIES OF EXPERIMENTS. (1) *General Account.*—These experiments were conducted in 1941 and 1942 with Mr. B. S. as guesser. Altogether 13 different agents were tried, but successful results were got only with three of them, viz., two women R. E. and G. A. and one man J. Al. The results with J. Al. were in some ways unlike those with the two women agents. The experimenters in this series were Dr. Soal and another member of the S.P.R., Mrs. Goldney.

Beside the primary question whether B. S. would continue to score significantly in his + 1 back-hits and his − 1 fore-hits, there were two important questions of detail which the experiments of the first series had left open. (i) Were the fore-hits really instances of *precognition*? They need not have been. For the cards which would be turned up later in the series were already on the table in the pack in the order in which they would be turned up. Therefore a − 1 fore-hit might arise through the guesser clairvoyantly perceiving the figure on the card which is lying face-downwards on the top of the pack at the time when he is aiming his guess at its immediate predecessor. (ii) In general, is it necessary for the agent to know what was on the cards at which the guesses were being aimed? Would it be enough if the agent merely lifted the cards successively but did not look at the face of them?

(2) *Experimental Details.* (i) *The Cards.*—In these experiments there are five cards each of which has depicted on it in appropriate colours one of the following five animals, viz., Lion (L), Elephant (E), Zebra (Z), Giraffe (G), and Pelican (P). There is also a set of five white cards, each bearing one of the numbers from 1 to 5.

(ii) *General Arrangements.*—Two persons beside the Agent (A) and the Percipient (P), i.e., Mr. B. S., take part in each experiment. These are the Experimenter controlling the Agent (EA) and the Experimenter controlling the Percipient (EP). EA and A are together in one room, and EP and P are together in an adjoining room. The only communication between the two rooms is a door, which is kept slightly ajar in order that the "calls" made by one party may be audible to the other. The room in which A and EA sit will be called RA, that in which P and EP sit will be called RP.

In RA there is a table, 24 in. square and 25 in. high, situated at about 9 feet from the wall which divides RA from RP. This table is divided across the middle by a screen 31 in. wide and 25 in. high, which stands upon it. At the middle of the upper part of this screen is a little window 3 in. square. A sits on the side of the screen furthest from the door into RP and facing towards RP; EA sits on the opposite side of the screen and faces in the opposite direction.

On the table in front of A is a box closed on all sides except that which faces A. On the floor of this box are placed the five animal cards face-downwards in random order from left to right. The object of the box is to ensure that no confederate who might be concealed in the room above RA and provided with a hole in the ceiling could see the cards as they are turned up and signal their nature to P in RP.

On the table in front of EA are the five white number-cards arranged face upwards in order 1 to 5 from left to right.

P and EP sit on opposite sides of a small table in RP. The position of this is such that P could not see either EA or the screen even if the door into RA were wide open. *A fortiori* he cannot see A or the box in which A's animal cards are laid out, since they are on the far side of the screen.

(It should be mentioned that Mr. B. S. is a professional photographer, and that the experiments were performed at his place of business. RA was his Studio, and RP was the Ante-Room to it. Further experiments performed with him at the rooms of the S.P.R. met with the same measure of success as those which are now being described.)

(iii) *Randomization.*—The five animal cards are shuffled before each set of 50 guesses to be recorded on a single scoring-sheet. This shuffling is done either by the Agent or by some independent person, never by or in sight of either EA or EP. The cards are then laid down in the resulting order face-downwards from left to right on the floor of the box.

The other part of the randomization was effected in two alternative ways, viz., either (*a*) by means of prepared random numbers (PRN), or (*b*) by drawing counters.

(*a*) ***PRN Method.***—Dr. Soal prepared a random sequence of the first five integers as in the first series of experiments. On the evening before a day on which an experiment was to be done he entered these numbers in their random order into the successive rows of the two A-columns of as many scoring-sheets as would be used next day. These prepared sheets remained in his control until the experiment was about to begin, when he would hand them to EA.

As an experiment goes on EA lifts up his five number-cards one by one in the random order in which the five numbers occur in the successive rows of the A-columns in his scoring sheet. As he lifts each number-card he shows it for a moment through the window in the screen to A and then replaces it. A thereupon lifts the animal-card which comes at that number of places in the row from the left in the box in front of him, looks at it, and then replaces it face downwards as before. This method ensures that A looks at the animal-

cards throughout the experiments in a random order. EA does not know at the time which animal-card corresponds to which number, so there can be no complication due to his acting as a supplementary agent.

(*b*) *Counter Method.*—Here EA had a bag containing equal numbers of counters of five different colours well mixed up. A different number, from 1 to 5 was associated with each different colour, and a row of five number-cards with a counter of the associated colour laid on each of them was laid on the top of the box in sight of A. EA would draw a counter from the bag at random and show it to A at the window in the screen. A would thereupon note the number that had been associated with the colour, and would then lift and look at the animal-card which lay at that number of places from the left of the row of such cards on the floor of the box.

(iv) *Presentation, Guessing, and Recording.*—The experiments fell into two classes, viz., (*a*) those in which A saw the picture on the front of each card at which P was aiming his guess, and (*b*) those in which he did not know what picture was on that card. These may be called *Telepathic* and *Non-Telepathic* respectively. In the former the picture was presented to A's attention in the way just described. In the latter the difference was that A merely touched the back of the card corresponding to the number or counter shown to him in the window by EA.

The guessing was in all cases conducted as follows. P is provided with some empty scoring-sheets. When EA holds up the number or counter, which is his signal to A, he pauses for about a second and then calls out ONE if it is the first guess of a series, TWO if it is the second, and so on up to TWENTY-FIVE. On hearing EA call this serial number P writes down in the corresponding line of the G-column of his scoring sheet the initial letter (L, E, Z, G, or P) of the animal which he guesses to have been on the card presented to A. There is a pause of a few seconds between the completion of the first set of 25 guesses and the second set on the same sheet. EA then calls NEXT COLUMN, and the procedure just described is repeated.

When P has completed a sheet it will contain 50 entries of permutations of the letters L, E, Z, G, and P in the two G-columns and nothing in the A-columns. The corresponding sheet used by EA will contain 50 entries of permutations of the numbers 1, 2, 3, 4, and 5 in the two A-columns and nothing in the G-columns. EA now goes round to A's side of the screen and turns up the five animal-cards in the box, keeping them in the order in which they were lying. He thus finds the correlation between the ordinal number of a card from the left of the row and the picture on that card. He records this on his sheet in the form of a code; thus, e.g., it might be

1	2	3	4	5
E	L	G	P	Z

In the meanwhile P and EP remain at their table in RP.

The numbers corresponding to the letters in P's G-column are now entered in the corresponding lines of the G-column of EA's score-sheet opposite to the numbers which are already in the A-column. This is done by EA and EP with a witness and with A looking on.

The direct hits, the + 1 back-hits, and the − 1 fore-hits are now counted and entered on the sheet. Each completed sheet was duplicated in ink and signed by both EA and EP. The duplicates were then put in an envelope in presence of all, stamped and addressed to the present writer at Trinity College, Cambridge, and posted in presence of not less than three persons. Dr. Soal took the originals home with him and re-checked all the counts. He also counted the + 2 back-hits and the − 2 fore-hits.

(3) *Results.*—I will begin by remarking that Mr. B. S. finds it most comfortable to work with an interval of between 2 and 3 seconds between successive guesses. This may be called the *Normal Rate of Scoring*. We will take first experiments done at this rate, and will consider later those in which the rate fell outside these limits.

(i) *Telepathic Experiments.* (*a*) *With R. E. as Agent and the PRN method.*—The total number of guesses was 3,946. The actual number of hits did not differ significantly from the number to be expected on the hypothesis of chance coincidence except in the case of -1 *fore-hits*. But here the deviation is staggering. The ratio of the actual to the standard deviation is $+13{\cdot}2$, and the probability of getting so great a deviation as this on the hypothesis of chance coincidence is 10^{-35}. Since this is one of 5 alternatives, viz., direct hits, $+1$ and $+2$ back-hits, and -1 and -2 fore-hits, we must multiply it by 5 to get the probability that at least one of these categories would deviate by as much as the -1 fore-hits did. But this makes no appreciable difference to the colossal odds against chance coincidence.

(*b*) *R. E. as Agent and the Counter Method.*—Here 1,578 trials were made. As before, only the -1 fore-hits are significantly above chance expectation. The ratio of the actual to the standard deviation for them is $7{\cdot}45$. The corresponding probability is $2{\cdot}56 \times 10^{-12}$. As before, this should be multiplied by 5, but this still leaves the probability of getting such results by chance coincidence at the ridiculously low figure of $1{\cdot}28 \times 10^{-11}$.

(*c*) *With G. A. alone as Agent and the PRN Method.*—288 trials were made. These was significant scoring only for -1 fore-hits. The ratio of the actual to the standard deviation for these was $3{\cdot}56$. The corresponding probability is $0{\cdot}004$. Multiplied by 5 this gives $0{\cdot}002$.

(*d*) *Aggregate Telepathic Results for all experiments in which R. E. or G. A. took part by either Method.*—6,290 trials. No significant results except for -1 fore-hits. The actual number of such hits was 1,755 out of a possible number of 6,039. The most probable number on the hypothesis of chance coincidence is 1,234. The actual deviation is therefore $+521$. The standard deviation is 31. So the ratio of the actual to the standard deviation is $+16{\cdot}8$. The probability of getting at least as great a deviation on the hypothesis of chance coincidence is considerably smaller than 10^{-35}. (The tables do not cater for such fantastically great deviations. Those at the end of Yule and Kendall's *Theory of Statistics*, e.g., do not go beyond deviations of $4{\cdot}5$ times the standard, in which case the probability is $0{\cdot}00001$.)

(*e*) *With J. Al. as Agent and the PRN Method.*—720 trials were made. There were significant scores *both* on -1 fore-hits and on $+1$ back-hits, but not on any of the other three alternatives under consideration. In the case of the -1 fore-hits the ratio of the actual to the standard deviation was $+5{\cdot}42$; in that of the $+1$ back-hits it was $+5{\cdot}84$. The probability of getting such a result by chance coincidence is in either case about 6×10^{-7}. But we have to notice that here *two* deviations of this order are got in the five alternative positions which are being considered. The probability of this happening by chance is approximately 10 times the square of the individual probability, i.e., 10 times 36 times 10^{-14}, i.e., $3{\cdot}6 \times 10^{-12}$.

Before going further I want to provide the reader with a concrete picture of the degree of improbability of scoring so many successes on the hypothesis of chance coincidence. Let the reader imagine himself to be tossing a fair coin, and let him ask himself this question: "How long a run of nothing but heads would be as improbable as it would be to score so many successes as are scored in one of these experiments on the hypothesis that nothing but chance is operating?" The answer is easy. If the probability corresponding

to the ratio of the actual to the standard deviation in an experiment is 10^{-n}, then the length of an equally improbable run of heads in tossing a fair coin is the nearest integer to the quotient of n by the common logarithm of 2, i.e., by 0·3010. Let us apply this rule, e.g., to the Percipient's scores with J. Al. as Agent. To be on the safe side we will take the probability corresponding to the ratio to be 10^{-11} instead of the actual lower figure of $3{\cdot}6 \times 10^{-12}$. Now 11 divided by 0·3010 is approximately 36. So the improbability of such high scores as the Percipient made with J. Al. as Agent is about the same as the improbability of a run of 36 heads in tossing a fair coin. The same method can, of course, be applied to all the other probabilities mentioned above.

(ii) *Non-telepathic Experiments.*—Still confining ourselves to experiments in which the Normal Rate of Scoring was used, we will now consider those in which the Agent merely touched the back of the card at which the Percipient was aiming his guess and so was unaware of the picture on the front of it.

Two series of such experiments were done. In the first series two sets of 50 guesses made under Non-telepathic conditions were interspersed at each sitting, more or less at random and unknown to the Percipient, among sets of guesses made under Telepathic conditions. In the second series sets of 50 guesses done under Non-telepathic and Telepathic conditions were alternated regularly with each other, and the Percipient was told which was which.

The results are of extreme interest. In each series the guesses done under *Non-telepathic* conditions gave *no* significant results, whilst those done under *Telepathic* conditions gave the usual highly significant excess of — 1 fore-hits. The figures are summarized in the following table, for the two series taken together. The Agent was R. E. and the PRN method of randomization was used.

— 1 *Fore-Hits*	*Non-telepathic*	*Telepathic*
Maximum possible number . . .	768	864
Actual number	160	243
Most probable number on chance .	157	174
Deviation	+ 3	+ 69

For the Non-telepathic experiments the actual deviation is considerably less than the standard deviation, and there is not the slightest reason to think that anything but chance coincidence is involved. For the Telepathic experiments which alternated with the Non-telepathic, as described above, the ratio of actual to standard deviation is 5·84. The probability of getting so large a deviation by chance coincidence is less than 10^{-8}.

This alternation of insignificant and highly significant scores within the same series of experiments, when no other condition is varied except that the former are got under Non-telepathic and the latter under Telepathic conditions, is plainly of the utmost importance. It strongly reinforces the conclusion that the high scoring in — 1 fore-hits under Telepathic conditions is a genuine effect of non-random causes.

(iii) *Effect of varying the Rate of Scoring.* (*a*) *Quickening.*—Here we have two sets of experiments. The first was done with R. E. as Agent using the Counter Method of randomization; the second with J. Al. as Agent using the PRN Method. The main effect was a most interesting one, viz., that with both Agents the success in — 1 *fore-hits vanished* and was replaced by a significantly high score in — 2 *fore-hits.* With J. Al. there were certain additional peculiarities. In each case the guessing was done at about twice the normal rate, i.e., the average interval was between 1 and 1·5 seconds. The results are as follows.

(α) *R. E. as Agent.*

	— *Fore-Hits*	— 2 *Fore-Hits*
Maximum possible number	831	794
Actual number	154	236
Most probable number on chance . .	167	159
Deviation	— 13	+ 76

The ratio of the actual to the standard deviation for the — 1 fore-hits is — 1·11, that for the — 2 fore-hits is 6·77. The former is quite insignificant, the latter enormously significant.

(β) *J. Al. as Agent.*—As I mentioned above, there is a peculiarity about the Percipient's scoring with J. Al. as Agent when the experiments are done at the *Normal Rate*. With J. Al., and with him only, there is a significant number of + 1 *back-hits* in addition to a significant number of — 1 fore-hits. (It is of interest to note that J. Al. acted as Agent for Mr. B. S. in the First Series of Experiments, and that there too there was significant scoring on + 1 back-hits.)

These peculiarities were reflected in a modified form when the experiments were conducted at the Rapid Rate. Three experiments were tried. In *none* of them was there any significant success in either + 1 back-hits or — 1 fore-hits. But there were significantly large numbers of + 2 back-hits in the first and in the third experiment, and significantly large numbers of — 2 fore-hits in the first and in the second experiment. Taking the three experiments together the results are as follows.

	Back-Hits		*Fore-Hits*	
	+ 2	+ 1	— 1	— 2
Maximum possible number . .	529	552	552	529
Actual number	151	112	126	149
Most probable number on chance	103	110	111	106
Actual deviation	+ 48	+ 2	+ 15	+ 43
Standard deviation . . .	9·2	9·4	9·4	9·2
Ratio Actual: Standard . .	+ 5·2	+ 0·21	+ 1·6	+ 4·7

It will be obvious to inspection that the success of both the + 2 back-hits and the — 2 fore-hits is enormously greater than can be reasonably ascribed to chance, whilst there is no reason to postulate anything but chance-coincidence in the other two positions.

(*b*) *Retarding.*—When the rate of guessing is reduced so that the interval between each guess becomes 5 seconds instead of the normal interval of 2 to 3 seconds Mr. B. S. shows signs of great discomfort and no significant numbers of successes are scored on any of the five alternative positions which come under consideration. In one series the Slow Rate and the Normal Rate were alternated; 384 trials at the slow rate gave a positive deviation of only + 1·5 from the number of — 1 fore-hits which might be expected on the hypothesis of chance coincidence. But the same number of trials at the normal rate gave a deviation of + 34·71, i.e., 4·4 times the standard deviation, which makes the hypothesis of chance coincidence quite incredible.

It is worth while to remark again that such systematic variations in the number of hits achieved when one condition is altered and all others remain unchanged is not only of intrinsic interest, but also reinforces the conclusion that the high scoring under Telepathic Conditions at the Normal Rate with — 1 fore-hits is a genuine effect of non-random causes.

(iv) *Psychological Conditions.*—The following observations on the relevance or irrelevance of certain psychological conditions in the percipient are worth recording.

(*a*) There was no significant correlation, positive or negative, between the Percipient's impressions that he had been successful or unsuccessful and the actual success or ill-success of his guesses.

(*b*) It is natural and convenient to ascribe the Percipient's overwhelming degree of success in guessing the nature of the card which the Agent has not yet looked at but will look at in a few seconds' time to "precognition" or "foreknowledge" on his part of what will be in the Agent's mind a trifle later. It is therefore natural and convenient to describe the result of the experiments by saying that they establish the occurrence of *Precognitive Telepathy*. We must note, however, that strictly speaking what has been established is "foreknowledge" or "precognition" only in the purely *behaviouristic* sense of "knowledge" or "cognition." What the Percipient does is to *write down the initial letter of the name of one of five pictures* on each occasion. What happens enormously more often than can be accounted for by the hypothesis of chance coincidence is that the letter which he writes down is in fact the initial letter of the name of the animal depicted on the card which the Agent will turn up next.

The Percipient says that he seldom gets a mental image of the animal, but writes down the initial letter of the name almost automatically. It should also be remarked in this connexion that experiments were done in which the Agent was provided with cards which had only the initial letters and not the pictures on them; and that others were done in which the cards had on them, instead of pictures, associated words, e.g., "Stripes" instead of a picture of a Zebra. In each case the results achieved by the Percipient were about as good as those which he got when the Agent used cards with pictures on them.

(v) "*Multiple Determination.*"—In Mrs. S.'s and Mr. B. S.'s results in the First Series of Experiments Dr. Soal discovered a certain interesting fact, which may throw some light on the causation of the phenomena. The same fact emerged from Mr. B. S.'s results in the Second Series. This fact is called "Multiple Determination," and it may be described as follows.

Consider G_r, the r-th. guess in any series of 25, and A_{r-1} and A_{r+1}, the cards which the Agent actually turned up immediatly before and immediately after the Percipient had aimed his guess G_r at the card A_r. It may happen either that A_{r-1} and A_{r+1} are the same, e.g., both lions, or that they are different, e.g., that one is a lion and the other a zebra. If they are the same, we say that the guess G is "multiply determined." It is plain that the question of multiple or non-multiple determination cannot arise for either the first or the last of a series of guesses. Therefore only the intermediate 23 out of each 25 guesses can be either multiply or non-multiply determined. Each of these guesses might be either a $+ 1$ back-hit or a $- 1$ fore-hit. Some might be both, and indeed any of them that was multiply determined would have to be both if it was either. So in each set of 25 guesses the maximum number of $+ 1$ or $- 1$ hits that *could* be scored by guesses which *could* be multiply determined is 2×23, i.e., 46. Now we can cross-divide these 46 possibilities into (*a*) those in which the guess was in fact either a $+ 1$ or a $- 1$ hit, and those in which it was neither; and (*b*) those in which the guess was in fact multiply determined, and those in which it was non-multiply determined. The degree of association between being a $+ 1$ or a $- 1$ hit and being multiply determined can then be calculated and we can use the ordinary χ^2 method to test whether it is significantly greater than might be expected on the hypothesis of chance.

Dr. Soal found that there is a significantly high positive association between a guess being multiply determined and its scoring either a $+ 1$ or a $- 1$ hit.

This was so with both Mrs. S. and Mr. B. S. in the first Series and with Mr. B. S. again in the second Series.

Summary of Results.—The main results of the two Series may be summarized as follows. (1) Out of 160 persons whom Dr. Soal tested as Percipients 2 and only 2 scored a significantly greater number of successes than might have been expected on the hypothesis of random coincidence. (2) He continued his researches on one of these Percipients and continued to get successes fantastically beyond chance expectation. (3) The successful Percipients were so only with certain Agents. (4) With one Agent B. S.'s successful guesses took the form of both + 1 back-hits and − 1 fore-hits; with the other two they took the form only of − 1 fore-hits. With none of the Agents did he score significant successes on the card at which the Agent was looking when he was making a guess. (5) There was no evidence that the Percipient had any power of clairvoyantly perceiving what was on the face of a card lying face downwards which the Agent would merely touch on the back in the course of the experiment. (6) If the interval between successive guesses is increased to as much as 5 seconds no significant successes are obtained. If it is diminished to between 1 and 1·5 seconds, the success in scoring − 1 fore-hits is replaced by success in scoring − 2 fore-hits with all three Agents. With J. Al. as Agent the success in scoring + 1 back-hits is also replaced by success in scoring + 2 back hits. (7) The "precognition" which the Percipient shows of what *will* very soon be perceived by the agent, and the "retrocognition" which he shows of what *has* very lately been perceived by the Agent, are (so far as these experiments tell us) purely behaviouristic. If consciousness, in the ordinary sense of the word, is involved, it takes place at some level of the Percipient's mind which is not open to his introspection. (8) The Percipient's impressions of success or failure are no safe guide to the actual success or failure of his guessing. (9) The proportion of "multiply determined" guesses which are either + 1 or − 1 hits is significantly greater than the proportion of non-multiply determined guesses which have that property.

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