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ACQUISITION AND EXTINCTION OF AN AVOIDANCE RESPONSE BY MILDLY RETARDED GIRLS

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ACQUISITION AND EXTINCTION OF AN AVOIDANCE RESPONSE BY MILDLY RETARDED GIRLS

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By

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ABSTRACT

This study investigated the effects of some of the variables operating on the acquisition and extinction of avoidance behavior by mildly retarded adolescent girls. The subjects observed were 20 patients of Parsons State Hospital and Training Center. All the subjects were 15 years of age or older and none of them had reached her twenty-first birthday at the time that the experiment was run. They had adaptive behavior levels of I, II or III.

The subjects were randomly assigned to one of two replications and to one of two experimental conditions (extinction and control). All the subjects were brought into a room and given avoidance instructions. If avoidance responding did not occur after the aversive stimulus, white noise with an intensity of 99 decibels, had been presented the experimenter prompted the subject. Prompting was continued until avoidance responding began. After 20 minutes the subjects were allowed to leave and were paid a nickel. After this first session, four more avoidance sessions with no special instructions were given. After this, two more sessions were given to all the subjects with the noise lowered to an intensity of 75 decibels. In the last two sessions the now lowered noise remained on continuously for the extinction subjects, while the control subjects could still avoid it by responding. Each subject was paid a nickel at the end of each session.

No replication effects of any kind were found. There were no session effects during acquisition. The extinction subjects decreased their response rate significantly more than the control subjects.

The main contribution of this study is considered to be the introduction of an extinction procedure that achieves its purpose relatively fast; however, it should be more directly compared to the traditional procedure that simply stops the aversive stimulus regardless of the subject's behavior, before definite conclusions can be made.

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CHAPTER I

INTRODUCTION

Conditioning has become a very important concept to the science of psychology. One form of conditioning is operant conditioning; this is mainly concerned with behavior learned through the reinforcement process. A great deal of human behavior is motivated by its own outcome or, in other words, by what will or will not happen as a result of the particular behavior. Manners and customs among other things, are learned mostly through this process.[1]

This present study is concerned with behavior that prevents an event from happening or, at least, delays its onset. Some very complex human behaviors are motivated by this goal. Driving a motor vehicle safely can be cited as a possible example of a complex behavior motivated mainly by the outcome of avoiding having an accident, or avoiding getting a traffic ticket and, therefore, having to pay a fine or even going to jail.

Statement of the Problem

The main purpose of this experiment was to study avoidance behavior as related to its functionality. A

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[1] B. F. Skinner, Science and Human Behavior, New York: McMillan, 1953, p. 415.

secondary purpose was to replicate the experiment under slightly different environmental conditions in order to get some indication as to how general the results might be. In order to accomplish these purposes, changes in avoidance behavior were studied and measured (1) from session to session while it was still functional; (2) under slightly different environmental conditions; and (3) when it was no longer functional.

Importance of the Study

Avoidance behavior plays a very important part in human behavior, however, most studies in avoidance behavior have used animals as subjects. Azrin[2] studied noise as an aversive stimulus with humans and reported avoidance behavior of a very high rate even after the noise had been discontinued and therefore avoidance behavior had ceased being functional; the experiment did not investigate the results of continuing the noise regardless of the responses; as a result of this situation the discriminative properties of the extinction contingency were small, besides these discriminative properties could not have appeared until the subjects stopped responding for a

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[2]N. A. Azrin, "Some Effects of Noise on Human Behavior," Journal of the Experimental Analysis of Behavior, 1:3, 1958, pp. 183-200.

few seconds, which was unlikely to occur very early under high rates of avoidance behavior.

The experimenter feels that there is a strong need for a study that uses human subjects and introduces an extinction contingency which is different from acquisition in such a way that the difference becomes apparent to the subjects after making one single response.

Limitations of the Study

The most important limitation of the present study is that the study was not carried out in a sound-proof room, therefore, the control of the intensity of the noise inside the experimental room was far from perfect.

Another limitation of the study is that due to scheduling problems the subjects had to be run two at a time instead of all at the same time as would have been desirable. An attempt was made to neutralize this effect by always pairing in time one extinction and one control subject.

Hypotheses

The following hypotheses were made prior to the collection of data for this study:

Hypothesis I. Avoidance behavior will become more stable from session to session as long as it is functional. It seems that avoidance behavior might be somehow erratic at first; but after the time contingency has been learned

through repeated trials, the behavior should become more stable. Sidman[3] found that at least two temporal variables operate on avoidance behavior: (a) the shock-shock, in this case noise-noise, interval; and (b) the response-shock, in this case response-noise, interval; if these two factors are kept constant avoidance behavior becomes more stable with time.

Hypothesis II. If the environment is not greatly altered, there will be no change in avoidance behavior. If the opportunity to emit a response, the requirements of the response and the aversive stimuli are the same, the generated avoidance behavior should be very similar.

Hypothesis III. Avoidance behavior will decrease when it ceases to be functional. All the literature of operant conditioning has shown this principle to be true; when reinforcement is no longer available, the frequency of behavior decreases to the low level present prior to conditioning. This principle of operant conditioning was discussed by Skinner in an early work[4] and is now widely accepted.

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[3] M. Sidman, "Two Temporal Parameters of the Maintenance of Avoidance Behavior by the White Rat," The Journal of Comparative and Physiological Psychology, 47:3, 1953, pp. 253-261.

[4] B. F. Skinner, The Behavior of Organisms, New York: Appleton-Century-Crofts, Inc., 1938, p. 74.

Even though another variable was studied, namely the change in the rate of avoidance behavior with repeated reinforced responses, no hypothesis was made with respect to this variable; it was felt that the parameters mentioned by Sidman,[5] that are involved in the rate of avoidance behavior, have not been sufficiently studied with the type of subjects used in this experiment; as a result, it was impossible to make even a haphazard prediction with respect to the rate of avoidance behavior during the acquisition sessions. Also, no prediction was made with respect to the stability of behavior during extinction because any decrease in the rate of responding at that time, regardless of how steady and lawful this decrease might be, will affect the measure of variability used in this study and what might be interpreted as variability could be simply a result of a steadily decreasing rate.

Definition of Terms

In this section critical terms will be defined. Some of these terms may have definitions that are different from those given here; the choice of these particular definitions was determined by the theoretical orientation of the experimenter.

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[5]Sidman, loc. cit.

Learning. "Learning is the process by which an activity originates or is changed through reacting to an encountered situation, provided that the characteristics of the change in activity cannot be explained on the basis of native response tendencies, maturation, or temporary states of the organism (e.g., fatigue, drugs, etc.)."[6]

Conditioning. The operations that are necessary in order to obtain learning. Two types of conditioning are presently recognized, classical or respondent conditioning and operant or instrumental conditioning.[7]

Classical conditioning. "A previously neutral stimulus (conditioned stimulus) acquires the power to elicit a response which was originally elicited by another stimulus (unconditioned stimulus). The change occurs when the neutral stimulus is followed or 'reinforced' by the effective stimulus."[8]

Operant conditioning. A response that is originally emitted is followed by an event. If, as a result of this event following the response, the probability of the recurrence of the response has been changed, it is said that operant conditioning has occurred.[9]

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[6]E. R. Hilgard, Theories of Learning, New York: Appleton-Century-Crofts, Inc., 1956, p. 3.

[7]Idem., p. 12.

[8]Skinner, 1953, op. cit., p. 53.

[9]Idem., p. 64.

Since this thesis is concerned primarily with operant behavior the remaining terms in this section will be defined mostly as they relate to operant conditioning.

Reinforcement. The process of making a response more probable or more frequent by an event that occurs following such a response.[10]

Positive reinforcement. A reinforcement that consists of the presentation of a stimulus or stimuli.[11]

Negative reinforcement. A reinforcement that consists of the removal of a stimulus or stimuli.[12]

Aversive stimulus. A stimulus whose removal is a negative reinforcement.[13]

Escape. Behavior which is followed by the removal of an aversive stimulus.[14]

Avoidance. Behavior that is reinforced by the failure to present an aversive stimulus, if this stimulus would otherwise have been presented.[15]

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[10] Ibid.

[11] J. G. Holland and B. F. Skinner, The Analysis of Behavior (New York: McGraw-Hill, 1961, p. 56.

[12] Ibid.

[13] Skinner, 1953, op. cit., p. 171.

[14] Ibid.

[15] Idem., p. 176.

Acquisition. "An increase in the strength of the tendency to respond after the administration of a reward."[16] Since it is difficult to isolate when the actual increase in the behavior ends and it might end at different times with different subjects, in order to provide clarity "acquisition" will be used in a slightly different way. For the purposes of this thesis the first five experimental sessions will be called the acquisition sessions.

Extinction. The process by which a response becomes less and less frequent as a result of the reinforcement being no longer available or, in other words, as a result of the fact that the response is no longer functional.[17]

Replication effects. This term will be used to refer to any possible differences between the two replications of this study.

Session effects. This term will be used to refer to any changes in behavior between any two given sessions.

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[16] H. B. English and A. C. English, A Comprehensive Dictionary of Psychological and Psychoanalytical Terms, New York: Longmans, Green and Co., 1958, p. 7.

[17] Skinner, 1953, op. cit., p. 69.

CHAPTER II

REVIEW OF RELEVANT RESEARCH

This chapter is primarily concerned with reviewing the area of operant conditioning with special emphasis on conditioning of avoidance behavior.

Classical Conditioning

Pavlov is credited with having done the first experiments in classical conditioning. Since his experiments are considered fundamental to the study of conditioning,[18] one of these experiments should be described in detail. A moderate solution of acid was introduced into the mouth of a dog, an abundant amount of saliva began to flow from the mouth. After this had been established, the same procedure was repeated several times and a sound was presented immediately before the acid. After several paired presentations, the sound was presented and the acid was not, it was observed that the same reaction was fully reproduced, the dog salivated even though no acid had been presented. Variations of this experiment investigated the effects of variables such as the intensity of the stimuli,

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[18] J. Deese, The Psychology of Learning, New York: McGraw Hill, 1958, p. 8.

generalization to stimuli slightly different from the one originally presented.[19]

The principles discovered by Pavlov were warmly welcomed by some American psychologists. The behaviorist movement modified and adopted these principles using them to explain all learning.[20]

Operant Conditioning

It appeared that there were many behaviors that were not learned in the same manner that Pavlov's experiments had suggested. The earliest recorded experiments with another type of learning were done by Thorndike. Thorndike constructed a box which contained a trap-door through which a cat could be dropped into the box. It also contained a door through which the cat could leave the box if he operated a simple release mechanism. The experiments consisted of putting food outside the box and a hungry cat inside, once the cat had left the box and eaten the food, he was placed in the box again. This procedure was repeated many times and the time required to leave the box each time was recorded. It

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[19] I. P. Pavlov, Experimental Psychology and Other Essays (New York: Philosophical Library, 1957), pp. 245-270.

[20] J. B. Watson, Behaviorism, Chicago: Phoenix Books, 1930, pp. 20-47.

was observed that, in general, the time decreased with successive trials up to a point and, then, it stabilized.[21]

Thorndike restated his experimental findings in a book published in 1911. In this book he formulated his now famous law of effect.

> Of several responses made to the same situation, those which are accompanied or closely followed by satisfaction to the animal will, other things being equal, be more firmly connected with the situation, so that, when it recurs, they will be more likely to recur; those which are accompanied or closely followed by discomfort to the animal, other things being equal, will have their connections with that situation weakened, so that, when it recurs, they will be less likely to occur. The greater satisfaction or discomfort the greater the strengthening or weakening of the bond. (p. 244)[22]

The conditions outlined by Thorndike had a very important limitation, they were not designed to obtain a sample of behavior in which an organism was free to respond at any time. He could only respond once after each time that he was placed in the box. A different box, that was intended to overcome this limitation, was designed; it also had a trap door, through which an animal could be introduced; the only inside mechanism was a lever that the animal could freely press; there was an outside mechanism, known as the magazine, that could deliver pellets of food through

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[21] E. L. Thorndike, "Animal Intelligence. An Experimental Study of the Associative Processes in Animals," Psychological Monographs, 2:8, pp. 1-109.

[22] E. L. Thorndike, Animal Intelligence: Experimental Studies, New York: McMillan, 1911, p. 244.

a hole next to the lever. The animal could now respond at any possible rate. The bar pressing response could be conditioned simply by attaching the lever to the magazine so that each lever-press is followed by the delivery of a food pellet. When an automatic recording device was attached to this apparatus, the experimenter did not even need to be present during the conditioning process. In this manner extensive samples of behavior could be obtained with a relatively short time investment.[23] This basic apparatus is now, with some slight modifications, extensively used in operant conditioning research and is commonly known as the Skinner-box.[24]

By using the appropriate apparatus it has been possible to collect enough information to develop a science of behavior.[25] The remaining part of this section will be devoted to a description of two experiments that established two basic principles for this science of behavior and to a mention of two applications of these principles.

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[23] Skinner, 1938, op. cit., pp. 48-60.

[24] Deese, op. cit., p. 9.

[25] Skinner, 1953, op. cit., pp. 1-449.

A hungry rat was placed in a Skinner box and pellets were discharged into the box periodically. The next day the same rat was placed in the box and the magazine was connected so that each lever press caused the delivery of a pellet of food. This procedure was repeated with a total of 78 rats. All but three rats were conditioned to press the lever within a period of three hours. It was concluded that some events (in this case the delivery of food) increase the probability of the recurrence of the behavior they follow.[26]

Four rats were conditioned to press the lever in a Skinner box. After a high and stable response rate was achieved, the magazine was disconnected so that the presses of the lever only activated the recording device. The overall rate of responding slowly decreased until it reached the same level it had prior to conditioning. It was concluded that when reinforcement is no longer available the probability of the recurrence of a response decreases to a level approximately equal to the pre-conditioning rate.[27]

The principles discovered by the experiments mentioned above did not hold exclusively for rats, other organisms

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[26] Skinner, 1938, op. cit., pp. 66-71.

[27] Idem., pp. 74-78.

behaved according to those two principles. A recent study confirmed that they hold true for mentally retarded children.[28]

The principles of operant conditioning have also been successfully applied to symptomatic treatment of mental patients.[29]

Escape and Avoidance

Human behavior has given many examples of escape. People escape from a loud noise by putting their fingers in their ears, by moving away from the source, by closing intervening doors, and so on. Similarly, human beings shut their eyes or turn their heads away in order to escape from a bright light.[30]

There are many cases in which human beings do not escape from a situation, they avoid it or, in other words, escape from it before it actually happens.[31]

Some experiments in escape and avoidance conditioning have used a device known as the shuttle box. This device

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[28] J. E. Spradlin, F. L. Girardeau, and E. E. Corte, "Fixed-Ratio and Fixed-Interval Behavior of Severely and Profoundly Retarded Children," Journal of Experimental Child Psychology, (In Press.)

[29] T. Ayllon and E. Haughton, "Modification of Symptomatic Verbal Behaviour of Mental Patients," Behaviour Research and Therapy, 2:2, 1964, pp. 87-97.

[30] Skinner, 1953, op. cit., pp. 172-173.

[31] Idem., pp. 176-178.

consists of an elongated narrow box divided into two compartments by a partition, this partition has a small hole or "doorway" in it. One compartment is painted white and the other is painted black. A rat placed in one compartment can escape an electric shock by moving to the other side or, if a delay before shock is introduced, the rat can avoid the shock by moving into the other compartment before the shock is started.[32] Other experiments have required the organism to jump over a barrier in order to avoid or escape shock.[33] However, most of the studies to be discussed in this section have used the Skinner-box.

In a classical avoidance experiment with rats, a buzzer was sounded for one-fifth of a second, two seconds later a shock was presented unless the animal jumped over a barrier in the period of time between the two stimuli. Of 91 rats all but six learned the avoidance response in 150 trials or less.[34]

Sidman introduced a slightly different procedure in which no warning stimulus was presented. The subjects could

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[32] O. H. Mowrer, Learning Theory and Behavior, New York: John Wiley and Sons, Inc., 1960, pp. 29-30.

[33] W. S. Hunter, "Conditioning and Extinction in the Rat," British Journal of Psychology, 26:2, 1935, pp. 135-148.

[34] Ibid.

postpone the onset of shock by pressing the lever during the no-shock interval; if the animal spaced its responses, in such a way that the interval between responses was less than the postponement of shock produced by the response, no shock would have been administered. After the shock had been introduced the animal could always escape by pressing the lever.[35]

Solomon, Kamin, and Wynne reported that avoidance behavior conditioned without a warning signal displayed great resistance to extinction.[36] Sidman confirmed these findings using rats and concluded that when the shock generator is disconnected the animals will continue to respond at high rates even though the avoidance response has ceased to be functional.[37] The same results were found by Azrin in a study that used humans; this study found that avoidance behavior is very hard to extinguish when human beings are used as subjects.[38]

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[35] M. Sidman, "Two Temporal Parameters of the Maintenance of Avoidance Behavior by the White Rat," The Journal of Comparative and Physiological Psychology, 47:3, 1953, pp. 253-261.

[36] R. L. Solomon, L. J. Kamin, and L. C. Wynne, "Traumatic Avoidance Learning: The Outcomes of Several Extinction Procedures with Dogs," Journal of Abnormal and Social Psychology, 48:2, 1953, pp. 291-302.

[37] M. Sidman, "On the Persistance of Avoidance Behavior," Journal of Abnormal and Social Psychology, 50:2, 1955, pp. 217-220.

[38] Azrin, loc. cit.

In summary, the last three studies mentioned suggest that, when avoidance behavior has been conditioned without a warning signal, it has been very difficult to obtain extinction. It seems to the experimenter that a different extinction procedure should be tried in order to investigate the possibility of accelerating extinction.

CHAPTER III

GENERAL METHOD

The purpose of this chapter is to describe (a) some pilot procedures, performed prior to the experiment in itself; (b) the subjects used in the present experiment; (c) the setting where these subjects lived; (d) the experimental setting; and (e) the experimental design and procedures.

Pilot Procedures

A 14-year-old girl, who had an intelligence quotient of 75 and who had been institutionalized for two years, was brought to the experimental room to be described later in this chapter. It was observed that avoidance behavior could not be obtained when noise of an intensity of 75 decibels was used as the aversive stimulus.

Subjects

The subjects were twenty mentally retarded adolescent females. They were selected from Willow and 2-South-3 cottages at Parsons State Hospital and Training Center (PSH&TC). These cottages are primarily concerned with patients between the ages of 16 and 21. Their adaptive behavior levels were I, II, and III. Children of adaptive behavior levels I, II, and III are described by Leland as being capable of effective social and economic functioning in a

low-demand environment, but still in need of some support and supervision in the management of their personal affairs; those of level I are considered to be able to function in a competitive environment; those of level II to be able to function in only a partially competitive environment, and those of level III probably to be able to function in only a noncompetitive or sheltered environment.[39] There were 49 patients living in the above-mentioned cottages, however, some patients had other activities scheduled at the time of the day that the experiment was run and had to be excluded from the population; as a result, only 41 patients were available. Twenty of these patients were randomly selected and assigned to one of two replications and to one of two groups. None of the subjects had deficient hearing according to the PSH&TC Speech and Hearing department. A description of chronological age, length of institutionalization and intelligence quotient of each subject is given in Table I.

Chronological age. All the subjects had chronological ages ranging between 180 and 243 months. The mean chronological age was 208 months with a standard deviation of 19.2 months.

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[39] H. Leland, "Some Thoughts on the Current Status of Adaptive Behavior," Mental Retardation, 2:3, 1964, pp. 171-176.

TABLE I

CHARACTERISTICS OF EACH SUBJECT*

Subject	Chronological Age (in months)	Length of Institutionalization (in months)	Intelligence Quotient
1	204	22	41
2	243	62	51
3	223	32	64
4	186	19	87
5	210	11	65
6	218	26	40
7	243	32	72
8	210	3	58
9	210	126	59
10	188	47	67
11	221	117	54
12	195	21	60
13	180	101	62
14	194	11	57
15	183	71	46
16	222	8	58
17	235	114	56
18	186	90	51
19	221	23	69
20	194	17	80

*Determined at the start of the experiment.

Length of institutionalization. All the subjects had been institutionalized for periods ranging between 3 and 126 months with a mean of 48 months and a standard deviation of 39.8 months.

Intelligence quotient. All the subjects had intelligence quotients ranging between 40 and 80 with a mean of 60 and a standard deviation of 11.5. These quotients had been obtained by use of the Wechsler Adult Intelligence Scale or Wechsler Intelligence Scale for Children or, in the cases of subjects who fell below the low limit of these tests, by the Draw-A-Person Test. Such a wide range in intelligence was mainly due to the fact that the selection was made on the basis of adaptive behavior rather than measured intelligence. Also, these data suggest that the population used for this study was not normally distributed.

Description of the Hospital Setting. Parsons State Hospital and Training Center is an institution for the mentally retarded. It is a 700-bed residential center comprised of 47 buildings. It is designed for ambulatory retardates between the ages of 6 and 21. The Center serves the entire State of Kansas and if offers (a) medical, pediatric, psychiatric and neurological diagnoses and treatment; (b) psychometric testing and evaluation; (c) medical, surgical and psychiatric nursing care; (d) psychotherapy; (e) social services; (f) religious training and counseling; (g) cottage life and recreation activities;

(h) speech, occupational and recreational therapies; (i) pre-vocational assessment, special education and vocational training.[40] Two new departments have been added, the research department and the demonstration and training department; these departments have been added in such a way that the hospital now consists of three major interacting activities (a) service; (b) research; and (c) demonstration and training.

The subjects used in this experiment were part of the Vocational Rehabilitation Division. This Division is primarily concerned with (1) patients being prepared for discharge; (2) patients who have been institutionalized because of their psychological problems; and (3) patients who are being prepared as lifetime institutional workers or sheltered workshop candidates.[41]

Experimental Setting

Experimental room. The experimental room was equipped with a one-way vision screen. It was approximately square with a surface which was approximately

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[40] Parsons State Hospital and Training Center, Parsons: Public Information Office, 1962, pp. 1-3.

[41] J. Crosson and H. Leland, "Institutional Planning for Community Living," Mental Retardation, 3:1, 1965, pp. 4-7.

90 square feet. The west half of this room is shown in Figure 1. It had two doors (one not shown) which could only be opened from the outside. The response panels to be described in the next paragraph were located on the south wall near the southeast corner.

Response panels. The response panel shown in Figure 2 was used during the first replication and the one shown in Figure 3 was used during the second replication. The operanda used were two Lindsley manipulanda.[42] A force of 1600 grams was required to activate these manipulanda. The left manipulandum of the panel used for the second replication was inoperative.

Programming equipment. The programming equipment was mounted on an operant conditioning rack.[43] This rack with equipment mounted on it is shown in Figure 4. Some parts of the equipment on this rack were not connected for the present experiment, only the pieces of equipment actually used will be mentioned. The connections were made through a plugboard (model 503).[44] The rest of the programming

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[42] O. R. Lindsley, "Operant Conditioning Methods Applied to Research in Chronic Schizophrenia," Psychiatric Research Reports, 5:2, 1956, pp. 140-153.

[43] Manufactured and sold by Grason Stadler Company, Inc., West Concord, Massachusetts.

[44] Manufactured and sold by MacPanel Company, High Point, North Carolina.

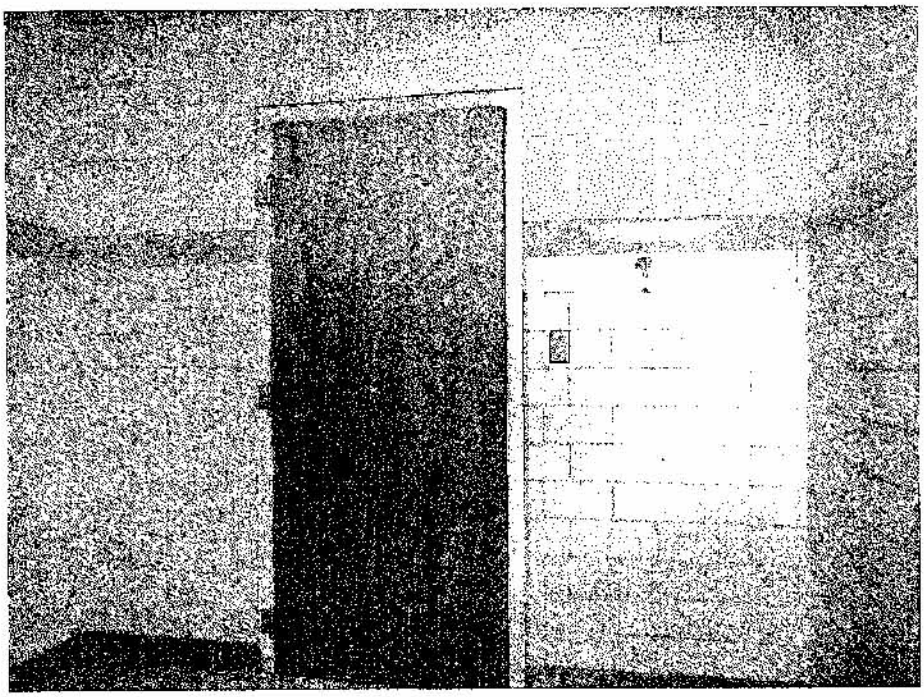

FIGURE 1

WEST SIDE OF EXPERIMENTAL ROOM

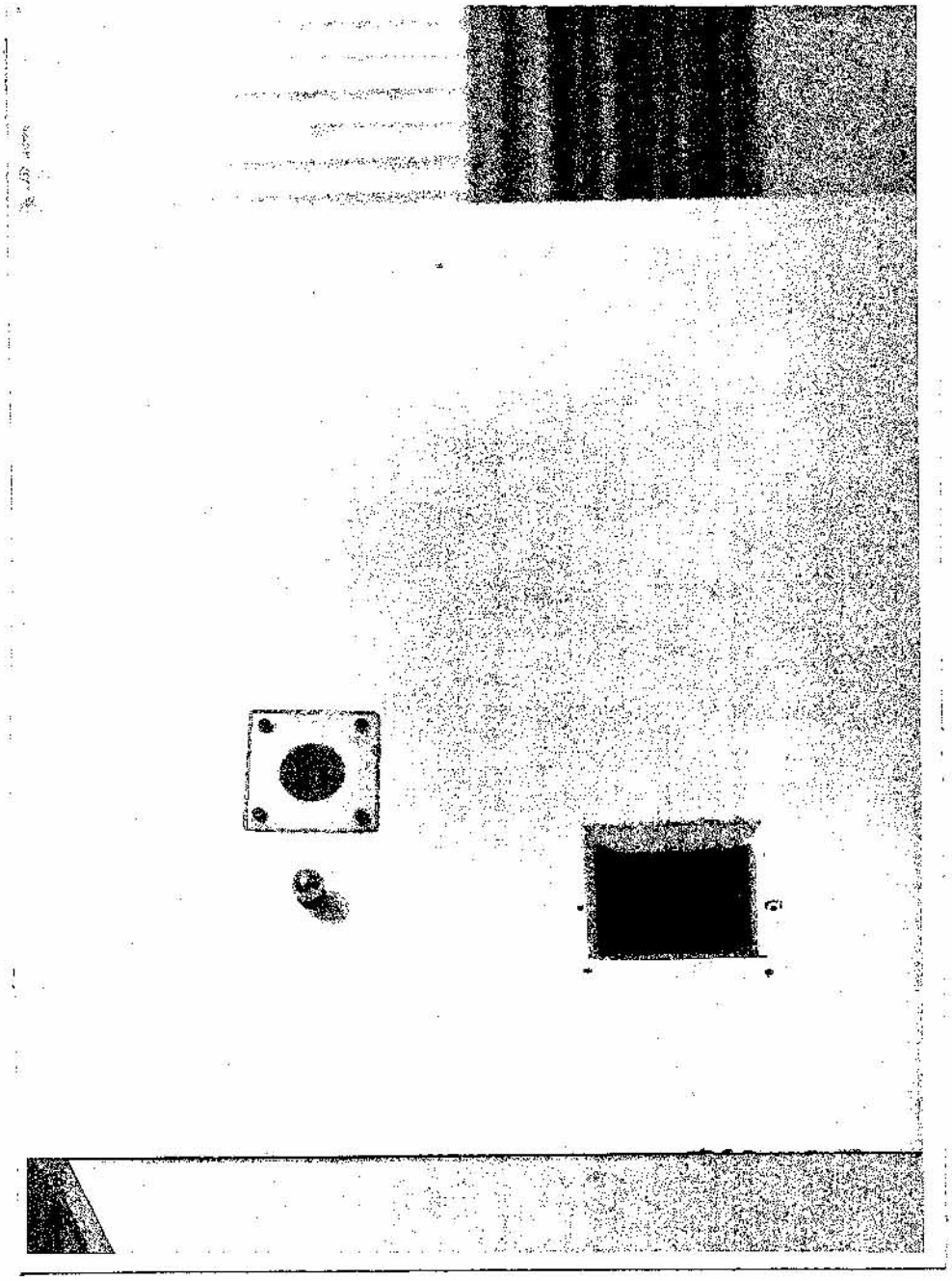

FIGURE 2

RESPONSE PANEL USED FOR FIRST REPLICATION

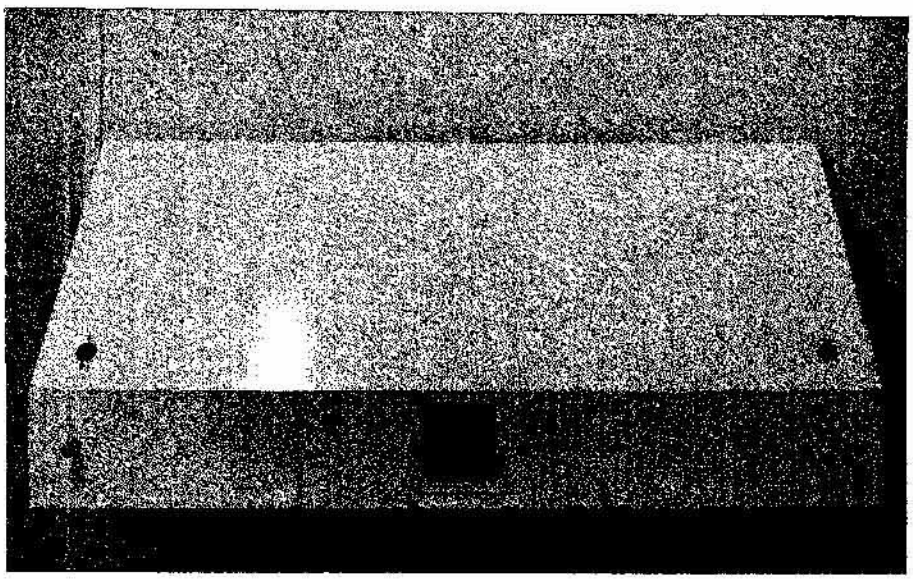

FIGURE 3

RESPONSE PANEL USED FOR SECOND REPLICATION

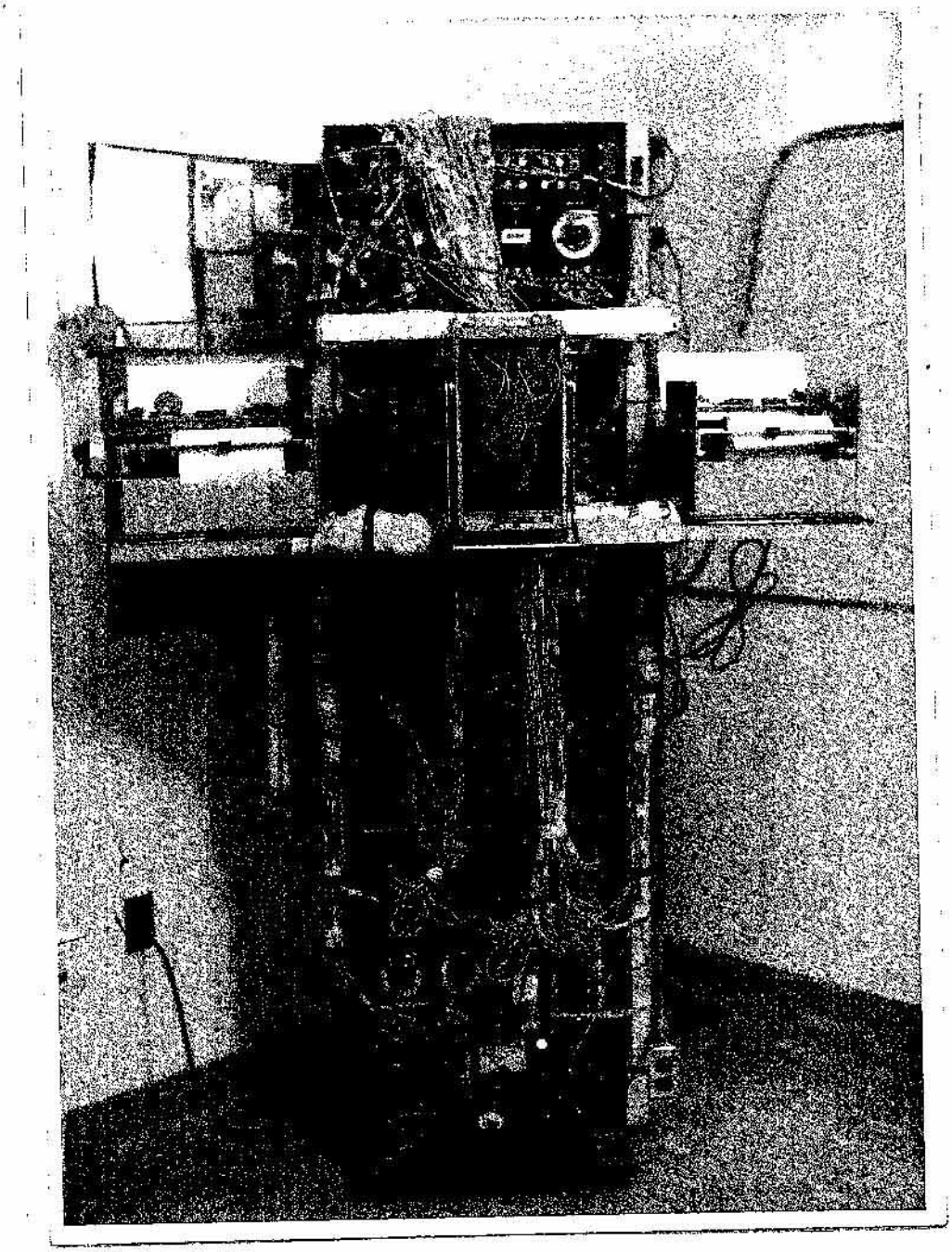

FIGURE 4

PROGRAMMING EQUIPMENT

equipment was manufactured and sold by the above-mentioned Grason Stadler Company; it consisted of (1) one control panel, model E4420; (2) one timer, model E7905A; (3) twelve counters, model E3700B; (4) one stepper, model E3129A; (5) one electronic timer, model E1100H; (6) one relay panel model E783B; (7) one power supply, model E1100D; and (8) one noise generator, model 901A.

Experimental Design

Ten subjects were run for each replication. All the subjects of each replication were given five acquisition sessions, the first one of these sessions was not used for the analysis of the data. After the first acquisition sessions, the five extinction subjects of each replication were given two extinction sessions with lowered noise, the five control subjects of each replication were given two more acquisition sessions with lowered noise. This design is summarized in Figure 5.

Experimental Procedures

Since the experimental room was only available for 45 minutes each day, it was only possible to run two subjects, each one for a twenty-minute session, on any one day. The subjects were thus artificially paired in time. Both subjects of each pair were given the first session on the same day. One member of each of these pairs was used

			Acquisition					Extinction	
		session / subjects	1	2	3	4	5	6	7
First Replication	Control Group	1							
		2							
		3							
		4							
		5							
	Extinction Group	6							
		7							
		8							
		9							
		10							
Second Replication	Control Group	11							
		12							
		13							
		14							
		15							
	Extinction Group	16							
		17							
		18							
		19							
		20							

FIGURE 5

EXPERIMENTAL DESIGN

in the extinction group and the other one was used in the control group. An attempt was made to run each two subjects for seven consecutive days; if an interruption was necessary, both subjects were interrupted.

The noise generator was set to an intensity of 99 decibels for the first five sessions and, in order to avoid tissue damage caused by long exposures to intense noise, to an intensity of 75 decibels during the last two sessions. When the noise generator was turned off, there was an ambient noise in the experimental room of between 48 and 58 decibels.

First session. The programming equipment was wired so that (1) while the apparatus was off, the experimental room was only dimly illuminated by a 25-watt blue light bulb; (2) when the apparatus was turned on, a bright overhead lamp came on in the experimental room; (3) five seconds after the apparatus had been turned on, if no response had occurred, noise was presented; (4) any response, while the noise was on, interrupted the noise for five seconds; and (5) any response, while the noise was off, reset the electronic timer so that there was a five-second period before the noise came on. The experimenter led each subject into the experimental room, while the apparatus was off, and asked her to sit down on a chair that had been placed in front of the manipulandum (the one on the right side for the second replication). Then the experimenter gave the following instructions:

> All you have to do is sit here for twenty minutes and you'll get a nickel. There's a little catch to it, though; there's going to be some pretty loud noise that you'll have to stand. I'm going to tell you a little secret; if you pull that knob you can stop the noise, but don't tell anybody that I told you. When the big light goes on, that means that your twenty minutes start and the noise might come at any time; when the light goes off, your twenty minutes are over and you don't have to worry about the noise any more.

The experimenter then left the experimental room, closed the door, and turned the apparatus on. If the subject had not responded five seconds after the noise had started, the experimenter walked in the room and said: "What's the matter, do you like that noise? Pull the knob if you don't." The experimenter kept prompting until the subject had responded, then he said: "See? The noise stops," and left the room again. This last procedure was repeated until the subject began avoiding the noise or escaping it within five seconds after presentation. If the subject escaped the noise but did not avoid it for four minutes the experimenter walked in the room again and said: "If you pull before the noise comes, the noise won't come." The experimenter then made five avoidance responses approximately four seconds apart and said: "See? No noise," and left the room. If the subject continued making more escape than avoidance responses, the experimenter went back into the room and repeated the last procedure. It was decided that any subject who did not make at least 20 avoidance responses in the last two minutes of the first session would be discontinued and replaced; this

was not necessary because all the subjects met the criterion. At the end of the session the experimenter opened the door, gave the subject a nickel and said, "We'll see you tomorrow."

Second, third, fourth, and fifth session. The programming equipment was wired to satisfy the same contingencies as in the first session. Also, the counters were connected in such a way that a distribution of the inter-response-times (IRT's) to the nearest second and up to 10 seconds could be obtained; another counter recorded the total number of responses emitted during the session. The subjects were led into the experimental room by the experimenter who said: "Same as yesterday, sit down and wait; you don't have to pull if you don't want to; you'll get your nickel anyway." Once the subject had sat, the experimenter locked the door and turned the apparatus on. The subjects were dismissed in the same manner they had been dismissed after the first session.

Sixth and seventh sessions. The noise was turned down to the 75 decibel setting for all the subjects, and all the subjects received the same instructions they had received in the previous four sessions. The connections of the programming equipment were not changed for the control subjects. For the extinction subjects the noise generator presented noise continuously whenever the apparatus was on, regardless of the subject's behavior. At the end of the sixth session the subjects were dismissed in the usual way. At the end of

the seventh session they were given another nickel and told: "Thank you for coming over and we'll see you around."

In summary, this procedure was designed to test (1) the stability during acquisition; and (2) the persistence during extinction of the avoidance behavior of mildly retarded girls when intense noise is used as the aversive stimulus.

CHAPTER IV

RESULTS

This chapter will be primarily concerned with analyzing the data obtained in the present experiment. The data for the first session will not be reported or analyzed. It was felt that any true measure of each subject's behavior would have been confounded with measures of the experimenter giving verbal instructions and, sometimes, even responding.

Stability

The variance of the IRT's from each subject in each of the four analyzed acquisition sessions was computed and is given in Table II.

Replication effects. Since the Mann-Whitney U Test[45] has been found to have a power efficiency that approaches an asymptotic value of 95.5 per cent as compared to the powerful parametric t-test[46] and the data did not seem to

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[45] S. Siegel, Nonparametric Statistics for the Behavioral Sciences, New York: McGraw Hill, 1956, pp. 116-127.

[46] A. M. Mood, "On the Asymptotic Efficiency of Certain Nonparametric Tests," Annals of Mathematical Statistics, 25:3, 1954, pp. 514-522.

TABLE II

VARIANCES OF THE INTER-RESPONSE-TIMES OBTAINED BY EACH SUBJECT IN EACH OF THE FOUR ANALYSED ACQUISITION SESSIONS

N = 20	Group \ Session	2	3	4	5
FIRST REPLICATION	CONTROL GROUP	.0356	.0485	.0099	.0574
		.3346	.1487	.1750	.1594
		.2699	.1880	.1847	.2179
		.0156	.0041	.0011	.0022
		.0437	.0254	.0293	.0236
	EXTINCTION GROUP	.2572	.3789	.3527	.3339
		.3006	.2248	.4541	.4965
		.4511	.9011	.6120	.8903
		.0086	.0073	.0098	.0119
		.0003	.0028	.0026	.0030
SECOND REPLICATION	CONTROL GROUP	.3226	.3038	.2575	.3543
		.4045	.1599	.1111	.2214
		.2772	.0763	.1040	.0315
		.0281	.0220	.0184	.1134
		.0365	.0469	.0095	.0085
	EXTINCTION GROUP	.0136	.0261	.0375	.0550
		.2274	.2581	.2323	.2781
		.0575	.0151	.0059	.0253
		.0444	.1693	.2746	.0501
		.3121	.7434	.3344	.2464

justify the assumptions of parametric statistics, it was decided that this test would be used to test for any replication effects; a U value of 731 was obtained and a value of 592 or less was necessary for significance at the $<.05$ level, therefore, there was no significant replication effect on the stability of avoidance behavior.

Session effects. Since no significant differences were found between the replications, it was considered legitimate to treat both replications together in order to analyze the changes in stability over sessions. A Friedman two-way analysis of variance by ranks[47] was used in order to test for changes in the stability of avoidance behavior over sessions; the Friedman two-way analysis of variance by ranks was used as opposed to an analysis of variance because the data did not seem to justify the assumptions of a parametric statistic. The obtained X^2 value was 1.56 and a value of 7.82 or higher was required for significance at the $<.05$ level, therefore, there was no significant session effect on the stability of avoidance behavior.

Amount of Responding

The total number of responses from each subject in each of the four analyzed acquisition sessions and in each

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[47] Siegel, op. cit., pp. 166-172.

of the two extinction sessions is given in Table III. These data show very wide individual differences. In spite of the fact that the rate of responding was very steady for each subject, when each subject's rate was compared with another one's rate, wide differences were observed. During acquisition one subject responded less than 700 times during each session, while another one responded more than 3000 times during each session. The same type of great individual differences can be observed in the last two sessions and is most marked in the extinction subjects where the conditions were drastically changed. One of the extinction subjects responded two times as soon as the sixth session started and just sat, making no avoidance responses, for the rest of the last two sessions. Another subject responded 15 times during the sixth session and none at all during the seventh session. She spent most of the time while she was not responding, walking around the room and swearing; however, when she was taken out of the room she acted in a very polite manner. Another subject responded 95 times during the sixth session and two times during the seventh session. This subject spent most of the time during these last two sessions covering her ears with both hands.

TABLE III

TOTAL NUMBER OF RESPONSES EMITTED BY EACH SUBJECT IN EACH OF THE SIX ANALYSED SESSIONS

N = 20	Session / Group	ACQUISITION				EXTINCTION	
		2	3	4	5	6	7
FIRST REPLICATION	CONTROL GROUP	3425	2687	3415	2818	2690	2334
		1982	2534	2542	2533	2353	2497
		936	1178	994	1168	1154	675
		1799	1716	1882	1780	1807	1769
		1881	2004	1963	2262	2266	2174
	EXTINCTION GROUP	1415	1108	1020	1009	2	0
		831	769	703	677	897	186
		927	397	405	468	95	2
		3034	3249	3143	2845	1153	1
		3035	3227	3440	3654	1570	63
SECOND REPLICATION	CONTROL GROUP	638	632	640	559	592	609
		1337	2208	2220	1736	2400	2606
		1562	1825	1669	1638	1484	1425
		1560	1583	1730	1265	1288	1514
		2581	2142	2301	2579	2452	2062
	EXTINCTION GROUP	2569	2812	2776	3429	1322	772
		1176	1093	1179	1119	15	0
		2540	2911	2858	2870	1159	266
		1939	1426	1137	1769	102	0
		2436	2302	2680	2876	290	509

The data shown in Table III do not seem to justify the assumptions of parametric statistics. Therefore, for the same reasons outlined above, they were treated with Mann-Whitney U tests and with Friedman two-way analyses of variance by ranks.

Replication effects. In order to test for replication effects the data were divided into four parts: (a) the four analysed acquisition sessions for all subjects; (b) the sixth and seventh sessions for the control subjects; (c) the sixth session for the extinction subjects; and (d) the seventh session for the extinction subjects. This was done because lumping basically different data together usually increases the within-group variability and, therefore, the probability of significance is decreased. Table IV summarizes the Mann-Whitney U tests for replication effects on the total number of responses. No significant replication effect was found.

Since no replication effects of any kind were found in the total number of responses, it was considered legitimate to treat both replications together in order to analyze the possible changes in the total number of responses (a) during the four acquisition sessions; and (b) between acquisition and extinction.

Session effects. A Friedman two-way analysis of variance by ranks reveals no significant session effect

TABLE IV

SUMMARY OF MANN-WHITNEY U TESTS FOR REPLICATION EFFECTS ON THE TOTAL NUMBER OF RESPONSES PER SUBJECT PER SESSION

Data Analysed	$N_1 = N_2$	U	U Needed for Significance at $< .05$ level
All analysed acquisition sessions for all subjects	40	791	592 or less
Sixth and seventh sessions for control subjects	10	37	27 or less
Sixth session for extinction subjects	5	12	4.04 or less
Seventh session for extinction subjects	5	9	4.04 or less

during acquisition on the total number of responses; the obtained X^2 value was 1.50 and a value of 7.82 or greater was required for significance at the $<$ .05 level.

Extinction effects. In order to minimize the error due to individual differences in the over-all rate of responding, the difference scores of the number of responses were used to test for extinction effects. These difference scores are shown in Table V. Each subject's difference score was obtained by adding her total number of responses in the sixth session to her total number of responses in the seventh session and, from this sum, subtracting the sum of her total responses in the fourth and fifth sessions; in symbols

$$D_s = (T_6 + T_7) - (T_4 + T_5)$$

Where D_s = difference score for a subject

T_r = total number of responses, made by the subject whose difference score is being computed, in the r^{th} session.

A Mann-Whitney U test revealed that the extinction subjects showed a significantly greater decrease in the number of responses than the control subjects. This difference was significant at the $<$ .001 level.

In summary, there were no significant replication or session effects in either the variances of the IRT's or the total number of responses per subject per session. The

TABLE V

DIFFERENCE SCORE FOR EACH SUBJECT

		Total responses in fourth session + total responses in fifth session	Total responses in sixth session + total responses in seventh session	Difference scores*
FIRST REPLICATION	CONTROL GROUP	6233	5024	-1209
		6072	4850	- 222
		2162	1829	- 333
		3662	3576	- 90
		4225	4440	+ 215
	EXTINCTION GROUP	2029	2	-2027
		1380	1083	- 297
		873	97	- 776
		5988	1154	-4834
		7094	1633	-5461
SECOND REPLICATION	CONTROL GROUP	1199	1201	+ 2
		3956	4006	+ 50
		3307	2909	- 398
		2995	2802	- 193
		4880	4514	- 366
	EXTINCTION GROUP	6205	2094	-4111
		2298	15	-2283
		5728	1425	-4303
		2906	102	-2804
		5556	799	-4757

*A Mann-Whitney U test revealed that the extinction subjects had significantly lower difference scores than the control subjects ($P \leq .001$).

subjects in the extinction group decreased in their total number of responses per session significantly more than the subjects in the control group.

CHAPTER V

DISCUSSION AND SUMMARY

Probably, the process of operant conditioning is almost as old as animal life itself. It is likely that operant conditioning played an important part in the evolutionary process, in that the animal that showed an increase in the probability of emitting a response after receiving food following such a response was more likely to get food again, and, therefore, survive. Similarly, the animal that could escape from aversive stimuli such as an attack by a stronger animal and that, subsequently, could avoid those aversive stimuli was less likely to become extinct. Besides, it was important to stop emitting the behaviors that were no longer functional, such as going for water to a pond that had dried; emitting non-functional behaviors subtracted from an organism's available time and energy to emit the behaviors that were functional. It also seems evident that long before the study of psychology as a science began, civilized man had been making use of these principles in activities such as raising children and training animals. This experiment was designed to investigate some variables present in the acquisition and in the extinction of avoidance behavior.

It is the purpose of this chapter to discuss and summarize this experiment. Specifically, the acceptance or

rejection of each hypothesis will be stated; other findings will be mentioned, even though no hypotheses had been made with respect to them; the results and the value of the study will be discussed; generalizations and recommendations with respect to further research will be made; and, finally, a summary will be presented.

Hypotheses

The hypotheses, made prior to the collection of the data for this experiment, are stated in Chapter I, pages 3 and 4. The analysis of the data, reported in Chapter IV allows for the acceptance or rejection of these hypotheses.

Hypothesis I. This hypothesis stated that avoidance behavior would become more stable from session to session as long as it was functional. The analysis of the data showed that Hypothesis I had to be rejected. The stability of avoidance behavior as measured by the variances of the IRT's did not change significantly from session to session, possibly because the first session was not recorded.

Hypothesis II. This hypothesis stated that a small change in the environment, not directly related to the aversive stimulus or to the response mechanism, would not cause significant changes in avoidance behavior. This hypothesis was accepted; the two measures of avoidance behavior used showed no significant differences between the two replications.

Hypothesis III. This hypothesis, which stated that the amount of avoidance behavior will decrease when it ceased to be functional, was accepted. The subjects whose behavior ceased to be functional in avoiding the aversive stimulus showed a significantly greater decrease in the number of responses emitted per session than the subjects whose behavior was still functional.

Other Findings

A very unexpected finding of the present study was the high rate of avoidance behavior; some subjects responded at rates higher than two responses per second. This was approximately ten times as many responses as it would have been necessary to prevent the aversive stimulus from being presented.

Another finding was that the rate of avoidance behavior did not change during the four analysed acquisition sessions, as is shown by the fact that there were no session effects on the total number of responses per session.

Conclusions

The findings of this study permit a few tentative conclusions about the behavior of mildly retarded girls at Parsons State Hospital and Training Center. This study should be replicated with other retarded populations before more general conclusions are drawn.

Until the study is replicated all the conclusions to be made apply only to the PSH&TC population.

Mildly retarded girls apparently reach an asymptotic value in the rate and stability of their avoidance behavior relatively early. This is substantiated by the fact that there were no significant differences among sessions from the second to the fourth one.

Mildly retarded girls seem to respond to the appropriate cues when they are emitting avoidance behavior. This conclusion is based on the acceptance of the second hypothesis of this study, which stated that a slightly changed environment will cause no change in avoidance behavior as long as the necessary elements (opportunity to emit the response, requirements of the response and aversive stimulus) remain unchanged.

Mildly retarded girls decrease the frequency of their avoidance behavior, when this behavior no longer serves the purpose of preventing the aversive stimulus. This conclusion is substantiated by the fact that the subjects whose behavior ceased to be functional decreased their response rate more than those whose behavior continued to be functional.

As a conclusion of the high rates of behavior, it can be said that, the rate of avoidance behavior of mildly retarded girls is far from optimum. It is possible that the situation is traumatic enough that it generates great quantities of unnecessary behavior.

Recommendations for Further Research

Replications with other populations. This study was carried out using mildly retarded adolescent females who had been institutionalized at Parsons State Hospital and Training Center and who did not have other activities scheduled at the time of the day that the experiment was run. It is the experimenter's opinion that the patients that had other activities were not basically difference from the subjects of the experiment and generalizations that do not take this factor into account can be made. However, this is still a small population, therefore it is necessary to replicate this experiment with different populations, before wider generalizations are made.

Replications with earlier measurement. Since the behavior reached asymptotic value before the data were recorded, it is impossible to determine when this value was reached. Further research that measures avoidance behavior from the beginning of the experiment is strongly recommended.

Research comparing extinction procedures. Extinction occurred very rapidly in this experiment. Other investigators such as Sidman[48] and Azrin[49] report very slow extinction; however, even though a different extinction procedure was

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[48]Sidman, loc. cit.

[49]Azrin, loc. cit.

used for this study, it is difficult to make any kind of comparison because other factors were also different. Further research in this area should compare both extinction procedures, using the same type of subjects and the same acquisition procedures.

Improvement of the extinction procedure. This study conditioned avoidance behavior by using noise with an intensity of 99 decibels as an aversive stimulus. This level of noise might be damaging to the ear drums if the organism is exposed to it for long periods of time; therefore the intensity had to be lowered during extinction. Some other stimulus, that is not damaging to the organism and that can be presented continuously during extinction, should be tried in the conditioning of avoidance responses.

Research in the maintenance of behavior. The results of this study indicate that at least some subjects continue emitting avoidance responses at high rates, even after the intensity of the aversive stimulus had been lowered considerably. It would be useful to investigate the parameters involved in this process, in other words, to find out how much the aversive stimulus can be lowered in intensity before avoidance behavior ceases to occur. Another possible line for further research would be to investigate the minimum intensity of the aversive stimulus needed to establish an avoidance response, and to compare such an intensity with the minimum intensity needed to maintain such a response.

The Value of this Study to the Fields of Psychology and Mental Retardation

A careful review of the experimental literature on avoidance behavior revealed no study that has used an extinction procedure comparable to the one used in the present experiment. This procedure seems to expedite extinction even though any comparisons are only tentative until both procedures are directly compared. This experiment studied extinction of avoidance behavior with a procedure that is basically the same as the traditional extinction procedure of behavior that has been positively reinforced; there is no reinforcement for the response. In the case of positively reinforced behavior, the response is not followed by positive reinforcement; in the case of avoidance behavior the response should not prevent the aversive stimulus from being presented. The procedure used by Sidman[50] and Azrin[51] can be interpreted in terms of "free" reinforcement; the subject does not receive the aversive stimulus, but as long as he continues responding, there is no cue to indicate that the response is no longer necessary. This study, therefore, opened the possibility of a new line of research with the possible practical implications of new knowledge about the way to extinguish or eliminate undersirable avoidance responses.

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[50] Sidman, loc. cit.

[51] Azrin, loc. cit.

This experiment also obtained information about the rate and stability of the avoidance behavior of mildly retarded girls.

Summary

Twenty mildly retarded girls were assigned to one of two replications and to one of two experimental conditions, extinction and control. All subjects received five acquisition sessions where an avoidance response to a loud noise was conditioned. Following the acquisition sessions, the control subjects were given two more sessions that were the same as the acquisition sessions with the exception that the intensity of the noise was lowered. The extinction subjects also received two more sessions with lowered noise after the first five sessions, but the noise was left on continuously during these last two sessions of the extinction subjects.

Statistical analyses of the data revealed no replication or session effects of any kind during acquisition. The subjects did not show any replication effect during the last two sessions. The extinction subjects decreased their total number of responses significantly more than the control subjects.

This study did not investigate all the parameters involved in avoidance behavior, therefore, further parametric research in this area is strongly recommended.

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