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The Application of Learning Theory to ESP Performance

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Biographical Note

CHARLES T. TART is currently Professor of Psychology at the University of California, Davis. He received his doctoral degree from the University of North Carolina in 1963, after previous study of electrical engineering and psychology. He taught at Stanford University and the University of Virginia School of Medicine before accepting his current position.

Professor Tart has conducted research in sleep, dreaming, hypnosis, psychedelic drugs, and parapsychology, with his research activities currently being focused in the areas of altered states of consciousness and transpersonal psychology, a concern with the unrealized potentialities of man.

Professor Tart's scientific publications include several books, Altered States of Consciousness (*Wiley, 1969*), On Being Stoned: A Psychological Study of Marijuana Intoxication (*Science & Behavior Books, 1971*), Transpersonal Psychologies (*Harper & Row, 1975*), States of Consciousness (*Dutton, 1975*), Studies of Psi (*Dutton, in press*)*, as well as more than one hundred scientific articles and papers.*

INTRODUCTION

One of parapsychology's greatest problems, pointed out by critics and defenders alike, is the lack of a repeatable experiment. This is not quite true: we have *statistical* repeatability. For example, roughly one out of every three experiments conducted by members of the Parapsychological Association obtained significant evidence for ESP (Tart, 1973a), and certain effects, such as the sheep-goat effect or decline effects, have been obtained in many experiments. Yet we cannot say with any certainty that if you carry out such and such a procedure, you will almost certainly obtain significant amounts of ESP.

Critics have cited this lack of a repeatable experiment as arguing against the existence of psi phenomena, a fallacious argument that will not concern us here. More important, the ack of a reliable way of getting psi performance is a serious drawback to understanding ESP. Most experimentation in science consists of starting with a poorly understood but occurring phenomenon and then varying the conditions it occurs under in order to understand its nature. This leads to better formulations (theories) of phenomena, more sophisticated experimental work, etc. This is scientific progress. But if you can't be sure of getting any ESP, or if it occurs only sporadically, your ability to study it by varying conditions is greatly weakened, and progress is slow and erratic, with much waste of effort.

An analogy I have often used in speaking about this problem is that parapsychology today is where the science of electricity was for most of mankind's history. You had two electrical phenomena, lightning and weak static effects. Lightning flashes were spectacular and had great effects: unfortunately any particular lightning flash occurred unpredictably and was over in an instant, making study difficult. You also had the fact that a piece of amber, rubbed with fur, would sometimes pick up a feather. It was a very weak and erratic force, it couldn't do much, and it often wouldn't manifest for non-apparent reasons (which, in retrospect, we can understand as things like relative humidity, etc.). We understood almost nothing about electricity with these two effects for most of our history.

Then the battery was invented. It couldn't compete with lightning for power and effect, but it was totally predictable and reliable, giving a steady strong flow of the phenomenon of electricity that amber and fur never gave. Now one could set up apparatus and invest energy in study and be amply repaid. Progress has been enormous.

In parapsychology we have our lightning: spontaneous phenomena, temperamental psychics, spectacular experiments that don't repeat. We have our amber: one out of three experiments showing statistically significant, but *practically negligible* ESP effects. We need our parapsychological battery.

Our great need is to learn how to train subjects so we can have a reliable flow of ESP. This is not for the purpose of convincing skeptics, for conviction is seldom a rational matter, but so that our studies of how psi manifests and what effects it will yield profitable returns, and enable us to understand it. The theory and studies reported in this paper are an attempt to develop the parapsychological battery.

The first chapter is my original attempt to apply learning theory to ESP performance, originally published in 1966. In the years since then, a number of studies have strongly supported the application, and these are reviewed in Chapter II. The third chapter presents a small-scale study of the application that highlights some of the complexities, such as psi-missing, that an expanded theory will have to deal with. The fourth chapter is the heart of this monograph, for in it I and Dana Redington describe a major study that demonstrates that the feedback called for in the learning theory application can largely eliminate the usual decline in ESP performance and produce learning in some subjects. Notes on the behavior and internal processes of the five best subjects of the most successful experimenter, Gaines Thomas, are presented in Chapter V. Implications are discussed in Chapter VI. The Ten-Choice Trainer used in the main study is described in Appendix 1 for the benefit of researchers who wish to build similar devices. As an illustration of more sophisticated electronics technology for such training instruments, Appendix 2 reprints a description of ESPATESTER, a device I developed simultaneously with the original application of learning theory to ESP to facilitate this sort of research.

Writing reports on parapsychological experiments has a special hazard, viz., so much detail is required that the reader may get bogged down in it and lose track of the main points. Unfortunately, this is necessary. For the serious reader who wants to check my interpretation of data, or consider his own alternative interpretations, precise detail is necessary. Too, many biased critics of parapsychological data invent all sorts of hypotheses to explain away results and tie these to any lack of information, so parapsychologists have developed a certain defensive level of precise detail to try to avoid giving false openings for criticism. The present monograph, covering the basic application of learning theory to ESP and reporting one pilot study and a three-phase major study is full of needed detail. While I have tried to keep the writing clear, the reader may get sidetracked on detail at times. The brief summary at the end (Chapter VII) can be consulted if you lose track of where we are going!

I am convinced that the application of learning theory, illustrated in this monograph, is a powerful tool for reliably producing and studying ESP. I hope that other workers will develop the theory and application even further than this initial attempt.

A preliminary version of these results was circulated to colleagues, and I would like to especially acknowledge comments by Charles Honorton, J. B. Rhine, Gertrude Schmeidler, and Helmut Schmidt that helped me improve this monograph.

Charles T. Tart

Davis, California
January, 1975

CONTENTS

I

CARD GUESSING TESTS: LEARNING PARADIGM OR EXTINCTION PARADIGM?*

In an excellent article, Rhea White (1964) has pointed out some striking differences between the conditions in modern card guessing tests of ESP and in older, but often more significant, experiments in which the subjects had time to use and analyze their internal imagery and other psychological processes. Her plea that we should evaluate and study the conditions of these older experiments in order to understand the means whereby ESP impressions can come into consciousness is one that should be heeded by all workers in this area.

White's article reflects a steadily growing disillusionment among workers in the field about the value of the standard card guessing tests** of ESP. This disillusionment is realistic in many ways, for we seem to have about exhausted this technique: despite many interesting and minor studies which remain to be done, one can be legitimately skeptical about the use of a technique where marginally significant results are the norm, where we are dealing with very weak manifestations of the underlying phenomena, and where the magnitude of this manifestation has not increased over decades of experimentation.

Important as the need for totally new approaches to studying ESP is, however, we should be doing *more* card tests at the same time because *the card guessing tests have, by and large, never been used in*

* Reprinted from the *Journal of the American Society for Psychical Research*, 1966, Vol. 60, pp. 46-55, by permission of the American Society for Psychical Research.

** The term "card guessing tests" is used broadly in this context to include all tests in which the subject chooses between several alternative responses on each trial.

a way which would bring out their possible potential. This paper will point out a basic flaw in our card guessing test procedures and discuss ways of rectifying it.

The assumption behind almost all ESP testing has been that we are trying to *detect* an extant capacity. It may be more profitable, however, to assume that whatever this capacity is, it is latent in the subject and he must *learn* to use this capacity within the context of the experimental situation. Let us now consider some basic facts about learning.

Learning refers to a hypothetical change within an organism (whether animal or human) which is reflected or manifested as a change (improvement) in performance during the course of practice at some task. Almost all learning takes place in situations where the correct response is rewarded on *each* trial and incorrect responses are not rewarded, or may even be punished. Thus, someone attempting to learn to play a scale on the piano is rewarded by a smile from his teacher (and, perhaps, the satisfaction of the harmony) if he runs through it correctly, but by disapproval (and disharmony) if he is incorrect. Reward can, especially with human subjects, also be conceived of as feedback of information on the correctness or incorrectness of performance, and insofar as the subject is motivated to perform correctly, knowledge that his response was correct is rewarding.

Two typical laboratory learning situations will illustrate some important facts about the learning process. As a case of animal learning, we have a pigeon inside a soundproof box. In one corner is a trough where pellets of food may appear as they are released by an automatic mechanism. As the pigeon is hungry, food is rewarding. On one wall of the box is a key that the pigeon may press with his beak, and over the key is a red light. We want the pigeon to press the key whenever the red light is on, but not when it is off, so a circuit is set up such that key presses while the light is on drop food pellets into the trough, while presses while the light is off have no effect.

When first put in the box, the pigeon will be agitated. After calming down, the pigeon will sooner or later press the key while the light is on, by "accident." He will be rewarded *immediately* by a food pellet. Over the course of a few hours, we will find that the pigeon pecks rapidly at the key whenever the light is on, and not when it is off. He has been rewarded for the correct response. Because his behavior is now correct, we infer that he has learned the proper response to the red light, viz., key pressing.

Take a human subject and have him extend his hand behind a curtain to hold a metal stylus. Put the tip of the stylus in a simple maze constructed so that whenever the stylus goes off the correct path of the maze it will sound an electric buzzer. Otherwise the subject has no way of knowing when he is on or off the correct pathway. Now instruct the subject to try to trace his way through the maze (which he cannot see) without going off the path. On his early trials he will make many deviations from the path, but whenever he hears the buzzer he will draw back the stylus from that direction. Eventually (assuming the maze is not too complex) he will be able to trace through the maze without any mistakes. The reward here is the lack of the buzzer sounding, for the buzzer is the feedback signal that he has made a mistake. Behaviorally we may analyze the responses of the human subject and the pigeon in the same way, viz., how many trials needed to reach a criterion of perfect performance. Introspectively, for the human subject, he might report that the task was difficult, that he had to coordinate his hand movements with some sort of image he was developing in his mind, and that while he might not be able to describe just what he did to get through the maze without activating the buzzer, he nevertheless learned to do it. This latter point is particularly important, for there are many things we learn to do in life which we cannot verbalize to others, or even adequately conceive of ourselves—try describing just how you ride a bicycle, for instance. The operation of ESP is probably no exception to this, i.e., it is possible for a person to use it without being able to understand or explain just how it operates.

Now a number of factors affect the course of learning over and above the simple presence or absence of reward or feedback, such as the subject's motivation to learn and his state of health. A very important factor is the time relationship between the subject's response and the reward or feedback. Almost all studies of learning show that learning is slower and less effective as the interval between response and reward increases. With lower organisms, particularly, a fairly lengthy interval between response and reward results in no learning at all, i.e., the organism never emits the correct response with greater than chance frequency. In general, intervals between response and reward or feedback are optimal if they are on the order of less than a second, and learning falls off rapidly in many instances if these intervals reach even a few seconds.

The opposite of learning is extinction, i.e., the correct response in a situation appearing less and less frequently, and finally failing to appear altogether. The typical laboratory procedure for producing extinction of a learned response is simply to stop rewarding each such response as it is emitted by the organism. Or one can give the reward, but give it in such a way that it is ineffective for the particular organism, e.g., by making the response-reward interval so long that the organism no longer "associates" the reward with the correct response.

In this light, let us examine the typical card guessing situation as used in almost all parapsychological experimentation. The subject comes in, with some motivation to do well on the test (whether "doing well" means scoring positively for sheep or negatively for goats). He is then required to give a large number of responses (guesses), usually twenty-five, and some of these responses are correct, some are incorrect. The correct responses may occur with greater than chance frequency; in fact, they frequently do on the initial run. *After* he has emitted a large number of responses, the experimenter usually tells him which were correct and which incorrect. *There has been no reward or feedback immediately after each response*. Indeed, the feedback coming after such a large number of trials is probably completely ineffective.* What little reward there is (feeling gratified at scoring above chance) tends to be associated with the entire run rather than with the individual responses. This paradigm, then, is basically an *extinction* paradigm, and is well suited to eliminate correct responses occurring with a greater than chance frequency.

Recall the learning situation with the pigeon, where a food pellet was produced *immediately* after each correct response. The same pigeon, superimposing the card guessing paradigm, would be put in the box and after it had emitted a large number of responses, correct and incorrect, the experimenter would give it a handful of

* We can ignore for the purposes of this discussion the use of intermittent reinforcement in psychology, for this is used only *after* some degree of learning has been brought about by constant reinforcement of correct responses.

food! No psychologist would expect the pigeon to learn the correct response; in fact, the key pecking response would remain at an extremely low frequency as this response would not become associated with the reward.

In the maze learning situation with the human, superimposing the card guessing paradigm, we would disconnect the buzzer, but tell the subject to trace the maze and not make any mistakes. After he had tried this a number of times we would inform him that he had made mistakes, and to try again! As before, no learning is likely to result.

Looking at the typical card guessing experiment introspectively, on each guessing trial the subject is responding to a host of internal cues, many of them probably not clearly represented in consciousness and many of them probably extremely transient. In going over his results with him at the end of twenty-five trials, we are asking him to do a rather heroic task, viz., to recall the particular set of amorphous feelings and sensations associated with each one of the twenty-five trials and to retrospectively associate these amorphous, transient feelings with this late knowledge of results. Moreover, as White (1964) has pointed out, the interval between trials has typically been much too short for the subject to attempt to clarify his internal feelings and perceptions in the first place.

Any psychologist, if asked to have *any* organism learn under conditions of massed, unrewarded trials, followed by occasional rewards which cannot be associated with particular responses by the organism, will throw up his hands in disgust and wonder where the idea for such a bizarre joke came from.

Not only does the typical card guessing paradigm fit this theoretical model of the extinction paradigm, but the empirical results bear it out. Almost all subjects, no matter how much above chance expectancy they are at first, eventually, with repeated testing, come down to chance expectancy (another of the factors which is leading to discouragement with card guessing tests). We have, unknowingly yet systematically, been extinguishing the operation of ESP in our subjects. Indeed, one might cite as an argument for the existence and lawfulness of ESP the fact that we are able to extinguish it by conventional procedures!

What can be done about it?

What is needed is an experimental procedure in which (a) the subject's guesses have virtually immediate consequences, i.e., knowledge of results and/or reward and/or punishment on every trial; (b) the testing situation is intrinsically motivating enough to the subject so that some ESP is operative in the first place; and (c) the mechanics of target selection, recording, and presentation of feedback, reward, or punishment are unobtrusive so as not to distract the subject or the agent. Note that requirement (b) brings out an assumption basic to the argument of this paper, viz., that the subject will utilize ESP in conjunction with some of his responses; otherwise there is nothing to reinforce! If a subject is simply guessing, immediate reinforcement of correct responses amounts to reinforcing randomly varying factors of no value and there will be no learning to use ESP. If, on the other hand, the subject is using ESP in conjunction with some of his responses, this is a constant factor that will be reinforced and we would expect learning to occur.

The situation is somewhat complicated by the fact that even with a subject who *is* utilizing ESP in conjunction with some of his guesses, he is also being reinforced for some responses that are pure guesses, but are correct by chance alone. One might think of this as "noise," and this consideration leads us to predict three general outcomes for experiments using immediate reinforcement: (a) For a subject who shows no ESP at first (indicated by chance-level scoring), there is nothing to be reinforced, so he will continue to score at a chance level no matter how long the experiment is continued; (b) for a subject who shows only a little ESP at first, the infrequent reinforcement of ESP responses and the more frequent reinforcement of chance responses may not allow learning to begin before extinction has started, i.e., there is far more reinforcement of "noise" than of "signal," so he will soon start to score at a chance level; (c) for a subject who shows a large number of ESP responses at first, their systematic reinforcement should outweigh the reward of chance responses, and learning should take place as manifested by an overall increase in scoring level with further trials. What the exact dividing line is between (b) and (c) constitutes an empirical problem that future research must solve.

There have been some experimental setups in the past which have come close to getting away from this extinction paradigm. The procedure of allowing subjects to check the calls they felt sure were correct, as in the research of Humphrey and Nicol (1955) was one approach, but here in many cases the feedback of correctness or incorrectness did not come until the end of the run; here it would have been difficult for the subject to remember just what his feelings were that made him check a particular call, such that he could learn to recognize them clearly in the future. Some experiments have been done, using open decks, where the experimenter tells the subject whether he is right or wrong after each call. These experiments would seem to fit a learning rather than an extinction paradigm, yet in retrospect it is questionable whether the feedback of correctness or incorrectness was very rapid—in dealing with such a nebulous and poorly understood phenomenon it may be that the difference between half a second and one second intervals between response and feedback is crucial. Moreover, the mechanics of the experimental procedure in these studies (randomizing, recording responses in duplicate, etc.) may have been a factor detracting from the opportunity for learning.

After reading an earlier draft of this paper, Laura Dale was kind enough to call my attention to a series of experiments carried out at the A.S.P.R. in which there was quick knowledge of results for the subject. The first of these (Murphy & Taves, 1942) was one in which the agent pressed a switch to give a signal to the subject as to whether he had been right or wrong on each trial. Considering the mechanics of this procedure, however, this feedback was delayed and variable, and thus not well suited for an initial investigation of the effect of knowledge of results on learning to use ESP. In three later experiments the apparatus was modified so that a bell rang immediately if the subject pushed the switch corresponding to a correct guess, thus giving immediate reinforcement of correctness. In the first study (Taves & Dale, 1943) the authors reported a marked decline effect rather than any learning. This result does not, however, constitute a demonstration that immediate knowledge of results or reinforcement fails to help a subject to use ESP. As pointed out above, there is probably some critical ratio of correct responses due to ESP versus correct responses due to chance which must be reached or exceeded early in the guessing so that learning can begin before the ESP responses begin to extinguish. Apparently this ratio was not reached in the Taves and Dale study. Nor was it reached in the two later experiments (Dale et al., 1944; Taves et al. 1943), as the authors reported there were no significant results either in overall scoring or in terms of decline effects: thus there was probably no ESP to be reinforced.

A number of mechanical devices have been proposed in the past which produced random targets and automatically scored responses (Smith et al., 1963; Stewart, 1959; Taves, 1939; Webster, 1949). Unfortunately, most of these devices never saw any use to speak of and many of them were actually rather awkward to operate, so that a quick reward of responses would have been difficult to accomplish.* A modern device which would easily allow the use of quick reinforcement (Cutten, 1961) has been proposed, but no one has backed its construction. Another modern device (Tart, 1966b and Appendix 2) designed to allow all the techniques of reinforcement used in modern psychology to be applied has also failed to receive backing for construction.** Apparently the reaction against card guessing tests has dampened enthusiasm for such testing aids, but they are absolutely necessary if we are to turn card guessing tests into a learning situation (using animal or human subjects) instead of an extinction procedure because manual procedures are probably too slow, cumbersome, and distracting to both experimenter and subject.

A properly designed testing aid, which automatically generated random targets and scored the subject's responses, could easily be set up to do all the following: (a) allow the subject to respond as slowly as he wishes, thus giving him a chance to clarify his internal feelings and imagery, or to work rapidly, almost automatically; (b) reward the subject for correct responses, with fixed or variable intervals between response and reward, and on a constant or variable reward schedule; (c) provide reward as straight information feedback (a buzzer for correct responses, say) or provide some-

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* Tyrrell's (1937; 1938) device seems a noteworthy exception. Here the subject tried to guess which box among several had a light on inside it. On opening the box, the subject saw immediately whether she was right or wrong. Tyrrell's tests were some of the most successful in the field, despite the drawbacks due to lack of randomicity in a number of his experiments.

** ESPATESTER was later constructed, although I did not have time to systematically use it.

thing like coins falling from a dispenser on each correct response, or (d) punish the subject for incorrect responses, either in an informational feedback way or by something like electric shock or monetary fines. Other techniques could be programmed in, but basically the point is that by the use of modern apparatus all the highly developed techniques of learning psychology and operant conditioning could be applied to guessing situations; and quite possibly we would find that subjects could learn to perform at more and more significant levels over time instead of dropping off to chance.

Considering the literature reviewed above, then, subjects have simply never been given an adequate chance to learn to use their ESP abilities, especially those high scoring subjects where the use of immediate reinforcement techniques would be most profitable. Undoubtedly there are some other experiments in the scattered literature of parapsychology which come closer to a learning paradigm than I (a relative newcomer to the field) know of; what is most amazing to me as a psychologist, however, is this well-nigh universal use of an extinction paradigm in parapsychology. The main point of this paper is a plea to workers in this field to give the learning paradigm a fair try before abandoning guessing tests entirely.

It should be noted that these comments are not a *sophisticated* analysis of the card guessing method as a learning situation; rather, they are based on knowledge that can be picked up in elementary textbooks on psychology (Hilgard, 1962; Morgan, 1956). Because we have been absorbed in the idea of detection instead of learning, we have actually been working against ourselves insofar as producing the phenomena we want to study goes. It is to be hoped that the application of these basic principles of learning will be carried out, for the crucial problem in parapsychology today is to produce the phenomena we want to study at a much higher level than the marginal one we are used to, and the proper application of the psychology of learning may be one way of accomplishing this.

Postscript: Although I cannot develop the idea here, it is obvious that everything discussed above about the subject learning to use ESP can also be applied to the problem of the agent learning to "send." The typical ESP experiment provides no immediate feedback of results to the agent, so that he is in a poor position to learn to "send" more effectively.

As an example of what this sort of feedback might accomplish, consider the old and remarkably successful experiment of Brugmans and his colleagues (1922, pp. 396-408), where the agent(s) were able to continuously observe the movements of the subject's hand as he attempted to locate the square to which the agent(s) were trying to direct him. Whenever the subject moved his hand in the right direction the agent(s) could intensify their "sending," but whenever it went in the wrong direction they could try another technique and thus continuously vary their "sending" behaviors in accordance with what seemed to produce the best responses in the subject. This sort of experiment could easily be carried out today, and now that closed circuit TV systems are reasonably priced, the agent(s) could be miles away, totally eliminating problems of sensory cues. They could jump about and shout if they thought it helped, and work up a tremendous emotional involvement in their task!

Giving both the subject and the agent a chance to learn to use their psi capacities should be more fruitful than either approach alone.

II

STUDIES OF THE LEARNING THEORY APPLICATION BY OTHERS, 1964-1974

In the early 1960's, while still a graduate student, it struck me that the repeated guessing procedure, the (at that time) almost universally used way of testing for ESP, had all the characteristics of a classic *extinction* paradigm in terms of basic learning theory. The way to allow *any* organisms, animal or human, to learn is to let them make a trial and then give them some kind of immediate feedback so that they know whether they have been right or wrong. The feedback may be intrinsically rewarding or coupled with an extrinsic reward. Under these conditions, *if* the organisms have any initial capacity to learn the behavior called for, we see a steady increase in correct performances, often plateauing at complete correctness.

If on the other hand, you want to extinguish behavior, you either punish performance and/or you break up the association between performance and feedback, so that the organism does not know whether it is right or wrong on any particular trial. Under these extinction paradigm conditions, performance steadily gets worse compared to the baseline level, and eventually reaches a chance level.

In the standard parapsychological repeated guessing experiment, usually with cards, subjects are given no feedback as to the correctness of each trial until the end of a run of twenty-five or more, when they cannot be expected to remember the subtle feelings associated with each guess and associate these with correctness or incorrectness. Thus this seems to be a classical extinction paradigm. The empirical evidence supports this. Pratt (1949), in reviewing the literature on repeated guessing, found that a decline effect was almost universal. Almost all good-scoring subjects, no matter how well they did at first, eventually lost their ESP abilities under this extinction procedure.

I discussed the possibility of teaching steady ESP performance by the application of immediate feedback with many people, including other parapsychologists, and, with the exception of Russell Targ and Herbert Puryear, who had had similar thoughts, the idea apparently fell on deaf ears. In 1966 I put it in the form of an article, "Card Guessing Tests: Learning Paradigm or Extinction Paradigm?" reprinted as Chapter I of this monograph. The article made the points above, and additionally pointed out that a subject would have to have some demonstrable ESP ability to begin with, or the application of immediate feedback would not be useful. That is, if there is no talent to reinforce, the application of feedback and reinforcement will be of limited value. If the subject has a good deal of ESP ability to begin with, learning would be predicted to be fairly rapid. At intermediate levels of ESP ability, we would expect either increased variability or stabilization of performance for some time, but probably not learning: the fact that a subject is being reinforced by chance very often in a repeated guessing experiment constitutes a kind of noise, and, coupled with the boredom of long testing, this noise may be sufficient to sap the subject's motivation and/or confuse him, so that learning does not occur. I could find no material in the psychological literature comparable to the standard ESP card guessing tests that would enable me to theoretically predict what the level of initial ESP had to be before learning could occur under feedback conditions, so finding this "talent threshold" is an empirical problem.* I shall propose an approximate empirical solution in Chapter VI.

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* The literature on testing for psychokinesis (PK) with dice might be of help here: since subjects usually saw the dice fall, they received relatively immediate feedback. Since decline effects are almost universal in PK studies (Pratt, 1949) and the amount of PK shown is usually very small (albeit statistically significant), subjects in PK studies have generally been below the necessary "talent threshold" needed for learning. Helmut Schmidt's work is particularly relevant here, as his electronic PK machines usually provide immediate feedback, but I have not had the opportunity to adequately review the PK literature.

One rough way of expressing the need for some ESP ability to begin with, if reinforcement is to be effective in producing learning, is to predict that there should be a positive correlation between measures of subjects' ESP ability and the slope of the regression lines fitted to their performance under conditions of immediate reinforcement. This is only rough because a correlation coefficient assumes linearity, and there may be something like a step-function here, i.e., below the necessary talent threshold amount of ESP will correlate with slope only moderately.

Also in 1966 I published a design for an automated ESP testing and training machine (ESPATESTER) that not only made convenient testing in repeated guessing situations easy, but provided immediate feedback so that learning could occur (Tart, 1966b and Appendix 2). I built an ESPATESTER while at the University of Virginia Medical School and informally had several dozen subjects try their hands at it, but since none of them showed significant ESP scores to begin with, these results did not constitute any kind of test of the application of learning theory to ESP.

The publication of the theory in 1966 created some interest among parapsychologists, and a number of experimenters incorporated immediate feedback of results into experimental designs, although it was not always assessed as an independent variable. The general finding seemed to be that no spectacular results followed from providing immediate feedback, so interest in the theory waned. As will be shown, however, almost all of the published studies were inadequate tests of the learning theory application, for they dealt with subjects who showed only small amounts of ESP, thus not adequately recognizing the provision of the theory that calls for some minimal talent threshold before feedback produces clear learning. We shall see that this waning of interest was premature and invalid.

In spite of this waning of interest, almost two dozen scattered studies have appeared which give substantial support to the learning theory application. I shall review them here. I have restricted myself to studies with human subjects, but I suspect that the animal ESP studies would also support the learning theory application.

Because of the importance of the need for some initial ESP talent to overcome the extinction effects inherent in reinforcement for chance hitting, I shall review the published literature under three headings: those in which no apparent ESP was shown, those in which moderately talented subjects were used, and those in which highly talented ESP subjects were used. Ideally, we should have a measure of subjects' ESP talent level before they begin work in an immediate feedback situation, but this was seldom the case, so the feedback experiments themselves must also be used in roughly classifying subjects' ESP talent levels.*

Studies with Subjects with No Apparent ESP:

Five studies have appeared whose overall results do not show significant hitting above chance, but which employed immediate feedback. The learning theory application does not definitely predict learning for such cases, for subjects are below the necessary talent threshold for the learning process to predominate over the extinction process. The situation is a little ambiguous, of course, for some subjects may appear to be untalented in initial testing but have latent abilities that, if their motivation is high, might be tapped after a period of training with feedback.

The first such study was carried out by Beloff (1969). He used the Edinburgh Electronic ESP Tester (Beloff & Regan, 1969), a 5-choice device providing immediate feedback. Twenty males and 20 females, university students, did five runs of 25 trials each with immediate feedback via the correct target lamp lighting. The subjects showed no ESP and there was no improvement with practice. This kind of result is consistent with the learning theory application, but in a trivial way.

Banham (1970) had 22 college student subjects work with a toy slot machine. They had to drop a marble into one of four slots. One outlet, selected at random, was blocked on each trial so the marble would not roll out, and the subjects were to try to drop the marble into this slot. Whether or not the marble rolled out almost immediately was the feedback. Both men and women scored higher in the second half of the experiment than in the first, the women

* There is a procedural problem here also that should be recognized before further experimentation. While ideally we should have a measure of subjects' ESP talent level before beginning feedback training, we must be careful not to extinguish the very talent we want to measure in the course of assessing it through testing (without feedback) that is too lengthy.

significantly so ($P < .001$), but the scores of the group as a whole did not differ significantly from chance. Although no details are provided, Banham also mentions that a *post hoc* analysis of another experiment (presumably like this one) showed a similar result.

In a replication of her earlier study, again reported only in a short abstract, Banham (1973) reported no significant differences between scores in two sequential 100-trial blocks for 30 college student subjects. There was a typical decline effect when the first and last ten trials within each 100-trial block were examined: Banham attributes this to the feedback, although why she does this is not clear, since such declines are the typical result in non-feedback, repeated guessing studies.

Beloff and Bate (1971), impressed by others' significant ESP scores on the Schmidt machine (reviewed later), which incidentally provides immediate feedback even though Schmidt has not conceptualized such feedback as important, ran four subjects for fairly extended series (2900 trials or more) on their 5-choice Edinburgh Electronic ESP Tester.* The subjects had various numbers of trials trying to guess the state of the machine (clairvoyance) in real time or to predict its forthcoming state (precognition). For some runs feedback was immediate, for others the feedback lamps were disconnected. These four conditions were intermixed throughout the series.

Beloff and Bate found no statistically significant ESP for any of these four subjects, and had non-significant indications that their subjects did better when immediate feedback was withheld. They do not provide performance curves under the various conditions, however, making it difficult to evaluate the feedback and non-feedback conditions adequately. They do provide overall (conditions intermingled) cumulative response curves for their subjects, and, using this graphical data, I approximately extracted actual score deviations above and below chance for blocks of 20 runs and calculated the slopes of the performance curves of their subjects. One (R.S.) showed a significant decline effect (slope $= -.461$), but the three others were showing positive slopes (.517, .481, and .600 for M.W., E.B., and M.M., respectively), one of which was sug-

* A fifth subject had to quit the experiment much sooner than the rest, so his results will be disregarded.

gestively significant (for E.B., $P<.10$), even though their overall scores were low. The reason the slopes were positive was that each of these three subjects showed scores below chance at the beginning of their training. Cases of positive learning slopes coming about through initial psi-missing, followed by chance scores or hitting, are complex and not covered by simple learning theory: see the discussion in Chapter III.

Thouless (1971) attempted to train himself on the 4-choice Schmidt machine (Schmidt, 1970). Although he felt there was a suggestively positive trend through his twelfth session, it was followed by a decline on the thirteenth session, just before he had to terminate the experiment as the machine became unavailable, and his overall scores were not significantly above chance.

The general picture, then, is that of immediate feedback often having no effect on the performance of subjects who apparently have no ESP talent; yet, in spite of the fact that we do not expect it, some subjects seem to show some learning.

Studies with Mildly Talented Subjects:

The criterion for classifying studies in this section is that the results of the study had to show significant psi-hitting. There was a natural break of these studies from those reviewed in the following section, in that psi-coefficients (discussed fully in Chapter IV), measures of effect per trial, tended to run below .05, while they ran much higher in the studies of talented subjects.

The expectation from the learning theory application for mildly talented subjects is that the feedback should stabilize performance (eliminate declines) for short to moderate length experiments and perhaps allow some (presumably highly motivated) subjects to show some learning.

Mercer (1967) ran 20 subjects for 14 sessions each of 20 trials each, on a binary guessing test. Subjects given immediate feedback showed significantly more hits than chance ($P<.0006$), while those not receiving immediate feedback scored at chance. No details are available in the brief abstract reporting this study.

Schmidt (1970) designed a 4-choice electronic ESP testing machine. Subjects tried to push the button which corresponded to the target lamp that would be selected next (a precognition study).

The correct lamp immediately lit, providing feedback, although Schmidt did not consider feedback an important variable. In two precognition studies (Schmidt, 1969a) with four subjects who were preselected to show mild ESP ability, overall scoring for precognition was quite high ($P < 10^{-8}$ in each study). No analysis for the slopes of performance curves was reported, but in a later report on the same study (Schmidt, 1969c), Schmidt comments that scoring was "fairly steady," implying neither a consistent increase or decline for any subjects. It is of particular interest to note that subjects carried out more than 16,000 trials each in the first study, and more than 4,000 trials each in the second study. Since two of the three subjects in the second also participated in the first, "fairly steady" performance over more than 20,000 trials is remarkable, given the near universality of decline effects in studies without immediate feedback.

In another study Schmidt (1969b) modified his apparatus to use targets already punched on paper tape, so they existed in present time and allowed for clairvoyance. Again subjects were preselected to have mild ESP ability: one had participated in the earlier (Schmidt, 1969a) study. Significant ESP ($P < 10^{-6}$) for the group was shown over a total of 15,000 trials. No data on performance slopes was presented.

Haraldsson (1970) used a slightly modified version of the Schmidt machine to try to show that subjects could score above chance (show precognition) on it, to test a method of selecting for mildly talented subjects, and to compare full feedback of results with partial feedback of results. He modified the Schmidt machine so that a buzzer sounded when hits were made, as well as the subject seeing the correct target lamp light (full feedback condition), or by disconnecting the lamps but leaving the buzzer connected (partial feedback condition, where subject knows whether he was right or wrong but not what the correct target was if he was wrong).

In his selection study 74 subjects did 10 runs of 100 trials each, with the conditions alternating with each run between full and partial feedback. For the 740 runs overall there was a non-significant deviation below chance and no difference between the full and partial feedback conditions.

Individual subjects were allowed to go on to Haraldsson's main study if they scored suggestively above chance (psi-coefficients of about .02 or higher). Eleven subjects qualified and went on into the main series, where they did variable numbers of runs until the preset goal of 100 runs for the total group was met. (Haraldsson introduced a further selection procedure of dropping subjects who started showing negative scoring, but later further tested these subjects anyway and found only small differences, so we can ignore this procedure.) Scores were significantly above chance ($P<.002$) for the full feedback condition in the main study, but less significant for the partial feedback condition ($P<.04$), although the formal difference between the two conditions was not significant. No slope data on performances over time are presented. Haraldsson noted that some of his better subjects preferred the partial feedback condition, for in lacking information about exactly what the missed target had been, they were less caught up in trying to figure out "patterns" in the target sequences.

Lewis and Schmeidler (1971) carried out a quite complex study of purposeful and non-purposeful ESP calls in the context of a biofeedback study for training alpha rhythm control. Extracting data immediately relevant to feedback, they used a 4-choice machine of the Schmidt type with partial feedback: a red light came on for hits only. In two sessions, while hooked up for EEG recording, 14 unselected subjects each did a pre-test for precognition on the machine, had a free practice period, and then a post-test. Partial feedback was provided during both pre- and post-tests and free practice.

Pre-test precognition scores were insignificantly higher than chance, while the post-test scores were significantly above chance ($P=.02$), but the difference was not statistically significant. There were significantly more hits when the subjects showed more alpha rhythm than usual: this study provides interesting hints for integrating biofeedback control of physiology and learning ESP.

Honorton (1971b) used a binary choice precognition testing machine of the Schmidt type with a subject, M.B., who had many types of ESP experiences and was known as a "sensitive." Judging from his actual performance in this study, I would classify him as mildly talented for this type of study (psi-coefficient = .02). Immediate feedback was provided by the correct lamp immediately lighting. M.B. worked in 16 trial runs, 10 runs to a set, and 12 sets per session, for a total of 1,920 trials per session. His overall score for eight sessions (total of 15,360 trials) was significantly above chance ($P = .002$). I computed the slope of his performance curve from Honorton's Table 1 and found it to be +3.27, although this does not reach statistical significance for eight sessions. This does not represent uniformly increasing performance, for he scored very well in his first session, then showed a huge falloff in his second and third sessions, with a uniform improvement after that, back up to his original level of scoring, significantly above chance. Honorton also found significant decline effects within each *set* when M.B. was trying to hit the target. For a subset of runs where M.B. deliberately tried to miss (a procedure he strongly disliked), there was a significant increase in hitting within the sets. Thus we have short-term variations imposed upon an overall increase in performance.

Schmidt and Pantas (1972) tested a number of groups of unselected subjects on Schmidt's 4-choice precognition machine, with full and immediate feedback from the correct target lamp lighting. In their first experiment, subjects deliberately tried to miss, and as soon as a subject hit, his place was taken by the next subject in the group. However, Schmidt and Pantas manipulated the psychological atmosphere of the testing conditions so they expected psi-hitting, even though the subjects were trying to miss. A total of 500 trials, set in advance, was carried out. The results were significant above chance ($P < .01$), and there was a slight increase in scoring rate (28.4% to 29.2%) from the first to the second half of the experiment, although it was not statistically significant.

The second part of the Schmidt and Pantas study involved a highly talented subject and will be reported on later.

This study is also of great methodological significance, for in another series Schmidt and Pantas modified the internal circuitry of the test machine so that it required psychokinetic action on the generator to score above chance. Subjects still believed they were trying to *predict*, not knowing of the modification, but they significantly *influenced* the machine. Thus subjects who believe they are trying to use some form of ESP may alter the behavior of a random number generator by unconsciously using psychokinesis.

Honorton (1970; 1971a) and McCallam and Honorton (1973) carried out three studies which further support the application of learning theory to ESP performance. Honorton's second study was a replication of the first, and the McCallam and Honorton study extended and replicated the first two. The basic design was to have 20 subjects, divided into experimental and control groups of 10 each, tested individually. There was immediate feedback of results in the experimental group and *false* feedback in the control group.

Initially each subject guessed at targets in six standard closed decks of Zener cards (5 each of 5 symbols), and also indicated when they felt particularly confident about the correctness of a call. The cards were in their boxes for this, the "DT clairvoyance" procedure, and there was no feedback. The experimental group then had immediate feedback runs on three more decks: whenever the subject was correct, the experimenter immediately called out "Right!" This constituted partial feedback of information. The control group had an apparently similar (to them) session of three feedback runs, except that the experimenter called "Right!" when the subject's response was actually incorrect, a false feedback condition. The experimenter called "Right" about the same number of times in each condition. Both groups then went on to three more DT clairvoyance runs, again making confidence calls, as in the pre-feedback condition.

In the two Honorton studies this false feedback condition was used: in the McCallam and Honorton study, a no-feedback condition was used for the control group instead.

In all three studies, there was a significant increase in the proportion of *correct* confidence calls, so subjects were learning something about the internal feelings that go with correct ESP performance. Further, in the first and third studies, the feedback group showed significant ESP hitting per se after the feedback condition, even though their scoring had not differed significantly from chance before the feedback training. Note also that, as would be expected from the learning theory application, subjects in the false feedback group showed a tendency, although it was not statistically significant, to make *lower* overall ESP scores and a *lower* proportion of correct confidence calls after the false feedback condition.

The McCallam and Honorton study found a result which, at first glance, seems incongruous with the learning theory application. They ran two other groups who received six and nine feedback runs, respectively. We would expect that more training would produce an even greater effect, but the feedback training did not produce any effect at all in these other two groups. Why? My speculation is that the more extended training intensified a flaw in Honorton's and McCallam's training procedure, viz., that they used closed decks (5 of each of 5 symbols) for the feedback conditions. It has long been known that you cannot legitimately *test for* ESP when giving immediate feedback with closed decks: by keeping track (consciously or unconsciously) of what has already turned up, the subject can optimize his guesses near the end, i.e., if he knows all five stars have already come up he will no longer guess star, and thus increase his hit probability on the remaining cards. I suspect that in the more extended training with closed decks, McCallam and Honorton's subjects began improving their memories, not their ESP abilities. This probably didn't happen much in the short (3 run) training groups because of the subjects' focus on the ESP task, but it would have become the winning strategy in the longer training.

Kreiman and Ivnisky (1973) replicated Honorton's first two studies with a larger group, and while they did not find an increase in the proportion of correct confidence calls, as had Honorton, they did find a significant increase in overall ESP performance after the feedback training, as Honorton (1970) and McCallam & Honorton (1973) found.

Dagle (1968), in an unpublished Master's thesis (abstracted in Dagle & Puryear, 1969), reported on three studies utilizing immediate feedback. Subjects worked at a binary choice GESP task, the experimenter trying to "send" the correct button to push from another room. Pushing their response button gave immediate feedback. Student subjects were preselected on a card test and divided into those who scored above and below chance, a very crude division into possibly mildly talented and non-talented subjects. For both groups, there was a significant increase in scoring when a block of non-feedback trials was followed by a block of feedback trials: this was true for all six subjects in the mildly talented group. When feedback trials came first, the level of scoring was roughly maintained in the subsequent non-feedback trials.

Unfortunately, Dagle used a closed deck in this first study, a fact known to the subjects, so it is possible that some subjects simply kept track of what targets had already been used and modified their guessing strategy accordingly, thus raising their scores by non-paranormal means. Use of the same target deck for all subjects also introduced the possibility of a stacking effect which could inflate scoring levels by 10% or more. The fact that the mildly talented subjects (by prior, non-feedback ESP card guessing test criteria) showed learning and the non-talented ones did not argue against this interpretation, but since we cannot be sure, Dagle's first study must be considered tentative.

Dagle carried out a second study similar to the first, but with subjects making confidence ratings of each call by moving a lever. Three of the six subjects showed individually significant results for ESP (assuming we are not dealing with a closed deck again, an item not specified in Dagle's thesis), although the results were not related to confidence ratings. The procedure inadvertently introduced fairly long delays between a subject's decision and his response, however, so it is not clear whether to consider this *immediate* feedback or not.*

In a brief third study, Dagle had two subjects carry out seven and six runs, respectively, with immediate feedback. Both showed individually significant scoring for ESP. One showed a highly positive slope (+2.085), although this resulted mainly from a very low score on the first run, and the other a steady performance. Again this study is flawed, however, by the use of closed target decks.

Targ, Cole, and Puthoff (1974) have conducted the most extensive studies to date, of the possibilities of learning ESP reporting four separate studies. Each study used the Aquarius Model 100 ESP Trainer (described in Chapter IV), with or without automatic data recording equipment. Their phase 0 pilot study resulted in two subjects whose hit scores and positive slopes of increasing performance were individually significant. One subject (A-1) showed a mean score of 26.06 hits per 100 trials when 25 would be expected by chance ($P = .008$), but while the increase in slope of this curve was statistically significant ($P = 10^{-6}$), the actual magnitude of the slope was very low (slope = .07). The second subject's scores showed much more ESP (a mean of 30.5 instead of 25) and a quite positive slope

* Schmeidler and Lewis (1968) also carried out a study where the feedback seemed variably delayed rather than immediate, so it is not reviewed here.

(slope = .714 over 1400 trials). His psi-coefficient is high enough (.07) to consider him with the highly talented subjects. Unfortunately, the second subject, a scientist, recorded his own data, and the first subject's data was reported by his father. Since it is a general rule in parapsychological research never to allow subjects *any* opportunity to make recording errors or cheat, these results must be considered tentative.

In the Targ *et al.* Phase I study, 145 subjects participated in at least five 15-20 minute sessions each on the Aquarius machine. Data was machine recorded. The total number of hits for the group as a whole was almost exactly what one would expect by chance, so, as a group, no ESP was shown. Nine of the 145 subjects showed positive learning slopes that were statistically significant at the .05 level or better, and 11 of the 145 subjects showed mean scores significant at the .05 level or better. This is not too many more subjects than we would expect by chance, given the .05 level of significance, but, allowing for the fact that some of the individual levels of significance were better, these results suggest at least some ESP operating. Curiously, none of the subjects who showed significantly positive slopes showed significant number of hits above chance expectation. Thus subjects showing significantly positive slopes must have had many below chance scores at the beginning of their performance. As will be discussed in the following chapter, such psi-missing greatly complicates the simple application of learning theory. Phase I results provide some support for the learning hypothesis, since there were no significantly negative slopes, but the amount of ESP was very small.

Targ *et al.* felt that unpleasant experimental conditions, such as the noise of the automatic data recording printer on the Aquarius machine, were at least partly responsible for poor scoring in Phase I, so their Phase II experiment was done under conditions of a more pleasant room and removing the noisy printer from the room, even though it was still connected to the machine and recording remotely. Twelve subjects participated, all of these selected as either having shown mean scores significantly above chance or having significantly positive slopes in Phase 0, Phase I, or some informal work. Subjects carried out 1,000-6,000 trials each. Unfortunately, no subjects showed mean hits significantly different from chance in Phase II, and no subjects showed significantly positive slopes. This is inconsistent with the predictions of learning theory for at least two of the subjects (A-2 and A-3) showed a great deal of ESP in earlier studies (each of them scored more hits than chance with a significance at the 10^{-6} level). Whether this argues against learning theory or may be due to the change in conditions of the Phase II study is unknown. Targ *et al.* feel the complex condition of Phase II still inhibited subjects' performance.

In their final study, Phase III, Targ *et al.* ran 8 subjects, again selected on the basis of significantly positive slopes or significantly high mean scoring in the earlier phases. Conditions were now more informal, with the experimenter remaining in the room to read the data from the machine, but the automatic recording removed, as they felt that it had an inhibiting effect on the subjects. Seven of the 8 subjects showed no significant results in terms of either number of hits or slopes. One subject (A-3), the only one who had shown extremely significant results in Phase I ($P = 10^{-6}$), did recover his ESP abilities. He scored an average of 29.57 when 25 was expected by chance over 2800 trials ($P = 10^{-6}$). However, his slope, while slightly positive (slope = +.135) was not significantly different from chance.

Two of the Targ *et al.* studies, Phases II and III, allowed me to examine the relationship between mean ESP scoring rate and the slopes of the curves obtained under conditions of immediate feedback. In their Phase II, where 2 subjects showed significantly negative scores, the correlation is –.29, which does not begin to approach statistical significance. But, since the range of ESP scoring was extremely limited, perhaps with no real ESP in the experiment at all (overall results were not significant), and since all the obtained slopes were essentially zero (the largest was –.0004), we cannot expect to see any relationship here.

Their Phase III results are presented for 7 subjects whose overall and individual results showed no significant deviations from chance (for either mean score or slope) and separately for an outstanding psi-hitter. For the 7 subjects, the correlation is +.91 between mean ESP score and slope ($P < .005$). This significance is achieved primarily because the largest negative slope by far was associated with the lowest scoring subject. If their high scoring subject's scored trials (not his practice runs) are added into the group of 7, the correlation becomes +.68 ($P<.05$). These results support my prediction from learning theory, even though the range of ESP scoring is even more restricted than in their Phase II. The slopes of subjects in their Phase III show a much wider range, however.

To summarize the Targ, Cole, and Puthoff experiments, most of their subjects showed no ESP, and of those who did, few were able to hold up in further studies. The same is true for those who showed significantly positive slopes (even though their overall ESP score was not significant). One subject out of 147 was able to show consistently good ESP results, and in the two studies in which he scored significantly (Phase I and Phase III) his slope, although positive, was not statistically significant, suggesting he was able to hold up in his ESP performance without extinguishing it, but not showing clearcut learning.

Studies with Highly Talented Subjects:

Although I have no *a priori* way of predicting the talent threshold, above which the learning process should predominate over the extinction inherent in success by chance, the studies reviewed in this section involve subjects who were outstandingly more successful than subjects in other studies. These subjects were often able to demontrate ESP by showing statistically significant scoring in a single test. We shall look at talent levels more precisely in the final chapter.

The first study to note here was by Ojha (1964). Although published in 1964, completely independently of my own formulation of the learning theory application, I did not learn of it until 1974. Ojha, working from a psychological approach dealing with *knowledge of results* (feedback), hypothesized that complete knowledge (what the target was) of results in a guessing situation would give higher scores than partial knowledge (right or wrong), and partial knowledge would be better than no knowledge of results. He used a closed deck of 100 cards with the numbers one, two, three, and four randomly assigned to the cards, 25 of each kind. Six groups of five individuals each received various degrees of immediate knowledge of results. The results fitted the hypothesis. Assuming that 25 out of 100 would be expected correct by chance, the group having complete knowledge of results had a mean of 32.6 correct, the group having partial knowledge of the results had a mean of 29.4, and the group with no knowledge of results, a mean of 24.6, highly significant differences.

Unfortunately, Ojha's study is seriously flawed from the parapsychological point of view because he used a closed deck. It is not clear whether he told his subjects that there was an equal frequency of each target card, but even if he did not explicitly tell them so, this would be a possible inference on their part. Thus, if many of a particular number had already turned up (known to the subjects through the feedback) the subjects would be less likely to call that number in the future and thereby elevate their scores without recourse to ESP. It is essentially the same procedure any good card player uses of keeping track of what's been played in order to improve his ability to guess what might be still concealed in other players' hands. Because of this possible drawback, Ojha's study can only be seen as tentatively supporting the learning theory.

Targ and Hurt (1972) developed a fully automated, four-choice machine similar to ESPATESTER (see Appendix 2). They report on 12 subjects. As in the other studies reviewed, there was no pre-selection for ESP ability, only for interest in working with the machine. One child subject showed clear ESP scoring on the task of clairvoyantly perceiving the state of the machine. In a total series of 64 runs of 24 trials each, she made an average of 8.6 hits per run, with a probability of approximately 10^{-15}. She showed clear improvement over her trials, learning to score at very high levels of significance on individual runs. At the 65th run, the machine was rewired to a precognition mode without informing the subject, i.e., the target was not generated until two-tenths of a second *after* the subject's guess. The subject at first said she no longer felt anything and was just guessing: she scored at chance. However in the course of 28 runs her performance increased to a level approaching her scores in the clairvoyance tests: in her first 4 runs, for example, she obtained 19 hits (when 24 would be expected by chance), and in her last 4 runs she made 38 hits. Again there was clear evidence of learning.

Targ and Hurt's study has a drawback however, in that it is not clear from their report whether the experimenter actually observed the subject's performance or not, even though presumably the machine did not allow for fraud.*

Kelly and Kanthamani (1972) describe a case of ESP learning under conditions of immediate feedback, although they do not conceptualize the task that way. A gifted subject, B.D., worked on a new Schmidt 4-choice precognition testing machine (Schmidt & Pantas, 1972), where he had to press a button to indicate which lamp would be selected next by a random number generator. The machine gave immediate and complete feedback as the selected lamp lit, and also emitted a single auditory click on misses and a double click on hits. His initial performance, under tight conditions, was extremely significant (180 hits in 508 trials when 127 are expected by chance, $P<10^{-7}$). When a mechanical punch was connected to the machine to automatically record data, however, he lost most of his ability, for psychological reasons not specified by Kelly and Kanthamani. He dropped from a level of about 33.3% correct to 27% correct. After a period of anger at the machine and frustration at his inability to score, B.D. determined to relearn his ability in spite of the mechanical punch. In eight days of intense, concentrated practice, with the machine providing immediate feedback, he steadily raised his scoring level from 27% back up to 30.8%, a clear case of learning (or perhaps *re*learning, depending on how important the change of connecting the punch was).

Kanthamani and Kelly (1974) performed another experiment with their exceptional subject, B.D., where he was shown a black folder containing a single playing card, and given almost immediate feedback on his call: the experimenter wrote down the call before pulling the card from the folder, so there was a delay of about one second.

B.D. had participated in an earlier experiment of this type with Irvin Child and had scored significantly ($P<.01$ on suit hits), but

*** The machine used by Targ and Hurt was a prototype of the Aquarius Model 100 ESP Trainer, described later. My son David discovered it was possible to cheat on this machine in the precognition mode to get one extra hit per trial. I have contacted the manufacturer to have this defect remedied. Whether this might have been possible on Targ and Hurt's prototype machine is doubtful, for their data indicate a fairly steady upswing in performance rather than a sudden step and then steadiness.**

not very well considering his outstanding performance on a variety of other ESP tests.

Usually one run of 52 trials composed a session, with a break about half-way through. The target cards were drawn from a large deck of 10 full decks, an effective open deck, so knowledge of calls would not significantly alter the probabilities of unused, upcoming targets. B.D. felt that the quick feedback was important for him to learn to do well in this task, although for some trials he asked not to be given feedback, usually when he felt very "hot" and sure of success.

There were four experimental series, the first two of 13 runs each, the second two of 10 runs each. Scoring was by an exact method initially proposed by Fisher that considers nine classes of responses, as well as an overall response. The overall Fisher z-score was not significant for the first series, although there were significantly more number-only hits than would be expected by chance. The overall Fisher z-score was extremely high for the second series ($z = 11.25$), primarily from an excessive number of exact (suit and number) hits. The overall scoring level fell to $z = 5.39$ and $z = 5.18$ in the third and fourth series, still well above chance expectation, again with most of the significance being contributed by an excess of exact hits.

Thus B.D. seems to have learned to some degree in the first series, pushed the learning process about as far as he could go in the second series, and dropped to a steady, but still extremely significant scoring rate in the third and fourth series, perhaps because they did not continue to constitute a challenge.

Kanthamani and Kelly compare scoring on the feedback and non-feedback trials, and find it much higher on the non-feedback trials. This comparison is irrelevant to the question of whether feedback can allow subjects to increase their ESP performance, however, for B.D. tended to request non-feedback trials at times when he felt "hot," i.e., when he felt confident as the result of the feedback training preceding these non-feedback trials.

Schmidt and Pantas (1972), in the second part of their study, performed a separate experiment on one of the authors, Lee Pantas, who had shown unusually high ability in self-testing on the Schmidt machine. He carried out 500 trials at the rate of 25 trials per session, one session per day, working quite slowly and practicing Zen meditation for about 20 minutes just before each session. He scored well above chance ($P \approx 5 \times 10^{-5}$), although no data is presented on the slope of his performance curve. He also scored well in attempting to psychokinetically influence the machine.

With highly talented subjects, then, we see either steady and highly significant performance and/or clear increases, learning, of ESP ability. We shall consider these differences among subjects at different talent levels more precisely in the final chapter.

III

A PILOT STUDY: PSI-MISSING AND FEAR OF PSI

In the spring quarter of 1972 the students in a small class in experimental psychology I was teaching became interested in working with the idea of teaching ESP ability through the application of feedback,* so an informal pilot study was carried out. Using the Ten-Choice Trainer (TCT), described in detail in Chapter IV, 10 student subjects (not class members) carried out anywhere from 60 to 1720 trials, in runs of from 10 to 40 trials each. On each trial the subject had to guess which of ten unlit lamps had been selected as target, while the experimenter was concentrating on telepathically sending it. The subjects were informally selected mainly on the basis of interest in participating, plus any sort of feeling by individual experimenters that the subject might have ESP abilities. While the experimental conditions were quite tight in terms of eliminating any conditions but ESP to account for scoring, they were otherwise quite informal. Run length, e.g., varied from 10 to 40 trials per run,** and the total number of sessions was not fixed ahead of time, but determined by how long each subject/experimenter team wanted to work together.

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* I want to acknowledge my thanks to my students who acted as experimenters: viz. Jim Guthrie, Hal McMillan, Mark Warren, and especially my colleague and assistant, Lois Dick, who also acted as an experimenter.

** When total ESP trials are not fixed beforehand, the question arises as to whether positive results are due to selective stopping, i.e., of subjects quitting right after a run of "chance luck" has stopped. This does not seem to be the case here. The most successful subject stopped because of emotional upset, and five of the other 9 subjects were showing mildly upward or steady trends when they stopped. Stopping was primarily a matter of the experimenters and subjects not having time to do further work.

Results:

Table I presents the results of the pilot study for each individual subject.

TABLE 1 — PILOT STUDY
RESULTS BY SUBJECTS, TCT

Subject	*Total Trials*	*Hits Expected*	*P (1-tailed)*	*Overall Slope*
PS1	425	98/42.5	$1x10^{-18}$	–.05
PS4	400	47/40	NS	.22
PS5	240	29/24	NS	–.49
PS7	280	31/28	NS	.54
PS10	260	28/26	NS	–.21
PS6	560	55/56	NS	–.00
PS8	1720	157/172	NS	–.25
PS2	60	3/6	NS	–.50
PS3	300	20/30	.03	–.00
PS9	1080	83/108	.006	.02
Total of 10 Subjects	5325	551/532.5	NS	–.07 (mean)

For the group as a whole, the number of hits is not significantly different from chance (551 hits where 532.5 would be expected). Inspection of the individual data, however, reveals that one subject scored exceptionally well: she (PS1) made 98 hits where 42.5 would be expected by chance, over double chance expectation ($P<1\times10^{-18}$, 1-tailed). Yet her highly significant scoring was wiped out in the group results because of other subjects who scored below chance. Two of these latter subjects scored significantly below chance (PS3 and PS9). A third below-chance subject, while not reaching statistical significance (PS8), had over four times as many trials as our high scorer, so his and the other two significantly negative subjects' scores wiped out the effect of our high scorer in the group average.

Although some of the slopes of the regression lines for individual subjects are high, none is significantly different from zero at even the .05 level of significance. As will be seen later in looking at performance curves of individual subjects, the slopes of fitted (straight) regression lines are often a poorly representative way of describing the actual performance. As would be predicted by learning theory, there is a positive correlation between mean psi-hitting and the slopes, but this correlation ($r=+.10$) is not statistically significant.

Individual Performance:

The performance of our high scoring psi-hitter is worth examining in detail. It is graphed in Figure 1. Because she varied her run length, the Z score of each run rather than the raw score is plotted.

A striking feature of this graph is the extreme variability. Her observed variance is more than four times that expected by chance ($P \ll .001$). She varied from runs at chance (1 hit/10 trials) or (non-significantly) below chance to runs that were significant at less than the 10^{-7} level: these highest two runs each showed scores of 6 hits in 10 trials, roughly indicating ESP was being used on half rather than one-tenth of her responses or, to express it another way, she was using ESP about five times as frequently as she was guessing on these two runs.

The second important feature of the graph is the below-chance scores in the last session, runs 18 and 19. She had done extremely well in the previous session, but had "freaked out" at the end of the session. She cried hysterically for a long period and did not want to participate any further in the study. She would not explain why, and she would not be comforted. Because of her extreme ESP success we did not want her to quit, and we later arranged, after considerable resistance on her part, for another session. This is the final session shown, where she scored below chance in two runs (3 hits in 40 trials and 0 hits in 10 trials). She made her determination not to participate further quite clear!

My hypothesis to explain this unusual behavior and scoring, judging from what the experimenter, Lois Dick, knew of her as well as general considerations about ESP, is as follows: up to a certain level of ESP scoring, unique for each individual, successful scoring can be dealt with as an *intellectually* interesting phenomenon. It's very statistical and abstract. Many people, however, have an unconscious or partially conscious fear of ESP and resistance to it. Ordinarily, people are never confronted with *obvious* instances of ESP, so they may either ignore it entirely or only play with it intellectually. It's not really *real*. Our subject apparently had some deep-seated fears of ESP, however, and her continually increasing success (the slope of her performance curve is .08 through run 17, which, while not statistically significant, is positive) finally forced her to confront or at least activated her *fear* of confronting, the

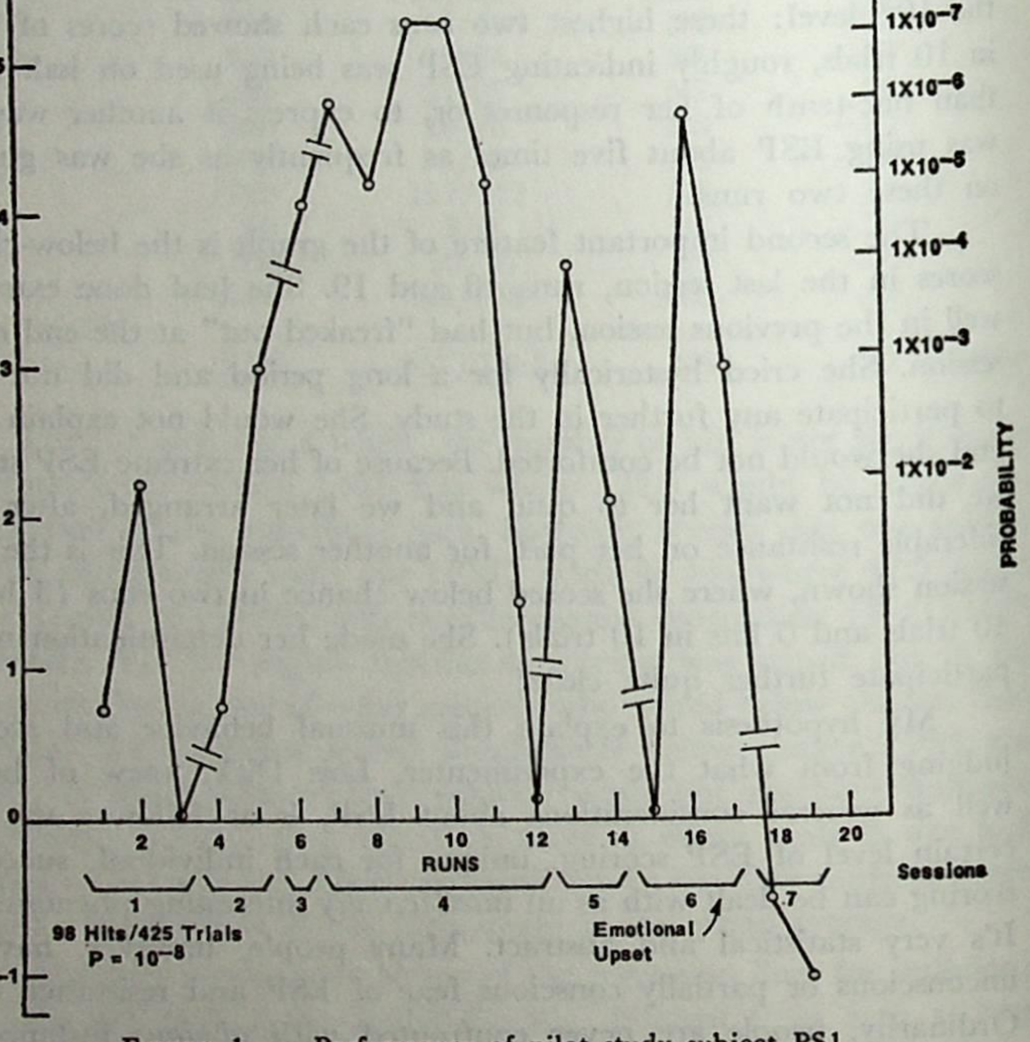

Figure 1 -- Performance of pilot study subject PS1

experiential, emotional reality of ESP, and this triggered the emotional outburst. The high variability in scoring before this may also have been reflecting her fear and ambivalence about ESP. Her resolution of this conflict was to suppress her ESP abilities, both by quitting the experiment so they could not be further trained, and by doing very poorly when we prevailed upon her to come back for another session.

I shall formalize this as a further prediction to add to the learning hypothesis: given that a subject has sufficient ESP ability to be showing learning under conditions of immediate feedback, if the subject has semi- or unconscious fears of and resistance to ESP, a performance level will be reached where the subject will have to confront in some form this non-conscious fear and resistance. This may manifest as an emotional outburst, as quitting the experiment, or as very erratic scoring, possibly culminating in psi-missing. The experimenter's and subject's willingness and ability to deal with the emotional bases of the conflict will have a great effect on the outcome. Some psychotherapy-type work oriented toward the conflict area would probably be useful.

Psi-Missing:

Psi-missing, where subjects score significantly below chance expectation, is a well-known phenomenon. It involves the operation of ESP as much as psi-hitting, for the only way to score significantly below chance is for some part of the subject's mind to correctly perceive targets by ESP but then affect the subject's conscious calling so as to ensure a wrong call.

We can distinguish two kinds of psi-missing: motivated and malfunctioning. Motivated psi-missing is exemplified by Schmeidler's classical experiments on the sheep-goat effect (Schmeidler & McConnell, 1958). Subjects who, before being tested for ESP, express a disbelief in ESP (the goats), tend to score significantly below chance compared to subjects who express a belief in ESP (the sheep). These goats are statistically naive subjects, who believe that scoring poorly (below chance) constitutes a demonstration that there is no ESP. Thus their psi-missing serves to reinforce their belief system; it is motivated.

Malfunctioning psi-missing would simply imply that a subject can somehow get the ESP "receptor mechanism" operating by trying, but there is a malfunctioning process somewhere between the receptor mechanism and his actual calls that creates errors. But there is no motivated need to score low; it is simply malfunctioning of the whole system involved.

What would happen to psi-missers put into an immediate feedback ESP training situation with instructions to improve their performance? For the malfunctioning psi-misser, we would probably see exceptionally high variability of scoring, for the feedback would allow him to start to affect the ESP-guessing system, crudely at first, then more precisely. Thus the malfunctioning psi-misser might be able to eventually correct the malfunctioning, and so begin to learn after initial variability.

Prediction of the performance of the motivated psi-misser put into an immediate feedback ESP training situation is more difficult. Here we are dealing not just with the mechanics of learning, but with unconscious motivation, cognitive dissonance, and styles of resolving conflict. If the need to miss dominated performance, e.g., and the subject got progressively *worse*, he would both realize that he was not living up to his conscious commitment to the instructions to try to get better, and/or he would suspect he was using ESP. I could predict great variability of scores, but cannot be more specific in predicting at this time.

The performance of the most outstanding psi-misser in the pilot study is plotted in Figure 2. She scored an average of 3.07 hits per run of 40, when 4 would be expected by chance ($P = .006$).

Was she a motivated psi-misser, or a malfunctioning psi-misser? We cannot tell from the performance curve alone. The extreme variability, mainly in the first 14 runs, may reflect an erratically malfunctioning process (or processes) involved in ESP and calling, or it might reflect swings due to emotional ambivalence as some learning began. If we fitted a regression line to these first 14 runs it would have an essentially zero slope of +.08, but then we have a much less variable performance curve that shows a significantly ($P < .05$) positive slope of +.18. Was the subject's motivated psi-missing resolved by run 14, so she no longer needed to miss and could now allow herself to learn, or had she finally started to learn to stabilize

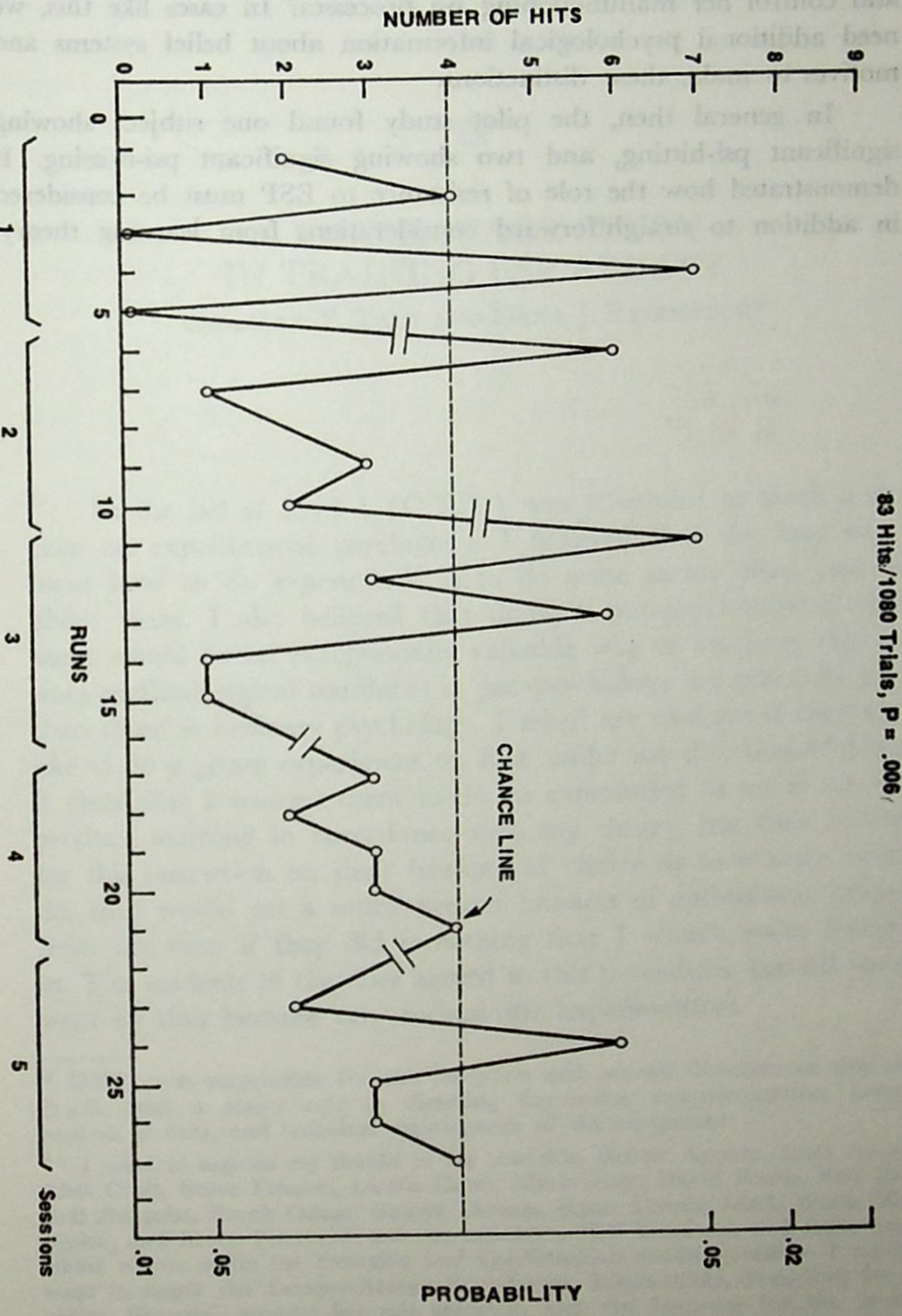

FIGURE 2. — Performance of pilot study subject PS9, a psi-misser.

and control her malfunctioning psi processes? In cases like this, we need additional psychological information about belief systems and motives to make these distinctions.

In general then, the pilot study found one subject showing significant psi-hitting, and two showing significant psi-missing. It demonstrated how the role of resistance to ESP must be considered in addition to straightforward considerations from learning theory.

IV

A THREE-STAGE STUDY IN TRAINING ESP ABILITY

CHARLES T. TART AND DANA J. REDINGTON*

In the fall of 1973 I (C.T.T.) was scheduled to teach a small class on experimental psychology. I believed that the best way to learn how to do experiments is to do some rather than just read about them. I also believed that doing a parapsychological experiment would be an exceptionally valuable way of teaching this class, since methodological standards in parapsychology are generally higher than those in ordinary psychology. I asked my students if they would like to do a group experiment on ESP under my direction.** I made it clear that I wanted them to do an experiment to see if we could produce learning in accordance with my theory, but that in return for this restriction on their freedom of choice as to exactly what to do, they would get a much greater amount of enthusiastic attention from me than if they did something that I wasn't really interested in. The students in the class agreed to this procedure. Indeed, as time went on they became very enthusiastic experimenters.

* C.T.T. was responsible for the inception and overall direction of this study; D.J.R. took a major role in directing day-to-day experimentation, computer analysis of data, and technical maintenance of the equipment.

** I want to express my thanks to my students, Hector Aponte, Scott Archbold, Alan Croft, Bruce Frankel, Laurie Gates, Mark Glatt, David Kraus, Eric Larsen, Judi Norquist, Frank Odasz, Gaines Thomas, Ryan Unruh, Mark Watts, Wanda Welch, and Bruce Westlund, and my assistants, Neil Goodman and Irene Segrest, whose efforts made the Selection and Confirmation Studies possible. I especially want to thank the Parapsychology Foundation, Eileen Coly, President, for providing financial support for this research, and the Institute for the Study of Human Knowledge, which provided the administrative structure for the financial support.

Experimenter Characteristics:

Since I strongly believe that the experimenter is very much a part of every experiment, it is necessary to say something about my relationship as principal investigator to the other experimenters, and later, about the relationship of the experimenters to the subjects. My relationship to the experimenters was bounded by the fact that I was a professor and they were students, with the constant pressure of grades in the background. I made it clear that I didn't like to give grades and was well aware of all their shortcomings, but that as long as everyone worked enthusiastically they would certainly get a B or an A, as my tests would not be difficult. This was made clear at the beginning of the class, with an option to students that if this was not acceptable procedure, if they did not want to do a lot of work on the experiment, they should not take the class. The class was not a required one, so the students had real choice in the matter.

In general, I acted in an open, friendly manner, and with a good deal of personal enthusiasm about the importance and significance of the experiment we were doing. I balanced this with exercises designed to stimulate the students'/experimenters' critical faculties about parapsychological matters, and a constant emphasis on the total honesty and highest methodological standards required for ESP work. I enthusiastically presented my 1966 theory that feedback would probably lead to learning, but also pointed out that it was not yet proven. I deliberately created an atmosphere, nevertheless, that it was almost certainly true, and we would have the opportunity to confirm or deny it in an important way. We planned all the detailed steps of the experiment together, discussing a very wide variety of options, and had an enthusiastic, cooperative relationship.

D. J. Redington was also a student in the class, which further helped in bridging any teacher-student gap.

General Procedure:

The general plan of the study we eventually put together is shown as a flow chart in Figure 3. Given that we needed individuals who could already show some ESP in order for the reinforcement to be effective, as called for by the theory, we realized we needed an initial phase (hereinafter called the Selection Study) to screen very large numbers of individuals and select only those who showed significant signs of ESP. Then we would need a second confirmatory phase (hereinafter called the Confirmation Study) in which to confirm that the individuals we had actually selected did indeed have ESP, rather than having scored high only by chance, as is bound to happen in testing very large numbers of subjects. Subjects who did well in this Confirmation Study would go on to the third phase (hereinafter referred to as the Training Study) where they would receive 20 runs of 25 trials each with immediate feedback, in an attempt to increase their ESP. We realized that 20 runs was probably much too short, but this was the compromise we had to make, given the reality of the academic quarter system and the time commitments of both experimenters and subjects.

We shall now consider each phase in detail.

SELECTION STUDY

The purpose of this first study was to find subjects who had demonstrable psychic ability. Since we considered such ability relatively rare, and our resources for screening subjects were limited, we decided to follow two procedures. The main procedure would be that of doing brief card guessing tests in large UCD classes, and the minor procedure would be to individually test some people, who, for one reason or another, the particular experimenter believed might have psychic ability.

For the main selection procedure, the experimenters worked in subgroups of three or four, and carried out ESP card guessing tests in classes whose size ranged from 20 to 400. The two decks of target cards consisted of ordinary playing cards which had had all the face cards and all the numbered cards from six and up culled from them, i.e., each became a deck of 25 cards with five aces, five twos, five threes, five fours, and five fives. Each target deck was thoroughly randomized by hand immediately before the class testing. Subjects were instructed that only the number was the target, the suit could be disregarded.*

Having obtained permission from the class instructor beforehand, the experimenters would come in ten to fifteen minutes before

* One subgroup used the 25 Zener card deck in their testing: statistically this procedure is identical with the main one, only the particular symbols used being different.

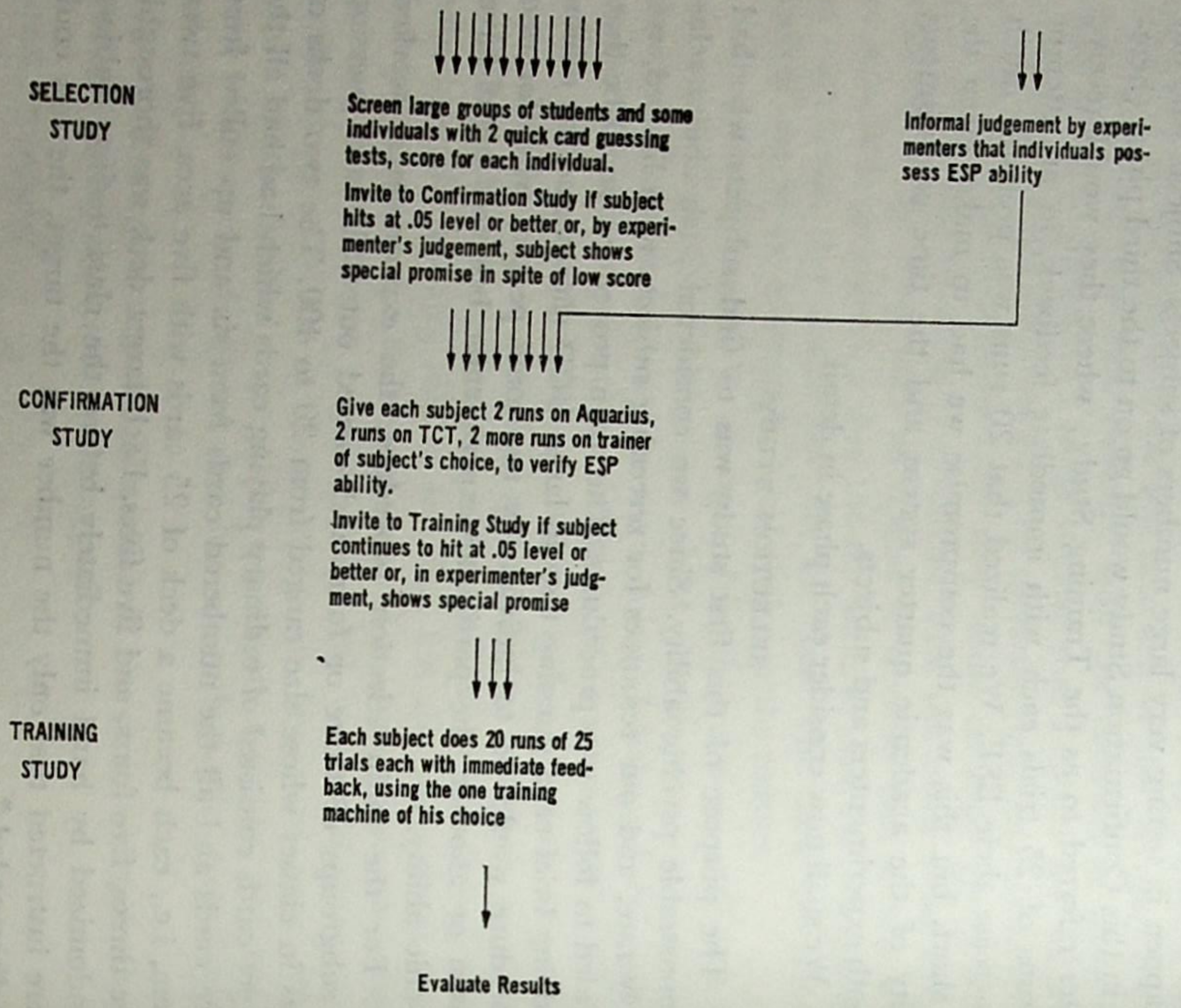

FIGURE 3. — Flow Chart.

the end of the class. While one experimenter gave a very brief (two or three minutes) talk on ESP, the purpose of this study, and instructions for the test, the others passed out response sheets to the students. The students had the option of not participating if they wished, but very few took this option. The students were told that this was a general test to see how much ESP we could find and, if they did very well on it, they might be contacted later for individual experimentation.

For the actual testing, the first run was designated a telepathy run, i.e., two experimenters acted as senders (agents) and looked at each card. A third experimenter, who could not see the cards and did not know their order, called a time signal approximately every five seconds so that the senders would look at a new card, and the students would have had a chance to put their response down. This was too fast a pace for comfortable working, but generally had to be adhered to because of the time limitations at the end of classes.

The second run was a clairvoyance run, i.e., a card was removed (face down) from the pack every five seconds, but it was not looked at. The score sheets were then collected, and the students departed for their next class. Within a few days a score sheet giving each students' correct number was posted in the classroom so that the students could have some feedback on how they had done.

Although the rushed conditions were far from psychologically optimal for eliciting ESP, we went to great pains to avoid giving any sensory cues, so that any high scores would have to be attributed to ESP and/or to purely statistical fluctuations.

Results:

Because of the delay of over six months between collecting the data and analyzing it, some data sheets were, presumably, lost. We say presumably because we do not have Selection Study data sheets for every subject who completed the Confirmation Study and who completed the Training Study: since a few subjects in these latter studies were informally selected by individual experimenters who thought the subject possessed high ESP abilities for reasons other than participating in and scoring highly in an earlier study, the presumably lost data sheets may never have existed in the first place for some subjects.

Although we feel it is likely that some data sheets were actually lost, it was also clear that this would probably not represent a random losing of data sheets, but a systematic loss. Experimenters pulled data sheets of high-scoring subjects out of various tested groups in order to contact them for later testing, so there was a bias toward the data sheets of better subjects getting lost. This would tend toward an underestimation of the results of the Selection Study.

For these reasons, we shall not present the exact results of the Selection Study here, although they may be analyzed for a future publication. Briefly, over 1,500 subjects were tested: since many more subjects than would be expected to by chance met the individual criteria discussed below for passing on to the Confirmation Study, there was clearly a fair amount of ESP in the group results as a whole.

The formal criterion for being selected for the Confirmation Study was that a subject had to score at at least the .05 level of significance on one run, or on his total score on the two runs of the Selection Study. In practice this meant a score of nine or greater on either run, or a score of 15 or greater combined for the two runs. However, if an individual experimenter chose to believe that a subject had ESP ability even if it didn't show up in the Selection Study, he could run that subject through the Confirmation Study. A common criterion applied by experimenters was the presence of several hits in a row, or displacement on to the previous or next target, even if the total score did not meet the formal criteria.

Of the 70 subjects who participated in the Confirmation Study, 23 did not participate in the Selection Study at all, but began with the Confirmation Study procedure because individual experimenters had various reasons to believe these subjects had ESP ability. Of the 47 subjects who did participate, 24 scored at the .01 level of significance or better, 6 at the .05 level, and 17 had non-significant formal scores. There were other significant-scoring subjects in the Selection Study who, for one reason or another, did not choose to participate in the Confirmation Study.

In general, the Selection Study was quite successful in terms of finding a large number of subjects who met our criterion of showing significant ESP. Considering how rushed it was, it was very successful.

CONFIRMATION STUDY

The purpose of the Confirmation Study was to eliminate from further training those few subjects who had met the .05 significance level (or informal) criterion of the Selection Study by chance alone: the likelihood that any subject would meet that criterion in the Selection Study *and* score significantly in the Confirmation Study by chance alone is very small. It also served to adapt the subjects to the laboratory setting in which they would be working in the Training Study, as well as giving us a more adequate sample of each subject's ESP ability. We shall use this more adequate sample in later analyses as a rough measure of a subject's initial talent level before beginning the Training Study.

The Confirmation Study was the first introduction of the subjects to the two training instruments, so these instruments will now be described.

The Aquarius Model 100:

The Aquarius Model 100 ESP trainer is a commercial instrument manufactured by Aquarius Electronics Company of Albion, California. It is based on a machine built earlier by Russell Targ and David Hurt (Targ & Hurt, 1972). It is an attractive machine, built in a hardwood case. There are four non-illuminated slides with a non-illuminated push button by each, plus another push button in the center of these buttons labeled Pass. Figure 4 shows the panel arrangement. We modified the target slides provided by the manufacturer to ones we believed more obviously discriminable, viz., a cross on a blue background, square on yellow, star on red, and circle on green.

At any given time, the subject knows that the machine has randomly selected one of the four slides as the target, even though it is not lit. The subject's task is to push a button corresponding to the slide he thinks has already been selected.

The randomization is done entirely by the machine by what is known as an "electronic roulette wheel" circuit. A block diagram of the entire machine circuit is shown in Figure 5. The electronic roulette wheel consists of an oscillator oscillating at approximately one million Hertz (cycles/second). Its output drives a counter which counts from one to four and repeats; so in a single second each output is selected

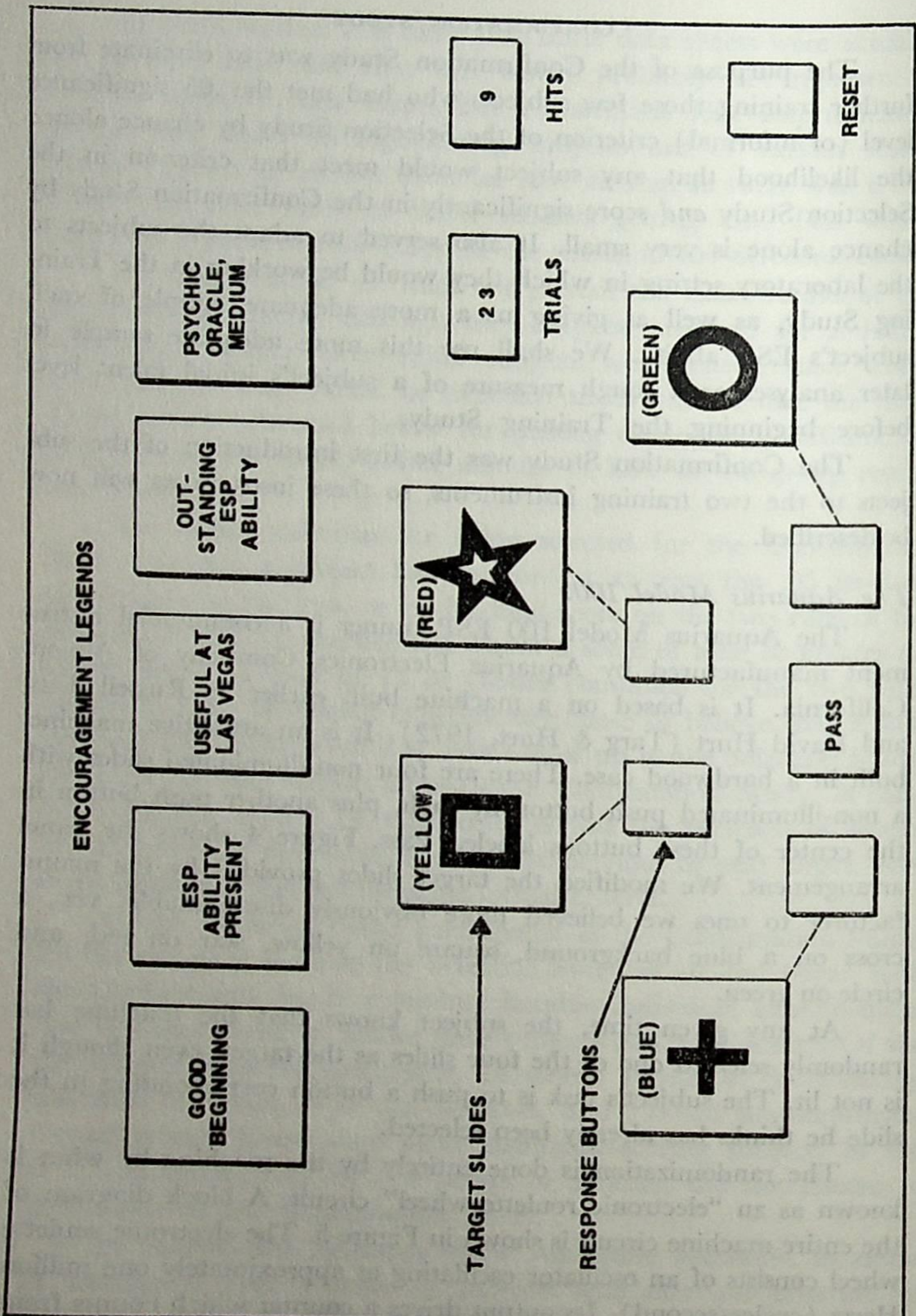

FIGURE 4. — Panel layout of the Aquarius model 100 ESP Trainer.

about two hundred and fifty thousand times. The cycling of the counter, 1-2-3-4-1-2-3- - - -3-4-1-2-etc., is like the spinning of a roulette wheel. The length of time a subject holds down his response button on the previous trial determines the length of time that the oscillator is connected to the counting circuit, and thus the ultimate outcome of the selection. Since human response time is about four orders of magnitude greater than the speed at which the oscillator oscillates, as well as being subject to random factors which are also several orders of magnitude greater than the period at which the oscillator cycles, this results in a totally random selection, with an equal probability for each of the four targets.

The machines are checked for randomicity before being shipped from the factory. The factory test procedure is that each of the four targets must appear approximately equally in a run of 700 trials, i.e., each target does not show a statistically significant deviation from appearing one-fourth of the time. The machine is also tested by the runs tests (Siegel, 1956) to be sure that there are no sequential effects, i.e., that each target selection is totally independent of the previous target selection.* Our tests of the Aquarius shortly after the end of the Training Study showed it to be still satisfactorily random.**

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* About one-third of the way through the training phase, the Aquarius machine broke down and began repeating one target with a very high frequency. The experimenters immediately spotted this and the data from these runs were discarded. The machine was repaired at the factory, and showed satisfactory randomicity before being used again.

** Randomicity was tested for both training machines by recording 1,000 consecutive targets. These data were tested with a Chi-square test for equal frequency of single targets, to be certain no particular targets were favored or under presented, and with a Chi-square test for equal frequency of all possible pair sequences of targets to be sure of serial independence.

We also decided, before beginning the study, that the randomicity tests were to be carried out on the equipment before and after the experiment, but not with data obtained when subjects were actually trying to use ESP. Since we do not understand how ESP works, and since the literature shows that subjects often use extrasensory and psychokinetic abilities in ways other than what they are consciously intending to do, we thought it might be possible for subjects to unknowingly affect the random generators psychokinetically during the actual experiment. We have since learned that Schmidt and Pantas (1972) have demonstrated precisely this by obtaining significant results in a study where subjects believed they were *guessing* the state of the electronic random number generator but actually they had to psychokinetically affect it in order to score above chance. A detailed analysis for such effects in the present study will be presented in a future publication by Lila Gatlin.

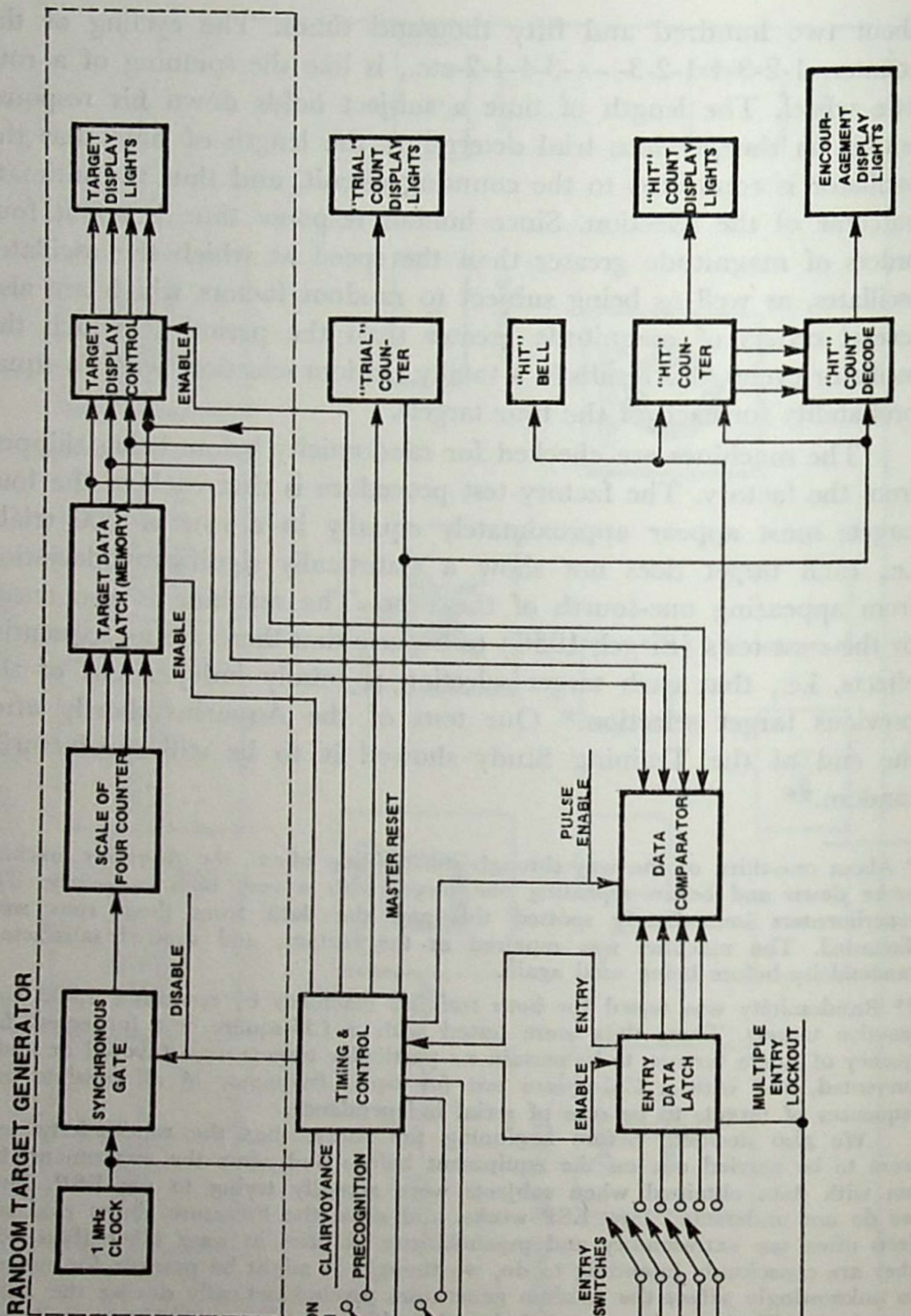

Figure 5. — Block diagram of the Aquarius model 100 ESP teaching machine. Reproduced by permission of Aquarius Electronics.

As soon as a subject pushed his response button, the slide (and its corresponding button) that the machine had selected lit up, giving the subject immediate feedback as to whether he had been right or wrong and what the target had been. In addition, if the subject had selected the right button, a pleasant-sounding chime inside the machine sounded. This was the immediate feedback and reinforcement to the subjects, important in the application of learning theory. In addition, the Aquarius machine has encouragement lights: after six hits a transparency lights up, saying "Good Beginning"; after eight hits one lights up saying "ESP Present" (this is not actually at a statistically significant level); at ten hits it says "Useful at Las Vegas"; at twelve hits it says "Outstanding ESP Ability"; and at fourteen hits it says "Psychic Oracle, Medium."

The machine is designed for runs of 25 trials: a trial counter keeps count of all trials, as well as a hit counter counting the hits, and locks the machine at 25 trials. In our procedure, the subject then pressed a signal button and the experimenter returned to the room to read the hit total from the counter.

Our experiment was procedurally a telepathy experiment, although technically we would say it was a GESP experiment since we did not know if the subjects got their ESP information from the senders' minds or the state of the machine itself. To make this a telepathy experiment, a special indicator panel showing which target had been selected was looked at by the experimenter, acting as sender (agent). It also showed which response button the subject pushed. Figure 6 shows the room arrangements used. The subject was in a room by himself with the Aquarius trainer (there was no way he could tamper with it), and the experimenter-sender watched the telepathy adapter panel in a room approximately 70 feet away. Two heavy closed doors and 69 feet of carpeted corridor separated the sender and the subject, and, since the sender kept quiet while attempting to concentrate, there were no sensory cues for the subject to respond to.

Ten-Choice Trainer Machine:

Figure 7 shows the subject's console of the ten-choice training instrument (TCT, Ten-Choice Trainer). This console, about two feet across, was in a horizontal position in front of the seated sub-

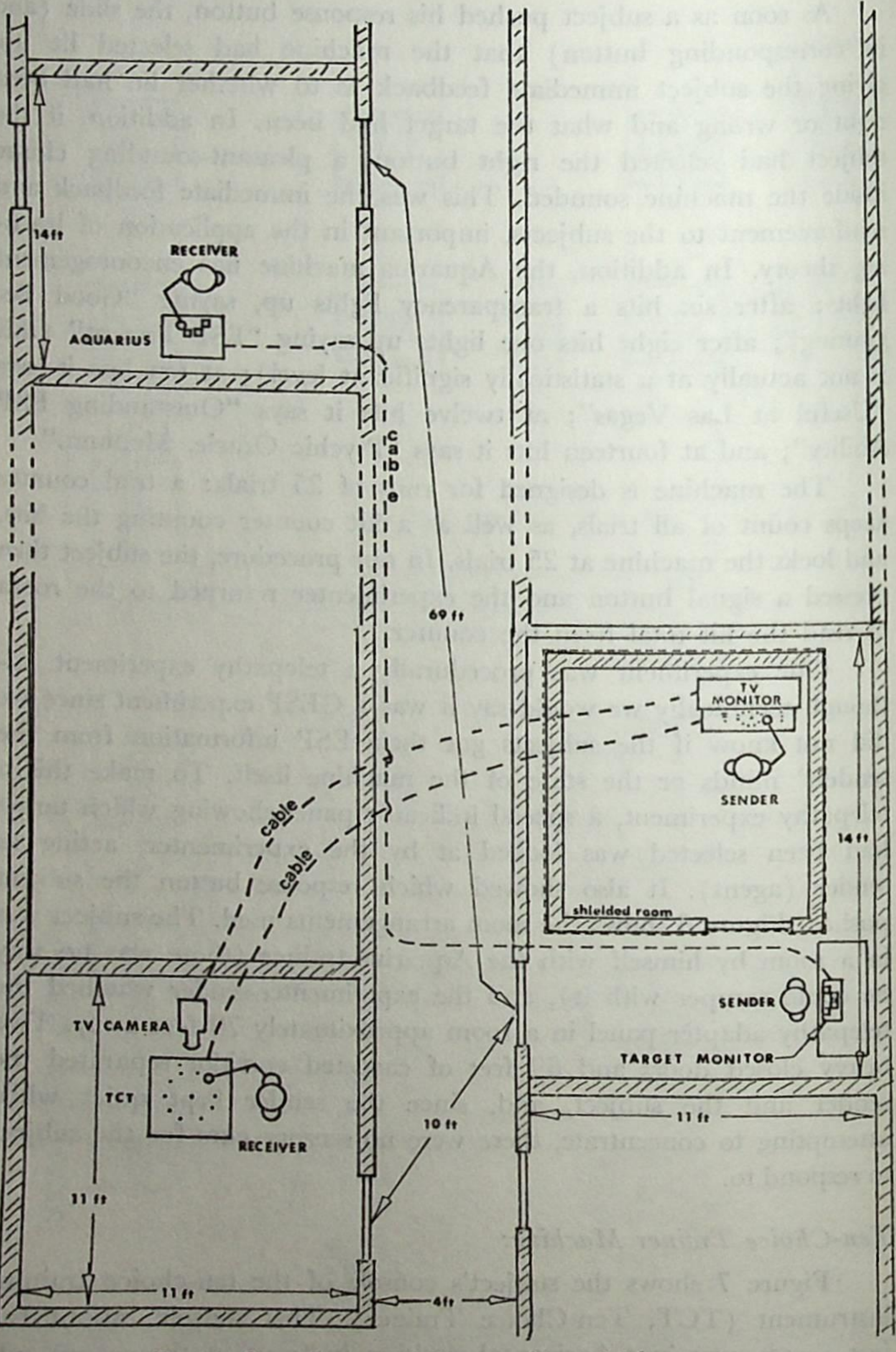

FIGURE 6. — Layout of the experimental laboratories.

ject. On any given trial, he was faced with a circle of ten unlit pilot lamps. When the signal lamp in the center of the circle, the Ready Light, came on, he knew that his experimenter-sender in a different room had selected one of the ten unlit pilot lamps as a target and was trying to send it. A playing card from ace to ten was beside each unlit pilot lamp, so the number of the playing card was an additional identifier of the selected target. After the Ready Light came on, the subject had to decide which light he thought had been selected as target and push the button beside it. As with the Aquarius machine, the correct target then immediately lit and, if the subject had chosen the correct target, a pleasant chime sounded inside the console. Thus again the subjects received immediate and complete feedback on the correctness or incorrectness of their choice.

The experimenter's TCT console was basically identical to the subject's: there was an identical-size circle of ten pilot lights and a switch beside each to switch it on if it had been chosen as a target. The console and associated equipment are shown in Figure 8. This console also contained a trials and hits counter. As with the Aquarius machine, the experimenter-sender also got immediate feedback as to what target the subjects had chosen and its correctness or incorrectness. If the response is correct, a red lamp also lights on the experimenter's console. Technical details of the TCT are presented in Appendix 1. The TCT was also used in runs of 25.

In order to generate the target sequence for each run, a commonly used card randomization procedure, known as an open deck, was used until an electronic random number generator was built to replace it. The experimenter had a large flat box beside him in which the ace to ten cards from ten identical-backed decks were placed, face down. This total deck of 400 cards, containing 40 aces, 40 twos, etc., was roughly shuffled with both hands by sliding the cards (always face down) about, under, and over each other for a minute or two. The experimenter then blindly pulled a batch of face-down cards from this large pool, the batch roughly to contain 30 to 40 cards. Although there were only 25 trials in a run, the extra cards were in case the subject used the Pass option.

This blindly selected subdeck was then dovetail shuffled by hand several times, without the experimenter looking at the cards, to further randomize the order. The subdeck was then put face down

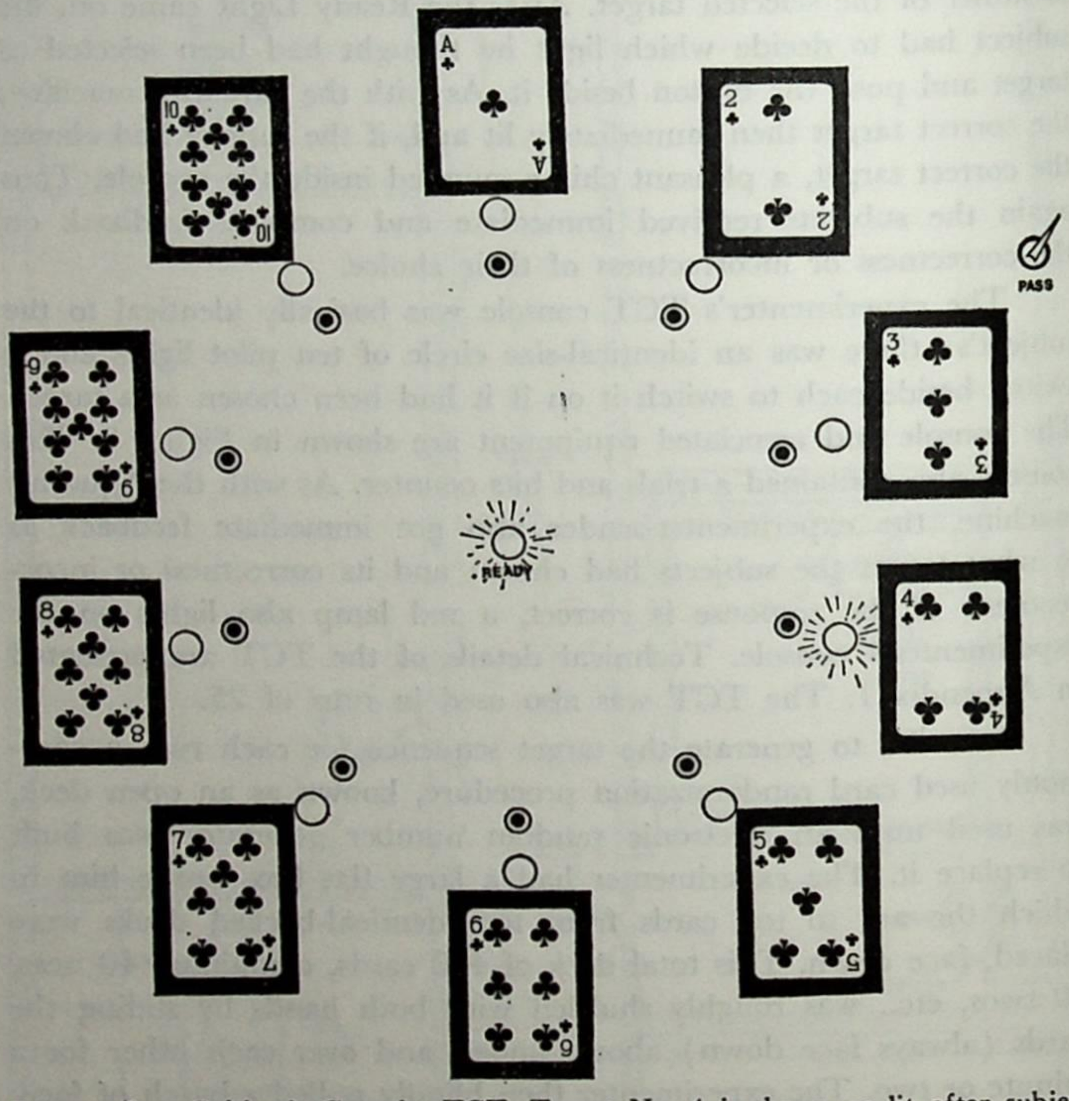

Figure 7. — Subject's Console, TCT. Target No. 4 is shown as lit after subject has made his response.

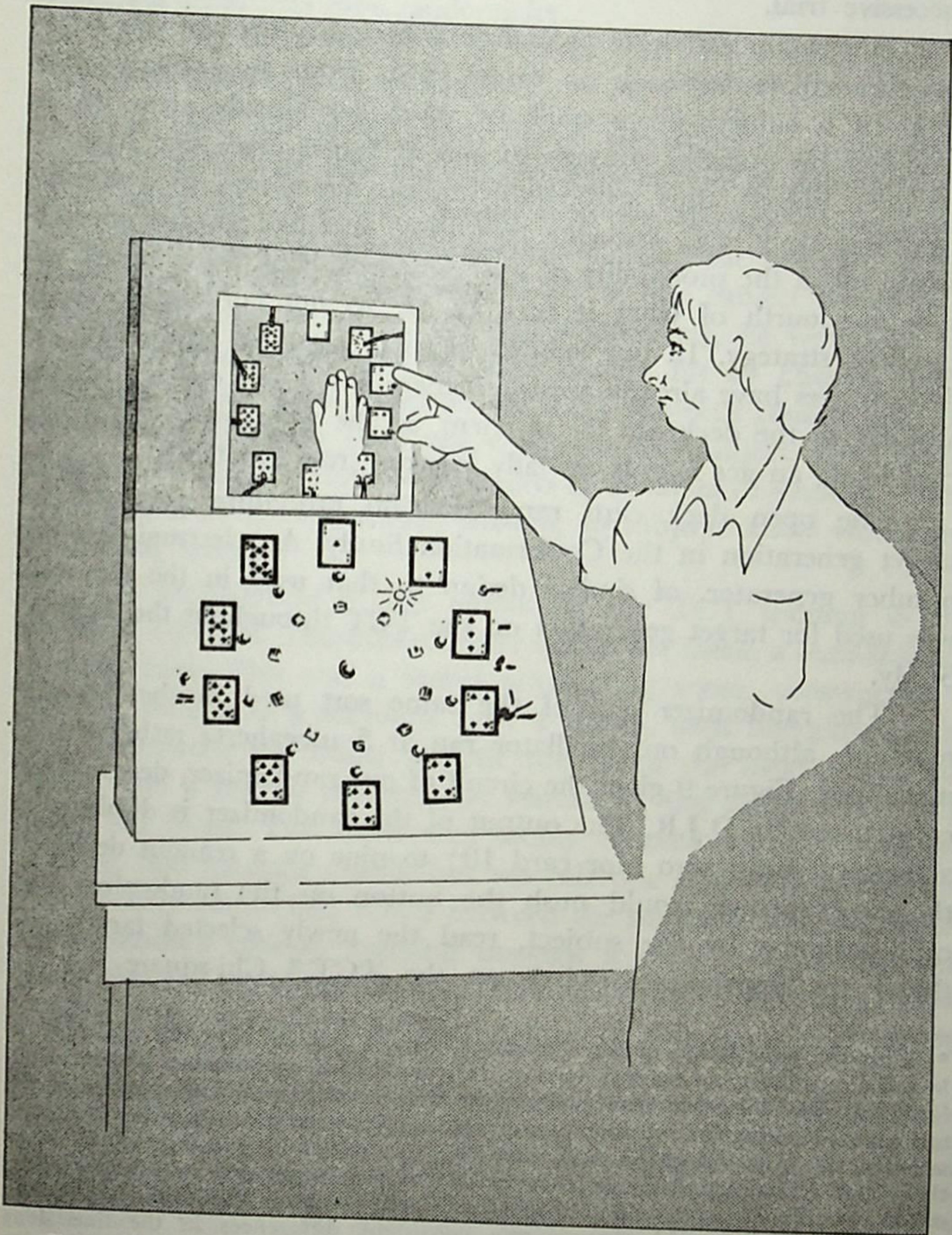

FIGURE 8. — Experimenter/Agent's Console, TCT Target No. 2 has been selected.

beside the experimenter's TCT console, and he would turn over the top card, regularly down through the deck, for the target on each successive trial.

This rather elaborate procedure is necessary because you cannot give immediate feedback on target cards from an ordinary closed deck: if a subject keeps track of what has already come up, he can alter his guessing strategy to aim at target cards that have not yet been played, thus artifactually raising his scores. In a 40-card, ace-to-ten deck, e.g., knowing that three aces had already appeared would mean the probability of any remaining card being an ace was only one-fourth of what it used to be, so not guessing ace is an excellent strategy. In our subdeck drawn from ten decks however, if three aces have already appeared there is not just one ace potentially left in the deck but 37 of them, so the probability of the next card being an ace is only trivially lowered from one-tenth.

The open deck card randomization procedure was used for target generation in the Confirmation Study. An electronic random number generator, of similar design to that used in the Aquarius, was used for target generation on the TCT throughout the Training Study.

The randomizer was of the same sort used in the Aquarius machine, although our oscillator ran at 5 megahertz rather than 1 megahertz. Figure 9 gives the circuit of our randomizer, designed and constructed by D.J.R. The output of the randomizer is displayed as a numeral from zero (for card 10) to nine on a readout device, so the experimenter would push the button on the randomizer after each response by the subject, read the newly selected target, and throw the appropriate switch on the TCT.* Chi-square tests for

* After the completion of the Training Study, I realized that this procedure allowed a possibility of sensory cueing. If a particular experimenter showed a differential time delay between reading the output of the random number generator and switching on various newly selected targets, a subject might become sensitive to this and artifactually increase his score. This is quite unlikely, as there was a variable delay between writing down target and response, switching off the previous target, and pushing the selection button on the random number generator, which would obscure any consistent differences in the time delay between reading the output of the random number generator and switching on the newly selected target. Indeed, El reports in Chapter V that he took variable lengths of time to switch on targets. Nevertheless, we hypothesized that there might be a longer delay in switching on targets whose switches were furthest from the random number generator (thus requiring a longer hand motion by the

equal frequency of selection and independence of pairs for sequencing effects on 1,000 trial blocks, taken before the introduction of this randomizer into the experiments and after their end, showed no significant departures from randomicity.

Differences between Instruments:

The TCT and its use differed from the Aquarius machine in a variety of ways. First was the one-tenth probability of any particular target being the one selected, rather than the one-fourth probability. This means that only two or three hits (2.5 on the average) would be expected by chance in a run of 25, so the subject would have fewer hits and more misses. To put it positively, he would be less frequently falsely reinforced through having hit by chance. There were no encouragement lights on the TCT subject's console, and the hit and trial counters were not visible to the subject, only to the experimenter-sender. There were charts of P values of various scoring levels posted by each machine, though, so subjects knew when they were doing well.

The arrangement of the rooms for the TCT training is also shown in Figure 6. The experimenter-sender sat inside a semi-shielded Faraday cage. This was a sound attenuating room, constructed of plywood walls over a standard 2 by 4 frame, with fiberglass insulation in between the walls, acoustic tile lining the inside walls and ceiling, and a rug on the floor. A ventilating fan made a soft hum inside the room. The room was totally covered with thin copper sheeting, and its door closed, but we call this *semi*-shielded because the necessary connecting cables between the subject's and the experimenter-sender's console, running through a small hole in the wall, meant that the shielding lost some of its integrity, electromagnetically speaking. The electrically shielded aspect of this room may be sig-

experimenter) that would make these targets more discriminable to subjects or, more generally, that El might have inadvertently used some consistent code of this sort which would have cued his subjects and thus inflate scores. We examined the results of the five subjects of El who scored significantly on the TCT in the Training Study, but found no consistent differential pattern at all across these subjects as to which targets they scored best or worst on, so this theoretically possible hypothesis received no empirical support. Nevertheless, this possibility should be eliminated in future work, and in Appendix 1 a simple modification of the TCT is described which makes the time delay between switching off one target and selecting the next uniform, and beyond the experimenter-sender's control.

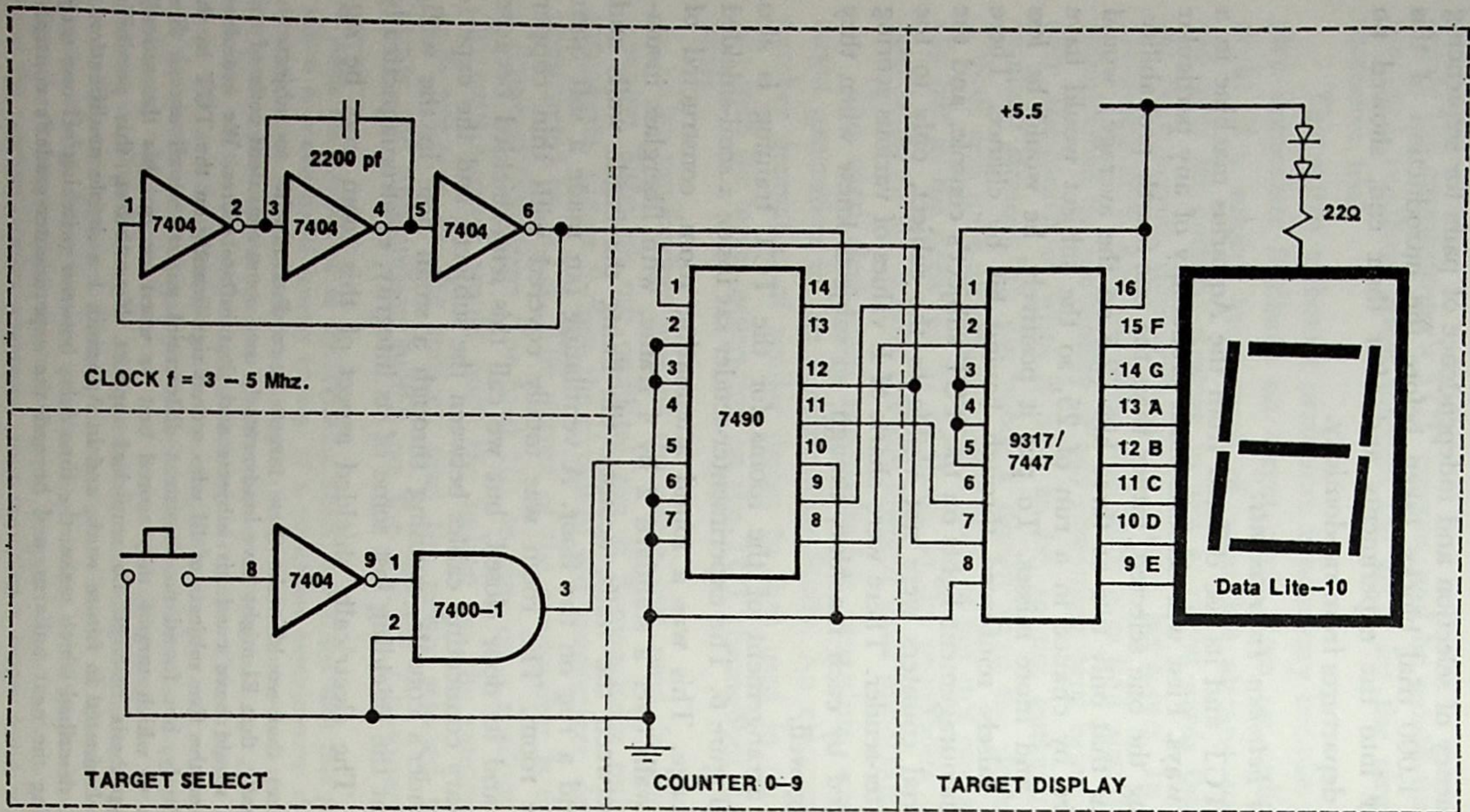

FIGURE 9. — Circuit of the random number generator used with the TCT. Integrated circuits are Signetics types 7404, 7400, 7447, and 7490, and the seven-segment display is a Litronix Data Lite 10.

nificant for, even though the shielding was imperfect, Puharich (1973) and Vasiliev (1963) reported that shielding increases ESP scoring. This inner room also rested on rubber tires to shock mount it from building vibration. The experimenter-sender was thus isolated from the subject by three closed doors, partial electromagnetic shielding, and about 20 feet distance.

Because of the circular arrangement of the target lights on the TCT, many subjects would slowly scan their hand around the periphery of the circle looking for "hot" and "cold" sensations or the like in trying to make their choice.* To give the experimenter-sender more feedback on this aspect of the subject's behavior, all through the Confirmation and Training Studies a closed-circuit TV camera (video only) was suspended above the subject's console, transmitting to a screen above the experimenter's console, so that the experimenter could watch the subject's hand motions and tell if he was getting closer to or further from the target, when he hesitated, etc. This was the kind of feedback to the sender that I argued (Chapter I), probably made the old Brugman's (1922) experiment so successful. To facilitate the experimenter keeping the correct target in mind, we put a transparent template over the TV screen which incorporated a small light-emitting diode over the TV image of each target: when the experimenter actually threw the switch to select a target, the light-emitting diode on the screen showed a red glow over the appropriate target, so the experimenter could concentrate fully on the TV screen. The experimenters reported that when a subject used this circular scanning, they got very involved in trying to send "hotter" and "colder," "push now," "go back," etc., kind of thoughts, as well as or instead of the number of the target.

Note that for the Aquarius machine the speed of response was controlled by the subject: he could press the buttons on the machine

* The "feel" some subjects searched for was not a perception of the DC electrostatic field from the selected (but unlit) target lamp. The circuit of the TCT (see Appendix 1) had the base filament connection of all target lamps connected to a common line, with a lamp being lit after a response by connecting the common line to the —24VDC lead of the power supply, so the electrostatic field at each of the ten unlit target lamps would be identical. Target lamps were partially recessed in a metal panel and covered with a plastic diffusing dome. Probing with a finger-size electrode, connected to a VTVM, shunted with body-equivalent resistance to ground, and capable of detecting 10 millivolt potentials, showed no measurable potentials on either the TCT or Aquarius machines.

as rapidly as he desired. This could be very frustrating to the experimenters, as they could make no real attempt to send under rapid response conditions.* On the TCT, the speed of response was controlled by the experimenter: there was always a lapse of several seconds between the subject's indicating his response and the ready light for the next trial coming on, as the experimenter needed time to write down the subject's previous response, select the next target (either from the open deck or from the randomizer), and then manually throw the appropriate control switch.

Experimenter-Subject Interaction:

We attempted to create a relaxed, comfortable, informal atmosphere for both the Confirmation and Training Studies. Thus the subjects' rooms were quite comfortable and were decorated with India print bedspreads: they were pleasant rooms by the standards of contemporary students. Subjects were shown the whole experimental setup the first time they came to the laboratory and all procedures were explained fully to them. We tried to always take an attitude of being totally open and friendly with the subjects. Early in the course I had discussed the covert hostilities that subjects can build up in the traditional, "colonial" paradigm of psychological experimentation, drawing on the experimenters' own experiences as subjects in other psychology experiments to make this personally real.

For the Confirmation Study, each subject was given a total of 6 runs of 25 trials each, with the same experimenter as sender all the way through. Two runs were on the TCT, and two on the Aquarius: which came first was decided by the unpredictable vagaries of when the rooms were available to fit a particular experimenter's and subject's schedule. Then the subject had two more runs on whichever machine he chose to do two more on.** At the end of each run of 25, the experimenter would go back to the subject's room, talk to him and encourage him, and generally keep up a positive relationship.

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* The manufacturer can now modify the Aquarius trainer so the experimenter/agent must push a button to select the next target.

** As mentioned before, procedurally these were telepathy runs, although we cannot rule out direct clairvoyant perception of the state of the machine. With the Aquarius, subjects may often have been using clairvoyance simply because by working very fast they did not give the experimenter-senders any real chance to focus on sendings.

At the end of the Confirmation Study, each subject was thanked and told that he might be contacted further for more extensive work. Subjects almost universally found the procedure quite interesting and were glad to participate. No subjects received any monetary rewards for participation in the Confirmation or Training Studies: a few received a small amount of credit for experimental participation in elementary psychology courses they were taking.

Results of the Confirmation Study:

Table 2 presents the overall results of the Confirmation Study.

TABLE 2

CONFIRMATION STUDY RESULTS

	AQUARIUS			TCT		
	Hits	*Runs*	*Subjects**	*Hits*	*Runs*	*Subjects**
All Subjects	1501	230	70	635	191	68
Expected/chance	1437.5			477.5		
Deviation	+63.5			+157.5		
Z score	1.93			7.59		
P (1-tailed)	.03			$1x10^{-14}$		
Subjects completing Training Study	484	70	21	225	55	20
Expected/chance	437.5			137.5		
Deviation	+46.5			+87.5		
Z score	2.57			7.87		
P (1-tailed)	.006			$1x10^{-15}$		
Subjects not completing Training Study	1017	160	49	410	136	48
Expected/chance	1000			340		
Deviation	+17			+70		
Z score	.62			4.00		
P (1-tailed)	NS			$6x10^{-5}$		

* While all subjects were supposed to be tested on both the Aquarius and TCT, occasionally subjects did not complete testing on both, so the number of subjects in the Aquarius and TCT analyses differs.

Seventy subjects were tested on the Aquarius machine and 68 on the TCT. Overall, there were 1501 hits on the Aquarius when only 1437.5 were expected by chance, a deviation of 63.5 hits over chance. This would occur by chance approximately 3 in 100 times, so GESP was being demonstrated on the Aquarius machine. For the

TCT, there were 635 hits when 477.5 would be expected by chance, a deviation of 157.5 above chance. This has a probability of 10^{-14}. These are exceptionally significant results, showing ESP operating with the TCT. This begins a pattern which showed up in the rest of the studies, viz., of results on the TCT generally being more significant than on the Aquarius.

Table 2 also shows the overall results broken down into two groups of subjects, subjects who later went on to complete the Training Study and those who either did not go into the Training Study at all or started the Training Study but did so few runs that they did not complete it. The not-going-on group, of course, would contain a fair number of people who showed no ESP in this Confirmation Study and thus were not eligible to go on to the Training Study.

For those subjects not going on and completing the Training Study, only chance results were obtained on the Aquarius machine. For the TCT, however, there were 410 hits when only 340 would be expected by chance, a deviation of 70 above chance ($P = 6 \times 10^{-5}$).

For subjects who did go on to complete the training phase, the results of the Confirmation Study were very significant. For the Aquarius, there were 46.5 more hits than would be expected by chance alone ($P = 6 \times 10^{-3}$), and for the TCT there were 87.5 hits more than expected by chance ($P = 10^{-15}$).

Learning in the Confirmation Study:

The Confirmation Study procedurally constituted a short training period, since immediate feedback was given, so we can ask the question whether there was any evidence of learning in it. Learning theory would not make a clear prediction for so brief a period, given the contrary effects of adaptation, but it is interesting to look at empirically. To examine this, we looked at whichever machine the subject had done four runs on and compared scores on the first pair of runs with those on the second pair of runs. This meant ignoring such niceties as whether or not the two runs on the other machine had come in between or later. For a few cases where a subject had actually done five runs instead of four (in spite of the instructions), we simply skipped the middle score. If there were six or more runs, the subject was not used in this analysis.

Table 3 shows the total number of hits in the first and second half of the Confirmation Study for all subjects, and then broken down for the subjects going on to complete the Training Study and those not doing so. For the Aquarius machine, by inspection, the

TABLE 3

LEARNING IN THE CONFIRMATION STUDY?

	AQUARIUS		TCT	
	First Half	*Second Half*	*First Half*	*Second Half*
All Subjects	543	554	191	159*
Subjects completing Training Study	195	205	69	64
Subjects not completing Training Study	348	349	122	95*

* P difference <.10 (2-tailed).

total number of hits in the first and second half is essentially the same. For the TCT, there is a suggestion (P<.10) of a decline in performance from the first to the second half of the Confirmation Study. This is not so, by inspection, for subjects going on to complete the Training Study, but for subjects not completing the Training Study, they dropped from 122 hits in the first half to 95 in the second half. A t test for correlated populations shows that this is almost a significant drop in mean score ($t = 1.78$, $df = 16$, $P<.10$, 2-tailed).* Perhaps the apparent difficulty of the TCT was too much for subjects who did not have a lot of ESP to begin with, so what ESP they had at first dropped off rapidly.

Did the Selection Study Predict Later Performance?

How well did Selection Study scores predict performance in the Confirmation Study? Would a really good scorer in one study remain a good scorer in the next, or what? To answer this question we must look at the correlation between subjects' scores in the two studies. Note, however, that because of the nature of the selection process, namely by usually taking only people from the Selection Study who

* A two-tailed statistical test is appropriate here for, in contrast to almost every other statistical test in this report, there was no *a priori* prediction of the direction of this difference.

were exceptionally high scorers, we reduced the range of variation and so automatically reduce the correlation coefficients, possibly obliterating significant relationships. Results are shown in Table 4, with Spearman correlation coefficients between mean scores of subjects in each study.

TABLE 4

CORRELATIONS, SELECTION/CONFIRMATION STUDIES

	Aquarius Performances		*TCT Performances*	
Subjects completing Training Study	–.13	(N=12)	.30	(N=11)
Subjects not completing Training Study	.26	(N=33)	.30*	(N=32)
All Subjects	.03	(N=45)	.22	(N=43)

* $P<.05$ (1-tailed).

It is of interest to note that subjects who went on to complete the Training Study generally showed strong scoring differences between the two machines they worked on in the Confirmation Study. There is a highly significant negative correlation ($r=-.69$, $P<.0005$, 1-tailed) between the mean score on one machine versus the other, although some subjects did well on both. For subjects who did not go on to complete the Training Study, the correlation was also negative ($r=-.25$), but insignificant.

TRAINING STUDY

In order to qualify for inclusion in the Training Study, the formal rule was that a subject must have scored at at least the .05 level of significance on at least one machine in the Confirmation Study, or on his or her combined scores on the two machines. As in selecting for the Confirmation Study, if an individual experimenter thought he had very good reason to continue a subject who did not meet these formal criteria, he was allowed to.

Forty-two subjects had at least one run in the Training Study. Seven of these had only one run each here and apparently had not been through the Confirmation Study (no data sheets), while 10 subjects had 2 to 14 runs on one or the other machine, sometimes dividing their runs between both machines. For the sake of accounting for all data, these improperly run and incomplete subjects' results will be analyzed in an overall look, but, in accordance with an *a priori* decision, only the subjects who completed all 20 training runs in the Training Study will be looked at in detail.*

The experimental procedure in the Training Study was basically the same as that of the Confirmation Study, except that each subject worked with only one machine of his choice for all 20 runs. Again, each subject had his individual experimenter,** and the experimenters felt they were successful in keeping up a friendly, informal relationship with their subjects through the experiment. Gaines Thomas' (E1) account of his relationships with his subjects, presented in Chapter V, further specifies the kind of experimenter-subject relationships we had.

Note however that while the experimental procedure was basically the same as in the Confirmation Study, the psychological conditions of this study were significantly different. In the beginning of the Training Study, subjects were informed that this was the important study; the others had been only preliminaries. They (the subjects) were *special*, and were expected to not only remain special, but we hoped that, by learning to use their ESP better, they would become even more special. Thus in spite of our efforts to keep things relaxed, the Training Study subjects were under a certain amount of pressure. Alterations in psychological conditions in ESP experiments have frequently been observed to change performance levels.

Sessions in the Training Study usually occurred irregularly, due to the vagaries arising from many experimenters needing to schedule the same room. Intervals between sessions ranged from a day to several weeks. The number of runs within a single session ranged from one to 13, depending on how fast a subject worked, which machine they were using, and whether the laboratory was available for only an hour (typical) or several hours.

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* After the study was completed, we discovered that one subject, S12, had done only 19 runs through experimenter oversight, but we decided to include his results anyway: this decision was made before any analysis had been carried out. As it turned out, exclusion of his results would not have materially affected our findings.

** The experimenters who ran subjects completely through the Training Study were Alan Croft, Bruce Frankel, Mark Glatt, David Kraus, Eric Larsen, Judi Norquist, Frank Odasz, Dana Redington, Gaines Thomas, Ryan Unruh, and Mark Watts. Irene Segrest assisted in all aspects of the study.

Overall Results of the Training Study:

Table 5 presents the results of the Training Study for all subjects run, and then a further breakdown into subjects who actually completed the Training Study and those who did not. For all subjects, results were highly significant. On the Aquarius machine, there were 2405 hits, a deviation of 161.25 above chance ($P = 2 \times 10^{-5}$). For the TCT, there were 828 hits, a deviation of 233 above chance ($P = 3 \times 10^{-24}$).

Breaking this down into subjects who did or did not complete this phase of the research, the subjects not completing the Training Study showed marginally significant results on the Aquarius machine and insignificant results on the TCT. Subjects completing the training, however, showed exceptionally significant results. For the Aquarius machine, there were 2006 hits, 137 more than chance ($P = 2 \times 10^{-4}$). For the TCT, there were 722 hits, where only 500 would be expected by chance ($P = 10^{-25}$).

Now let us consider the results in detail for subjects who completed the Training Study.

TABLE 5

	AQUARIUS			TCT		
	Hits	*Runs*	*Subjects*	*Hits*	*Runs*	*Subjects*
All Subjects	2405	359	21	828	238	21
Expected/chance	2243.75			595		
Deviation	+161.25			+233		
Z Score	3.93			10.07		
P (1-tailed)	2×10^{-5}			7×10^{-24}		
Subjects completing Training Study	2006	299	15	722	200	10
Expected/chance	1869			500		
Deviation	+137			+222		
Z score	3.66			10.46		
P (1-tailed)	2×10^{-4}			1×10^{-25}		
Subjects not completing Training Study	399	60	6	106	38	11
Expected/chance	375			95		
Deviation	+24			+11		
Z score	1.43			1.19		
P (1-tailed)	.08			.22		

Aquarius—Presence of ESP:

Fifteen subjects (6 males, 9 females) completed the training on the Aquarius machine. Eight of these had qualified for the Training Study at the .01 or better level of significance in the Confirmation Study, four at the .05 level, and one at the .10 level. Two subjects had their Confirmation Study data sheets lost. Table 6 presents the results by individual subject for the Aquarius machine, arranged in order of decreasing scores.

TABLE 6
AQUARIUS RESULTS,
TRAINING STUDY

Subject	*Hits/ expected*	*P (1-tailed)*	*Overall Slope*	*Mean within-session Slope*
E7S24	162/125	6×10^{-5}	.22*	.19
E2S9	155/125	9×10^{-4}	–.07	–.27
E7S22	151/125	.004	–.09	.41
E4S12	146/119	.002	–.01	–.80
E8S25	147/125	.01	–.08	.32
E1S6	141/125	.05	.01	–.20
E7S23	139/125	ns	.07	.20
E10S31	133/125	ns	.03	–.66
E6S1	133/125	ns	.09	—***
E4S13**	132/125	ns	–.17	–.13
E5S15	124/125	ns	.02	.40
E8S26	122/125	ns	–.06	–.62
E6S21	116/125	ns	–.08	—***
E9S29**	104/125	.02	–.17	–1.93
E6S20	101/125	.006	.02	—***
Total of 15 Subjects	2006/1869	2×10^{-4}	–.01	–.47

* P=.01, (1-tailed).

** Variance greater than expected by chance, P<.05 (1-tailed).

*** E6 copied his data in a way that did not allow computation of within-session slopes.

Six of the fifteen subjects showed results that were individually significant at the .05 level or better for scoring above chance. Another subject, S13, while not scoring significantly above chance, showed so much variability that his results also probably reflect the operation of ESP. Two other subjects scored significantly *below* chance, one at the .02 level (with significant variability), the other at the .006 level, suggesting psi-missing. The best subject made 162 hits where she would be expected by chance to score 125 ($P = 6 \times 10^{-5}$). Individuals' runs varied from a low of zero hits in a run of 25 ($P < .007$) to a high of thirteen ($P < .002$). The group as a whole had a mean of 6.71 hits per run versus a chance expectancy of 6.25 hits, which can be roughly interpreted as meaning that a genuine ESP response occurred at least once every other run, on the average. I stress at least, as this mean is lowered by the scores of the two subjects who scored significantly below chance.

Although there is a goodly amount of ESP in these Training Study results, with six of the 15 subjects showing individually significant psi-hitting, it is interesting to ask why nine of them did *not* show individually significant psi-hitting, given that the 2-step selection procedure used made it very unlikely that a subject with no ESP ability would have made it into the Training Study. Two major lines of explanation may be proposed.

First, four of the nine subjects do not have Selection Study data available: either it was lost or they went directly into the Confirmation Study because their experimenter believed they had ESP for other reasons. The possibility of picking subjects with no ESP or poorly controlled ESP is, of course, higher for a one-stage selection process than for a two-stage one.

Second, the increased psychological pressure inherent in participating in the Training Study may have inhibited or distorted some subjects' ESP abilities. S13, e.g., continued to show ESP in terms of significant variability in scoring, but could not focus it for hitting. Two of the other nine subjects, S29 and S20, switched to a significant psi-missing pattern. Since we did not collect target and call data for every response from the Aquarius subjects, we can only speculate that distortion of the ESP process may have occurred for some of these other subjects, but it is a possibility to be checked in future studies.

Aquarius—Learning:

Table 6 also shows two measures of learning for each subject, the overall slope of the regression line fitted to all runs in the Training Study, and the average within-session slope. The number of sessions varied from two to five per subject, with 2 to 13 runs within each session.

For the group as a whole, the mean overall slope is essentially zero. Looking at the overall slopes of individual subjects, most were essentially zero, none was significantly negative, and one was significantly positive (for S24).* These results support the learning theory application in that the usual decline effect (extinction) found in almost all ESP repeated-guessing studies is absent, and one subject showed a significantly positive slope. Her performance is shown in Figure 10, along with the fitted regression line.

S24 was an enthusiastic subject, who came into the experiment with the attitude that "I know I have ESP, and I'm going to show you!" She worked at a slow to moderate rate, and ran her fingers over the response buttons to get a "feel" for the correct one.

When performance is inspected by *sessions* (a temporal and psychological unit), it becomes clear that a subject's overall slope can sometimes be a very misleading descriptor. Thus, slope was also computed for each session, and the average of these within-session slopes is also presented in Table 6. These mean within-session slopes do not, to my knowledge, lend themselves to any clear test of statistical significance, so they must be regarded primarily as descriptors here. As descriptors, they reveal that there is probably more learning of ESP in the data than can be picked out by formal analysis. For example, consider the performance of S22, shown in in Figure 11. He had three sessions, with slopes, respectively, of +.13, –.40, and +1.5, for an average within-session slope of +.41, quite different from his overall slope of –.09. The discrepancy arises partly from an insignificant, overall decline in ESP performance, but primarily from drops *between* sessions. That is, this subject showed a pattern that others also showed, of what looked like learning (positive slope) within some sessions, but a loss of whatever ability he'd learned between sessions.

Although the formal data analyses for the Aquarius support the learning theory application, then, inspection of some of the individual performance curves in ways not readily susceptible to formal analysis suggests even more support.

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* The significance of slopes was tested using a standard table for the associated correlation coefficients.

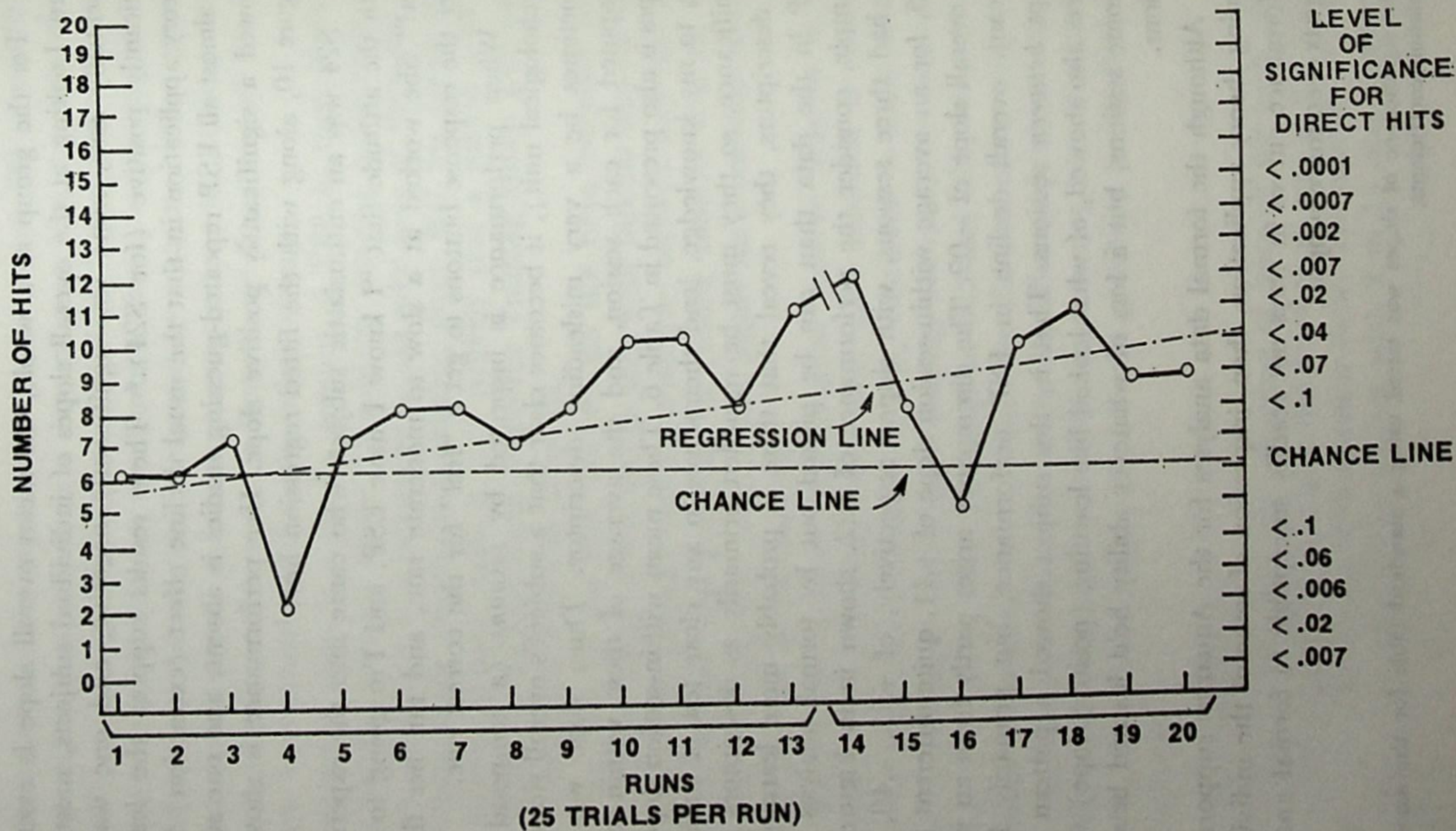

FIGURE 10. — Performance of S24, computer plot.

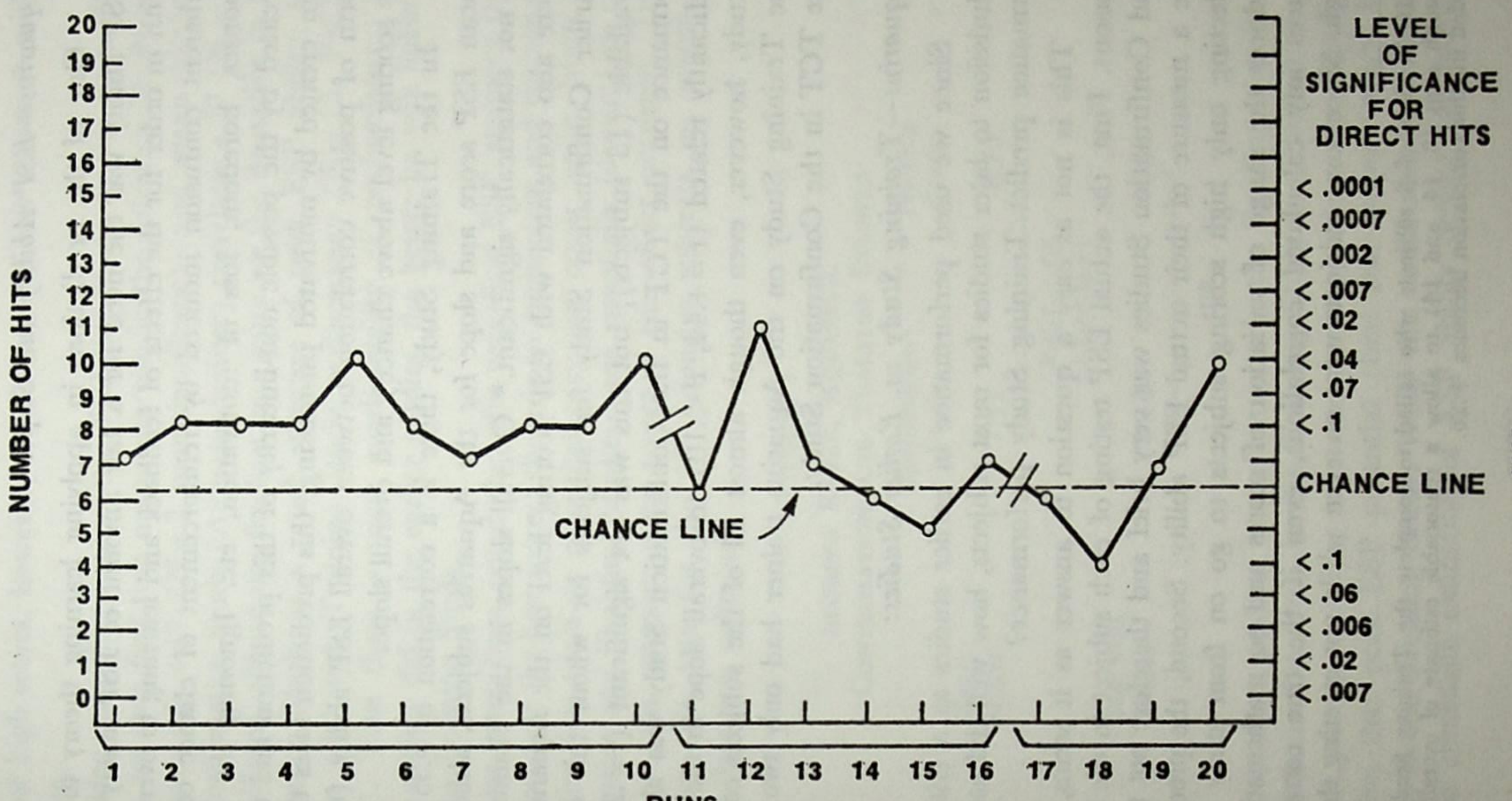

FIGURE 11. — Performance of S22, computer plot.

Aquarius—ESP Ability and Slope:

One of the predictions in applying learning theory to learning ESP ability was the need for a fair amount of ESP ability to begin with in order for the effects of feedback and learning to overcome the inherent confusion induced by reinforcement of chance correct responses, boredom, loss of motivation, etc. Ignoring the problems created by the possible non-linearity of this prediction and the problem created by motivated psi-missing, this prediction takes the rough form of positive correlation between overall ESP ability (measured by scoring level above chance) and overall slope.

In the Training Study, there is a correlation of +.35 between mean ESP score and slope for the Aquarius subjects, although this is not statistically significant.* Overall slopes in the Training Study were also correlated with ESP scoring level on the Aquarius in the earlier Confirmation Study for subjects for whom this data was available (13 subjects), but this was not significant ($r = .29$). Performance on the TCT in the Confirmation Study was almost significantly related ($r = +.44$, $P < .10$) to overall slope in the Training Study, however, even though almost all of the subjects completing the Training Study on the Aquarius trainer had only two runs on the TCT in the Confirmation Study.

Aquarius—Training Study vs. Earlier Studies:

Since we used performance in earlier studies as a criterion for admission to later studies for most subjects, how well did earlier performance predict Training Study performance?

This is not as easy a question to answer as it seems, for two reasons. First, the actual ESP testing of each subject in the Selection and Confirmation Studies was very brief and therefore not too reliable a measure of their actual ESP ability. Second, the procedure of selecting only high scoring subjects to go on from study to study reduces the range of variation of scores and so mathematically reduces any calculated correlations, even if the true correlation is high. Since some subjects went on even while not meeting the formal

* If the data of 3 subjects who failed to complete the Training Study but had enough runs (8, 14, and 14) to allow a reasonable estimate of overall slope are added in, this correlation becomes +.26.

criteria of high scores, however, there are some low scores to widen our range.

Taking mean hits/run in the Training Study as our main ESP measure, we then find that mean hits/run in the Selection Study correlates with this +.47 ($N = 7$, non-significant), and mean hits/run in the Confirmation Study (Aquarius trainer) correlates +.27 ($N = 13$, non-significant). If we use the best run score on the Aquarius in the Confirmation Study as a rough measure of peak ESP ability, this correlates +.50 with Training Study performance ($N = 13$, $P < .05$, 1-tailed). Thus there is some predictability of performance: the better a subject did in the earlier studies, the better he was liable to do in the Training Study.

It has often been noted that the very first ESP attempts by a subject produce the best scores: there is an excitement and enthusiasm in the first few trials or runs that may not occur again. Since the Confirmation and Training Studies were essentially identical in procedure, we can compare them to see if this effect occurred. Table 7 presents this data for the 13 Aquarius subjects on whom all relevant data was collected.

TABLE 7

SCORING RATES, AQUARIUS, CONFIRMATION AND TRAINING STUDIES

	Confirmation Study	*Training Study*
Mean Scores	7.41	6.75
	$P_{diff} < .05$ (1-tailed)	
Best run Scores	9.76	10.53
	ns	

There was a peaking in performance in the Confirmation Study, with an immediate drop in the Training Study to a sustained performance, on the average, for mean scores, with a non-significant suggestion that peak ESP potential (best run scores) might have gone up in the Training Study. While this could also be interpreted as some immediate extinction of ESP ability despite the feedback, this seems unlikely because of the psychological distinction between the two studies, the long time gap between them, and the slight (but non-significant) increase in performance from the first to the second half of the Confirmation Study.

The drop in mean performance came entirely from those subjects who did not show individually significant hitting or who switched to psi-missing in the Training Study. The Aquarius subject who showed clear evidence of learning, S24, showed a small rise in performance.

TCT—Presence of ESP:

Ten subjects (2 males, 8 females) completed twenty training runs each on the TCT, and their results are shown in Table 8. In terms of being selected from the Confirmation Study, nine of them had scored at the .01 level of significance or better, and one at the .05 level.

The left hand portion of Table 8 shows the direct (ON) hits for each subject. As a group, the results are highly significant, with 722 hits when only 500 should have occurred by chance ($P = 10^{-25}$). Five of the subjects showed individually significant results with probabilities of 2×10^{-5} or better for psi-hitting. One subject scored quite low, only 39 hits with 50 expected by chance, and this result is significant at the .05 level for psi-missing.

Individual significances went up as high as 124 hits when 50 were expected ($P = 2 \times 10^{-25}$). The results of this outstanding subject (S3) are shown in the lower curve of Figure 12. She scored at significance levels of .05 or better for 17 of her 20 runs for ON hits. With a mean score of 6.2 hits/run instead of the expected 2.5, this is roughly three-and-a-half ESP responses in addition to guessing in each run. Details of the behavior and experience of this subject and the other four significantly scoring subjects on the TCT are given in the next chapter.

Scores on individual runs over all 10 subjects ranged from a low of zero (which could readily occur by chance) to a high of ten ($P \approx 10^{-11}$).

For the group of ten subjects, there was a mean of 3.61 direct hits per run versus the 2.5 hits per run expected by chance, suggesting that there was one genuine ESP response on every run, in general.

TABLE 8

TCT Results, Training Study

Subject	*ON Hits/ Expected*	*P (1-tailed)*	*Overall Slope*	*Mean Within-Session Slope*	*—1 Hits/ Expected*	*+1 Hits/ Expected*	*(ON)+(±1) Hits/ Expected*	*P (1-tailed)*
E1S3	124/50	$2x10^{-28}$	.14	1.90	45/50	45/50	214/150	$1x10^{-10}$
E1S5	103/50	$1x10^{-14}$	-.03	-.00	44/50	57/50	204/150	$1x10^{-7}$
E1S4	81/50	$2x10^{-6}$	-.01	-.05	49/50	47/50	177/150	$4x10^{-3}$
E1S2	80/50	$4x10^{-6}$	-.02	-.01	66/50**	59/50	205/150	$6x10^{-8}$
E1S1	78/50	$2x10^{-5}$	.02	-.12	64/50*	44/50	186/150	$2x10^{-4}$
E13S17	59/50	ns	.02	.45	53/50	57/50	169/150	.03
E5S14	57/50	ns	-.10	-.36	49/50	51/50	157/150	ns
E2S7	54/50	ns	.03	-.16	61/50*	46/50	161/150	ns
E11S32	47/50	ns	-.07	-.20	45/50	45/50	137/150	ns
E4S11	39/50	.05	-.05	-.20	60/50	53/50	152/150	ns
Total of 10 Subjects	722/500	$1x10^{-25}$	-.01	.13	536/500*	504/500	1762/1500	$6x10^{-16}$

* P<.05, 1-tailed.
** P<.01, 1-tailed.

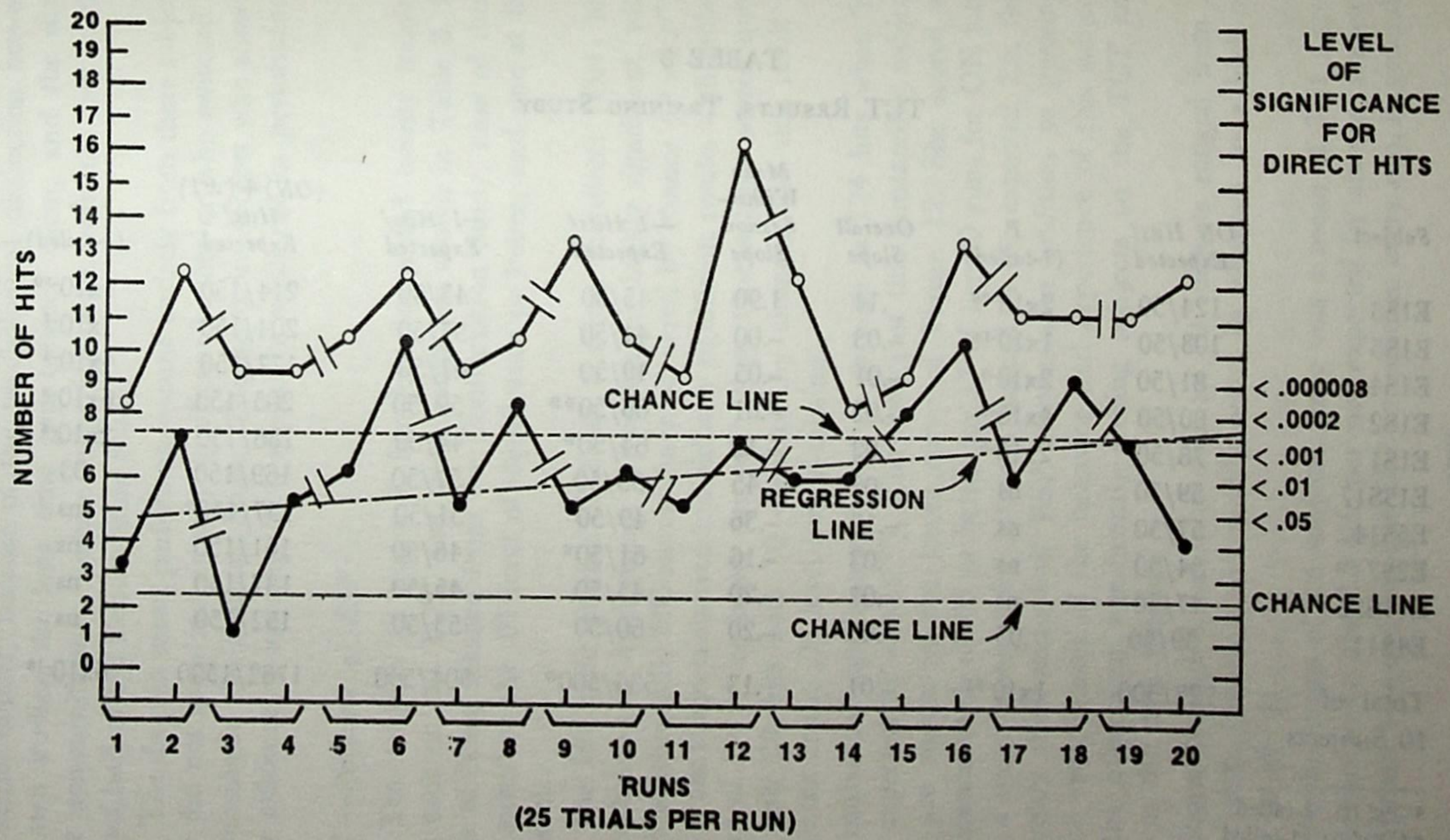

FIGURE 12. — Performance of S3, computer plot. Lower line is plot on direct hits, upper on direct + near hits.

TCT—Spatial Focusing:

A simple evaluation of the number of direct hits does not do justice to the TCT results. Because many subjects scanned the target circle by moving their hands around it, and because many subjects and experimenters conceived of the target in spatial position terms as well as or in preference to the numbers one through ten, it is legitimate to look at responses which were not direct (ON) hits but which were "Near" hits, which were immediately counterclockwise (−1) or clockwise (+1) spatial displacements to the correct target.

In order to collect data on possible spatial displacement, each experimenter filled out a prepared score sheet of what the target was and what the subject's response was for each trial, as well as when the Pass option was used. The number of hits from this hand record was checked against the number on the Hit counter at the end of each run: this eliminates the possibility of systematic recording errors for ON hits, but there may be some slight errors in the spatial displacement data, so the following analyses are suggestive, rather than absolutely firm.

The sixth and seventh columns in Table 8 present the −1 and +1 displacement scores. The −1 hits occurred significantly more often than chance expectancy. Three of the ten subjects were individually significant at the .05 level or better on −1 hits. Two of these (S1 and S2) were subjects whose direct hits were significantly greater than chance, suggesting that in addition to their well-focused ESP abilities, they also had some poorly focused ESP ability which displaced counterclockwise. A third subject (S7) scored significantly on counterclockwise displacement although not on direct hits, suggesting all of her ESP ability was improperly focused.

The final two columns of Table 8 show results if we consider the selected target plus both the −1 and +1 displacement targets as the actual ESP target, a "larger" target with a probability of .3 of being called on each trial, rather than .1. All five subjects who were individually significant on direct hits remain significant here, although with some change in rank order. A sixth subject (S17) shows individual significance on this larger target, and the subject who showed psi-missing on direct hits (S11) now shows chance results, suggesting poor focus.

Allowing for displacement then, as many as eight of the ten subjects apparently showed ESP in one form or another.

Visual inspection of performance curves on individual subjects for ON plus Near hits indicates that the curves rise and fall in close parallelism most of the time (see Figure 12 for an example), but there are occasional striking exceptions where, e.g., the ON plus Near hits rise dramatically. This suggests that the ESP is still functioning but is not as clearly "focused" on the designated target, so close attention should be paid to Near hits in future studies.

Although we made no predictions about possible spatial displacement of ESP other than the +1 and −1 Near hits, we did examine possible hits on the other possible displacements for the 10 subjects, viz., −4, −3, −2, +2, +3, +4, and (±)5. All of these showed deviations below chance, particularly the −4 displacement (428 "hits" when 500 were expected by chance), as responses were drawn off from them to produce the 722 ON hits.

Since we have trial by trial data for the TCT subjects, we can take a more detailed look at the question as to why five of these ten highly selected subjects did not continue to show individually significant hitting in the Training Study. Two of them (S7 and S32) began directly with the Confirmation Study, so there was only a one-step selection process involved, not a two-step one. The possibility that they scored high originally through chance fluctuation, rather than ESP, while still quite unlikely, is more likely than for those subjects who went through the two-step selection process. The possibility of insufficient selection is particularly unlikely for S7, however, as she showed individually significant displacement hitting on the −1 target.

Of the other three subjects who went through the two-step selection procedure but did not continue to score above chance in an individually significant manner, one (S11) scored significantly below chance for ON targets and almost significantly above chance for the −1 displacement targets, so the increased stress of the Training Study seems to have distorted the focusing of the ESP mechanism, rather than it disappearing. Some preliminary studies of the trans-information function, an information theory measure of relationship between targets and calls, by Lila Gatlin, suggest that in general there was a distortion of the ESP process for four of these five non-significant subjects: these analyses may be presented in a future publication.

TCT—Learning:

The fourth and fifth columns of Table 8 present the overall slopes and the mean within-session slopes for the TCT subjects. For the group as a whole, the mean overall slope is zero, and no individual slope is significantly different from zero. As with the Aquarius, this provides moderate support for the learning theory application in that there is no decline effect (extinction) occurring, but the absence of any significantly positive overall slopes seems counter to the theory.

Inspection of the mean within-session slopes, however, shows some very positive slopes. Inspection of the performance curves of the highest scoring subject, S3, already presented in Figure 12, shows that eight of the ten sessions had highly positive slopes, one a zero slope, and one a negative slope. If we take a null hypothesis that the probabilities of positive and negative session slopes occurring by chance are equal (ignoring the one zero slope), then the probability of eight of the nine slopes being positive is .002, 1-tailed, using the exact binomial distribution. Thus S3 learned to increase her ESP performance in almost all of her sessions, but lost most of this newly learned ability between sessions.

Examination of the intervals between sessions for S3 shows that they ranged from one to 29 days. There is a suggestive, but non-significant rank order correlation coefficient of +.42 between the length of the intervals between sessions and the sizes of the inter-session performance drops. Future studies should minimize time between training session.

TCT—ESP Ability and Slope:

In the Training Study, there is a correlation of +.66 between mean ESP score and slope ($P < .05$), as predicted by learning theory.* ESP scoring level on the TCT in the earlier Confirmation Study was also significantly related to slope in the Training Study ($r = +.71$,

* Two incomplete subjects had enough runs (10, 10) to allow a reasonable slope estimate. If these data are added in the correlation is +.64, a ngligible change.

P<.025). In general, the more ESP a subject has, the more likely his performance curve will show an increase with practice.

TCT—Training Study vs. Earlier Studies:

The same statistical considerations that automatically reduce calculated correlations even when true correlations might be high apply here, as they did for the Aquarius.

Taking mean hits/run in the Training Study as our main ESP measure, we find that mean hits/run in the Selection Study correlates +.21 (N = 5, non-significant) with it, and mean hits/run in the Confirmation Study (on the TCT) correlates +.70 (N = 8, P<.05, 1-tailed). If we use the best score on the TCT in the Confirmation Study as a rough measure of peak ESP ability, this correlates +.27 (N = 10,* non-significant) with Training Study performance. Thus there is some predictability of performance from the earlier studies, somewhat better than for the Aquarius. The better predictor here is mean performance, while the better predictor for the Aquarius was peak performance.

As with the Aquarius results, there was a significant drop in scoring level from the Confirmation Study to the Training Study. The data is presented in Table 9 for the eight TCT subjects having all necessary data. The drop was in mean scoring rate, rather than peak performance. With the exception of S3, the TCT subject who

TABLE 9

SCORING RATES, TCT,
CONFIRMATION AND TRAINING STUDIES

	Confirmation Study	*Training Study*
Mean Scores	4.78	3.85
	p_{diff}<.05 (1-tailed)	
Best Run Scores	6.50	6.50
	ns	

*N is 10 rather than 8 here, for two subjects did only one run each on the TCT in the Confirmation Study: while this was used as a best score, it was not used as a mean.

showed clear evidence of learning, the drop was, by inspection, spread equally between subjects who continued to show significant ESP abilities in the Training Study and those who did not.

TCT—Speed of Response:

A number of experimenters thought it was their slower working subjects who tended to do best. The best subject (S3, whose results are plotted in Figure 12) was one who generally took half an hour to an hour to do a single run of 25 on the TCT. In order to see if this relationship held in general, we used the mean number of runs done per session, since sessions were generally about an hour long, as a crude measure of speed for each subject. The rank order correlation coefficient between speed of response and the significance of overall scoring for each subject was –.62 ($P<.05$, 1-tailed). Thus slower subjects generally scored better.

TCT—Experimenter Differences:

All five subjects who scored significantly for ON hits on the TCT were run by one experimenter, E1, Gaines Thomas. His subjects had higher ESP ability to begin with, using Confirmation Study scores as criteria. His subjects showed a mean performance of 5.45 hits versus 3.66 for the other subjects (P diff = .025, 1-tailed, by t-test for independent samples) in the Confirmation Study. In terms of peak performance in the Confirmation Study, however, E1's subjects were not significantly better (mean best score of 6.6 versus 6.4). E1 was a very patient experimenter, as his subjects often worked very slowly.

Performance Differences on Aquarius and TCT:

Far more ESP was exhibited by the subjects using the TCT than those using the Aquarius in the Training Study. The probability of results on the TCT was 1×10^{-25}, while for the Aquarius it was 2×10^{-4}, considering the total groups of subjects using each machine. For the Aquarius this is about one genuine ESP response in addition to guessing about once every other run, while for the TCT we would estimate one genuine ESP response of a more difficult sort on every run. Thus there seems to be more than twice as much ESP manifested on the TCT as on the Aquarius.*

Comparing results on the two training devices by significance level alone is misleading, however, for it is known that for a given amount of ESP operating, a test that uses a lower probability target will give a higher statistical significance than one which uses a higher probability target (Schmidt, 1970). The psi-coefficient, described by Timm (1973), allows a comparison of effect per trial when target probabilities are different. For psi-hitting, it is calculated by dividing the hit deviation above chance (obtained hits minus hits expected by chance) by the expected number of misses. The coefficient obtained ranges from −1.00 for complete psi-missing to +1.00 for hitting on every trial.

Computing psi-coefficients on those subjects who showed psi-hitting, the values for the Aquarius subjects range from .042 to .098, with a mean of .071, while for the TCT the values range from .066 to .164, with a mean of .100; so there was more ESP operating with the TCT.

Is the TCT a better device for eliciting and maintaining ESP than the Aquarius? Or did it just happen that a more talented group of subjects chose to work with the TCT than the Aquarius?

We can begin examining this question by comparing the Selection Study performance of the two groups of subjects. Those who finally trained on the Aquarius scored an average of 6.42 hits/run in the two-run Selection Study, while those who went on to train on the TCT scored an average of 6.60 hits/run. In terms of the best score from either run in the Selection Study, the Aquarius subjects averaged 7.42 and the TCT subjects 8.83. While the TCT subjects were slightly higher in each case, neither difference approached statistical significance. Note however that two runs per

* This is a rough estimate because we are counting in subjects in each group who showed no individual evidence of ESP. We can make a somewhat more accurate estimate by using only those subjects whose scores were individually significant at the .05 level or better, including the psi-missers. We can count psi-missers' scores as if they were positive deviations to estimate the amount of ESP in the study. Doing so, we get 1197 hits (203 above chance) for the Aquarius, $P \approx 10^{-14}$, an average of 7.53 per run, 1.28 over chance. For the TCT, we get 527 hits (227 above chance), $P \approx 10^{-41}$, an average of 4.39 per run, 1.89 above chance. So our ratio becomes roughly three to two.

subject is a very insensitive measure that would only reveal very large differences in initial ESP talent.

If we take performance in the Confirmation Study as a more adequate measure of initial ESP ability of the two groups, and use scoring on the training device later selected by each subject in the Training Study as a measure of initial ESP talent, we find that the TCT group was definitely more talented. The Aquarius subjects totaled 392 hits versus 325 expected by chance, a highly significant performance ($P \approx 10^{-6}$) of an average of 7.53 hits/run, or 1.28 hits/run greater than would be expected by chance. The TCT subjects totaled 141 hits when 72.5 would be expected by chance ($P \approx 10^{-17}$), an average of 4.86 hits/run or 2.36 hits/run above chance expectation. So in the Confirmation Study the TCT subjects are already showing about twice as much ESP per run as the Aquarius subjects *on the training device of their later choice.* In terms of psi-coefficients, the Aquarius subjects showed an effect of .069 per trial, while the TCT subjects showed one of .105 per trial.

It is important to emphasize that these performances were on the devices they later chose to work on in the Training Study, for strong differences appeared in performance on the two devices in the Confirmation Study. When tested on the Aquarius machine in the Confirmation Study, those subjects who later trained on it scored an average of 7.40 hits/run* while those who later trained on the TCT scored only an average of 5.40 hits/run, a highly significant difference of ($P<5\times10^{-4}$). When tested on the TCT in the Confirmation Study, those who later trained on the Aquarius showed an average of 3.30 hits/run, while those who later trained on the TCT showed an average of 4.63 hits/run, a significant difference ($P<.025$). So although some subjects scored well on both devices, there was generally a strong difference. As mentioned earlier, there was a highly significant negative correlation ($r = .69$) between performance on the two devices.

Because there was such a strong preference for one machine

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* These means are slightly different from those in the previous paragraph because here the analysis uses only subjects who worked on both devices, while in the previous analysis a few subjects are included who worked on only one or the other device.

over the other, we cannot tell for certain whether the TCT group had more ESP talent to begin with before starting the studies, or whether the TCT is a better training device. I am inclined toward the latter view, as I believe the 4-choice set of the Aquarius gives too much feedback (i.e., the subject is rewarded for being correct quite often when the correctness has been due to chance), as well as for other differences between the machines discussed earlier, such as the experimenter/agent getting extra feedback on the subject's hand motions during his decision process.

Summary:

The present procedure of serial selection for ESP ability in an ordinary student population, plus ESP training under conditions of immediate feedback, found 11 subjects (14 if the psi-missers are counted) showing individually significant ESP results. Six of them performed at significance levels of 10^{-4} and higher, one at the 10^{-28} level. The very large amount of ESP found makes this one of the most successful ESP experiments ever done, and represents an amount of ESP that would lead to productive functional studies. No subjects showed significantly negative slopes, and two learned to perform better. This method offers promise of a new era in ESP research, based on high level, reliable performance.

V

TRAINING SUBJECTS ON THE TEN-CHOICE TRAINER

GAINES THOMAS

During my (Gaines Thomas) initial contact with each subject at the beginning of the Training Study, I covered the following topics:

1. I gave them a complete explanation of the phased testing, referring to the past Selection and Confirmation Studies as screening procedures and the Training Study as the actual experiment, which they wouldn't be disqualified from.

2. I pointed out assumptions that we made in reference to ESP and this experiment, such as (a) the concept that everybody probably has ESP, but the ability and/or the amount that can be demonstrated on our tests is highly variable within a population; (b) that in our tests, we cannot accurately discriminate between telepathy and clairvoyance, possibly not even precognition or, even more extreme, psychokinesis; and (c) that demonstration of ESP will be based on their beating chance as much as possible.

3. The purpose of the experiment is to determine if ESP ability can be increased through practice and feedback.

4. We'll work on the machine they prefer for the duration of the experiment.

5. The experiment will consist of 20 runs of 25 trials each.

6. We'll try to make regular hours for testing, each from one to two hours in duration or until one of us becomes tired.

7. ESP is severely affected by distractions, so if they don't feel well, are tired, are under pressure because of tests, personal problems,

etc., or they just don't want to take part that day, to let me know by phone or note ahead of time and it will be all right. In fact, I'd rather cancel our appointment than go through with it if I didn't feel their heart was in it.

8. I gave them a general rundown on the equipment, how it works, use of random number generators, etc. For this I stressed that numbers were random, and that one must keep in mind that the same numbers may come up repeatedly and that they shouldn't be overlooked.

9. Before each session they can ask me any questions, cancel out that appointment, give me suggestions, complaints, etc. Also I indicated to them that I'd be interested in hearing about experiences that might be related to ESP, including what reactions they got from other people when they found out that they (the subjects) were being tested for ESP.

10. The speed at which we will do each run will be dependent on them, unless they are so fast that I can't keep up with them.

11. After each run, I'll indicate to them how well they did, how close they came, and ask how they made their decisions. We'll also discuss how I concentrate on numbers and how they would like me to focus my attention (i.e., on the panel, the TV monitor, on the random number generator, or with my eyes closed). In the case of the Aquarius, this could be a matter of color, position, or figure, on the TCT a matter of number or position.

12. I'll indicate to them various processes I'd like them to try, based on their successes and how they made their choices.

Based on what I observed when I was doing runs at the same time other experimenters were doing them also, and what subjects of other experimenters told me, I was different in my techniques in the following ways:

1. I spent more time with the subjects before runs and between them, discussing their results.

2. Initially I did *not* suggest any process for them to follow (i.e., hot-cold, strongest feeling, "electric" charge, etc.) in making their selections.

3. Once subjects were able to discriminate between hits and misses to some degree, based on some feeling or strategy *they* had developed, I began to have them experiment with one process at a

time for a run or two, making changes depending on their degree of success. In the case of the TCT, this involved characteristics (tendencies) of the choices they made, such as being one off right or left, hand movements (such as initial placement of a hand on the board before going around the circle of buttons and being often over right number), or when the subject had two numbers that stood out, and working with the criteria they used to make their decisions.

4. I made a strong effort to schedule times that were convenient for the subjects, at times of the day when they felt most alert and comfortable.

5. I made attempts to remind subjects by telephone about their appointments throughout the experiment.

6. At the end of each run, in the case of the TCT, I lit up all of the lights, except the correct one, as a signal to them that the run was completed, and that I would be with them in a few minutes, instead of leaving them hanging, expecting a green light to come on shortly.

7. With most of my subjects, we traded places for one or two runs to make both of us more familiar with each other's position and feelings. These, of course, did not count as part of the 20 runs. These occurred as monotony breakers approximately halfway through the 20 runs.

8. I attempted to indicate to the subjects what methods (concentration methods) I could use on the sending unit. I then asked them which method or methods they would prefer me to use and generally followed their instructions, unless I became uncomfortable or I thought their performance was suffering.

9. I arrived about ten minutes early for each appointment so that I could have the machines plugged in and warmed up, ready to go as soon as the subjects arrived. This included taking care of the paperwork, so that I could spend the maximum of time with the subject without little distractions, and a minimum of delay between the time I left the subject and when I began sending (unless the subject requested a specific delay to relax and begin his concentration).

10. I took a neutral attitude as far as my own beliefs were concerned. I stressed the fact that no matter how well the subjects did, there was always a possibility that chance was responsible,

although evidence for the phenomena was getting greater. I preferred to refer to ESP as a "phenomenon," as opposed to using the initials, as some of my subjects were cynical of ESP but were more accepting of themselves as exhibiting a "phenomenon."

11. Something that I believe I differed in from the other experimenters was in the impression I gave my subjects as to my idea of an acceptable score. Although I defined to the subjects that they would have scores that formed a normal curve if their ability was actually due to chance alone, I personally felt that any score below six (on the TCT) was not significant to me, and that scores at chance levels were not significant for me. I recall now that all of my subjects picked up my personal set of standards. They became unhappy if they scored at chance levels, below chance, or only one or two above, although I am certain that at no time did I overtly degrade their scores or demand that they do better. However, I am also certain that they could detect if I was either disheartened or very pleased about their scores, so I believe these expectations played an important part in the performance of my subjects.

These standards were reinforced by having the probability of each score on the wall in the form of a table, within view of all of the subjects. Also, my expectations changed as the experiment progressed. At the beginning I was looking for chance and slightly higher performance, but as subjects improved, and setting up processes became fruitful, my concept of a good run increased in relation to their scores. It also appeared to me that their own concept of a good score increased.

Comments on Individual Subjects:

S1 became involved mostly out of curiousity. He was my only subject who didn't go through Selection Study testing. After the Confirmation Study, he took a course in Transcendental Meditation, which made me curious as to whether or not his scores would improve as a result of it. I didn't note any difference and neither did he despite his having five to twenty-minute meditation periods immediately before each test session, which we later dropped.

He approached the testing more as a curiosity than as a scientific undertaking, although he expressed great interest in knowing about our procedures and the eventual results. His process was a fundamental one. He chose the number that seemed strongest to him. He had difficulty though, trying to keep himself from falling prey to strategies, trying to out-guess the random number generator. He characteristically would do three runs per session in the beginning, the first being poor, the second good, and the third poor again. Consequently, to keep himself from getting depressed, he later preferred to do only two runs a session. It generally worked; his scores averaged higher and he wasn't as disheartened, but he never thought, nor did I, that his scores were significant overall.

S1's performance is graphed in Figure 13. He scored 78 ON hits instead of the expected 50, $P = 2 \times 10^{-5}$, with an essentially zero (.02) overall slope. He showed significant spatial displacement on the −1 hits ($P < .05$), with his displacement hits (shown in the upper curve) for ON plus ±1 hits generally paralleling the ON hit curve, suggesting a relatively constant distortion of the ESP focusing mechanism.

S2 is what I call a "spacy chick." You could never really know where her mind was at any given time. She characterized her technique as seeing vectors of light between various numbers on the board. I had her point out her "vectors" as she saw them before making a choice. She pointed them out in order of them coming to mind. They seemed pretty random, but quite often the first number she pointed out was right, or one off in either direction. She was very moody, causing me to cancel a number of appointments due to her feeling tired or tense, or she would forget to come to the appointment. She gave me the feeling of silently accepting the idea herself that she had some ESP ability and seemed rather enthused in the experiment. Seldom did her hits correlate with her feelings of "strong choices."

S2 scored 80 ON hits, $P = 4 \times 10^{-6}$, with an essentially zero overall slope (−.02). She also displaced considerably both to left (−1) and right (+1) of the target, with the −1 displacement being independently significant ($P < .01$). Her performance is plotted in Figure 14. As with S1, the ON hit and ON plus ±1 hits curves are generally parallel, suggesting a constant distortion of the ESP mechanism.

Of all my subjects, S3 was my star, my highest scorer. She was also unique in that she was by far the slowest. On the TCT, she would take about forty-five minutes to complete one run. She was

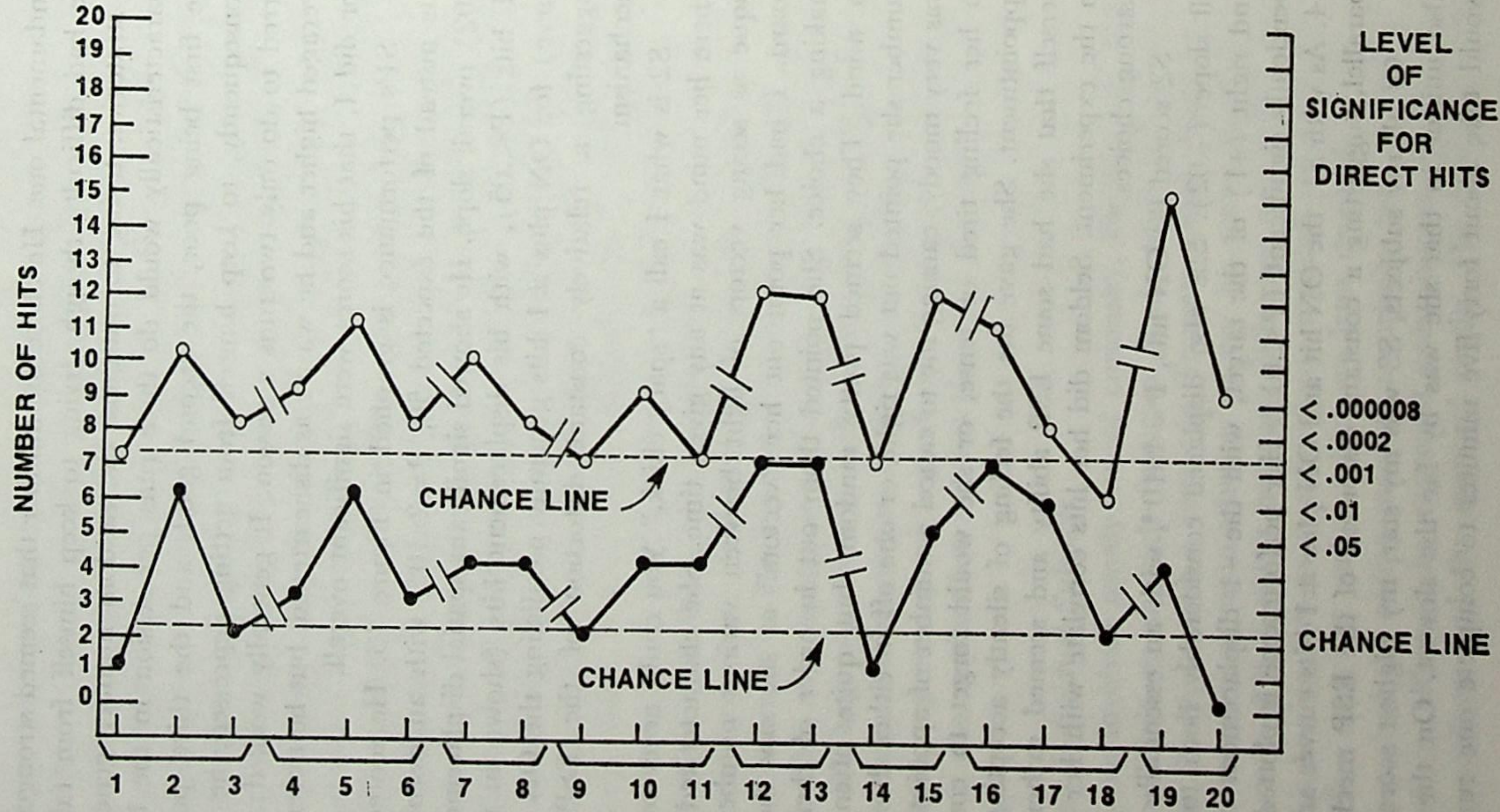


FIGURE 13. — Performance of S1.

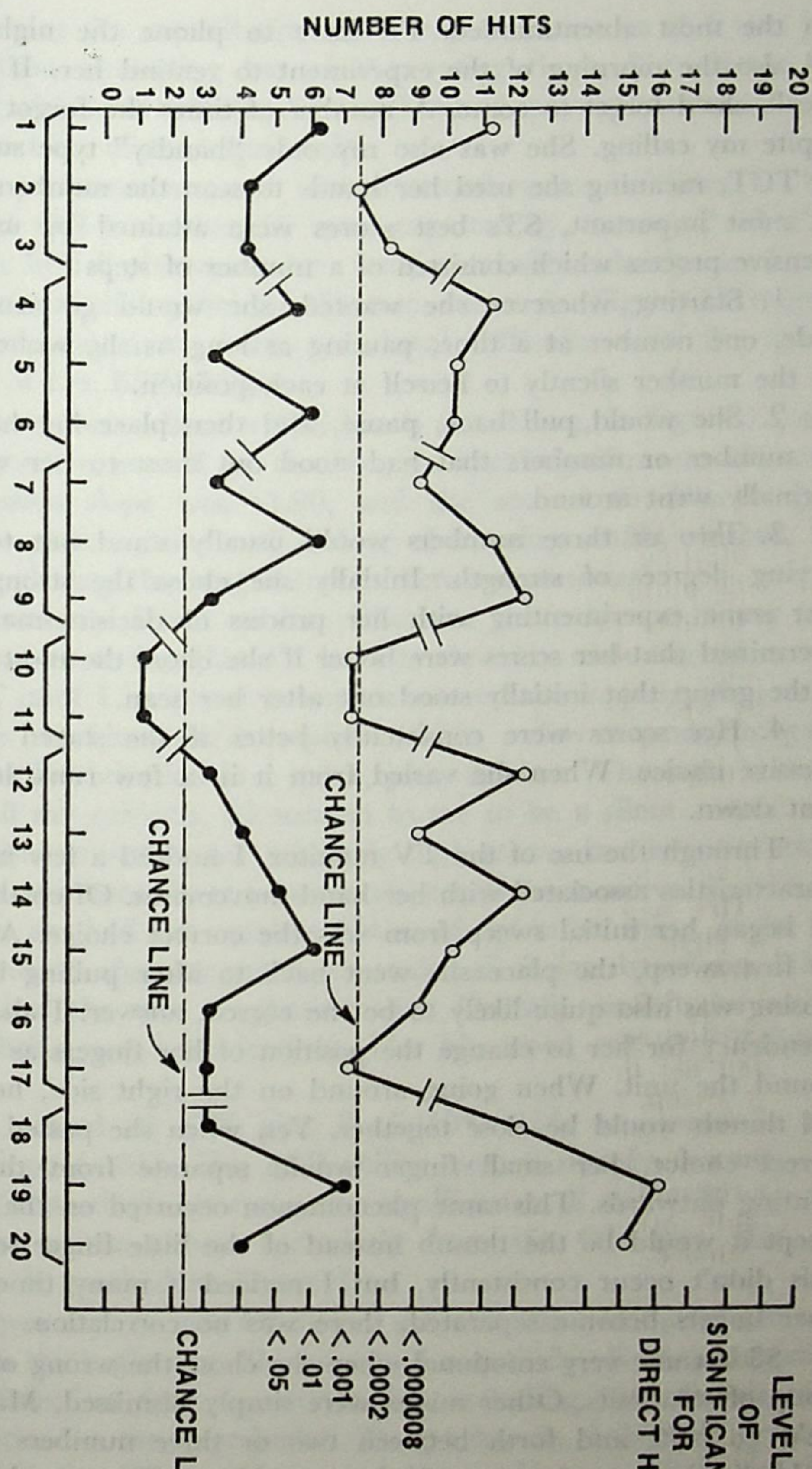


FIGURE 14. — Performance of S2.

also the most absentminded. I'd have to phone the night before and also the morning of the experiment to remind her. If I forgot to call, she'd forget to come. A number of times she forgot to come despite my calling. She was also my only "handsy" type subject on the TCT, meaning she used her hands to scan the numbers. Lastly, but most important, S3's best scores were attained by use of an extensive process which consisted of a number of steps:

1. Starting wherever she wanted, she would go around the circle, one number at a time, pausing as long as she wished. She'd say the number silently to herself at each position.

2. She would pull back, pause, and then place her hand over the number or numbers that had stood out most to her when she originally went around.

3. Two or three numbers would usually stand out to her in varying degrees of strength. Initially she chose the strongest, but after some experimenting with her process of decision-making, we determined that her scores were better if she chose the most recessive of the group that initially stood out after her scan.

4. Her scores were consistently better if she stayed with the recessive choice. When she varied from it in a few runs, her scores went down.

Through the use of the TV monitor, I noticed a few interesting characteristics associated with her hand movements. Often the button she began her initial sweep from was the correct choice. Also, after the first sweep, the place she went back to after pulling back and pausing was also quite likely to be the correct answer. I also noticed a tendency for her to change the position of her fingers as she went around the unit. When going around on the right side, her fingers and thumb would be close together. Yet, when she passed over the correct choice, her small finger would separate from the others, pointing outwards. This same phenomenon occurred on the left side, except it would be the thumb instead of the little finger separating. This didn't occur consistently, but I noticed it many times. If the other fingers became separated, there was no correlation.

S3 became very emotional when she chose the wrong one of her group of standouts. Other misses were simply dismissed. Many times she'd go back and forth between two or three numbers until she could discriminate the strengths between them. She was always very excited about the experiment, and would continue on if I was persistent about reminding her of the testing times. She always was surprised with how well she did and has had some phenomenal things happen outside of the experiment.

S3's performance graph was presented earlier in Figure 12. She made 124 ON hits when 50 were expected by chance, $P = 2 \times 10^{-28}$. Although her displacement hits were not independently significant, the occasional divergence of the two curves in Figure 12 suggests that there may have been occasional difficulty with the spatial focusing of her ESP abilities.

The regression line for ON hits is also shown, in Figure 12, as it is quite positive, even if not reaching statistical significance. S3's mean within-session slope was +1.90, and she seemed to show a quite consistent pattern, discussed earlier, of learning within sessions, but dropping during the long intervals between sessions.

S4 was my fastest subject. She was the only one of my subjects who was so fast that I'd have to slow her down by not setting the TCT until I had time to concentrate on the number. As soon as I set the machine, she'd respond within a few seconds by going directly to her selection in a quick, jerky manner. The most businesslike of all my subjects, S4 seemed to me to be a silent skeptic who showed amusement at her relatively high scores, but became noticeably tired and bored in response to chance or lower scores. She did her best when she had one number that stood out in her mind. If she had two numbers, she attempted to make a choice based on which number had the most emphasis to her. Overall, she left the impression of being very conscientious. Her hits stood out very definitely to her.

She scored 81 ON hits, $P = 2 \times 10^{-6}$, with an essentially zero overall slope (–.01). Her ESP ability seemed sharply focused, with no significant displacements: the significance of the ON plus ±1 hits curve comes almost exclusively from the ON hits. Her performance is graphed in Figure 15.

S5 was my convert. Of all my subjects, she was by far the most cynical in the beginning. She answered negatively all of the questions on the Selection Study questionnaire, including the one regarding participation in the experiment. To get her in, I had to persuade her that if she did participate and her performance indicated that

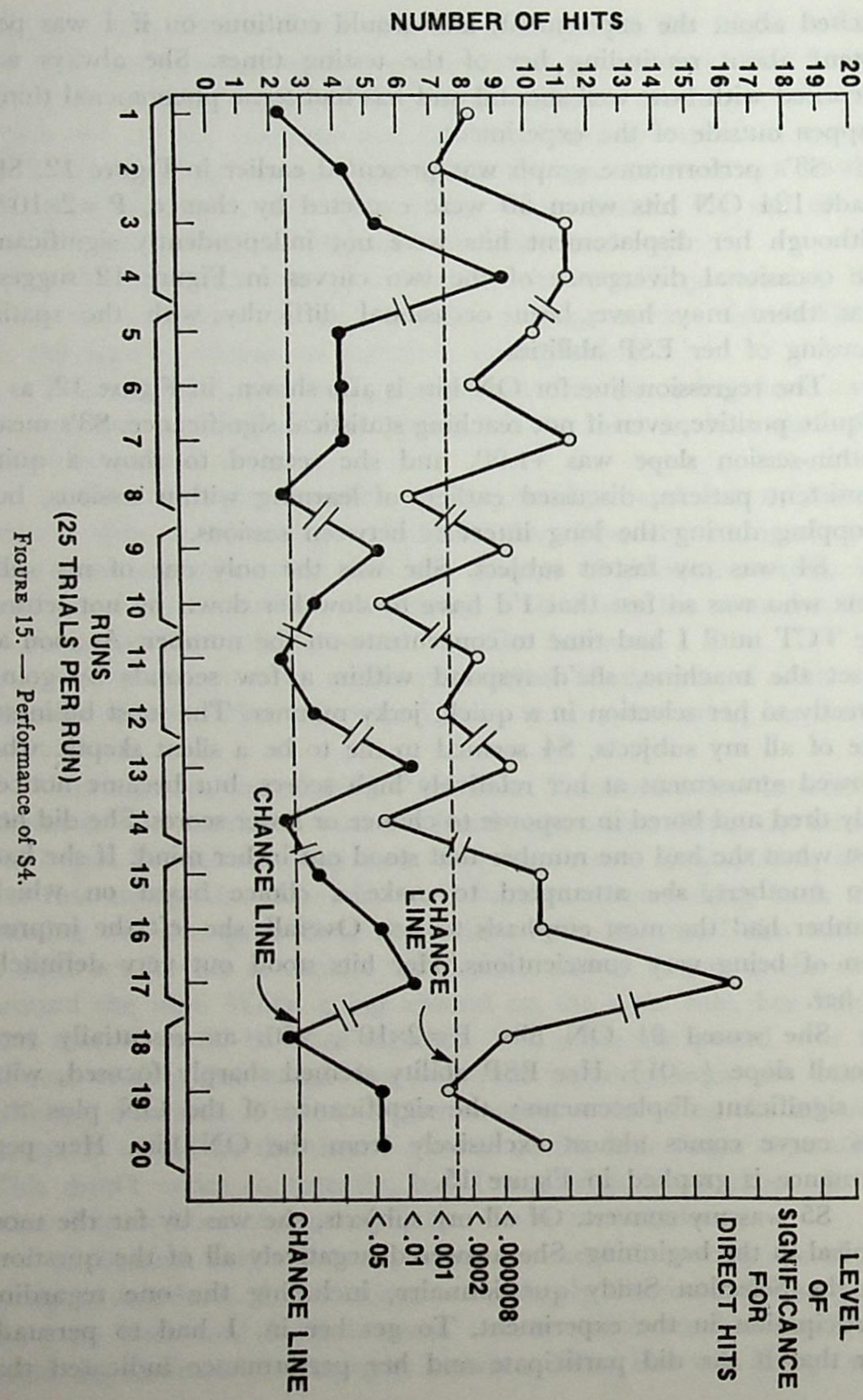


FIGURE 15. — Performance of S4.

she didn't have ESP, then it would verify her own concept that she didn't have any ability and would indicate that our selection techniques were not effective, or else that ESP doesn't exist. This appealed to her. I had her hooked.

When I brought her in for Confirmation Study testing, I was surprised to find her more cynical than I had expected. She was blunt in her criticism, not failing to mention she was pressed for time, didn't believe in ESP, and that she wanted to hurry and get it over with. The first day she did two runs, scoring 5 and an 8 on the TCT. This shocked her visibly, but she didn't say anything and maintained her coolness.

I didn't see her again until after the Thanksgiving vacation. When she came back her attitude was completely different. She was a different person; she wanted to know all she could about ESP, the experiment, etc. She was very enthusiastic and cheerful. When I pointed this out, that she was a different person than the one I had seen, she displayed some agreement. I then asked her if she had talked to anyone about the experiment. She answered that she had told her family. Her father was pessimistic, but curious. Her mother was very enthusiastic and interested. Her brother and sister had been involved in some simple experiments in their elementary and junior high schools and were excited over her involvement. With that encouragement, she approached the experiment from a new perspective from then on.

Her scores were consistently above chance. Her process was simply determining which number was strongest in her mind and pushing the button. She would take about ten to fifteen seconds to make a decision. She noticed some correlation between the feeling of a hit and correct guesses. Even now, though, I get the feeling she doesn't believe in a phenomenon of some sort, but attributes her scores to chance.

S5 scored 103 ON hits instead of the 50 expected by chance, $P = 1 \times 10^{-14}$. Her performance is graphed in Figure 16. The performance slope for her ON hits was essentially zero (–.03). She scored suggestively low (44/50) on –1 hits and suggestively high (57/50) on +1 hits, but not significantly so. Her displacement performance seems more erratic than her ON performance, suggesting some erraticism in focusing the ESP mechanism.

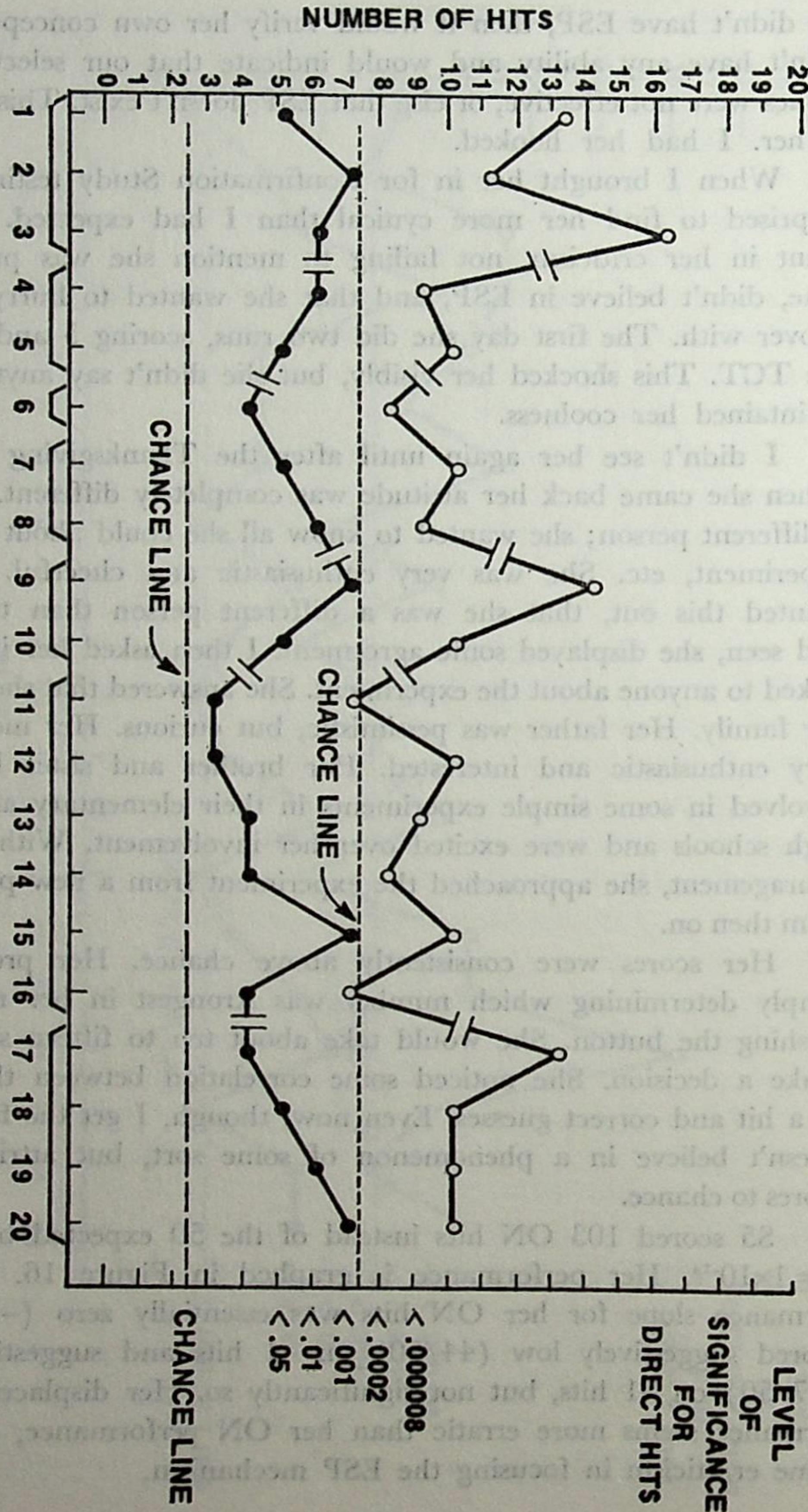


Figure 16. — Performance of S5.

The Sending Process:

Lastly, I want to say something about my own methods of concentration. My normal procedure on the TCT was to push the button on the random number generator right after the subject had made his choice on the preceding trial and I had switched off the selection and recorded his choice. I then entered the new target number on the score sheet and then silently repeated the number to myself, attempting to position it in my mind in a fashion that I can only describe as keeping it just "posterior to the upper part of my ears." Success very often correlated with a numbing feeling in that location. Once I felt I had the number positioned, I'd turn on the proper target switch (which activated the Ready light on the subject's console). I would then stare at the number (card) on the TV monitor until he made his choice, all the while maintaining the number in that location of my brain. Sometimes I'd orally coax the image on the screen, or swear at their near misses. In relation to the Aquarius, I preferred to focus on the color, which I felt centered in my forehead someplace, for best results.

Recommendations:

1. Duration of the experiment should be set over a far longer period of time (4 to 6 months at least).

2. "Processes" (strategies) should be worked out ahead of time, and then remain constant if possible during the actual experiment.

3. More attention should be paid to the subject's mood and to standardizing when runs are done (i.e., regular appointment dates and times).

4. Determine ahead of time a set number of runs per session that is comfortable for experimenter and subject, and maintain this for the duration of the experiment.

5. Maintain the same experimenter-subject pairs throughout the experiment.

6. More stress should be placed on informal discussions and feedback between experimenter and subject before, in between, and after runs.

7. A number of subjects seemed to avoid numbers on the TCT

because they were hard to reach or out of their normal visual range. Tilting the panel might help.

8. In the case of the Aquarius, a switch to signal the subjects when you are ready for them to make a choice would help.

9. A TV monitor might also help with the Aquarius to give more feedback and process determination.

10. Academic credit should be given to subjects, if possible, for the large amount of time investment.

VI

DISCUSSION AND CONCLUSIONS: ESP ABILITY CAN BE TRAINED

Surveying the present pilot study, main study, and other relevant studies in the literature, we may now draw some conclusions about the validity of my application of learning theory to ESP. We shall deal with the main predictions of the theory first, and then discuss various other points.

Prediction—Feedback Will Stabilize ESP Performance:

Since repeated guessing without feedback constitutes an extinction procedure according to the theory, provision of immediate feedback should generally eliminate the usual decline effect, at least for short to moderate length experiments where boredom and loss of motivation do not bcome major problems. This is a minimal prediction about the effects of immediate feedback, but an important one, given the near universality of the decline effect (Pratt, 1949).

Table 10 summarizes the present studies and all recent studies by others that were reviewed in Chapter II.* Our attention here belongs in the third column. In 11 studies where slope data on individual subjects were available,** for a total of 195 subjects,

* I have not included the much older studies reviewed in Chapter I in Table 10, as I put less reliance on very old data. Their inclusion would not have changed any conclusions, however.

** Although the Ojha (1964) and Dagle (1968) studies are included in Table 10 for reference, I have not included their data in this or subsequent calculation due to their methodological flaws.

TABLE 10
Studies of Feedback and ESP

Study	*Number of Subjects**	*Significant Negative Slopes?*	*Results Supporting Learning Theory Application*
		Studies with Highly Talented Subjects	
Tart, pilot study	10	No	1 subject may have learned but great conflict
Tart & Redington, main study	25	No	2 subjects showing clear learning, perhaps more
Targ & Hurt, 1972	1	No	1 subject learned clairvoyance and precognition
Kelly & Kanthamani, 1972	1	No	1 subject showing clear learning
Schmidt & Pantas, 1972 (study 2)	1	?	
Kanthamani & Kelly, 1974	1	No	1 subject learned rapidly then fell off to steady, high scoring
Targ et al, 1974 (Phase O)	1	No	1 subject clearly learned ESP
Ojha, 1964	10	not calculated	Group showed very high improvement, but study methodologically flawed
		Studies with Mildly Talented Subjects	
Mercer, 1967	20	not calculated	Group with feedback scored significantly, non-feedback group scored at chance
Dagle, 1968	12	No	Feedback following non-feedback raised scores, reverse order kept scores high, but study methodologically flawed
Schmidt, 1969a	4	No	Steady ESP over 16,000 trials
Schmidt, 1969b	6	not calculated	Significant performance

Study	*Number of Subjects**	*Significant Negative Slopes?*	*Results Supporting Learning Theory Application*
Haraldsson, 1970 (main study)	11	not calculated	Full feedback better than partial feedback
Lewis & Schmeidler, 1971	14	not calculated	Scores insignificantly higher with feedback
Honorton, 1971b	1	No	Learning, but erratic
Schmidt & Pantas, 1972 (study 1)	214	not calculated	Increase, but non-significant
Honorton, 1970	10	not calculated	9 of 10 subjects increased rate of correct confidence calls; significant increase in hitting
Honorton, 1971a	10	not calculated	8 of 10 subjects increased rate of correct confidence calls
McCallam & Honorton, 1973	14	not calculated	13 of 14 subjects increased rate of correct confidence calls; significant increase in hitting
Kreiman & Ivnisky, 1973	15	not calculated	Significant increase in hitting for group
Targ et al, 1974 (all phases)	146	No	6 subjects showed significantly positive slopes
		Studies with Apparently Untalented Subjects	
Beloff, 1969	40	not calculated	No significant hitting
Banham, 1970	22	not calculated	Increase in scoring, but overall score not significant
Banham, 1973	30	not calculated	Decline effect for group, but overall score not significant
Beloff & Bate, 1971	4	1	3 subjects with positive slopes, one significant decline, no significant overall ESP
Thouless, 1971	1	No	Perhaps learning with subsequent decline, overall score not significant

*** Note: Number of subjects given in this column is the number who were run under immediate feedback conditions, not the total number used in the study.**

there is only one significantly negative slope (decline), and that in a subject who showed no overall ESP ability. In three further studies (Honorton, 1970; Honorton, 1971a; McCallam & Honorton, 1973) with another 34 subjects, 30 of them showed an increase in the proportion of correct confidence calls after feedback training, although we cannot evaluate whether these were significant on an individual subject basis. The other studies do not present relevant data on individual subject performance, although they reinforce the impression of steady, non-declining performance. Altogether, 225 of 230 subjects failed to show any significant decline (extinction) effect, and only one of the remaining five subjects definitely showed a significant decline.

There is little doubt that this prediction is confirmed: an application of immediate feedback eliminates the usual decline effect.

Prediction—Feedback Can Produce Learning of ESP:

All 22 of the studies presented in Table 10 are consistent with this prediction, although the bottom five are only trivially consistent since there was no clear manifestation of ESP in them.

For the 11 studies where relevant individual subject data are available, at least 14 of the 195 subjects showed learning, possibly more, given the difficulty of evaluation of this in some subjects in the Tart and Redington main study. For the three Honorton studies, 30 of the 34 subjects showed increases in their proportions of correct confidence calls, although the significance of these increases cannot be evaluated for each subject individually. Three other studies showed significant increases in ESP scoring for the group as a whole, even though we have no individual subject data, and two more showed increases in scoring, even though the increases were not statistically significant. Only one (Banham, 1973) found no ESP at all and no improvement for feedback.

In the first six studies where individual subjects clearly showed learning, they also showed very high amounts of ESP. Insofar as these subjects can continue scoring at these levels, much less continue to increase with further training, they are the "parapsychological batteries" we need.

Prediction—Greater ESP Ability Facilitates Learning:

In the original presentation of the learning theory application, I noted that since the repeated guessing tasks become boring, because there is confusion caused by reinforcement for hits that are actually caused by chance, etc., we have a dynamic conflict between the learning potential and the extinction process. Thus I postulated a "talent threshold," some necessary minimal level of ESP ability on starting the learning task. Below this threshold, the processes of extinction would be stronger, so even though immediate feedback would be expected to slow the extinction process, it would eventually predominate. Above the threshold, learning would predominate.

Note that the talent threshold is not a fixed entity. For a given talent level, higher motivation, higher general learning ability, etc., might shift the balance toward continued learning. For a higher talent level, we could tolerate less motivation, etc.

On a statistical level, ignoring possible non-linearity, this becomes a prediction of a positive correlation between ESP ability (scoring above chance expectation) and the slope of the regression line fitted to the performance curve.

Table 11 presents all relevant data.

TABLE 11

CORRELATIONS BETWEEN ESP ABILITY AND SLOPE

Study		*Correlation*	*Significance Level (1-tailed)*
Tart, pilot study		+.10	NS
Tart, training study:			
Aquarius:	TS slope vs TS mean	+.35	NS
	TS slope vs CS mean	–.29	NS
	TS slope vs CS TCT mean	+.44	.10
TCT:	TS slope vs TS mean	+62	.05
	TS slope vs CS mean	+.71	.025
	TS slope vs Aq CS mean	–.49	NS
Targ, Cole, & Puthoff:			
Aquarius:	Phase II slope vs mean	–.29	NS
	Phase III slope vs mean, without outstanding subject	+.91	.005
	Phase III slope vs mean, with outstanding subject	+.68	.05

Note: TS=Training Study, CS=Confirmation Study, TCT=Ten-Choice Trainer.

Recalling the statistical limitation that most of the calculated correlation coefficients are probably lower than true population values because of limited ranges of variation caused by the selection procedures in all these studies, we nevertheless see a good confirmation of the prediction. Seven of the ten calculated coefficients positive and five of these seven are significantly different from zero; none of the negative coefficients are significantly different from zero. Greater learning is associated with higher ESP ability.

Estimating the Talent Threshold:

Although there is no way known to me of predicting the approximate talent threshold for learning to predominate from the conventional psychological learning literature, we can now make a rough empirical estimate of it. If we accept that definite learning was shown by PS1 in the present pilot study, by S3 and S24 in the Tart and Redington study, by the subject in the Targ and Hurt (1972) study, by B.D. in the Kelly and Kanthamani (1972) and Kanthamani and Kelly (1974) studies, and by A2 in the Targ *et al.* Phase O study, we can calculate psi-coefficients for them of .145, .164, .098, .145, .139+ for B.D., and .073, respectively. This is a distribution generally quite higher than the range of .042 to .118 for subjects in the Tart and Redington Training Study who did not show learning, although there is some overlap, and a range considerably higher than all the other studies with mildly talented subjects given in Table 10, where psi-coefficients are generally less than .03 or so. This suggests that the talent threshold corresponds to a psi-coefficient for an individual subject of about .10 or so.

I emphasize that this is a rough calculation. Not only is it based on the very data in which learning occurred, which would boost the psi-coefficient, but it is based on subjects who were obviously successful in learning in relatively short training series. The threshold might be lower for well-motivated subjects willing to undergo long training. Certainly there is some suggestion of learning in less talented subjects on both the Aquarius and TCT in the main study.

Length of Training:

Inspection of individual performance curves in the Training Study shows that 20 training runs is too little to adequately evaluate the full potential of the learning theory application. Most subjects were still showing high variability: none had reached a clear performance plateau.

The performance data are very much like that seen in biofeedback training, where a subject tries to acquire voluntary control over some normally uncontrollable bodily function, while getting immediate feedback on the state of that bodily function through instrumentation. Subjects will frequently start to show a rise in performance learning, then a major drop, often to below the level at the start of the learning curve. What happens is that they find a strategy that works to some degree, they get better at using that strategy, but then realize that this particular strategy takes them only so far; it's not the real answer, so they abandon it (showing a great drop in performance) in order to explore new strategies. The subjects in the Training Study were often doing the same thing, judging from their comments as well as their performance curves: they would improve a strategy that seemed to work, then realize it wasn't that good, or it wasn't continuing to show improvement, so they would drop it.

While there is little doubt that immediate feedback in talented subjects can eliminate declines and sometimes produce learning in short training efforts, the ultimate potential of the learning theory application must be tested in much longer studies. We can expect even greater improvements in performance than we have seen so far. It is also likely that we will obtain performance plateaus that will be long-lasting and difficult to break free from: once a person finds a very successful strategy for accomplishing a task, it is often psychologically difficult to handle the big drop in performance that comes from discarding the strategy to try something new.

Note that motivation will be a problem in longer studies. In the short studies the novelty of the task, the subject's interest in ESP, etc., make the immediate feedback of hitting reinforcing. But as this novelty wears off, why should the subject continue working hard at a task which no longer seems so interesting? It may be necessary to then make hitting rewarding by adding external rewards to it.

Alternative Interpretations of the Results:

I have interpreted the results of the present study and other studies as strongly supporting my original hypotheses, generated from applying elementary learning theory to repeated guessing processes in ESP, viz.: (1) immediate feedback can stabilize ESP performance; (2) immediate feedback can produce learning in some subjects; and (3) greater initial ESP ability to begin with produces more learning under immediate feedback conditions, i.e., some level of initial ESP talent is required for immediate feedback to be highly effective. I am aware that there are alternative explanations of the present data that do not consider immediate feedback a relevant factor. To briefly mention some:

(1) The present good results came about through the serial selection procedure, locating subjects who were able to keep up their ESP for unknown reasons.

(2) Feedback *might* be relevant, but depending on the results of other studies that show decline is well-nigh universal without feedback is a weak procedure. A no-feedback control group is needed.

(3) Using California college students produced much better ESP results than older studies because these young students are in a new generation that is more open to ESP generally.

(4) ESP performance stayed up because the experimenters maintained a close, friendly, supportive relationship with the subjects.

(5) Because the experimenters believed that decline would be eliminated and learning could occur, it happened. That is, we are dealing with experimenter influence rather than an effect of immediate feedback.

There is some merit in all of the above counter-hypotheses, at least in suggesting other variables which may be important in addition to immediate feedback. I shall not argue against them here, for my purpose in this monograph is not to say the final word on the learning approach, but to emphasize that it could be a key to reliable ESP performance, and to show that much evidence supports this idea. Any large, complex set of data can be interpreted in a variety of ways: I emphasize the learning interpretation to stimulate research that may be very important.

Finally I want to note an alternative interpretation that is actually a misinterpretation, but as I have found several colleagues making it, it deserves emphasis. This alternative notes that since most or all of our subjects did not show significantly positive slopes, immediate feedback does not produce learning of ESP ability. It comes from ignoring the qualifications of the original hypothesis presented in Chapter I. I do *not* hypothesize that any or all subjects can learn better ESP performance if they are given immediate feedback of results. Because of the "false" reinforcements in hitting by chance alone, a repeated guessing procedure is noisy and, to some extent, will always be an extinction procedure, *unless* a subject has a high enough initial ESP talent level for the learning process to predominate. The specific hypotheses, supported strongly by the present and other studies' data, are:

(1) ESP performance will be stabilized by immediate feedback, i.e., the typical decline will be eliminated for short to moderate periods for subjects with some ESP to begin with;

(2) *Some* subjects will show learning under immediate feedback conditions; and

(3) There will be a positive relationship between overall ESP ability and the slope of the learning curve. The more ESP you have to start with, the more chance of learning. A talent threshold was postulated, interacting with motivation and innate, general learning ability, as another way of stating this relationship.

In suggesting things to be considered in future research, I shall continue to interpret the results in terms of the learning approach, in order to be maximally provocative.

Suggestions for Further Research:

Based on the findings of the Training Study, a number of tentative suggestions will be made for guiding future research, in addition to the main conclusions drawn above.

First, the fact that at least some subjects may show sharp drops in ability between sessions should be taken into account. Whatever subtle cues are learned during a session that aid the ESP calling process may not be retained very well in memory. Thus we should probably move in the direction of long training sessions (but taking care not to cause fatigue and boredom) and short intervals between sessions.

Second, particular attention must be given to the talent threshold concept. If our main interest is to produce exceptionally high-scoring ESP subjects, we should follow serial selection techniques, as used in the present study, and devote our training efforts only to those subjects who show high ESP abilities to begin with. Given the limited manpower available to parapsychological research, this is probably the best course.

On the other hand, we need more information to estimate accurately the talent threshold and/or to determine how critical this talent threshold is. This means giving extensive immediate feedback training to many subjects who span a wide range of initial ESP ability.

Third, we need more information on the threshold or level for the "experiential reality" of ESP, subjects' reactions to reaching this level, and ways of dealing with conflicts this may engender. Our discussion of Pilot Study subject PS1 is relevant here. This reality threshold is probably far more variable from subject to subject than the talent threshold, for it will depend on the compatibility or incompatibility of ESP with individual belief systems, previous ESP experiences, etc. Some of the performance plateaus we can anticipate finding in extended feedback training may be actually resistances to reaching the reality threshold.

Fourth, I favor the 10-choice TCT over the 4-choice Aquarius for a variety of reasons. Comparison between the two trainers was not a major goal of the study, so the comparisons are not strict. My feeling is that a 4-choice machine encourages guessing too much; there is too much hitting by chance alone, adding confusion and noise to the learning process. The 10-choice TCT moves toward the free-choice situation that White (1964) argued so cogently was the most effective for eliciting ESP. Perhaps even more choices would be useful, such as a 10×10 checkerboard arrangement.

The feedback to the experimenter/agent via the closed-circuit TV was probably also useful in teaching the experimenter/agent to "send" better, although there is no way of formally testing this hypothesis in the present study. It certainly kept the experimenter/agents psychologically involved in their roles.

The finding that slower speeds of response on the TCT led to generally higher scores is also important. Some subjects working with the Aquarius reported that when they weren't doing well in a run, they just dashed through the rest of it to finish it. While this may have helped them express their feelings, it defeats the whole purpose of giving immediate feedback, at least in terms of *conscious* learning, where we expect a person to note the kinds of feelings he has just before making a guess, note whether the guess is successful or unsuccessful, and keep mental notes on the optimal strategies that emerge from this. Subjects could not dash through a run on the TCT to the extent that they could on the Aquarius because there was always a delay of a few seconds while the experimenter recorded the previous response and set up the new target. Perhaps a modification of the Aquarius so that the experimenter has to remotely set up the next target (now available as an option) would be advantageous.

Note, however, that while I think a 10-choice task is better than a 4-choice one, this preference must be modified to match the subject's preference, or we sap motivation.

Finally, I want to emphasize that my application of learning theory to ESP performance is an elementary one, made while I was still a graduate student. I am not an expert in learning theory. But, given how well this elementary application has worked out, where might a sophisticated application take us? Suppose, e.g., we took into account the multiple-step nature of the ESP process (Tart, 1973b) in order to provide a more complex type of feedback that would be more informative to the subject?

I hope the future will see more sophisticated experimentation here, for I am confident that the learning theory application may give us our parapsychological batteries. Even at the elementary level of the present study, exceptionally significant amounts of ESP were steadily manifested in an ordinary, college-student population.

VII

SUMMARY

In practically all learning situations, a subject receives almost immediate feedback as to whether he was correct or incorrect in his response. His performance then improves with practice. To extinguish a learned response, or to keep it from being learned in the first place, no feedback is given.

In the typical ESP testing procedure, results are not known to a subject until the end of many trials: the run. This delays feedback so long that, from the point of view of learning theory, there is little or no effective feedback. The decline effect, a falloff in performance with practice, is well nigh universal in published studies of ESP and supports this analysis of the typical repeated guesses/no feedback procedure as an extinction procedure.

When you are right by chance alone a certain proportion of the time, the situation is more complicated, for you are rewarded for irrelevant guessing rather than for using ESP. If a subject has no ESP ability to begin with, giving immediate feedback should have no effect. If he has a little ESP, immediate feedback should stabilize performance and slow extinction, but the confusion/noise generated by chance reinforcement may eventually bring about extinction. If the subject has ESP ability above a critical "talent threshold," the learning process should predominate. The talent threshold is not absolute, but interacts with motivational level and overall learning ability.

Given subjects with some ESP ability, three formal predictions follow from this analysis:

(1) Immediate feedback of results will stabilize ESP performance,

eliminating decline/extinction effects for short to moderate length experiments;

(2) *Some* subjects will show increasing performance with repeated practice under conditions of immediate feedback; and

(3) The greater a subject's ESP abilities, the more improvement is expected.

This theory is spelled out in detail in Chapter I.

A number of experiments have appeared in the literature which support the learning theory application. They are reviewed in Chapter II.

A pilot study, reported in Chapter III, demonstrated the feasibility of equipment for supplying immediate feedback, showed results indicative of ESP, and showed that the learning theory application must be modified if unconsciously motivated psi-missing occurs.

The major test of the theory was a three-phase study reported in Chapter IV. Since subjects with ESP ability were needed to adequately test the learning theory application, the first two phases of experimentation were for selection purposes, the Selection Study and the Confirmation Study. Significant amounts of ESP were found in both. Most subjects went serially through the studies if they showed individually significant ESP ability in each, a few skipped one study. Twenty-five subjects graduated to the main study, the Training Study, in which they carried out 20 runs of 25 trials each with immediate feedback. Fifteen subjects worked throughout with a 4-choice Aquarius trainer, 10 with a 10-choice trainer.

Both final groups showed highly significant ESP results, especially on the 10-choice trainer. The predictions stemming from the learning theory application received strong support, viz.:

(1) ESP performance was stabilized; there were no significant declines within the Training Study;

(2) One subject showed a significant increase on the 4-choice trainer for overall performance, while others showed patterns of increases within training sessions (several runs), but falloffs in performance between runs, so some subjects did show learning; and

(3) Slope of the overall performance curve was positively related to degree of ESP ability, although the correlations did not always reach statistical significance.

Reports of the more successful subjects' mental processes and their ESP performances are presented in Chapter V.

The Training Study results are combined with those of other investigators' studies in the discussion in Chapter VI to show that the predictions of the learning theory application have received excellent support from some 200+ subjects. Additionally, a rough estimate of the talent threshold, above which the learning process outweighs the extinction inherent in repeated guessing, was made. The threshold estimated is a psi-coefficient of about .10 for a given subject.

The magnitude of ESP obtained in the present study was very high, high enough to allow productive functional studies of the nature of ESP. Parapsychology has been plagued by intermittent, unreliable, low-level ESP manifestations that have made functional studies very difficult. The present procedures may offer a key to practically significant and reliable ESP performance, and warrant extensive research.

APPENDIX 1

THE TEN-CHOICE TRAINER

The ten-choice trainer (TCT) was originally built for use in the pilot study reported in Chapter III. At that time there was no grant support available for the research, so the construction of the TCT was a dual challenge: to both build a training device that was technically adequate, and to do it by scrounging the kinds of surplus parts that would be lying around unused in most psychology department shops. The resulting machine met these challenges, would cost a hundred dollars or less for parts gotten by shopping on the surplus market, and can be built by any technician with a basic knowledge of electricity and simple hand tools. I shall suggest some specific improvements that can be made while describing the TCT, and Dana Redington and I are designing a far more sophisticated TCT for use in future research. But the present design should do quite well for others who wish to start work in this area.

The TCT has been designed for a 10-target guessing situation, but the design is redundant and may easily be adapted to any number of targets from two upwards.

Randomization and target selection can be accomplished in the traditional fashion of the experimenter thoroughly shuffling a target deck of appropriate symbols. This deck should be a subdeck from a much larger deck to keep it open. This deck then determines the order in which switches will be closed by the experimenter throughout the experiment. We switched to the random number generator shown in Figure 9, Chapter IV, part way through our main study.

For a given trial, the experimenter turns up a card and closes the appropriate Target Selection Switch on his console. This simultaneously lights a pilot lamp beside that switch (with the target symbol beside it), giving the experimenter a fixation point if he is attempting to send telepathically, and lights a Ready Light on the Subject's Console, informing the subject that a target is being sent and he may guess when he is ready. The panel layout is shown in Figure 8.

The subject makes his choice by pushing the appropriate button on his console. The Subject's Console is laid out to be almost identical to the Experimenter's Console, and is shown in Figure 7. Pushing the button: (1) activates the Trials counter on the Experimenter's Console to increase this count by one; (2) activates the Hits counter on the Experimenter's Console if the subject's guess was correct. If the Feedback Control Switch is in the off position, nothing further happens. If it is in the All Trials position, the correct lamp, the one the subject *should* have guessed, lights on the Subject's Console, giving him complete feedback on the target. If the Feedback Control Switch is in the Hits Only position, the correct lamp comes on only if the subject guesses correctly .A chime in the Subject's Console wil also automatically sound on hits if it is switched on at the Experimenter's Console.

The experimenter then opens the Target Selection Switch, cutting off all lamps on both panels, and goes on to select the next target card and repeat the above procedure. The mechanics of the experimenter selecting the card and activating the machine take only about two seconds after practice, longer if the experimenter takes notes on targets and responses: the subject may respond as rapidly or slowly as he desires once the Ready Lamp comes on.

The Subject's Console also contains a Pass Button: if he does not want to guess on a given trial he may press this, signaling the experimenter who can then select a new target. The Pass Counter records this, but neither the Trials or Hits Counter is activated, and the subject receives no feedback on what the passed target was.

The Experimenter's and Subject's Consoles are interconnected by multiple-conductor cable, which may be several hundred feet in length. Low voltage is used for safety. Cable lengths up to several thousand feet may be used if large cable is used.

Let us now consider the electrical operation of the TCT in detail.

Target Setup:

Figure 17 presents the circuit (except for a power supply) of the TCT. We shall trace the operation of the circuit by assuming that Target #2 has been selected.

When the power is initially turned on, no lamps light and no current flows anywhere in the apparatus. Then the experimenter closes Target Selection Switch #2 (S-2), and several things happen. Consider them from the top contact on down.

First, Target Lamp #2, the experimenter's fixation point, is connected in parallel with Lamp #2 on the Subject's Console. Neither lamp lights yet.

Second, the common Hit Line in the Experimenter's Console is connected to a contact of Relay #2 of the Subject's Console, but, as Relay #2 is open, no current flows. No voltage exists in the common Hit Line unless the subject presses Button #2 (thus closing Relay #2), an event we shall consider below.

Third, voltage is applied from the + Power Bus to the experimenter's Target Lamp #2, which lights. The corresponding Lamp on the Subject's Console does not light because the Feedback Relay (Subject's Console) is open.

Fourth, voltage is applied from the + Power Bus to the Ready Line, lighting the Ready Light on the Subject's Console, informing him that he may guess.

The above four actions are, of course, simultaneous, since all four poles of the switch close together, but they were looked at sequentially for the sake of analysis.

Subject Responds Incorrectly:

Let us assume that the subject incorrectly responds by pushing Button #1 (B-1) on his console. This closes two separate sets of contacts on Relay #1. The upper set applies voltage from the Ready Line to the individual Hit Line for target #1, but as this contact in Target Selection Switch #1 on the Experimenter's Console is open, it does nothing. The lower set applies voltage from the Ready Line to the Trials Line: this voltage does two things. First, it activates the Trials Counter to increase the count by one. Second, it goes to the Feedback Control Switch.

If the Feedback Control Switch is in the off position, nothing

Subject's Panel

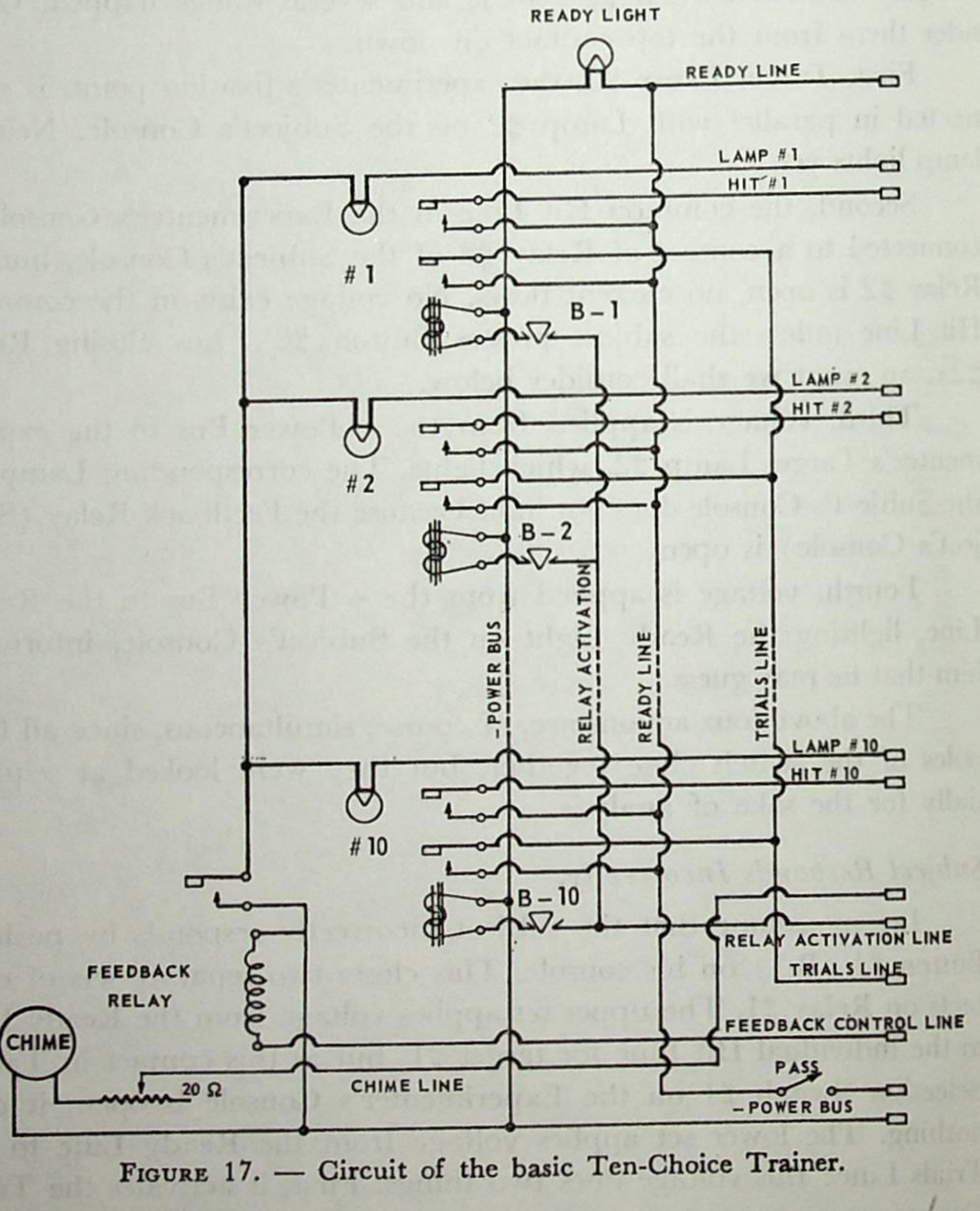
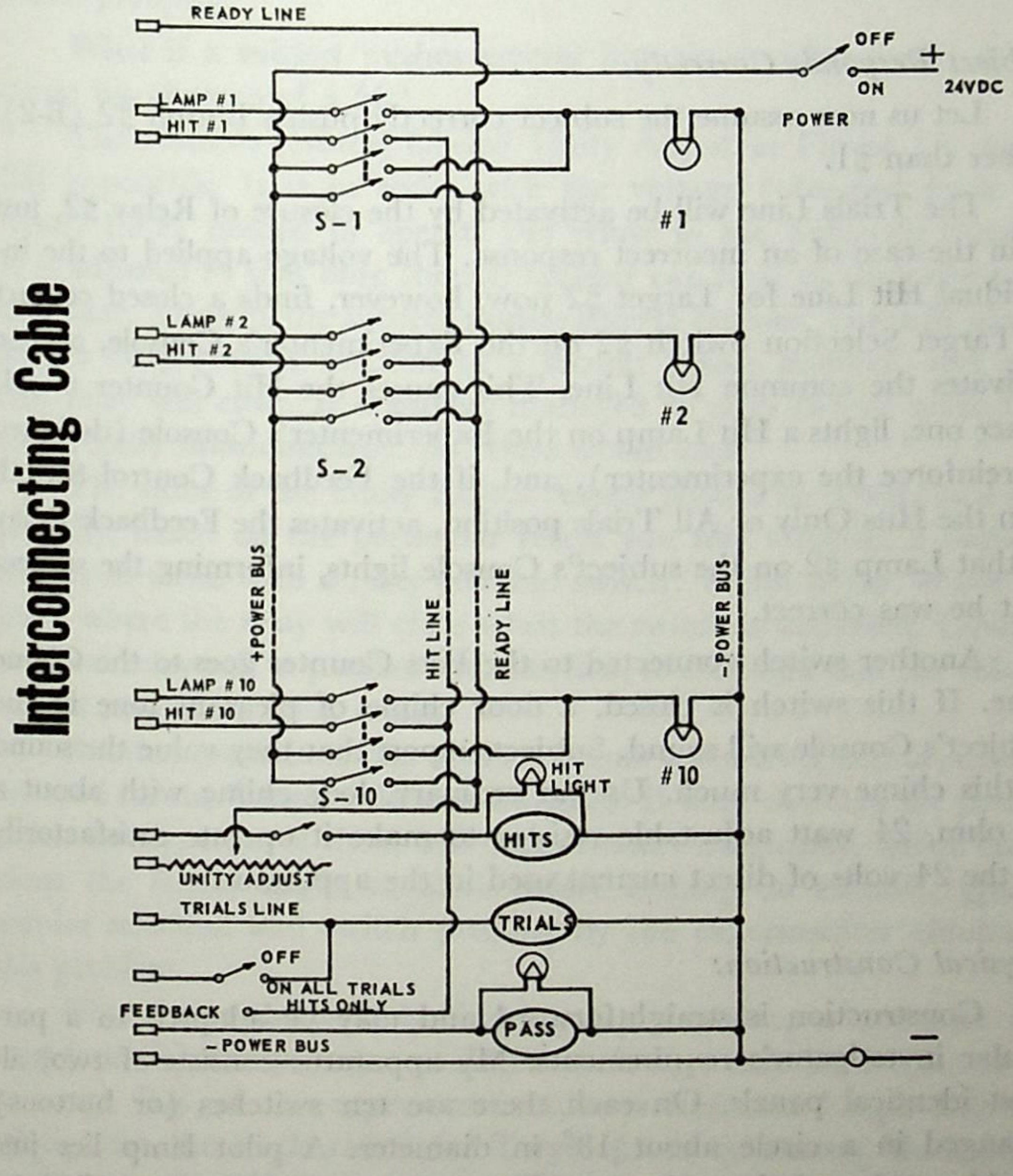


FIGURE 17. — Circuit of the basic Ten-Choice Trainer.

Experimenter's Panel



happens, and the subject receives no feedback on the correctness or lack of it of his guess. If the Switch is in the All Trials position, as it was for all studies reported herein, voltage is applied to the Feedback Control Line and activates the Feedback Relay. Its contacts complete the circuit for the lamps on the Subject's Console, and whichever lamp was chosen as target (#2 in this case) will light, showing the subject that he should have guessed at #2 instead of #1. If the switch is in the Hits Only position, nothing will happen on this trial.

Subject Responds Correctly:

Let us now assume the subject correctly pushes Button #2 (B-2), rather than #1.

The Trials Line will be activated by the closure of Relay #2, just as in the case of an incorrect response. The voltage applied to the individual Hit Line for Target #2 now, however, finds a closed contact in Target Selection Switch #2 on the Experimenter's Console, and so activates the common Hit Line. This causes the Hit Counter to advance one, lights a Hit Lamp on the Experimenter's Console (designed to reinforce the experimenter), and, if the Feedback Control Switch is in the Hits Only or All Trials position, activates the Feedback Relay so that Lamp #2 on the subject's Console lights, informing the subject that he was correct.

Another switch connected to the Hits Counter goes to the Chime Line. If this switch is closed, a door chime of pleasant tone in the Subject's Console will sound. Subjects report that they value the sound of this chime very much. Use an ordinary door chime with about a 20 ohm, 24 watt adjustable resistor to make it operate satisfactorily on the 24 volts of direct current used in the apparatus.

Physical Construction:

Construction is straightforward and may be adapted to a particular investigator's requirements. My apparatus consists of two, almost identical panels. On each there are ten switches (or buttons) arranged in a circle about 18″ in diameter. A pilot lamp lies just outside each switch or button. Thus targets may be identified by number (1-10), position (top, 30°, etc.), or a symbol (playing cards) placed beside the lamp and switch.

The Subject's Console is completely enclosed to prevent tampering with the circuit.

The Experimenter's Console also contains a Power Switch, counters for Trials, Hits, and Passes, a Feedback Control Switch, a Hit Light, and a Pass signal lamp. (A duplicate Ready-Light is in the center of the circle on the experimenter's Console to further make the panels physically alike, but its function is redundant in this case.)

Fraud-proofing:

What if a subject pushes several buttons simultaneously, to increase his chances of a hit?

The variable resistor, labeled Unity Adjust in Figure 17, makes this impossible. It is in series with the voltage (obtained from the Ready Line) needed to operate the relays in the Subject's Console. It is adjusted so that only enough current can flow to close one relay at a time. Thus, if the subject pushes several buttons, one will almost always be pushed a fraction of a second before another, and only that relay will close. If a subject managed to push two or more buttons exactly simultaneously, no relays would close.

The value of the Unity Adjust resistor should be determined empirically, based on the particular relays you use. Connect a variable resistor in series with a relay coil and switch: adjust it just above the point where the relay will close when the switch is activated. Connect a second relay coil in parallel with the first, to ascertain that the voltage cannot now close both relays.

Another possible source of error occurs when lever action switches are used for the Target Selection Switches. If these switches are pushed rather slowly, some of them will make contact irregularly, which could cause the Ready Light to blink before coming on steadily. Quick, regular selection and switch pushing by the experimenter eliminates this problem.

Note that a deliberately cheating experimenter, or one with unconscious response patterns, could transmit cues that the subject could pick up. E.g., if the experimenter always hesitated longer between trials when the cards called for Target #1 to be chosen, the subject could learn that this long delay was associated with that target. Again, quick and regular action by the experimenter seems to eliminate this problem, and we found no empirical support for it in our main study.

An alternative would be to install a timing circuit in the power line, such that the interval between trials was fixed and always long enough for the experimenter to have completed the selection process, an improvement that I shall use in future experiments but which will automatically slow down the rate at which the subject could respond.

Components:

I have deliberately refrained from putting part numbers on the components, so that the experimenter may adapt the circuit to whatever parts he can obtain. Many surplus components, at very low prices, can provide all the necessary parts. Some general comments do apply, however.

First, use low voltage components for safety. I have used 24 volts direct current because of its wide availability in many psychological laboratories.

Second, select lamp sizes that are not too bright for comfort. Small pilot lamps can be very irritating to look at if they are too bright or not in an adequate shielded fixture.*

Third, be careful not to get the "make before break" type of switch, as this can cause the circuit to malfunction..

This completes the description of the basic apparatus, which has been successfully used and "debugged." Several improvements that have since been added to the apparatus and were used in all the studies described earlier will now be described.

Self-Contained Power Supply:

For those not having access to 24 volts direct current, a simple

* Since the pilot light fixtures used protruded about half an inch above the panel face, the reader might wonder if subjects who tried to "feel" for the correct target might have actually been detecting an electrostatic field from the selected (albeit unlit) target lamp through some little-known cutaneous sense, rather than using ESP with the idea of a "feeling" being only a convenient readout mechanism for the subject's ESP abilities. The TCT was designed to avoid this possibility. Referring back to Figure 17, note that the base of all ten target lamps were connected to a common line, and that this common line was not connected to the –24VDC power bus until a response button was pressed. Thus, even though power from the +24VDC bus was applied to the filament of the selected target, this same voltage was, in terms of possible electrostatic fields, applied to *all* target lamp filaments equally. Thus the TCT presented a flat metal face with all circuitry shielded except an equal, minute electrostatic field theoretically occurring at each of the ten target lamps where the lamp filament (inside its glass bulb, in turn inside a plastic shield, the pilot lamp fixture diffusing shield) protruded about an eighth of an inch through the panel.

power supply is shown in Figure 18. Using an 18 volt secondary on the transformer, a bridge rectifier, and a single, large, filter capacitor provides 24 volts direct current. It is poorly regulated, but regulation is not important in the basic circuit. The transformer secondary need supply only an ampere or two, unless you use very low resistance relays. The chime draws several amperes on hits, but that is only a momentary load.

Total Feedback to Agent-Experimenter:

The basic circuit only tells the experimenter whether the subject has guessed correctly or incorrectly on any given trial. If the experimenter is trying to learn how to "send," and/or wants to note individual responses, he needs to know exactly which button the subject pushes on each trial. A simple modification of each Target Selection Switch on the Experimenter's Console will accomplish this, and is shown in Figure 19, with the modified wiring shown as a heavier line.

Instead of the four-pole single throw switches shown in Figure 1, four-pole double throw switches are used. When a target has not been selected, the pole connected to the individual Hit Line from the subject's Console is not simply off, but connected to the corresponding lamp on the Experimenter's Console. If the subject pushes that button, the corresponding lamp on the Experimenter's Console will light. All other aspects of circuit operation are identical. The closed-circuit TV feedback, described in Chapter IV, also gives the experimenter more opportunity to learn to send.

Response Locking:

In the basic TCT (with or without the modification for giving total feedback to the experimenter), the various scoring and feedback circuits are active only so long as the subject continues to hold his response button down. If the subject just jabs at the button, this may be adequate to activate the Trial and Hit Counters, but the brief blink of the panel lamps may not provide adequate feedback. Also, if the experimenter wants to keep a record of individual responses, rather than just total scores, he cannot under these circumstances.

The heavy line in Figure 20 shows a modification, made to each Relay, that locks the Relay closed as soon as the subject pushes his

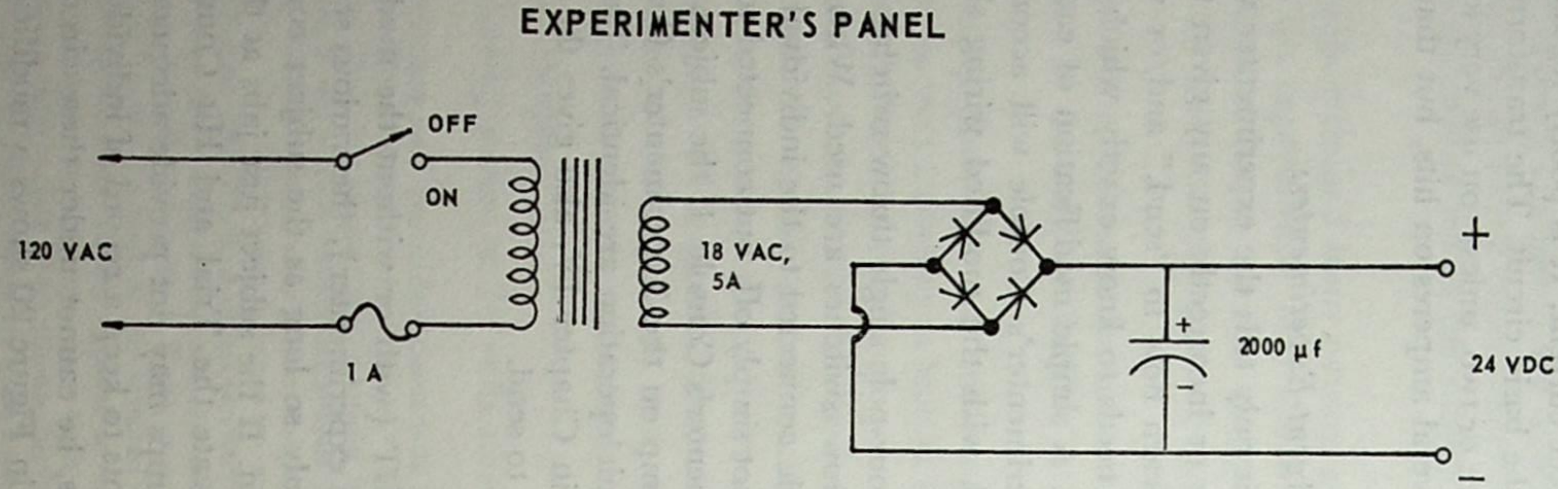


FIGURE 18. — Simple power supply for the Ten-Choice Trainer.

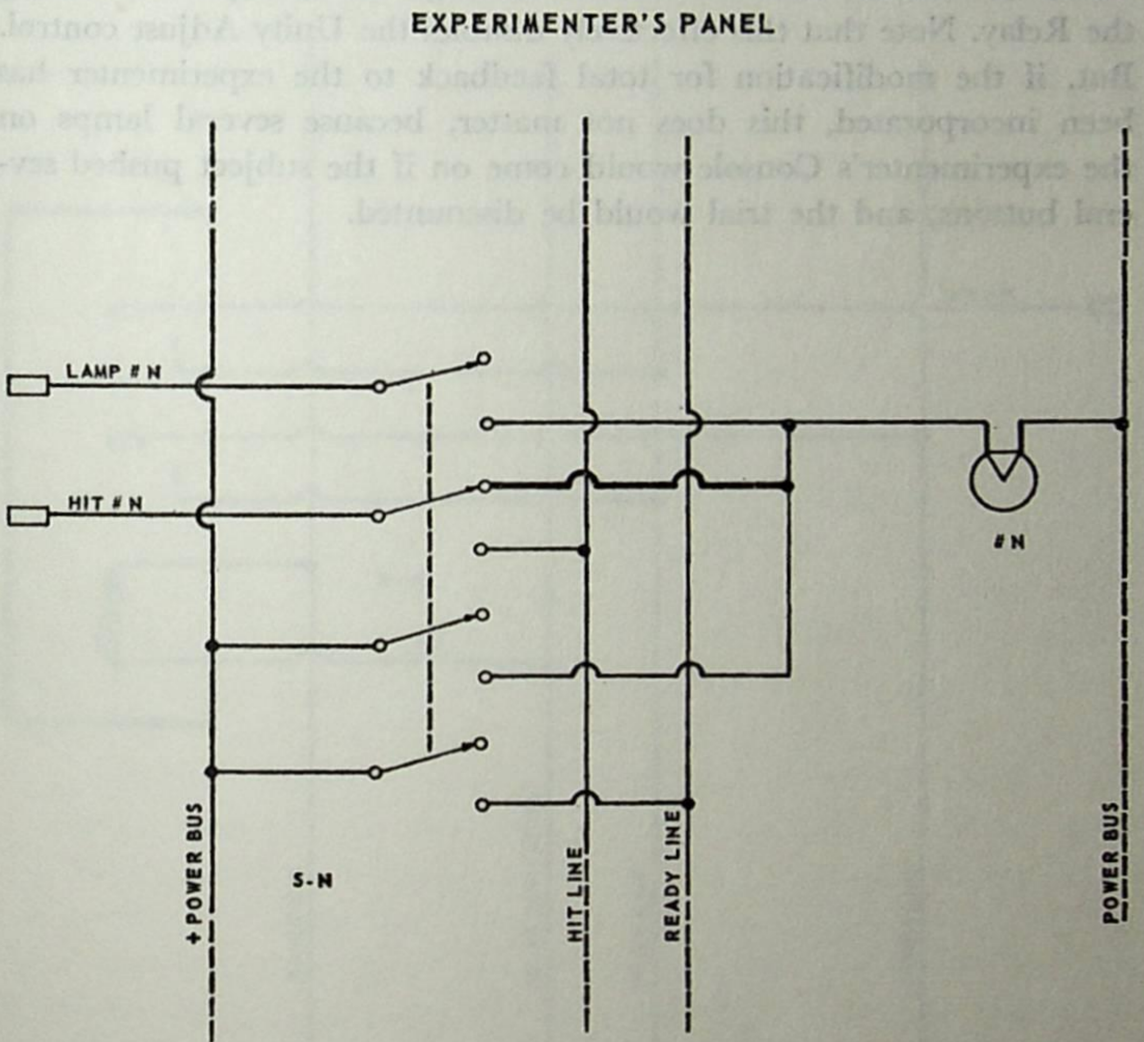


Figure 19. — Modifying the Ten-Choice Trainer to give feedback to the agent/experimenter as to what the subject's choice was.

button. Even though the subject removes his finger, the Relay stays closed for that trial on the Experimenter's Console. Thus the experimenter has as much time as he needs between trials.

Electrically, this works because as the upper relay contacts close, the voltage from the Ready Line is thus connected to the Relay coil, in parallel with the voltage applied through the Button. When the Button is released, current still flows through the Ready Line, locking the Relay. Note that this effectively disables the Unity Adjust control. But, if the modification for total feedback to the experimenter has been incorporated, this does not matter, because several lamps on the experimenter's Console would come on if the subject pushed several buttons, and the trial would be discounted.

SUBJECT'S PANEL

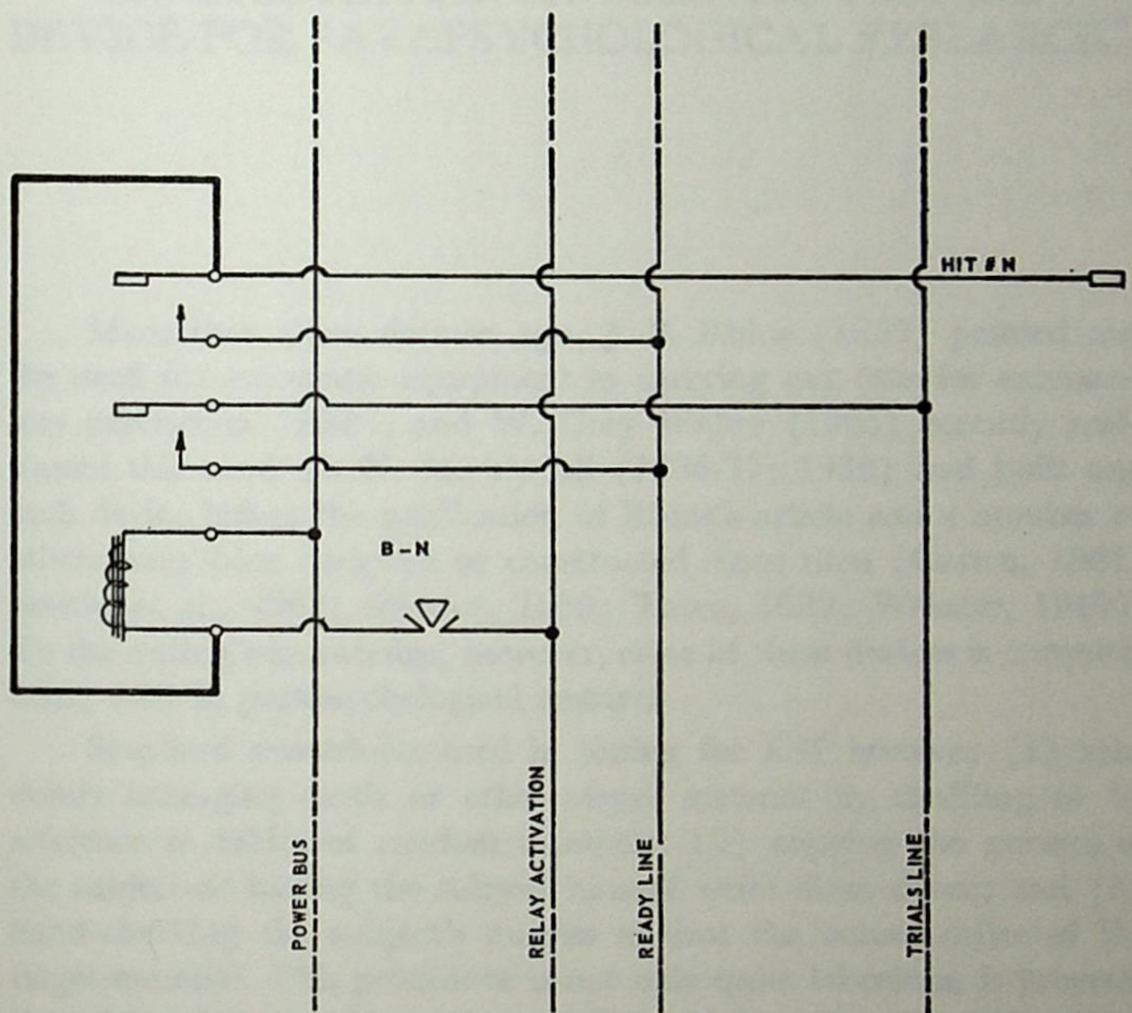


FIGURE 20. — Modification to the Ten-Choice Trainer for response-locking: after a subject presses the button of his choice, the selected target lamps (target and response) remain on until the experimenter opens the selection switch.

APPENDIX 2

ESPATESTER: AN AUTOMATIC TESTING DEVICE FOR PARAPSYCHOLOGICAL RESEARCH*

More than three decades ago, J. B. Rhine (1939) pointed out the need for automatic equipment in carrying out tests for extrasensory perception (ESP), and W. Grey Walter (1965) recently reaffirmed this need. G. N. M. Tyrrell (1936-37; 1938) had built one such device before the publication of Rhine's article and a number of others have been designed or constructed since then (Cutten, 1961; Smith, *et al.*, 1963; Stewart, 1959; Taves, 1939; Webster, 1949). To the author's knowledge, however, none of these devices is currently being used in parapsychological research.

Standard procedures used in testing for ESP involve: (1) randomly arranging cards or other target material by shuffling or by reference to tables of random numbers; (2) copying the guesses of the subject or having the subject himself write them down; and (3) hand-checking the subject's guesses against the actual order of the target material. This procedure is not only quite laborious, it prevents the subject from working very rapidly; and, in order to guard against scoring errors, a perennial criticism raised by critics of parapsychology —see, e.g., Price (1955)—elaborate and time-consuming procedures of duplicate records, independent checkers, etc., are necessary (Humphrey, 1948). A most important drawback of these standard procedures, however, is that they add a *constant* psychological condition to almost

* Reprinted from the *Journal of the American Society for Psychical Research*, 1966, Volume 60, pp. 256-269, by permission of the American Society for Psychical Research. I have updated a few passages.

all ESP experiments, viz., that the experimenter is rather busy and cannot devote his full attention to the subject during the testing. Since this is an experimental condition that may influence the test results, it should be possible to vary it in order to assess its effect, and not have it always present whether we want it or not. Thus there is a definite need for a device which would accomplish three basic functions in order to free the experimenter for more profitable activities: (1) automatically generate random targets; (2) allow the subject to respond at whatever speed he desires, and not be concerned with record keeping; and (3) make an objective record of the results. Additional desirable features have been discussed by Rhine (1939) and many of these will be mentioned in the discussion of the device proposed below.

Of considerably more potential importance than the convenience and safeguards against error that would be provided by an ESP testing machine, however, is the fact that only with automatic testing aids does it become feasible to use and investigate the effects of immediate reinforcement on ESP performance. As was discussed at length earlier (see Chapter I), standard card-guessing tests probably constitute an *extinction* procedure rather than a *learning* procedure. This discussion pointed out that automated testing devices were required in order to provide the immediate reinforcement necessary for learning. The device described in this paper will extend the earlier discussion by illustrating how such an automatic testing device may be constructed.

In view of the need for a testing device, then, and the fact that several have been proposed and/or built in the last two decades, why are such devices not in common use today? There were a number of practical drawbacks, shared to various degrees by almost all of the previously proposed machines, which may explain why they are not in use today. The chief drawbacks were: (1) lack of true randomicity in the generation of targets; (2) so much complexity that only highly trained technical personnel could construct and maintain the devices; (3) expense; (4) lack of sufficient flexibility to justify the expense and time involved in their construction and maintenance; (5) slow and cumbersome operation, most of them requiring the subject to push two or more buttons or levers on every trial; and (6) lack of portability. There were various other disadvantages peculiar to individual machines.

THE ESPATESTER

This paper will describe the construction and operation of a proposed device, ESPATESTER (*ESP A*utomatic *TESTER*), which should satisfy the need for instrumental aids in ESP testing. The first section of this paper will describe the device generally and the second will give a detailed technical description of its operation.

The ESPATESTER performs two basic functions:

1. It automatically generates a randomly selected target within 50 milliseconds following the subject's previous response. This target may be an indicator light, the internal electronic state of the apparatus, an agent's perception of an indicator light, or any other sort of event which can be controlled electrically by the addition of accessory apparatus (slides, sounds, music, etc.).

2. It automatically scores each response of the subject as correct or incorrect, and on three electromechanical counters displays (a) the total number of trials, (b) the total number of hits, and (c) the total number of misses (this counter is optional).

The same outputs that provide scoring information may be used to operate information feedback devices or reinforcement devices.

The ESPATESTER has been designed around a line of behavioral programming equipment widely used in psychological research.* As will be explained in detail below, this has resulted in an extremely flexible device, for ESPATESTER can readily be used with a wide selection of behavioral programming equipment, thus making many of the techniques developed in psychology in the last few decades readily adaptable to parapsychological research. It would have been possible to build all the units of the ESPATESTER from generally available electronic parts, but this would have resulted in no financial savings when all the extra time required was figured in, as well as sacrificing the considerable advantage, discussed below, that ESPATESTER may be constructed by most laymen.

The uses and advantages of the ESPATESTER will be outlined now.

1. ESPATESTER may be used for GESP tests by having an agent observe pilot lights indicating the target selected, or for "pure"

* My particular thanks go to Mr. Herbert Bello and Mr. Robert Bello of the Massey-Dickinson Company (9 Elm Street, Saxonville, Massachusetts) for their aid in designing the ESPATESTER with standard Massey-Dickinson components.

clairvoyance tests by having no agent observe the indicators and having only the total trials and total hits indicated on the counters. It may be used for precognition tests by having the target selection take place after the subject indicates his response (slight changes in the basic ESPATESTER circuitry are made for precognition tests).

2. With some modification, ESPATESTER could be used for PK tests by asking the subject to attempt to influence the random selection process.

3. Because the target selection process is much faster than the highest speed at which a human subject can respond, the subject may respond as fast or as slowly as he wishes. Pushing one button to indicate his selection is all that is required on each trial. The push buttons are all that the subject has on his console (except for optional reinforcement devices), so the machine is psychologically inconspicuous.

4. Cheating by the subject is virtually impossible. An electronically sophisticated subject, left alone with ESPATESTER for some time, might be able to cheat, but this contingency is easy to guard against.

5. With the addition of a polygraph, any or all of the following may be automatically recorded for *each trial*: (a) which target the machine selects; (b) which target the subject selects; and (c) a marker signal indicating the correctness or incorrectness of the subject's choice. The purpose of this latter signal is to even further reduce chances of scoring error when later going over the polygraph record. If either (a) and (b), or (a) and (c) are recorded, the following variables may be measured from the polygraph record for each trial: (a) the subject's reaction time; and (b) the length of time the subject held down his selector button.*

6. The problem of scoring errors by the experimenter is virtually eliminated with ESPATESTER, for the experimenter's only task is to write down the totals on the various counters at the end of each run. If a polygraph record is also taken, a completely objective record of the experiment is permanently available. It would be quite feasible to run subjects on ESPATESTER without the experimenter even being present.

7. ESPATESTER should be useful in studies attempting to

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* By instructing the subject to depress his button longer for those guesses about which he is more confident, an automatic scoring of confidence can be accomplished.

find physiological correlates of ESP, because such physiological measures can be recorded on the same polygraph as the ESPATESTER output, thus making a convenient and accurate record. Or they can be written out on two separate polygraphs to insure independent scoring. (Or part of one record may be masked during scoring.)

8. Most of ESPATESTER consists of standard, commercial modules that an intelligent layman (which is how the typical parapsychologist is classified when it comes to electronics) could plug together in a few hours (including mechanical assembly). The other units can be built by anyone who can use simple hand tools and solder.

9. Because ESPATESTER is mostly constructed of commercial, off-the-shelf units, trouble-shooting and repair can be carried out by the layman by substituting units. The commercial units used have very high reliability, however, and malfunction should be rare.

10. ESPATESTER is very flexible. By adding other commercial modules made by the same company, many other additional functions can be carried out. As a few examples: (a) the data on each trial can be punched directly on tape suitable for computer analyses; (b) rewards of various types (money, buzzers, pin-ball-machine type displays) can be given to the subject on fixed or variable schedules with fixed or variable delays for correct responses; and (c) negative reinforcements (the nice word for punishments), such as electric shock, can be given on fixed or variable schedules after fixed or variable delays for mistakes. Such positive or negative reinforcement could be given to the agent as well as to the subject. A simple form of reinforcement could be carried out by simply mounting the hits and misses counters on the subject's console, giving him immediate knowledge of results on each trial.

11. By the addition of a few switches a novel experimental technique is feasible—the mixing of GESP and clairvoyance trials within a single run. Here the agent would know what the targets were on some trials (or some of the targets on all the trials) but not on others by the experimenter disconnecting some of the indicator lights. Other novel techniques could easily be programmed.

12. Auditory cues from the operation of ESPATESTER are not of such a nature as to give away what target has been selected. It is almost completely silent in operation, except when the counters operate. Nevertheless, ESPATESTER is designed so that the subject's

console may be located remotely from the device itself. The experimenter can use up to several miles of connecting cable to separate the subject from the apparatus. Remote placement of the indicator lights would also allow the agent to be situated at considerable distance from the apparatus. It would also be possible (at extra expense) to develop a telemetering device to allow ESPATESTER to work over telephone lines, so the experimenter who really wants distance can conduct tests from one end of the earth to the other!

13. The whole device may be built in a large suitcase, allowing ESPATESTER to be taken into the field for investigation.

14. ESPATESTER is of very general use in the laboratory whenever random number sequences are desired. While this paper focuses on the parapsychological uses of ESPATESTER, the random generating section of ESPATESTER can be used separately in many areas of scientific research.

The cost of the components for the basic ESPATESTER is about $1600,* not including a polygraph if this sort of record is desired. While this is somewhat high, it is within the reach of many parapsychologists. When compared to the extent it will free their time for more productive experimentation instead of clerical work, it is an excellent bargain.

ESPATESTER was set up and checked by the author and found to operate quite satisfactorily. In addition, the Massey-Dickinson Company set up an automatically operated version of the random generator section of ESPATESTER and sent the results of over 300,000 trials to the author to analyze for randomicity. These data are presented in Sub-Appendix A, Table 1, and indicate a satisfactory degree of randomicity for equal probability of target selection. Later, target blocks of 1,000 targets each were tested for equal frequency of doublets and triplets by the Chi-square test, and showed no significant departures from randomicity.

We now turn to the technical description of ESPATESTER. This description stresses principles of operation, and many modifications could be introduced in collaboration with an electrical engineer. The particular circuit shown, however, is complete in itself, and this version of ESPATESTER can be built directly by any experimenter who has any proficiency with electrical circuits.

* By 1966 prices.

ESPATESTER consists of two units, the subject's console and the main unit. The subject's console consists of a box on which there are five pushbuttons* and any reinforcement equipment desired, such as counters to indicate hits and trials. Such counters may or may not be connected for a particular experiment. The subject's console is placed in a different room from the rest of the ESPATESTER, and from the agent (if one is used), in order to eliminate all problems of sensory leakage. A cable, of any desired length, connects the console with the main unit.

Operation of the ESPATESTER consists simply of turning on the power and telling the subject to start guessing. As the electronics equipment is all solid state, there is no "warm-up" time. A "ready" light can easily be added to perform this latter function, if desired.

In order to understand the operation of the ESPATESTER, the component modules will first be briefly described. Each module is a transistorized unit which plugs in to the ESPATESTER. These modules are described more fully in the Massey-Dickinson catalog.

The *Output Control* is a transistor driven relay. Two output control units are mounted on a single panel.

The *Input Modifier-Delay* is a device which provides a signal output of fixed duration once it is triggered. This output should be set to approximately 50 milliseconds duration for ESPATESTER use.

The *Electromechanical Counters* count the number of input pulses delivered to them and display this count at all times.

An *AND Gate* is a device which has two input "legs" and one output. It produces an output signal only as long as an input signal is present at *both* input legs simultaneously.

An *OR Gate* produces an output signal as long as there is an input signal on *any one* of its input legs.

An *AND-Inhibit Gate* is a device that produces an output if a signal is present at *one* of its input legs, but produces no output if a signal is present at the inhibit input leg. The later signal "inhibits" the output.

The *Counter-Stepper* unit counts the number of input pulses

* Five target possibilities are used as this number is common to most ESP studies. The device can select among 2-10 targets. With the purchase of additional equipment, it could select among hundreds.

coming into it by selecting a new output for each input, up to ten. In ESPATESTER applications, it is set so that on the fifth count it goes back to one and begins again. Thus a continuous train of input pulses makes the outputs cycle "around and around" a series of five positions.

On the *Subject's Console* are a set of five push buttons, controlling a series of DPDT relays with mercury wetted contacts.* These push buttons should be of the mechanically interlocked type, so that only one may be depressed at a time. Electrical interlocking could be substituted for mechanical interlocking.

The *Lamp Driver* is a multiple amplifier unit which makes an input signal strong enough to light a small lamp.

The circuit of ESPATESTER is shown in Figure 21.

The operation of the ESPATESTER may be considered in three aspects: (1) the generation of targets; (2) the scoring of responses as correct or incorrect; and (3) the production of signals for external recording of targets and responses. These functions will be discussed in this order.

The targets are randomly generated as follows: One *Output Control*, shown in the upper left of Figure 21 has its output fed back into its input, so that it oscillates at a frequency of several hundred cycles per second, the exact frequency being determined by the mechanical inertia of the relay armature. Because of a mechanical factor, namely the relay contacts bouncing as they hit each other, output pulses are actually produced at a rate of several thousand per second, on the *average*. These output pulses are quite variable in their timing and duration, and over a fixed time interval the total number of output pulses varies randomly.

Such a fixed time interval, of 50 milliseconds (an arbitrary time), is produced by the *Input Modifier-Delay* unit. At the *end* of each response by the subject (when he releases a pushbutton), a signal is generated on the Reset Line via an *OR Gate* which activates the *Input Modifier-Delay* unit. This 50 millisecond pulse is applied to one of the input legs of *AND Gate* #6 (designated E_6 on the dia-

* These relays are used to eliminate "contact bounce" in the switches. Five additional *Input Modifier-Delay* units could be used instead. This would eliminate much of the soldering required in constructing ESPATESTER, but at considerable expense.

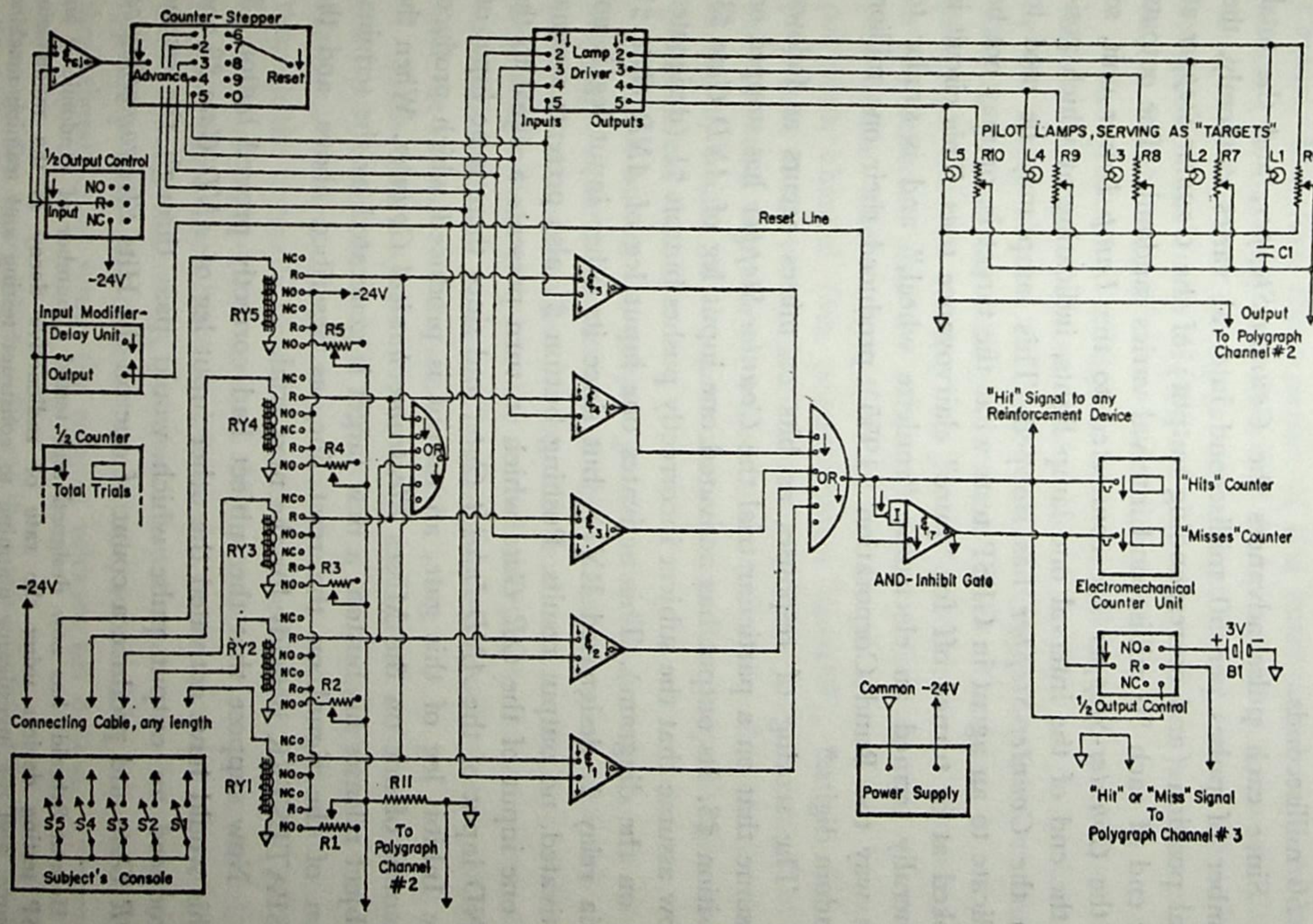

FIGURE 21. — The circuit of ESPATESTER.

gram). The pulses from the oscillating *Output Control* are always being fed to the other input leg of *AND Gate* #6, and so these pulses are allowed to reproduce themselves at the output *AND Gate* #6 for 50 milliseconds.

Since each pulse advances the *Counter-Stepper*, and the total number of pulses per 50 millisecond interval varies randomly, the final position (and corresponding output) of the *Counter-Stepper* at the end of each 50 millisecond interval varies randomly. The outputs of the *Counter-Stepper* are connected to the *Lamp Driver* unit, so at the end of the interval one lamp lights, indicating at which posiion the *Counter-Stepper* has stopped. This lamp may be used to indicate to an agent in GESP tests what the target is, or may not be looked at or turned off for "pure" clairvoyance tests. This circuit is generally termed an electronic "roulette wheel," and is similar to the way the Rand Corporation (1955) produced their one million random digits.*

The scoring of responses as hits or misses occurs as follows. Assume that on a particuar trial the *Counter-Stepper* has stopped on position #3. Its output has activated one input leg of *AND Gate* #3. Now assume that the subject incorrectly pushes button #1 (designated S1 on the diagram). This activates one input leg of *AND Gate* #1 (via relay 1, designated RY1), but since its other input leg is not activated, no output results. Pushing button #1 also presents a signal to one input of the *OR Gate* which in turn presents a signal to the AND input of the *AND-Inhibit Gate*, and since there is no input on the Inhibit leg of this gate, an output is produced which produces a count of one on the Misses *Electromechanical Counter*. When the subject releases his button, a new target is generated by the termination of the signal on the reset line, as described above, and the ESPATESTER is ready for the next trial.

Now suppose that the subject had correctly pressed button #3. This would have activated the other input leg of *AND Gate* #3 and produced an output pulse which would pass through the second *OR Gate* and produce a count of one on the Hits *Electromechanical*

* Helmut Schmidt has now designed and tested a number of randomizing and ESP testing devices using the rate of radioactive decay as the randomizing source, and the investigator planning to construct testing and training machines in this area should consult Schmidt's work (Schmidt, 1970; 1973; Schmidt & Pantas, 1972).

Counter. This signal would also inhibit the *AND-Inhibit Gate*, via the first *OR Gate,* blocking off the signal generated by all push buttons that would otherwise activate the Misses *Electromechanical Counter*. As before, the cessation of this latter signal from the push button (via the relay and first *OR Gate*) would activate the *Input Modifier-Delay* and set up a new target for the next trial. Each activation of the *Input Modifier-Delay* also produces a count of one on the Total Trials *Electromechanical Counter*.

The production of signals for external recording of trials and responses occurs as follows. When one of the five lamps has been lit by the *Lamp Driver*, indicating which target has been randomly selected, part of the voltage developed across the lamp is led to a polygraph channel, causing the pen to deflect a fixed distance, and to stay deflected until the subject makes a choice and lets up on his push button. The voltages from all five lamps are fed into the same polygraph channel (via potentiometers R6-R10), but a different proportion of the voltage is taken from each lamp, so the height of the pen deflection depends on which lamp is lit. Five heights can easily be set, by means of the potentiometers in the lamp circuits, to be quite discrete visually.

Which button the subject presses may be recorded on a second polygraph channel. By means of the voltage dividing network composed of potentiometers R1 to R5 and resister R11, a different amplitude voltage is fed to the second polygraph channel, depending on which button is pressed. The polygraph pen will remain deflected until the subject releases the button.*

Each trial may be conveniently designated a hit or miss on a third polygraph channel.** If it is a hit, the signal going to the Hits *Electromechanical Counter* is fed directly out to the polygraph through the normally closed contacts on the *Output Control* (drawn in the lower right-hand corner). If the response is a miss, the signal going to the Misses *Electromechanical Counter* activates the *Output Control* and switches the polygraph input over to a fixed signal of opposite polarity and different amplitude, supplied by a battery. Both these signals cease when the subject releases his button.

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* It would also be possible to write out the target selection and responses on a 10-channel event marker polygraph, and some investigators might prefer this.

** This is redundant, but convenient information.

Figure 22 illustrates how a polygraph record of three trials might look.* The top channel records the target selected, the middle channel which button the subject pressed, and the third channel whether each response was a hit or miss. Although this information can be gotten by comparison of the first two channels, the presence of this third channel greatly reduces the possibility of scoring errors in reading the polygraph record, since only a much grosser discrimination is required.

Time interval t_1 is the time taken to set up a new target for each trial, viz., 50 milliseconds. Time t_2 is the reaction time between push button presses for the subject, and time t_3 is the length of time a subject holds down a button. In this particular hypothetical example, target #2 has been selected. The subject responds by pressing button #4 and holding it down for only 50 milliseconds (indicating a very brief jab at the button). This produces a Miss signal on the third channel. The ESPATESTER then selects target #5, the subject correctly presses button #5 500 milliseconds after his previous press, holding the button down for 100 milliseconds, and a Hit is registered on the third channel. The ESPATESTER then selects target #3, the subject presses button #1 450 milliseconds later, a Miss is indicated, etc. The subject's finger lingers on the button for almost half a second. The counters have meanwhile indicated a total of three trials, one hit, and two misses.

Mechanically, all the Massey-Dickinson module units are mounted by simply plugging them into rail units which contain the power connections. These rail units are designed to mount on standard 19-inch relay racks. Such a small rack could in turn be mounted in a suitcase. Signal connections and output connections among the units are made with patch cords with snap connectors on the ends, so these interconnections are quite simple. The only soldering required is for the push buttons on the subject's console, the relay circuits, the voltage divider units, and the lamp sockets for the target lamps.

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* The presence of capacitor C1 across the target indicating output eliminates the "hash" that would otherwise appear during the selection process, thus assuring a clean polygraph record.

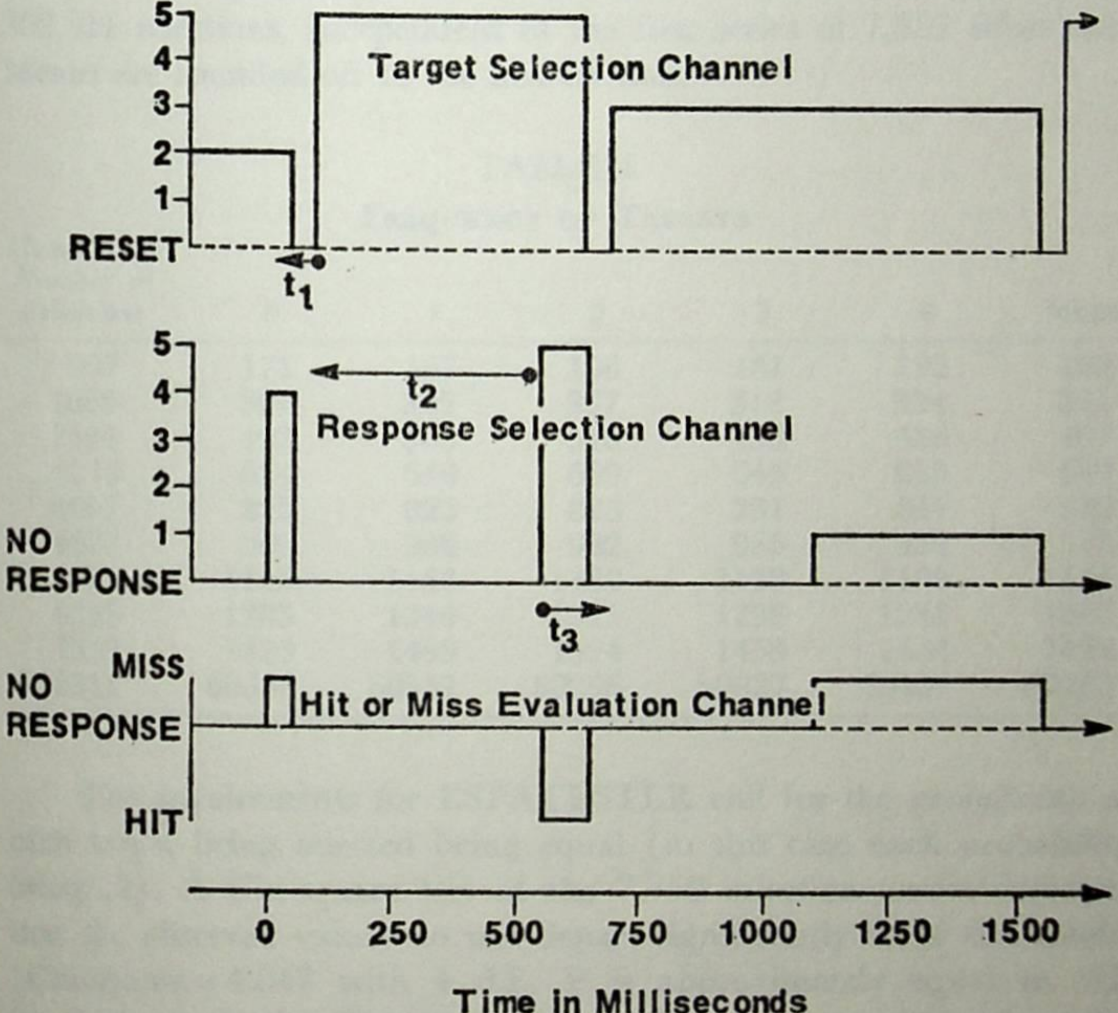

FIGURE 22. — Polygraph record of three ESP trials.

The Massey-Dickinson Company set up the random generator section of ESPATESTER to automatically produce a new target every one-tenth of a second. The targets were the digits zero through four. The first nine rows of Table 1, represent the cumulated sums of frequencies of occurrence of the five possible targets. The tenth row is the frequencies of occurrence of a very much longer run of 302,311 selections, independent of the first series of 7,359 selections. Means are rounded off to the nearest unit.

TABLE 1

FREQUENCY OF TARGETS

Cumulative Number of Selections	*0*	*1*	*2*	*3*	*4*	*Mean*
907	171	167	196	181	192	182
1605	321	305	337	318	324	321
2484	492	503	510	493	486	497
3249	654	648	669	643	635	649
4051	825	823	828	791	847	810
4877	980	988	992	965	952	975
5671	1132	1163	1139	1129	1108	1134
6525	1283	1344	1321	1296	1281	1305
7359	1429	1499	1524	1453	1454	1472
302311	60336	60551	60096	60927	60401	60462

The requirements for ESPATESTER call for the probability of each target being selected being equal (in this case each probability being .2). A Chi-square test of the 7,359 selections series indicates that the observed values do not depart significantly from this model (Chi-square = 4.047 with 4 d.f., P is approximately equal to .35, 2-tailed). A similar Chi-square test of fit of the much larger series in the tenth row of Table 1 is also non-significant (Chi-square = 6.249 (4 d.f.) and P is approximately equal to .15, 2-tailed). While it would be more satisfactory to have the probability of this second set somewhat higher, this variation is probably only a chance deviation, for the "favored" target in this second series is not the favored target in the first series, and the least favored targets also change identity between the series.

ESPATESTER Parts List

Massey-Dickinson Equipment:

1	Counter Stepper, cs-34	
1	Lamp Driver, 6 module, id-41	
1	Output Control, medium duty (2DPDT reed relays), r-42	
1	Input Modifier-Delay, d-14	
2	Electromechanical Counter (2 counters/module) emc-40	
1	Multiple AND Gate (6 two-legged gates/module), mc-27	
1	Inhibited AND Gate, ic-21	
1	OR Gate, or-22	
1	Power Supply, p-4	
78	Patch Cords	
4	Middle Rails, r-76C	for mounting above equipment
1	Top Rail, r-76A	for mounting above equipment
1	Bottom Power Rail, r-76B	for mounting above equipment

Other Components:

1	S1,2,3,4,5	5 button push switch, mechanically interlocked to prevent more than one switch being pressed at a time. *Switchcraft* "Multiswitch" line suitable.
5	RY1,2,3,4,5	DPDT relay, mercury wetted contacts, 24VDC coil, such as Potter-Brumfield JM2-1-9-22, or Clare HG2A-1003-2A2.
10	R1 to 10	10,000 ohm 2 watt potentiometers, linear taper.
5	L1,2,3,4,5	Pilot light bulbs, types 320, 327, 334, 335, or 1829.
1	C1	.05 uf, 600VDC paper capacitor.
1	R11	1,000 ohm, ½W.
1	R12	10,000 ohm, ½W.
1	B1	3VDC battery.

REFERENCES

Banham, K., "The Effect of Feedback on Guessing." *J. Parapsychol.*, 1970, *34*, 226.

———, "Feedback, Learning, and Guessing." *J. Parapsychol.*, 1973, *37*, 72-73.

Beloff, J., "The 'Sweethearts' Experiment." *J. Soc. Psych. Res.*, 1969, *45*, 1-7.

Beloff, J., & Bate, D., "An Attempt to Replicate the Schmidt Findings." *J. Soc. Psych. Res.*, 1971, *46*, 21-30.

Beloff, J. & Regan, T., "The Edinburgh Electronic ESP Tester." *J. Soc. Psych. Res.*, 1969, *45*, 7-13.

Brugmans, H., "Une communication sur des expériences télépathiques au laboratoire de Psychologie à Groningue faites par M. Heymans, Docteur Weinberg et Docteur H. I. F. W. Brugmans." *Le Compte Rendu Official du Premier Congrès International des Recherches Psychiques.* Copenhague, 1922.

Cutten, J. H. "'ESPIAR' (ESP Indicator and Recorder)." *J. Soc. Psych. Res.*, 1961, *41*, 32-41.

Dagle, L., "The Effect of Immediate Reinforcement in a Two-Choice ESP Test." Unpublished MA thesis, Trinity University, 1968.

Dagle, L., & Puryear, H., "The Effects of Immediate Reinforcement in a Two-Choice GESP Test." *J. Parapsychol.*, 1969, *33*, 339 (abstract).

Dale, L., Taves, E., & Murphy, G., "Research notes." *J. Amer. Soc. Psych. Res.*, 1944, *38*, 160-170.

Haraldsson, E., "Subject Selection in a Machine Precognition Test." *J. Parapsychol.*, 1970, *34*, 182-191.

Hilgard, E., *Introduction to Psychology*. New York: Harcourt, Brace & World, 1962.

Honorton, C., "Effects of Feedback on Discrimination Between Correct and Incorrect ESP Responses." *J. Amer. Soc. Psych.* Res., 1970, *64*, 404-410.

———, "Effects of Feedback on Discrimination Between Correct and Incorrect ESP Responses: A Replication Study." *J. Amer. Soc. Psych. Res.*, 1971, *65*, 155-161. (a)

———, "Automated Forced-Choice Precognition Tests With a 'Sensitive.'" *J. Amer. Soc. Psych. Res.*, 1971, *65*, 476-481. (b)

Humphrey, B., *Handbook of Tests in Parapsychology*. Durham, North Carolina: Parapsychology Laboratory, 1948.

Humphrey, B., & Nicol, J., "The Feeling of Success in ESP." *J. Amer. Soc. Psych. Res.*, 1955, *49*, 3-37.

Kanthamani, H., & Kelly, E., "Card Experiments With a Special Subject. I. Single-Card Clairvoyance." *J. Parapsychol.*, 1974, *38*, 16-26.

Kelly, E., & Kanthamani, B., "A Subject's Efforts Toward Voluntary Control." *J. Parapsychol*, 1972, *36*, 185-197.

Kreiman, N., & Ivnisky, D., "Effects of Feedback on ESP Responses." *Cuadernos de Parapsicologia*, 1973, *6* (No. 2), 1-10. Abstracted in *J. Parapsychol.*, 1973, *37*, 369.

Lewis, L., & Schmeidler, G., "Alpha Relations with Non-Intentional and Purposeful ESP After Feedback." *J. Amer. Soc. Psych. Res.*, 1971, *65*, 455-467.

Mercer, S., "Instrumental Conditioning in a GESP Experiment." *J. Parapsychol.*, 1967, *31*, 83-84.

McCallam, E., & Honorton, C., "Effects of Feedback on Discrimination Between Correct and Incorrect ESP Responses: A Further Replication and Extension." *J. Amer. Soc. Psych. Res.*, 1973, *67*, 77-85.

Morgan, C., *Introduction to Psychology*. New York: McGraw-Hill, 1956.

Murphy, G., & Taves, E., "Current Plans For Investigation in Psychical Research." *J. Amer. Soc. Psych. Res.,* 1942, *36,* 15-28.

Ojha, A., "Amount of Knowledge in ESP and Guessing Situations." *J. Gen. Psychol.,* 1964, *71,* 307-312.

Pratt, J., "The Meaning of Performance Curves in ESP and PK Test Data." *J. Parapsychol.,* 1949, *13,* 9-22.

Price, G., "Science and the Supernatural." *Science,* 1955, *122,* 359-367.

Puharich, A., *Beyond Telepathy.* New York: Doubleday, 1973.

Rand Corporation, *A Million Random Digits.* Glencoe, Illinois: Free Press, 1955.

Rhine, J., "Requirements and Suggestions For an ESP Test Machine." *J. Parapsychol.,* 1939, *3,* 3-10.

Schmeidler, G., & Lewis, L., "A Search For Feedback in ESP: Part II. High ESP Scores After Two Successes on Triple-Aspect Targets." *J. Amer. Soc. Psych. Res.,* 1968, *62,* 255-262.

Schmeidler, G., & McConnell, R., *ESP and Personality Patterns.* New Haven: Yale University Press, 1958.

Schmidt, H., "Precognition of a Quantum Process." *J. Parapsychol.,* 1969, *33,* 99-108. (a)

———, "Clairvoyance Tests with a Machine." *J. Parapsychol.,* 1969, *33,* 300-306, (b)

———, "Quantum Processes Predicted." *New Scientist,* 1969, *44,* 114-116. (c)

———, "The Psi Quotient (PQ): An Efficiency Measure for Psi Tests." *J. Parapsychol.,* 1970, *34,* 210-214. (a)

———, "A Quantum Mechanical Random Number Generator for Psi Tests." *J. Parapsychol.,* 1970, *34,* 219-224. (b)

———, "PK Tests with a High-Speed Random Number Generator." *J. Parapsychol.,* 1973, *37,* 105-118.

Schmidt, H., & Pantas, L., "Psi Tests with Internally Different Machines." *J. Parapsychol.,* 1972, *36,* 222-232.

Siegel, S., *Non-Parametric Statistics for the Behavioral Sciences.* New York: McGraw-Hill, 1956.

Smith, W. R., and others, *Testing for Extrasensory Perception with a Machine.* Bedford, Massachusetts: Air Force Cambridge Research Laboratories, 1963.

Stewart, W. C., "Three New ESP Test Machines and Some Preliminary Results.,, *J. Parapsychol.,* 1959, *23,* 44-48.

Targ, R., & Hurt, D., "Use of an Automatic Stimulus Generator to Teach Extrasensory Perception." *Proc. IEEE International Symposium on Information Theory,* 1972.

Targ, R., Cole, P., & Puthoff, H., *Development of Techniques to Enhance Man/ Machine Communication.* Menlo Park, Calif.: Stanford Research Institute Project 2613 report, 1974.

Tart, C., "Card Guessing Tests: Learning Paradigm or Extinction Paradigm?" *J. Amer. Soc. Psych. Res.,* 1966, *60,* 46-55. (a)

———, "ESPATESTER: An Automatic Testing Device for Parapsychological Research." *J. Amer. Soc. Psych. Res.,* 1966, *60,* 256-269. (b)

———, "Parapsychology." *Science,* 1973, *182,* 222. (a)

———, "Preliminary Notes on the Nature of Psi Processes." In R. Ornstein (Ed.), *The Nature of Human Consciousness.* San Francisco: W. H. Freeman, 1973. (b)

Taves, E., "A Machine for Research in Extrasensory Perception." *J. Parapsychol.,* 1939, *3,* 11-16.

Taves, E., & Dale, L., "The Midas Touch in Psychical Research." *J. Amer. Soc. Psych. Res.,* 1943, *37,* 57-83.

Taves, E., Dale, L., & Murphy, G., "A Further Report on the Midas Touch." *J. Amer. Soc. Psych. Res.*, 1943, *37*, 111-118.

Thouless, R., "Experiments on Psi Self-Training with Dr. Schmidt's Precognitive Apparatus." *J. Soc. Psych. Res.*, 1971, *46*, 15-21.

Timm, U., "The Measurement of Psi." *J. Amer. Soc. Psych. Res.*, 1973, *67*, 282-294.

Tyrrell, G., "Further Research in Extrasensory Perception." *Proc. Soc. Psych. Res.*, 1937, *44*, 99-168.

————, "The Tyrrell Apparatus for Testing Extrasensory Perception." *J. Parapsychol.*, 1938, *2*, 107-118.

Vasiliev, L., *Experiments in mental suggestion*. Church Crookham, England: Institute for the Study of Mental Images, 1963.

Walter, W., Grey, "Mechanical Techniques in Future Telepathy Research." *Inter. J. Parapsychol.*, 1965, *7*, 135-149.

Webster, D., "An Automatic Testing and Recording Device for Experiments in Extrasensory Perception." *J. Parapsychol.*, 1949, *13*, 107-117.

White, R., "A Comparison of Old and New Methods of Response to Targets in ESP Experiments." *J. Amer. Soc. Psych. Res.*, 1964, *58*, 21-56.

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