A Methodological Refinement in the Study of "ESP," and Negative Findings

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A recent improvement in the study of extrasensory perception ("ESP") has been the use of tables of random numbers in the shuffling of target-items (*1–3*; cf. *4*). Despite this increased rigor, however, there continue to be reported small, but statistically significant, deviations from "chance expectancy."

These findings raise the suspicion that tables of random numbers may not be entirely random; that such tables may, in some small degree, actually embody conventional preferred sequences of digits. There is some ground for such a suspicion in the mode of construction of the most widely used of these tables (*5*), which was carefully checked and adjusted to insure "randomness." Furthermore, there is available Brown's (*6*) recent observation that

> . . . statistically significant results similar to those of psychical research are obtainable simply by making selections in published tables of random numbers as if the tables were themselves the data of a psychical research experiment. This procedure . . . produced . . . results which differed from the mean expectation by more than three standard deviations.

It should be of interest to determine whether or not "ESP" manifests itself in the face of an experimental methodology that avoids the pitfalls of "randomness." The investigation reported here attempted such a determination.

Two targets were prepared. Each target consisted of a sheet of 8.5 × 11-in. paper bearing 25 items in five rows of five items each. Each item consisted of a pair of ¼-in. squares, of which either the right-hand square or the left-hand square was blacked in. In point of fact, one target was constructed by filling in the left-hand square in *every* item, and the other target by filling in the right-hand square in *every* item. The targets were sealed in identical opaque envelopes, independently shuffled, and given arbitrary designations. They were not unsealed and identified until after all experimental responses had been tabulated.

Mimeographed response-sheets were also prepared. Each sheet bore a pattern of items exactly like that of the target-sheets, except that, of course, none of the squares was blacked in. Instructions at the head of each response-sheet directed the subject to work in privacy and in an atmosphere of relaxation, and to fill in the items as he thought they were filled in on the target to be assigned to him. The instructions also cautioned the subject not to be surprised by the manifestation of an unusual target-pattern.

Finally, a brief mimeographed questionnaire was devised. By advance decision, only one of its questions was considered material ("Do you think that extrasensory perception ever actually occurs?"); the remaining, related, questions were intended to serve as buffers.

The subjects were 540 students of both sexes distributed among 14 classes in introductory psychology. Each class was addressed by the same experimenter at the beginning of a class-hour. Briefly and sympathetically, he outlined the history of "ESP." The questionnaires were then distributed, filled out by the students, and re-collected by the experimenter.

The experimenter now left the class and proceeded to sort the returned questionnaires to identify subjects who were believers and subjects who were nonbelievers in "ESP." Names of believers and names of nonbelievers were alphabetized separately; then, for each subject whose name appeared in an odd-numbered position on either list, a response-sheet assigning "the target in Old Main Building" was prepared; for each of the remaining subjects, a response-sheet assigning "the target in the Library" was prepared. The experimenter now returned to the class, distributed the response-sheets, explained exactly where the targets were located, and requested that the completed response-sheets be returned at the next class meeting. Individual scores were promised (and subsequently furnished), and class interest was high.

Table 1. Mean number of leftward choices in each experimental subgroup and associated statistics.

	Target assigned		Difference-statistics	
	Rightward	Leftward		
Believers	N = 186 M = 13.06 SD = 2.34	N = 186 M = 13.22 SD = 1.81	D = +.16 (P = .46)	D = +.54 (P = .34)
Nonbelievers	N = 44 M = 12.95 SD = 2.95	N = 44 M = 12.57 SD = 1.76	D = −.38 (P = .47)	
All subjects	N = 230 M = 13.04 SD = 2.46	N = 230 M = 13.10 SD = 1.82	D = +.06 (P = .76)	

All P-values arise from two-tailed tests of the null-hypothesis. Other symbols have their conventional meanings (N, number of cases; M, mean; SD, standard deviation; and D, difference).

The targets were rotated between the locations, and subjects were eliminated from consideration by means of a table of random numbers (considered adequate for this purpose), in such a fashion that finally: (i) in each class, equal numbers of believers had responded to each target, and equal numbers of nonbelievers had also; and (ii) over-all, equal numbers of believers had responded to each target in each position, and equal numbers of nonbelievers had also. There now remained 372 believers and 88 nonbelievers, a total of 460 subjects.

Each subject's response-sheet was scored for *the number of items in which the left-hand square was blacked in.* If "ESP" exists in the general population, as has been recently alleged (*1–3*), one would expect distinctly more leftward choices in response to the leftward target, distinctly fewer in response to the rightward target, and thus a distinct and significant difference between the mean scores for groups responding to the two targets.

The mean number of leftward choices among all 460 subjects was 13.07, a figure very significantly different from the "chance" expectancy of 12.50 ($P < .0_51$). The mean number of leftward choices in each of the subgroups is indicated in Table 1, and it will be seen that the means of the subgroups closely approximated the over-all mean. Neither among believers, nor among nonbelievers, nor among all subjects taken together was the mean number of leftward choices significantly related to the nature of the target assigned. It is true that the differences found among believers and nonbelievers, respectively, although insignificant, were in the opposite directions sometimes hypothesized (*2, 3*; cf. *1*); however, a test of the difference between these differences showed it also to be statistically unreliable (final column, Table 1).

Under the conditions of this investigation (which summated the responses of a large number of subjects to balanced, systematically nonrandom targets), there arose no evidence whatsoever that "ESP" does in fact exist. Discovered incidentally was a general preference for left-hand choices, a preference that might have been misleading in the context of another experimental design.

References

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Communications

Etymology of Autoradiography

Scientific techniques are often named carelessly by experimenters more interested in precision of results than in precision of communication. Once started, etymological errors are easily perpetuated. Such is the situation for the technique of locating and measuring radioactivity by placing a radiation source in contact with or in proximity to a photographic emulsion, followed by exposure and development of the emulsion. Many names have been applied since Becquerel first used the technique in 1896. Among them are *autoradiography* (*1, 2*), *radio-autography* (*3*), *curiegraphy* (*4, 5*), *radiumgraphy* (*4*), *and photography by local application* (*5*). Terms for the results of the techniques have been *autoradiograph* (*2, 6*), *radioautograph, autophotograph* (*7*) *autoradiogram* (*1*), *radium gram* (*2*), *radiograph* (*2, 6*), *organoradiumgraph* (*5*), *curiegraph* (*5*), *cliché radiographique* (*2*), *microradioautogram* (*8*), *autograph* (*9*), *radiograph* (*10*), *historadiograph* (*11*), *radiogram* (*2*), and *histoautoradiograph* (*6*). One author (*2, 6*) used five terms in a single paper to indicate this technique. It is perhaps time to eliminate this confusion.

Since these words are, for the most part, derived from the Greek, it is preferable to be consistent within the system of word-building from that source. Although the ancient Greeks would probably not have used any of these terms, since they seldom employed more than two stems, three-stem words are correct and have their value in modern English. Multiple-stem words enable classification of ideas. For example, *prorubricyte, rubricyte,* and *metarubricyte* (*12*) classify red blood cells according to their age.

Similarly, in the class of radiographic techniques, we already have *gamma radiography* and *x-radiography. Autoradiography* then is a third member of the class—the descriptive prefix, *auto-* (self), being added in the same sequence to give autoradiography.

Another argument for autoradiography is that *auto-* acts in Greek as a prefix and is therefore very seldom found in the middle of a word. This logic eliminates the term *radioautography* unless one wishes to think of the technique as belonging in the class with autography. However, it does not seem logical to place the technique in the same category with the writing of one's signature. Another argument against radioautography is that four vowels—*i, o, a, u*—occur together. This should be avoided because of possible phonetic difficulties. *Curiegraphy,* named after Madame Curie, is not sufficiently descriptive and its use had but limited vogue. It is of historical interest only.