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EXTRASENSORY PERCEPTION: EFFECT OF TIME

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Abstract:

A major reason for the controversial scientific status of so-called extrasensory perception (ESP) has been the lack of any relationship between ESP performance and physical variables, such as would allow assimilation into current scientific theories. A new analysis of successful ESP experiments done over a 43-year period shows a very strong effect of time: present-time ESP studies can show information transfer rates ten times as high as precognitive ESP studies, where the target is generated after the response.

Data on so-called extrasensory perception (ESP) have been difficult to integrate with the knowledge base of the physical sciences. While numerous studies have shown correlations between psychological factors and the level of ESP functioning[1], no strong or consistent relationships have been found with physical variables. This paper describes such a newly discovered relationship.

Basic ESP studies are carried out by sensorily shielding a percipient from target material and then comparing the number of hits in the percipient's calls of the target material with theoretical chance expectation for hits and/or empirical controls. Basic probability theory is used to evaluate the outcome, usually by the standard convention that if the number of hits exceeds that expected by chance at $P < .05$, ESP is hypothesized to explain the results. Targets have been randomized arrangments of fixed targets (as in guessing at card order), a multiple-choice type test, or randomly selected scenes for which a qualitative description is required, but we shall restrict our attention to the multiple-choice test procedure because of ease of quantification.

Information transfer rate

Given that the null hypothesis of chance results is rejected in a given ESP experiment, a more interesting question than is usually asked in the parapsychological literature is how much information was obtained by the percipients? If we model the information transfer process by a binary code, as in conventional information theoretic approaches, we know that it requires one bit per trial to make a hit in a binary calling task, 2.32 bits per trial (on the average) in a five-choice task, 3.32 bits per trial in a ten-choice task, etc. A mean bit rate per trial cannot be obtained simply by multiplying the bits required per trial by the percentage of hits in a multiple-choice guessing task, however, because p percent of the hits (where p is the chance probability of success on a single trial) are, on the average, due to chance. Timm[2] proposed the psi coefficient, Ψ_+, to represent the proportion of successes after the chance baseline of hits has been factored out: $\Psi_+ = (H - N_p)/N_q$, where H is the number of hits, N is the number of trials, p is the chance probability of successful calling on a single trial, and $q = 1 - p$. For successful use of ESP on every trial, $\Psi_+ = 1.00$, while for no use of ESP, $\Psi_+ = 0$. The psi coefficient does not take the difficulty of the multiple-choice task into account, however.

If we let R_t represent the mean number of bits required for success on a single trial, we can now characterize the observed mean bit rate per trial of any experiment, $\overline{R}_\Psi$, as $\overline{R}_\Psi = R_t \Psi_+$.

In 1980 I became interested in the question of what the maximum possible information transmission rate could be in multiple-choice type ESP experiments. As a first approach, I modeled the ESP process itself as having some maximum capacity, but assumed that this capacity is usually accessed at less than its maximum due to non-optimal psychological factors. To estimate the inherent capacity of the ESP process per se, then, the most successful performances by percipients, where psychological factors were presumably favorable, were the most relevant data. In checking a small sample of very successful experiments, I noticed that they were all real-time ESP studies, i.e., the targets existed contemporaneously with the percipient's calling activity. Precognition studies, in which the ESP targets were not generated by a random process until some time _after_ the percipients had recorded their calls, were absent from my sample. Wondering whether this was an artifact of small sample size, I systematically surveyed the bulk of the published scientific ESP literature in accordance with the following criteria.

Criteria for data gathering

Simply carrying out an ESP experiment is no guarantee that it will be successful. Its elicitation seems to depend on currently unknown psychological factors. A survey of reputable parapsychologists showed that only about one in three studies are successful[3]. Thus the first selection criterion was to survey only studies where there was above chance hitting at the .05 level of significance or better. A large number of studies which were significant only by correlations or group differences were thus excluded.

Second, I assumed that sound methodology for ESP studies had been worked out through extensive professional exchanges following the widespread scientific debate evoked by the studies of J. B. Rhine and his colleagues in the 1930's. Sound methodology includes such basic factors as (a) adequate exclusion of conceivable sensory modalities that might function as information carriers by physical shielding; (b) blindness as to target identity by experimental personnel in sensory contact with percipients; (c) adequate randomization of target orders (thorough shuffling of cards in earlier studies, electronic random number generators in more modern studies); (d) data recording techniques excluding the possibility of systematic errors; and (e) statistical analysis by generally accepted procedures[4]. To operationalize this, I reviewed only articles published in the refereed parapsychological journals after 1936 as a basic quality control criterion. This included the _Journal of Parapsychology_ from 1937 through 1980, the Journal of the _American Society for Psychical Research_ from 1941 (earliest issue available to me) through 1980, the _Journal of the Society for Psychical Research_ (London) from 1937 through 1980, and the _European Journal of Parapsychology_ from its earliest publication date (1975) through 1980. In rare cases I included sound studies that I knew of that were published only in book form but not in these journals. A few articles reported several discrete experiments, so the number of references cited is not equal to the number of experiments.

Third, I continued to look at best performance, so if a study had _a priori_ divisions by conditions, percipients, or the like, I used the best performance conditions to calculate $\bar{R}_{\psi}$. Fourth, I did not use data from studies where the integrity of the experimenters had subsequently been seriously questioned. These criteria led to a sample of 53 successful real-time ESP studies and 32 successful precognitive studies[5-65]. Intervals to target generation in the precognitive studies ranged from as short as .2 second in electronic machine studies to as much as one year in one precognitive card-guessing study.

Since there is a general bias in scientific journals to publish only positive results, could the procedure used here of only reviewing statistically significant studies artifactually produce a case for ESP performance? This can be examined by the statistical argument that if a certain effect does not exist except as an artifact of such publication procedures, then for every case published which is significant at the .05 level there should be about 19 insignificant, unpublished studies; for every published case significant at the .01 level there should be about 99 unpublished, insignificant studies, etc. I combined the levels of significance of the 53 real-time ESP studies by Mosteller & Bushs' method[66]. The probability of the combined results being due to chance is $P \ll 10^{-20}$. A similar result was obtained with the 32 precognitive studies. Since it is unlikely that more than 10^{20} insignificant ESP studies have been carried out, this sort of sampling bias problem is ruled out in the present study.

There is considerable procedural variation in the conduct of the 85 studies surveyed, other than the selection requirements listed above, so any effect of time on ESP would have to be quite robust and general to be detected.

<u>Bit rate and time</u>

Figure 1 presents the results of this comparison of mean bit rates in ESP performance versus temporal interval to target generation. Logarithmic scales are used because of the wide range of the data. As can be seen, real-time studies, while overlapping precognitive studies in their lower performance range, can show an order of magnitude better mean performance. Precognition studies show a maximum $\bar{R}_{\psi}$ of .66 bits per trial, but most (73%) do not exceed .20 bits per trial. Real-time ESP studies show bit rates as high as 5.7 bits per trial. Because of the lack of normality of the distributions, they were compared with a Mann-Whitney U-test[67]: the null hypothesis that the distributions are the same was rejected with $P < 5 \times 10^{-4}$, two-tailed.

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Insert Figure 1 about here

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The difference does not seem to be one of regularly decreasing bit rates with temporal distance to the target generation, but of real-time versus any future generation per se. The linear correlation of bit rates and temporal distance, including real-time data, is only r = .05, nor does the correlation rise appreciably if we consider only precognitive data. Note, however, that my selection criteria gave only 32 data points, unevenly distributed over a year of time to target generation in precognitive studies, so the question of whether temporal distance per se affects precognitive ESP performance may not be settled.

Possible mechanisms

This difference between real-time ESP and precognitive ESP is quite strong. The total lack of high mean bit rates in precognitive studies is striking. Three tentative hypotheses may guide further investigation. First, perhaps the idea of precognition is so incredible to members of Western culture that the expectation of failure or great difficulty adversely affects percipients' performance for psychological reasons. While this may be true to some extent, we would expect a few percipients of the many who have been tested in precognition studies to have been free of this bias, yet there are no outstanding precognitive performances. Second, precognitive ESP and real-time ESP, whatever their nature, may be different mechanisms, with the precognitive mode being inherently less effective at information gathering. Third, the performance differential as soon as one goes from the existing present into even a close future may represent a basic physical constraint, and so have important implications for understanding the physical nature of time.

This finding of a relationship between ESP performance and a basic physical variable is encouraging and will hopefully lead toward an integration of parapsychological data with physical knowledge. More systematic comparisons of real-time and precognitive ESP are needed.

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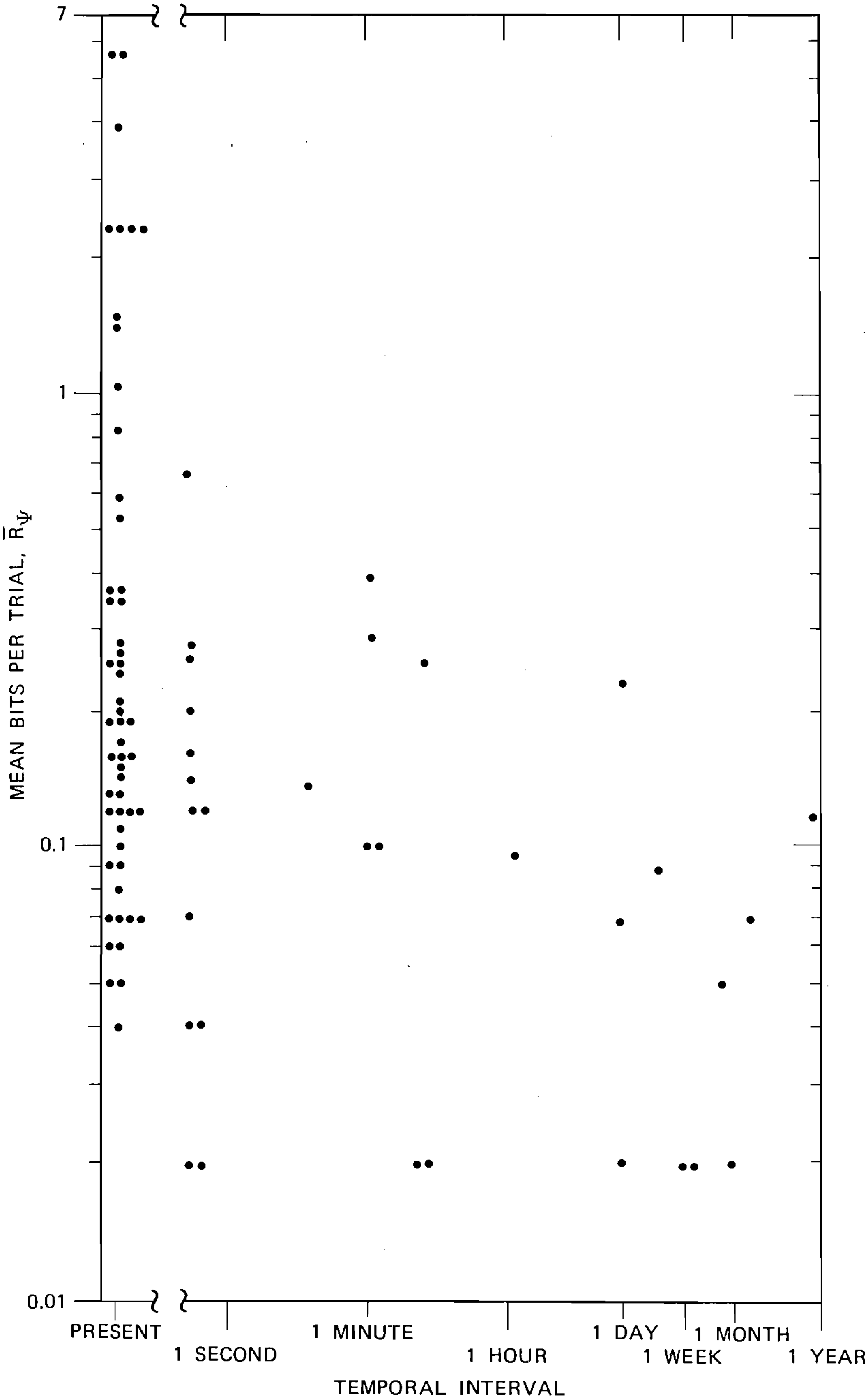

7
1
0.1
0.01
MEAN BITS PER TRIAL, $\bar{R}_\Psi$
PRESENT
1 SECOND
1 MINUTE
1 HOUR
1 DAY
1 WEEK
1 MONTH
1 YEAR
TEMPORAL INTERVAL

Figure Legend

Fig. 1 Mean bit rate per trial ($\bar{R}_{\psi}$) in ESP experiments versus temporal interval to target generation, plotted for 53 successful real-time and 32 successful precognitive experiments. Note that while there is considerable overlap in less successful outcomes, 73% of the precognitive outcomes do not exceed a maximum of .2 bits per trial, while real-time outcomes go as high as 5.7 bits per trial.