Reprinted from the Journal of the American Society for Psychical Research
Volume 60 — January 1966 — Number 1

CARD GUESSING TESTS: LEARNING PARADIGM OR EXTINCTION PARADIGM?

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ABSTRACT: The standard psychological procedure for teaching skilled behavior to an organism (whether human or animal) consists of administering immediate reward when the correct response is emitted by the organism, and/or administering punishment when the incorrect response is emitted. If reward and punishment cannot be clearly associated with correct and incorrect responses by the organism, the desired behavior is not learned or, if already present, is extinguished. An analysis of the typical card guessing test situation in parapsychology suggests that it is an extinction paradigm. Empirical support of this hypothesis is provided by the fact that the scores of even the highest-scoring subjects who have come into the laboratory have finally fallen off to chance in almost all cases, as would be expected if they were subjected to an extinction procedure. This article makes a plea that the basic principles of learning theory be applied to parapsychological tests in an attempt to have subjects learn to use their psi abilities more effectively rather than extinguishing whatever abilities they have.

In an excellent article (17), Rhea White 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[1] 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 a way which would bring out their possible potential.* This

[1] The term "card guessing tests" will be used broadly in this context to include all tests in which the subject chooses between several alternative responses on each trial.

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 (*S*) 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 *S*s, also be conceived of as feedback of information on the correctness or incorrectness of performance, and insofar as the *S* 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 key 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 *S* 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 *S* has no

way of knowing when he is on or off the correct pathway. Now instruct the *S* 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 *S* and the pigeon in the same way, viz., how many trials needed to reach a criterion of perfect performance. Introspectively, for the human *S*, 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 *S*'s motivation to learn and his state of health. A very important factor is the time relationship between the *S*'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 *S* 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.[2] 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 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 *S* 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 *S* 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 amor-

[2] 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.

phous, transient feelings with this late knowledge of results. Moreover, as White (17) has pointed out, the interval between trials has typically been much too short for the *S* 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 *S*s, 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 *S*s. 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 *S*'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 *S* 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 *S* or the agent. Note that requirement (b) brings out an assumption basic to the argument of this paper, viz., that the *S* will utilize ESP in conjunction with some of his responses; otherwise there is nothing to reinforce! If an *S* 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 *S* 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 an *S* 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 an *S* 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 an *S* 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 an *S* 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 over-all 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 *S*s to check the calls they felt sure were correct, as in the research of Humphrey and Nicol (5), 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 *S* 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 *S* 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 *S*. The first of these (7) was one in which the agent pressed a switch to give a signal to the *S* 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 *S* pushed the switch corresponding to a correct guess, thus giving immediate reinforcement of correctness. In the first study (12) 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 an *S* learn 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 (12). Nor was it reached in the two later experiments (3, 13), as the authors reported there were no significant results either in over-all 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 (8, 9, 11, 16). 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.[3] A modern device which would easily allow the use of quick reinforcement (2) has been proposed, but no one has backed its construction. Another modern device (10) 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 *S*s) instead of an extinction procedure because manual procedures are probably too slow, cumbersome, and distracting to both experimenter and *S*.

A properly designed testing aid, which automatically generated random targets and scored the *S*'s responses, could easily be set up to do all of the following: (a) allow the *S* 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 *S* 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 something like coins falling from a dispenser on each correct response, or (d) punish the *S* 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

[3] Tyrrell's device (14, 15) seems a noteworthy exception. Here the *S* tried to guess which box among several had a light on inside it. On opening the box, the *S* 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.

techniques of learning psychology and operant conditioning could be applied to guessing situations; and quite possibly we would find that *S*s could learn to perform at more and more significant levels over time instead of dropping off to chance.

Considering the literature reviewed above, then, *S*s have simply never been given an adequate chance to learn to use their ESP abilities, especially those high scoring *S*s 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 that 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 (4, 6). 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 *S* 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 (1, pp. 396-408), where the agent(s) were able to continuously observe the movements of the *S*'s hand as he attempted to locate the square to which the agent(s) were trying to direct him. Whenever the *S* 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 *S*. 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 *S* and the agent a chance to learn to use their psi capacities should be more fruitful than either approach alone.

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PRINTED IN BRUGES, BELGIUM, BY THE ST CATHERINE PRESS, LTD.