THE EFFECTS OF FOOD DEPRIVATION ON DISCRIMINATION LEARNING IN PSYCHOTIC CHILDREN

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ABSTRACT OF THESIS

The purpose of the present study was to examine the effects of two manipulations of food deprivation on the acquisition of a simple visual discrimination in psychotic children. In addition, attention was given to the contribution of position habits to errors made in acquisition.

Twelve subjects ranging in age from five to nine years were given a series of simple discrimination tasks in order to investigate the effects of eighteen hours (Experiment I) and four hours (Experiment II) food deprivation. A number of performance measures were taken and position responses were recorded.

The trends in the data suggested that there may be a decrease in the number of trials required to learn a task as a result of food deprivation. The results indicated that there was a non-significant increase in the correlation between response latency and other more direct measures of acquisition in the food deprived group. It also appeared that Ss tend to revert to position choices as a function of the length of time it took them to learn the task. A number of suggestions were made but no definite conclusions were drawn.

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CHAPTER I

INTRODUCTION

The purpose of this study was to examine the effects of hunger on acquisition of a discrimination habit in psychotic children. In addition, attention was given to the contribution of position habits to errors made in acquisition on a discrimination task.

Treatment problems with psychotic patients

The problem of developing techniques that are effective in the treatment of psychotic children has received increasing attention in the past few years. Behavior therapists, following the lead of Eysenck, Wolpe, and Skinner, have reported an impressive number of changes toward improvement in the behavior of psychotic children. In essence, their approach involves replacing bizarre or psychotic behavior with more appropriate responses. Other investigators including Wolfe, Risley, and Mees (1964) and Ayllon and Haughton (1962) also have shown that the behavior of psychotic children can be altered through conditioning. The problem facing therapists at present is to develop new behavioral techniques and improve the ones presently in use. The present study examines a possible method for the improvement of the general technique, namely, the control of primary drives in an attempt to facilitate the conditioning process in disturbed patients.

The general literature on conditioning provides ample evidence of successful conditioning of all types of human Ss

(Ullmann and Krasner, 1964) from aged, long term resident schizophrenic patients (Ayllon and Haughton, 1962) to four month old "normal" infants (Brackbill, 1958). This literature has served as a basis for clinicians' expectations that they could teach "normal responses" to psychotic or disturbed patients. However, most of their attempts of teaching such responses have been limited by attention to a single response, use of a single reinforcing stimulus, and application to a single patient at one time (Ayllon, 1963; Ayllon and Michael, 1959; Baer, 1962; Williams, 1959; and Wolfe Risley and Mees, 1964). More recently however, Ayllon (1965) has expanded this procedure somewhat by employing groups of Ss and groups of Es. In essence, the procedure he has used has been to give "token reinforcements" to a ward of patients for the performance of certain desirable acts. The frequency of these acts is recorded and compared to a previously recorded baseline or a period in which no reinforcements are given. The difference in the performance between these two periods is taken as evidence of the success of the technique.

An experimental design such as Ayllon's (1965) is useful for the investigation of incentive motivation incurred by various trial-related variables such as reinforcement. However, at no time does Ayllon relate the effects of a particular method employing Ss under different levels of motivation induced prior to testing. If behavior therapy is to be fully investigated, this aspect of the phenomenon cannot be overlooked. Consequently, the present study explores the manipulation of Ss by drive (D) in the form of food deprivation.

Drive as a theoretical construct

Hull (1943) proposed both that D energizes habit strength (H) multiplicitively to produce excitatory potential (E) and that response strength (R) depends upon the value of E, as symbolized in equation 1.0.

$$R = (E) = (D) \times (H) \qquad (1.0)$$

In a two response situation two equations are necessary as follows:

$$E_1 = (D) \times (H_1) \text{ and } \qquad (1.1)$$

$$E_2 = (D) \times (H_2).$$

In a two choice situation this becomes:

$$E_1 - E_2 = (D) \times (H_1 - H_2). \quad (1.3)$$

As symbolized by equation 1.3, the probability of the occurence of the stronger habit will increase with increasing D and with increasing difference between H_1 and H_2. Hull has proposed that the above equations describe post acquisition performance. On the other hand, learning, as represented by the construct habit ($_SH_R$) is not a function of D, but a function of number of reinforcement, and stimulus-response asynchronism. The hypothesis that D in the form of food deprivation is not a relevant variable in habit acquisition has been both supported and refuted by studies employing both rats and human Ss.

The investigation of drive in animal experiments

Animal studies supporting the hypothesis that there are no D effects on learning have generally required Ss, under varying amounts of food deprivation, to make simple choices (Elsman, Asimow, and Maltzman, 1956) or to perform simple operants such as pressing a bar in a Skinner Box (Brown, 1956; Strassburger, 1950). Those studies refuting the hypothesis have generally required Ss to perform multiple-choice tasks (Meyer, 1951; O'Kelly and Heyer, 1951) or to run straight alleys (Barry, 1948; Campbell and Kraeling, 1954; O'Kelly and Heyer, 1948). D effects have usually been observed on measures of vigour of response or response duration. Changes in these measures have been attributed to a heightened orienting response (Campbell and Kraeling, 1954). Cotton (1953) and King (1955) suggest that this heightened orienting response is a result of fewer competing responses interfering with the performance of Ss under high D. In summary, whether facilitory effects of D are observable appears to depend upon whether the performance measure taken is affected by competing responses.

The investigation of drive in human experiments

Few investigations have been carried out to study the effects of food deprivation on the learning behavior of human Ss. Instead,,investigations have been directed towards describing the effects of emotionally based drive on behavior. Contrary to Hull's postulates, the work of Spence (1956, 1960) appears to indicate that D does have an effect on learning.

In a series of investigations of Manifest Anxiety (A) as measured by the Manifest Anxiety Scale (Taylor, 1951), Spence (1956, 1960) concludes that A affects acquisition in the manner that Hull proposes of post acquisition performance in equation 1.3. On simple tasks A facilitates acquisition because the required response is prepotent in the S's hierarchy. On difficult tasks A does not facilitate and may inhibit acquisition as the response required is one of a series of responses of equal strength all elicited by the experimental situation.

In a further elaboration of D and its effects on performance, Spence (Chapter 2, 1956) distinguishes between two different types of D, appetitional and emotional. In considering their differences he does not suggest that either affects performance differently from Hull's (1.3) postulate. However it should be noted that the studies of Spence on emotionally based D represent a comparison of two inherently different types of Ss, high A Ss and low A Ss, performing under the same conditions. Studies of other types of D such as hunger represent a comparison of two equivalent groups of Ss under varying experimentally manipulated conditions. It is possible therefore that an inherently high A S makes various adjustments to an inherent level of A which a normal S under a manipulated level of emotional or appetitional D does not. In order to examine possible differences in the effects of these two types of D (i.e. inherent and manipulated), related studies done by Eysenck and his co-workers will now be reported and compared to the studies of Spence.

Eysenck (1964) reports a number of investigations in which the effects of situationally induced D were explored. A high level of D was induced by telling Ss that their performance would determine their acceptance into an apprenticeship program for which they were applying. Low D Ss were already in the program. High D Ss showed increased autonomic responses and better performance on a number of learning tasks (Feldman, 1964; Willet, 1964a; Willet, 1964b; Willet and Eysenck, 1962). The most interesting result of these studies was that each demonstrated the facilitory effects of D at every level of task difficulty investigated. That is, increasing task difficulty did not prevent observation of the facilitory effects of D. Thus the formulations of Spence were not supported in the above studies of situationally induced D, although they appear to be valid in his own investigations of Manifest Anxiety. Because comparable tasks were employed in the studies of Eysenck and Spence, the conflicting findings cannot be contributed to task variables. They may, however, be the result of the differential effects of inherent D and situationally induced D on performance.

In addition to the studies of emotionally based drive, there are al least two relevant sutdies in which the effects of food deprivation on the conditioning of human Ss have been investigated. For instance, Franks (1957) found that 20 hours of food, drink and smoking deprivation did not affect the eyeblink rate of the apprenticeship candidates used in the Eysenck studies (1964). Epstein and Levitt (1962) in "the only study" that has been done on the directive effects of primary drive on learning in human Ss" (p.130) found that hunger (defined as the state of Ss just before the evening meal) increased the rate of acquisition, as measured by trials to criterion, of a word memorization task over that of Ss tested following the evening meal.

In summary, the studies employing human Ss indicate that the effects of D depend partially on the operational definition of D employed. Inherent A appears to facilitate performance only of simple tasks. Situationally induced D appears to facilitate the performance of nearly all tasks regardless of task difficulty. Although food deprivation appeared to facilitate Ss' performance on some tasks used by Epstein and Levitt (1962), in general, evidence gained from the food deprivation studies is equivocal.

Discrimination Learning

As the results of the above empirical studies on complex tasks involving the effects of A, situationally induced D, and food deprivation are inconsistent with Hull's theoretical formulations, it is necessary to examine further the multiple-choice situation in relation to the effects of D. The simplest example of this is the two-choice discrimination task. Each stimulus in the two-choice situation has a generalization gradient as shown in Figure 1.

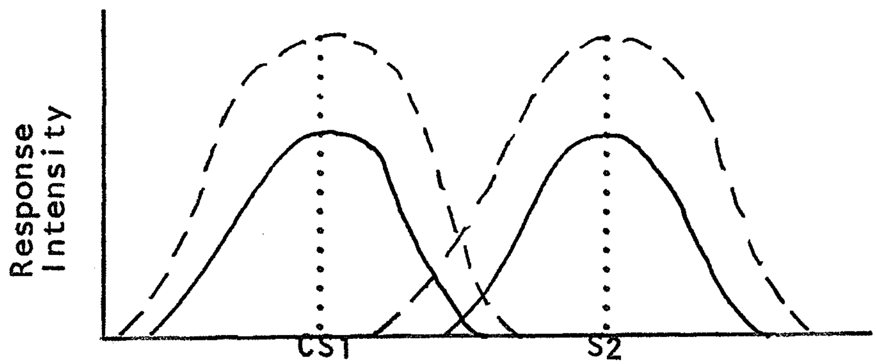

Figure 1. Generalization gradients of a two-choice discrimination situation, high and low D.

These gradients represent the property of stimuli similar to a conditioned stimulus (CS) to evoke the same response as evoked by the CS. The strength of the response to the similar stimulus increases with increasing similarity between it and the CS. In Figure 1, both the distance between the peaks of the two curves and the shape of the two curves represent the difficulty of the discrimination, i.e. the greater the distance between the two peaks the easier the discrimination and, the less the amount of overlap of the two curves the easier the discrimination.

In a discrimination task the effect of D is both to energize the organism and to broaden the generalization gradient in a multiplicative fashion as shown by the broken lines in Figure 1. In a discrimination situation D facilitates performance according to Hull's equation (1.3), but it also hinders performance by broadening the generalization gradients. In an easy discrimination D increases the overlapping of the gradients, but not enough to overcome the stronger energizing function (Hull, 1.3). Therefore, in an easy task D facilitates discrimination performance. In a difficult discrimination D substantially increases the overlapping of the two curves, enough to overcome the energizing function. Therefore, in a difficult discrimination D produces a performance decrement. Yerkes and Dodson (1908) have proposed a law which summarizes this interaction between task and drive. This law states that for every task there is a maximum facilitory stimulus intensity above and below which discrimination is more difficult.

The Yerkes-Dodson analysis of maximum facilitory stimulus strength is supported by evidence from studies by Cole (1911) and Dodson (1915). Both Cole and Dodson have manipulated physical stimulus intensities and have found that increased stimulus intensity facilitates learning of a discrimination task. Cole, however, had difficulty finding the maximum point. He has postulated that it might have been at a physiologically damaging level for the task which he was employing.

More recently Broadhurst (1957), Easterbrook (1958), and Gray (1965) have manipulated subjective stimulus strength by the application of D variables. Broadhurst and Easterbrook have interpreted their results as supportive of the Yerkes-Dodson hypothesis, although they, like Cole, had difficulty determining the point of mazimum facilitory stimulus strength. Gray does not refer directly to the Yerkes-Dodson hypothesis, but he has found D facilitory at several levels of task difficulty.

In summary, discrimination studies in which D is manipulated show, as Yerkes and Dodson predict, the effects of D on

per

performance depend partly on the difficulty of the task. Although there are few instances in which the maximum facilitory stimulus intensity is exceded, there is no evidence that suggests that there is not a maximum facilitation point for every task. Part of the usefulness of the Yerkes-Dodson analysis lies in its applicability to more complex situations than the two-choice discrimination task. Application of this analysis to the studies of more complex situations reported earlier using both animal and human Ss allows more definite identification of the relevant variables in those situations.

Discrimination analysis of complex learning

The studies of Spence (1956,1960) and the studies of Eysenck (1964) considered separately are amenable to analysis on the basis of the Yerkes-Dodson law, but considered in combination they are not. To illustrate, Spence has stated that inherently high A Ss perform worse than inherently low A Ss in serial rote learning (Montague, 1953); however, Eysenck and Warwick (1964) have found that Ss under high situationally induced D perform better than Ss under normal D. This, Eysenck and Warwick report, occurs on both easy and difficult serial rote learning tasks. This inconsistency between the findings of Spence and those of Eysenck and Warwick strongly suggests qualitative differences between these two types of emotionally based D, (inherent and situationally induced).

Animal investigations show that D is instrumental in reducing competing responses thereby facilitating performance. Competing responses can be said to have approximately the same intensity as the required response in a low *D* condition thus hindering performance (see Figure 2). High *D* however energizes the required response as this response is instrumental in decreasing the induced drive state. This is analagous to Hull's explanation of the strengthening of a habit by high *D*. Consequently, under high *D*, overlapping of the gradients of the response required by the gradients of the competing responses becomes much less prevalent and learning is facilitated.

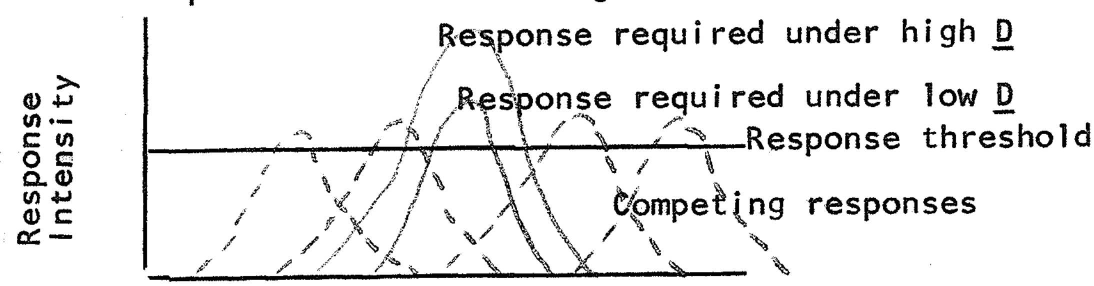

Figure 2. The effects of competing responses and their generalization gradients under high and low *D* conditions.

Discrimination performance of psychotic *S*s: a special case

As this study is concerned with psychotic children, it is necessary to examine how they differ from normal *S*s with respect to their learning performance. Spence (1956, 1960) and Mednick (1955, 1958) hypothesize that psychotic *S*s have a much higher anxiety level than normal *S*s (i.e. one degree higher than high *A* normal *S*s). The relevance of this hypothesis is that, according to the discrimination analysis presented, the physical value of the maximum facilitory stimulus strength will be lower for psychotic Ss. Mednick stated that schizophrenic Ss also have a broader generalization gradient (increased overlapping of stimulus generalization gradients) than normal Ss. This means that facilitation for psychotic Ss would occur only on tasks somewhat easier than those at the maximum facilitation point for normal Ss. As Cowden (1962) has found that anagrams of three different levels of difficulty were too complex to show the effects of stress on the performance of schizophrenic Ss, the task chosen for this study was considerably less complex than the anagrams used by Cowden.

A second measure of drive effects on discrimination learning

Discrimination performance also allows the recording of an additional measure, latency. The foregoing discussion of D effects on discrimination learning was concerned implicitly with direct measures of acquisition such as number of trials to criterion and number of errors. Yet both Hull (1952) and Spence (1956) postulate that response time is inversely related to absolute response frequency. Empirical evidence indicates that this inverse relation is not as strong as one might expect from the postulates of Hull and Spence. Kellogg and Walker (1938), in a study on the classical conditioning of a flexion response, report a latency-amplitude correlation of -0.22 and a latency-frequency correlation of -0.18. Campbell and Hilgard (1936), in a study on classical conditioning of an eyeblink response in human Ss, report a latency-amplitude correlation of-0.15 and a latency-frequency correlation of -0.54. Both these sets of correlations are low for at least two reasons: (1) the distribution of latency scores is positively skewed (in comparison to a relatively normal distribution of other response measures) and, (2) latency scores include extraneous effects such as competing responses and incomplete responses. These two conditions can be corrected by: (1) employing latency reciprocals to correct for the positive skewness of the distribution of the latency scores and, (2) employing a level of D to decrease the effects of competing responses (Cotton, 1953; King, 1955).

Several investigators have attempted to reduce the effects of competing responses in human Ss by exerting various controls on the testing situation (Buss, 1950; Kellogg, 1931; Laberge, 1961; Wollen, 1963). They have reported a high inverse relation between total response frequency and response latency. Wollen examined a discrimination situation and found that total response frequency was inversely correlated with response latency. In other words, choice time (the time required for S to choose a response) decrease systematically with the number of choices S has already made. This finding suggested that a similar decrease as a function of D might be found in the present study. In order to examine this possibility, comparisons were made of both reciprocal latency scores between groups and latency versus trials to criterion within groups. Both these comparisons aid in the examination of the effects of

D. Coupled with a direct comparison of trials to criterion between groups these comparisons should adequately test the hypothesis proposed.

The present study

The purpose of the present study was to investigate the effects of hunger on the performance of psychotic Ss in a two-choice discrimination task. Because Yerkes and Dodson (1908) postulate that there is a maximum facilitory stimulus strength which, according to Mednick (1955) and Spence (1956, 1960), would be more easily exceeded by psychotic Ss, two separate experiments were used to investigate two manipulations of D which for the sake of convenience will be denoted as high D in Experiment I, and as moderate D in Experiment II.

Experiment I. Experiment I investigates the effects of 18 hours food deprivation on discrimination performance. It was hypothesized that Ss under 18 hours food deprivation would learn a two-choice discrimination task in fewer trials than Ss under no deprivation.

The task chosen for this study was a simultaneous two-choice discrimination task in which the stimulus dimensions of figure, colour and position were irrelevant and a shading-non-shading dimension selected as the relevant cue. As well as a "pretraining" task which equated the groups on discrimination performance a task, response training (RT), was designed and administered to Ss to insure that all Ss would respond under normal D to the apparatus when the stimuli were presented. Similarly a second task, response differentiation (RD), was administered (1) to insure that Ss could make the easiest possible discrimination; (2) to reduce the interfering effects of irrelevant response tendencies such as position preferences. The administration of these two tasks (RT and RD) sufficiently manipulated the Ss' hierarchy so that a hypothesis of facilitory D was considered justified (Spence, 1960).

Experiment II. Experiment II investigates the effects of 4 hours food deprivation, in comparison to no deprivation, on the performance of a two-choice discrimination task. The hypothesis was the same as that in Experiment I, i.e. Ss under 4 hours food deprivation would learn a two-choice discrimination in fewer trials than Ss under no deprivation. A slightly different experimental design was used from that in Experiment I. As the formulations of Yerkes and Dodson, and Mednick, considered in combination, support the conclusion that the point of maximum facilitation for these Ss is lower than for normal Ss, this second experiment represents an attempt to ensure that a facilitory level of D will be investigated. In this second experiment the task chosen was a simultaneous two-choice discrimination in which the dimensions of figure, colour, and position were irrelevant and, unlike Experiment I, the dimension of shape was the relevant dimension.

As Cowden (1962) has found a great variability in performance within a clinical category Ss were assigned to matched groups in both Experiment I and Experiment II to prevent the occurrence of spurious group differences. The criteria used in this assignment of Ss to matched groups were language development, age, and performance on the pretraining task. The basis for the use of age and language development comes from Gollin and Liss (1962)[1] who studied the effects of age on discrimination performance and the pilot study for this thesis which suggested that language development is a relevant variable in the acquisition of a discrimination task.

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[1]Gollin and Liss have found that older children learn a reverse discrimination faster than younger children (8 years vs 4 years).

CHAPTER II

EXPERIMENTAL METHOD AND RESULTS: EXPERIMENT I

1. METHOD

Subjects

Eight male and four female Ss between the ages of 5.7 and 8.25 from Peter Pan Ward of Thistletown hospital were assigned to two groups matched for age, language development and performance in pretraining. All Ss were diagnosed as psychotic, autistic, or atypical schizophrenic by the ward psychiatrist.

Apparatus

Discriminanda, described in Table I, consisting of individual slides containing two stimulus figures, were projected by means of a Kodak Carousel projector onto the rear of two adjacent acrylic sheet screen (Perspex Opal 030) each four inches square. S was seated at arm length from the screens on the opposite side from the projector. By pushing on either the left or the right screen with his fingers, S could indicate his choice of one of the two stimuli presented simultaneously on the two panels. A non-correction procedure was used throughout the experiment. By means of a code punched on each slide and a photocell system, each response was recorded as correct or incorrect on either of the two counters. At the same time a relay system moved the projector ahead to a solid slide which showed as blank on the two acrylic panels. This provided an intertrial interval which consisted of the length of time it

Table I

Task Description and Schedule of Administration

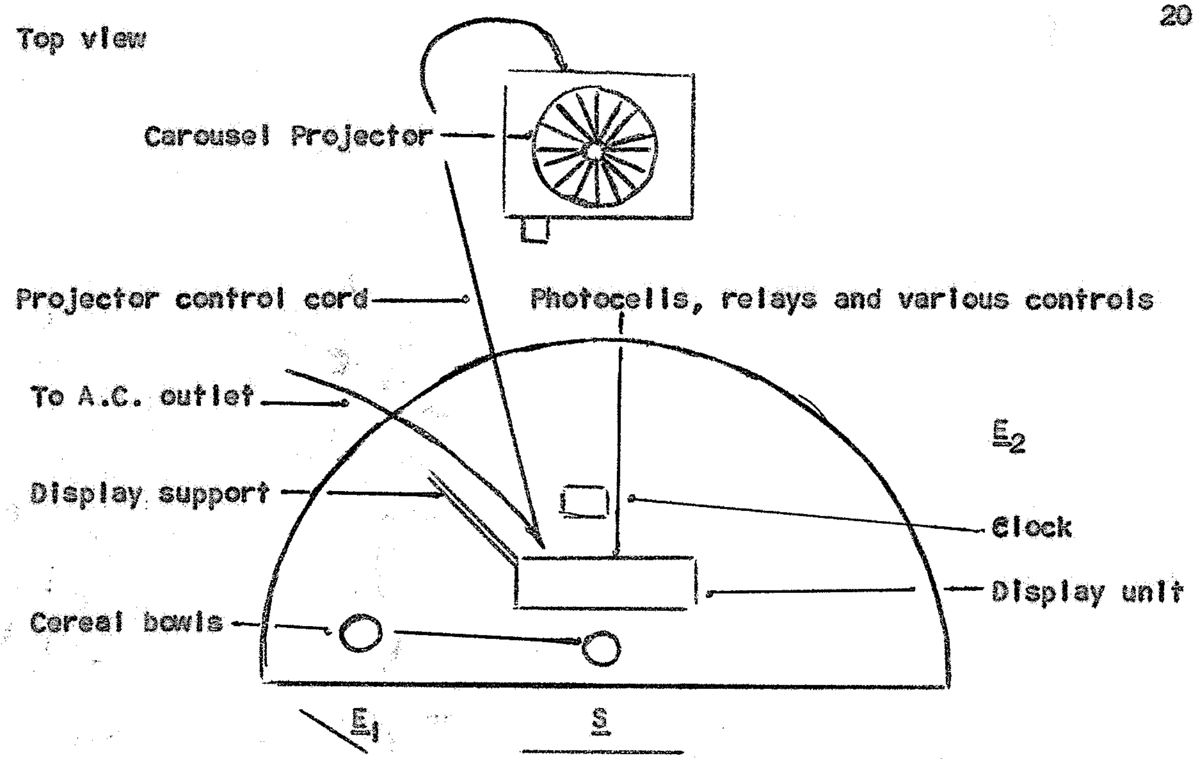
Session	Day	Name of task	Stimuli	Relevant dimension	Irrelevant dimension
I	I	Pretraining	toy tree beneath yellow and black box tops 4"x2"x1" varied in position	colour	position
	2	no testing			
	3	no testing			
	4	no testing			
2	5	Response Training (<u>RT</u>)	unpatterned white light to both panels	light "on"	
		Response Differentiation (<u>RD</u>)	bright yellow hue to one panel, nothing to the other	brightness and hue	position
3	6	*Initial Discrimination(<u>DI</u>)	shaded and unshaded triangles on red and green grounds to separate panels	shading	position colour
	7	no testing			
4	8	Extinction	same stimuli as <u>DI</u>	non-reinforcement	

*Administered to the experimental group when it was under 18hours food deprivation.

took the second experimenter ($\underline{E}_2$, Lorimer) to record the position of each response, whether it was correct or incorrect and its latency (a total intertrial interval ranging from 4 to 6 seconds). Latency was measured as the time between the onset of the stimulus light and S's pressing one of the two panels. The first experimenter ($\underline{E}_1$, Lees) meanwhile informed S as to whether his response was correct saying, "that's the right one", or incorrect saying, "that's the wrong one" and placed a Kelloggs Corn Chex in a bowl at S's left on each correct response. The next stimulus was presented by $\underline{E}_2$ when he had completed recording the response measures, irrespective of what S was doing.

Experimental Design

There was one pretraining task (not using the apparatus) and four different tasks performed on the apparatus. As two of the four tasks performed on the apparatus were completed in one testing session there was a total of four testing sessions. The training schedule is presented in Table I. Pretraining, RT and RD were all essentially pretraining tasks as explained in the introduction. Task 3, initial discrimination (DI), was designed to measure the differences in speed of acquisition between the experimental group (E) and the control group (C). Task 4, extinction, measured the number of trials taken by S to stop responding to the stimuli. Task 4 differed from a normal extinction task in that Ss received an instructional change. Ss were told that they would not receive any reinforcement for



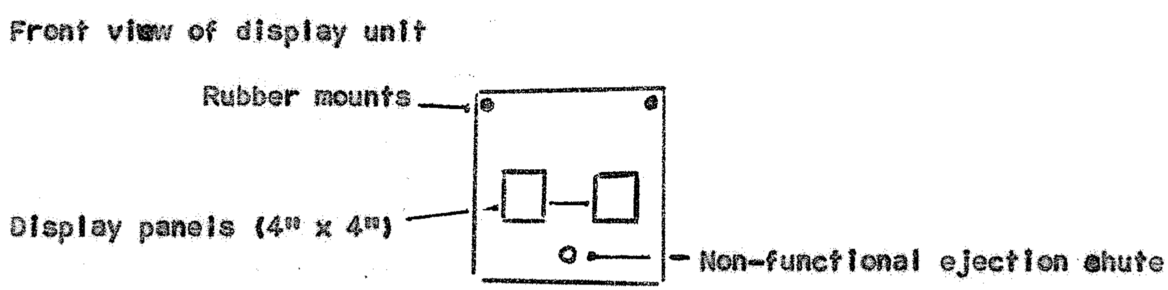


Figure 3. Testing apparatus

tinued according to the criteria in Table 2. This occurred either at seven successive correct trials, at the end of eighty trials, or when two or fewer responses occurred within five minutes.

Table 2

Criteria for Termination of Training

Task	Criteria for Termination of Training
Pretraining	1. 7 successive correct trials
Response Training (RT)	1. 15 trials 2. Longer latency than 5 minutes on one response
Response Differentiation (RD)	1. 7 successive correct trials 2. Longer than 5 minute latency
Initial Discrimination (DI)	1. 7 successive correct trials 2. Longer than 5 minute latency 3. 80 trials
Extinction	1. When S moved away from the stimulus lights and indicated that he was not going to respond further.

II. RESULTS

Groups were matched on pretraining performance, age, and language development. The data for this are summarized in Table 3. Ss not reaching criterion within 80 trials were assigned a score of 80 for the purpose of making group comparisons. This number was an approximate reflection of the maximum number of administrable trials (within one session) and was somewhat larger than the number of trials taken by any S to reach criterion. Because inspection of the trials to criterion data revealed a correlation between group means and group variances, a square root transformation was applied to the individual scores. The effects of food deprivation, as shown in the reciprocal latency and root trials to criterion data, are summarized in Table 3. In Task DI there appeared

Table 3

Group Comparison before and during Task Administration

Task	Measure	Mean Group E	Mean Group C	t
Pretraining	Trials to criterion	5.0	5.8	0.50
	Age	6yrs.	5.9yrs.	
	Language development ranked on language competance	6.0	6.7	
DI	Trials to criterion (sq.rt.)	5.76	6.47	0.886
	Latency (Ave. recip.)	0.366	0.298	0.11
Extinction	Trials to ext. (sq.rt.)	6.55	5.67	0.054
	Latency (Ave. recip.)	0.407	0.449	0.286

to be no group differences on mean root trials to criterion and average reciprocal latency (t, matched = 0.886 and 0.054; df=10). The acquisition data were further examined by Vincentizing (Vincent, 1912) each S's acquisition curve into eight equal divisions for both per cent correct and latency (Figures 4 and 5).

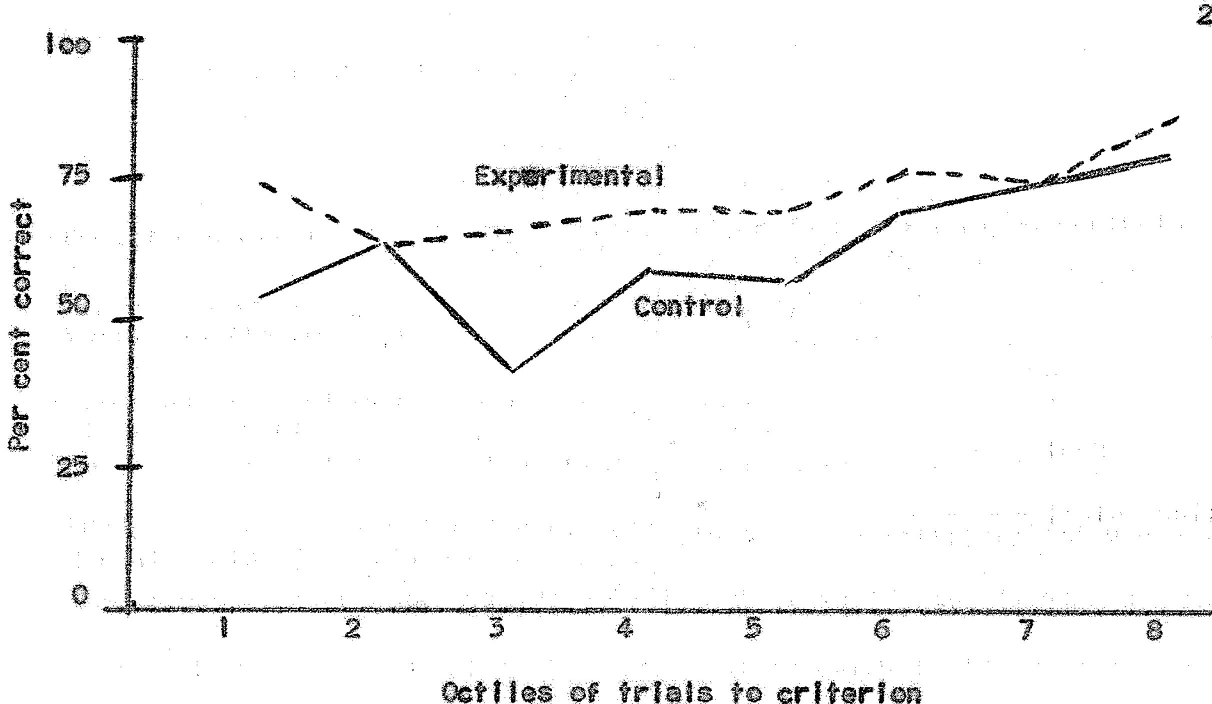


Figure 4. Per cent correct as a function of Vincentized trials to criterion

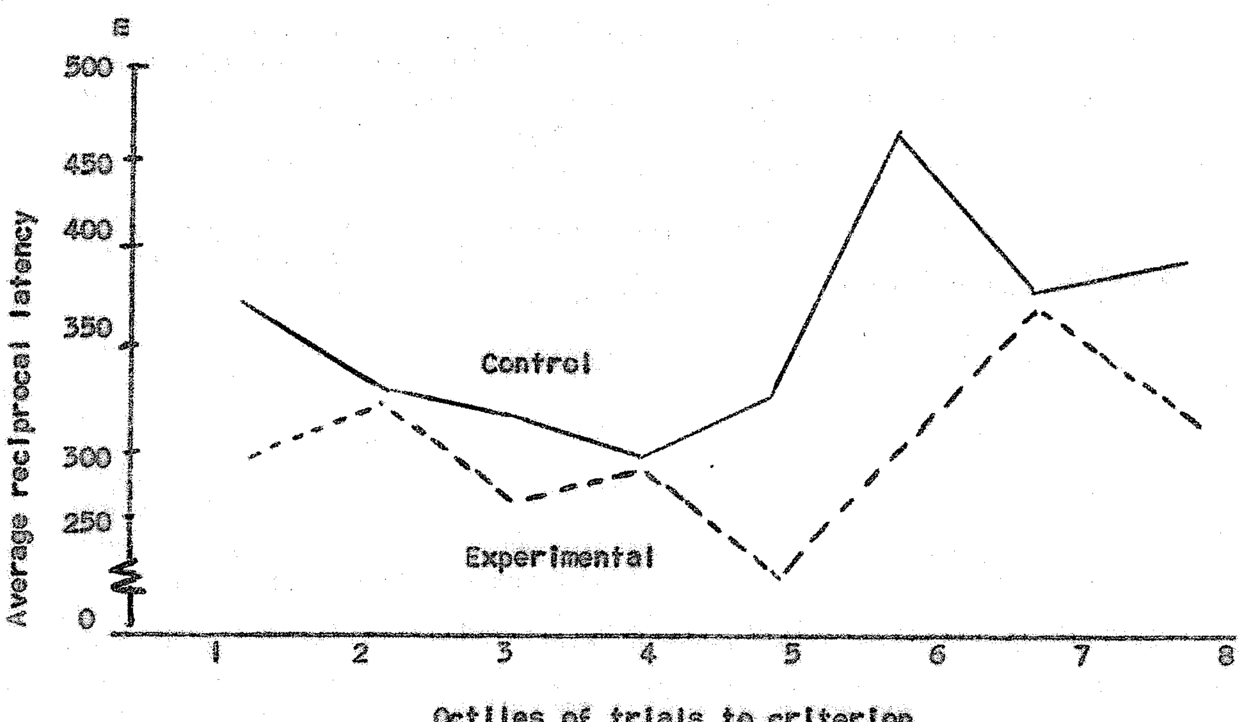


Figure 5, Reciprocal latency as a function of Vincentized trials to criterion

Figure 4 shows a slight improvement in per cent correct over trials for both the experimental and control groups. The variability of the individuals was reflected somewhat in the lack of smoothness of both curves. The relatively small differences between the curves suggest that there were no significant differences between the groups. However, the curves do suggest that the experimental group was slightly superior.

Figure 5 relates trials to average reciprocal latency in acquistition. Although there appears to be a high degree of variability from trial block to trial block this variability is probably a function of the size of the graphic unit used for the latency measure. Latency reciprocals over trials show a slight increase which represents on increased speed of responding. Although no significant differences in latency reciprocals were observed between the groups the curves suggest that the control group was slightly quicker in making a response.

Latency and trials to criterion data were also compared. A Pearson product-moment correlation was applied between number of trials to criterion and average reciprocal latency. For Group C the correlation was very low, -0.26, but for Group E it was higher, -0.76, but not significant (r at p = 0.05, =0.811; df = 4). Because both of these obtained correlations are not significantly different from zero and both are negative, it can be stated that there are probably no significant differences between them. The trend however, is for the coefficient of Group

E to be higher than the coefficient for Group C. This trend in the coefficients between latency and trials to criterion suggests that the Ss in Group E were less variant than Ss in Group C in their performance as defined by these two aspects of their response.

Inspection of the trials to criterion data for Task DI appeared to indicate that some Ss, notably those who learned slowest, showed a position preference. This occurred in spite of the fact that no position preferences were observed in RD (in RD, 11 of the Ss made all correct choices and the twelfth made one error). As such tendencies (position preferences) have been identified as Error Factors (Harlow, 1959) a rank-order correlation was calculated to test whether these tendencies were systematic with respect to the number of trials required to learn the task. Combining the data across groups, in acquisition of Task DI there was a rank-order correlation of 0.95 ($p < 0.001$, df = 10) between trials to criterion and a ratio designed to measure position preference:

$$\frac{\text{number of errors made to the preferred side of the apparatus}}{\text{total number of errors made}}$$

A further inspection showed that 5 of the 12 Ss (in general the slowest learners) made greater than 75 per cent of their errors to one side of the apparatus. These data strongly suggest that position tendencies play a major role in the acquisition of a more complex (Table I) and presumably more difficult discrimination (DI) of psychotic Ss. Also increased position habits appeared in association with slower learning when position tendencies were corrected for total number of errors (ρ = 0.95)

In Extinction there were no significant differences between the groups (t = 0.29 and 0.32, df = 10) as measured by mean root trials to extinction and average reciprocal latency (see Table 3). This result is consistent with the acquisition data.

In summary, there were no significant differences between the groups on any of the measures taken in either acquisition or extinction.

CHAPTER III

DISCUSSION: EXPERIMENT I

A brief discussion is presented to clarify the results. However, a full discussion of the results and their implications follows in the general discussion.

The hypothesis, stating that there would be differences in number of trials to acquisition of a discrimination task between the Ss who were food deprived and those who were not, was not supported. Also there were no significant group differences in latency measures (in either acquisition or extinction) or number of trials to extinction.

The acquisition data are Vincentized and illustrated in Figures 4 and 5. The data of Figure 4 suggest a slight constant superiority of Group E on per cent correct. However the data of Figure 5 suggest a slight inferiority of Group E in speed of responding. In neither Figure 4 nor in Figure 5 does there appear to be increasing differences between the curves of the two groups as a function of trials. An increasing difference between the curves would be expected as a result of summating facilitory effect of D over trials. Therefore there is no basis on which one might expect a trend toward increased speed of acquisition as a function of D.

Although the discrimination data showed no differences in speed of acquisition due to food deprivation, it seemed certain that deprivation had some other effects on the experimental Ss. Just following meal time on Day 5 (the day of deprivation), two of the six experimental Ss showed some verbal aggression. One S directed his hostility to the ward psychiatrist saying, "That Doctor Ward, he doesn't know how to handle us children". A second S said to a staff member, "John, you should be ashamed of yourself. I missed ham, corn ..." A third S complained on the morning after the day of deprivation that he wanted to "take his stomach out", while a fourth banged his head against a wall immediately prior to and following testing on Day 5. This behavior ceased upon his entering the dining area following testing.

These behaviors suggest that food deprivation evoked some anxiety in the Ss. Three of the experimental Ss were sick to their stomachs on Day 5, two immediately following testing and one just before testing. None of the control Ss was sick at any time during the study. As this sickness also occurred on the first day of deprivation in the pilot study for this thesis the Es were aware of its possible reoccurrence in the present study. In the pilot study however, on the second non-successive day of deprivation sickness did not occur. At that time it was thought that the sickness of the Ss on the first day of deprivation was partly attributable to ward staff anxiety brought on by the novelty of the deprivation technique. Therefore, as the deprivation period for the present study was the third opportunity the staff had had to deal with the deprivation technique (two in the pilot study) it was decided that no day of deprivation administered prior to the beginning of the study was needed.

Whatever the cause of the anxiety in the _S_s it provides a possible explanation of the lack of differences between the groups. It is possible that as a result of (1) the inherent excess _A_ in these psychotic _S_s (Mednick, 1955); (2) the added hunger _D_ plus situational anxiety as the result of the deprivation technique, the level of _D_ exceeded the hypothesized maximum facilitory value proposed by Yerkes and Dodson (1908). The effects of _D_ might have produced facilitation for faster learning _S_s and inhibition for slower learning _S_s. This might have prevented the statistical identification of any group differences as a function of increased _D_.

CHAPTER IV

EXPERIMENTAL METHOD AND RESULTS: EXPERIMENT II

I. METHOD

Subjects

The Ss were the same as those of Experiment I. The six Ss assigned to Group I of this experiment were half from Group E and half from Group C of the first experiment. Group II had the remaining six Ss, three Ss from each of Groups E and C. Group I and Group II were matched in terms of discrimination performance in Experiment I.

Apparatus

The apparatus was the one used in Experiment I, however the stimuli were different. In Task 1 red and yellow stars and squares were used; in Task 2 blue and green circles and hearts. All had black dots in the centre. Colour, shape and position were each varied randomly, the only restriction being that each possibility of each dimension occurred exactly 50 per cent of the time. Consequently, in the long run, if all his responses were correct, S pushed the same number of each possibility in the irrelevant dimensions of colour and position. Shape was the relevant dimension; in Task 1 squares, and in Task 2 circles.

Procedure

Testing was administered one half-hour prior to and following the large meal of the day, the noon meal. Ss tested before eating were under 4 hours deprivation (moderate D). Ss tested after the noon meal were under less than one half-hour deprivation (low D). A full description of the task administration is presented in Appendix B (same as for Task DI of Experiment I). Instructions are presented in Appendix A. Each correct response was rewarded in the same fashion as in Experiment I.

Experimental Design

In order to compensate for the few Ss available, a mixed design, deprivation by groups by Ss analysis of variance, was used. Also tasks were counterbalanced and nested within groups by deprivation conditions. In other words one half of the Ss of each group were administered tasks in a reverse order to that administered to the other half. Groups were equated for both deprivation experience and previous speed of discrimination performance. Group 1 received deprivation followed by non-deprivation. Group 2 received non-deprivation followed by deprivation. Assignment of Ss to groups and order of task administration are summarized in Table 4.

II. RESULTS

As was done in Experiment I, all Ss who did not learn to criterion were assigned a score of 80 for the purpose of applying an analysis of variance to the data. Inspection of the trials to criterion data revealed a correlation between means and variances. This correlation was lessened by perform-

Table 4

Administration of Testing and Assignment of Subjects to Groups

Group	Number of *S*s	1st session	2nd session
1a	3	Hungry--Task 1	Not hungry--Task 2
1b	3	Hungry--Task 2	Not hungry--Task 1
2a	3	Not hungry--Task 1	Hungry--Task 2
2b	3	Not hungry--Task 2	Hungry--Task 1

ing a square root transformation on the raw scores, so that the distribution of the data more closely met the assumption underlying the analysis of variance. A mixed design was applied between mean root trials to criterion classified by groups, deprivation conditions and *S*s. The analysis is summarized in Table 5 and illustrated in Figure 6.

Although none of the terms was significant, the contrast between the negative slope of Group 2 and the positive slope of Group 1, illustrated in Figure 6, suggested application of the same type of analysis of variance on the same scores reclassified by groups by *S*s by temporal order of task administration. The effect of reclassification was to reverse the slope of the line drawn between the deprived and non-deprived points of Group 2 (see Figure 6a). This manipulation appeared to change the pattern of F ratios (see Table 6), but again none was significant. Figure 6a shows a trend towards increased number of trials to criterion in the second administration of testing. This appeared to be more pronounced in Group 1, the group that received deprivation first.

The latency scores were transformed to reciprocals to correct for the positive skewness of the curve showing the distribution of the values for the latency scores. The data were classified according to groups, deprivation conditions and Ss. A mixed model of the analysis of variance, used on the average reciprocal latency scores (summarized in Table 7), indicated that there were no significant main effects or interactions. The data illustrated in Figure 7 suggested no necessity for the application of the same analysis to reclassified scores as was done with the trials to criterion data. Because the latency scores were suggestive of some differences between groups at both levels of deprivation, performance on an earlier task (DI) of Experiment I was examined. A t-test was applied between Group 1 and Group 2 on the average reciprocal latency scores of these Ss in task DI of Experiment I. A significant difference was found ($t = 3.01$, $df = 10$, $p < 0.01$; two tail) between the groups. This difference suggested that there was an initial bias in the assignment of Ss to groups (Group 2 shorter latencies than Group 1). The explanation of the trends in the data therefore took this bias into account. In short, latency did not reflect any group differences between tasks.

It was decided that a clarification of the possible effects of this initial latency bias on the other measure of

Table 5

Analysis of Variance of the Square Root of the Number of Trials to Criterion for the Effects of Deprivation Conditions, Counterbalanced Groups and Subjects

Source	df	MS	F
Between Subjects	23		
Groups	1	1.12	<1
Error (between)	22	5.14	
Within Subjects	24		
Deprivation Condition	1	0.92	<1
Groups x Deprivation	1	1.26	1.00
Error (within)	22	1.26	
Total	47		

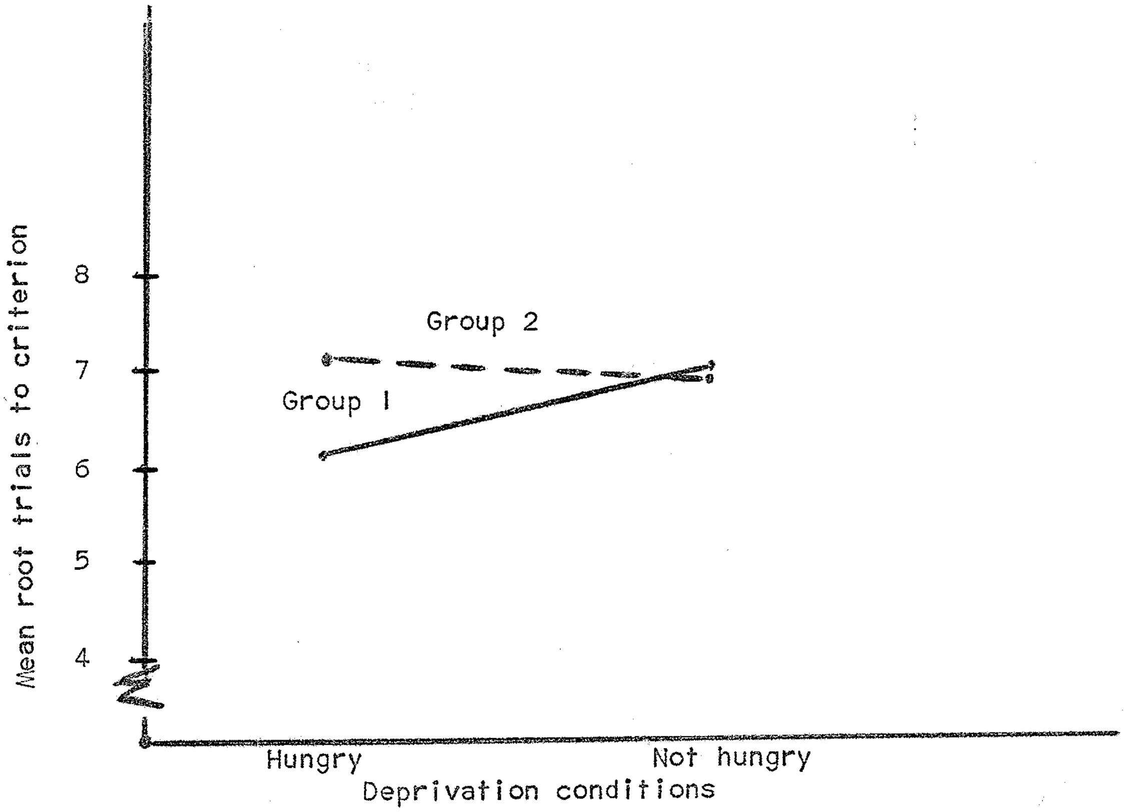


Figure 6. The effect of food deprivation on the number of trials to criterion.

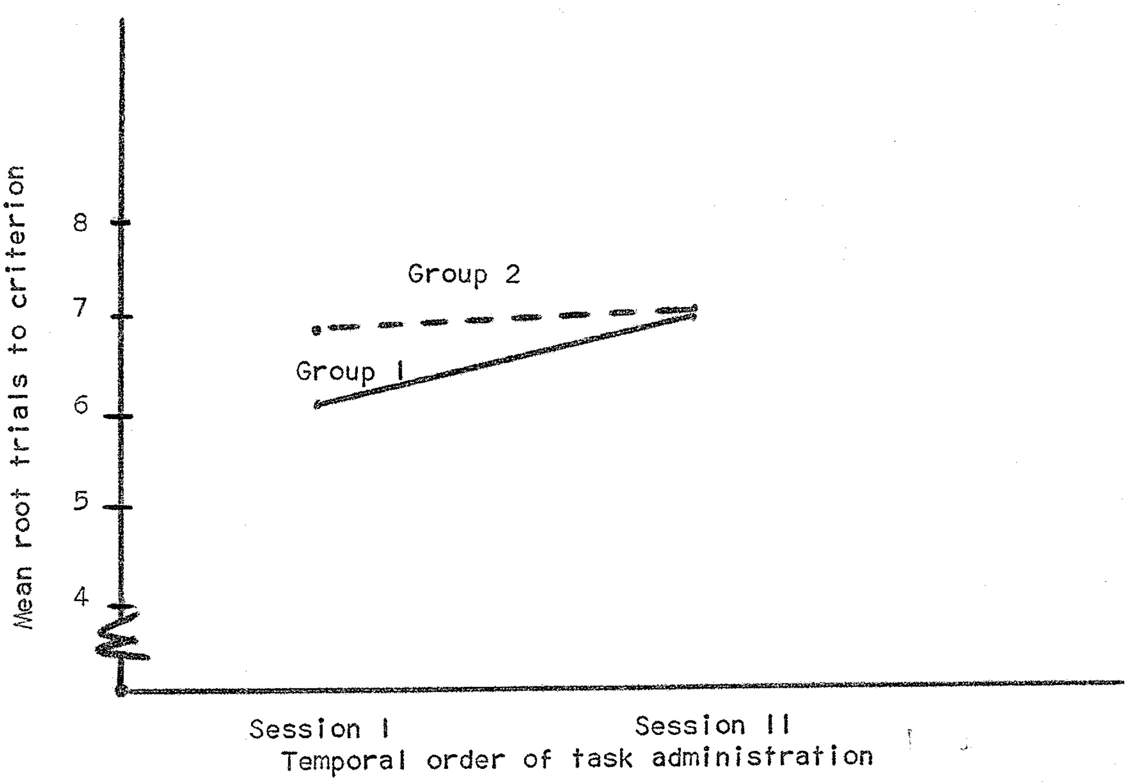


Figure 6a. The effect of temporal order of task administration on trials to criterion.

Table 6

Analysis of Variance of the Square Root of the Number of Trials to Criterion for the Effects of Temporal Order of Task Administration, Counterbalanced Groups and Subjects

Source	df	MS	F
Between Subjects	23		
Groups	1	1.12	<1
Error (between)	22	5.14	
Within Subjects	24		
Temporal Order of Task Administration (1st vs 2nd)	1	1.28	1.02
Groups x Task Order	1	0.90	<1
Error (within)	22	1.26	
Total	47		

Table 7

Analysis of Variance of the Average Reciprocal Latency of Response for the Effects of Deprivation Conditions, Counterbalanced Groups and Subjects

Source	df	*MS*	F
Between Subjects	23		
Groups	1	37.21	<1
Error (between)	22	47.25	
Within Subjects	24		
Deprivation	1	10.41	<1
Groups x Deprivation	1	24.51	2.41
Error (within)	22	10.67	
Total	47		

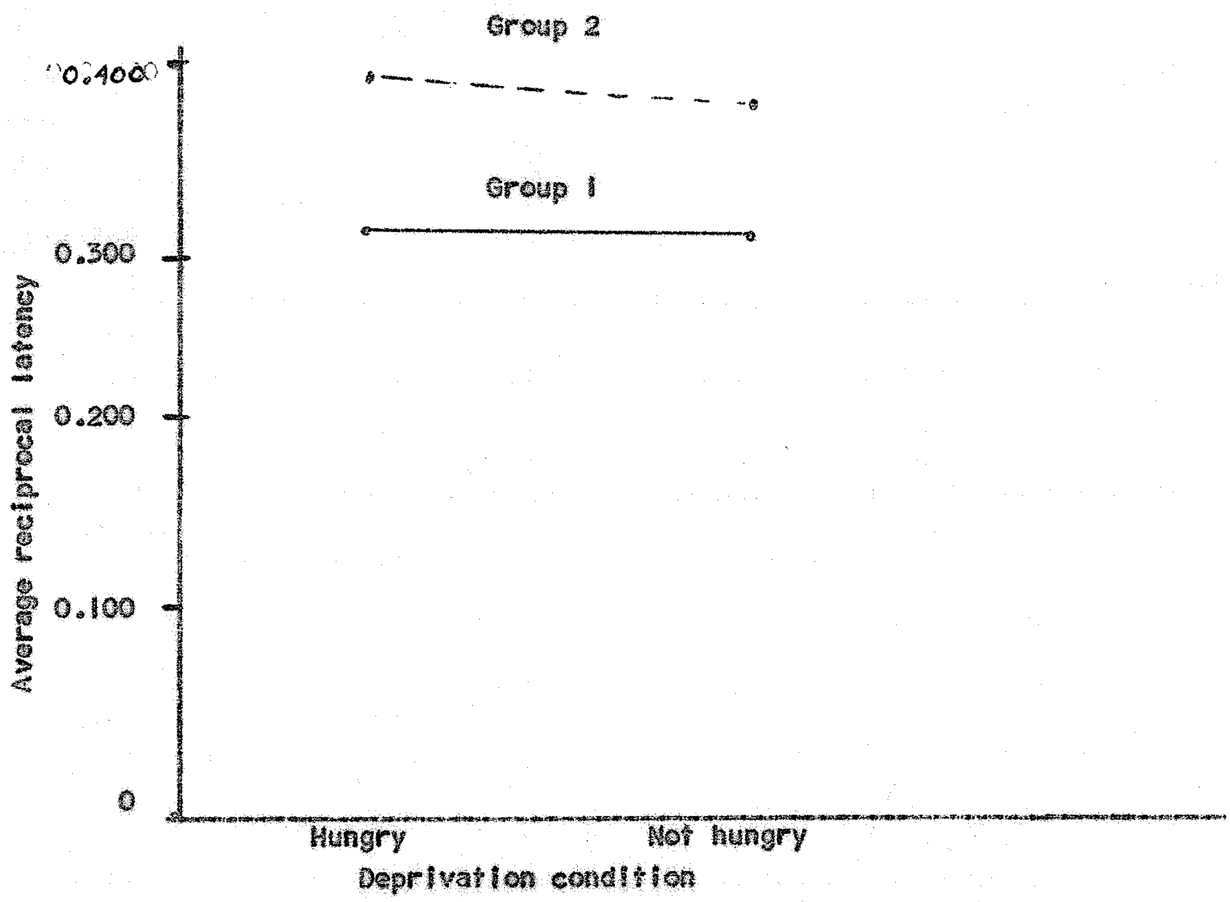


Figure 7. The effect of food deprivation on average reciprocal latency

acquisition, trials to criterion, was needed. Therefore a Pearson product-moment correlation was computed, comparing the initial latency scores; (first five trials of testing) to the number of trials to criterion (both measures combined across groups, i.e. classification of Ss by groups was ignored). The correlation ($r = 0.02$, $df = 10$) indicated that as initial latency did not correlate highly with speed of learning the latency bias probably did not affect the trials to criterion comparisons.

As the average reciprocal latency and the mean root trials to criterion data showed very little change between deprivation and non-deprivation a closer examination of the results was conducted (as in Experiment I). A Pearson product-moment correlation was computed comparing number of trials to criterion to average reciprocal latency across Ss. In the non-deprivation condition the correlation was negligible ($r = 0.02$, $df = 4$). In the deprivation condition the correlation was larger, but still very small ($r = 0.29$, $df = 4$). As these correlations were weak but consistent with those of Experiment I an attempt was made to clarify the correlation by comparing latency and per cent correct in Experiment II. A Pearson product-moment correlation was calculated for average reciprocal latency and per cent correct over Vincentized trials (8 equisections) as shown in Figure 8. For Ss under deprivation there was a correlation of 0.935 ($p < 0.01$, $df = 6$) between the two measures. For Ss under no deprivation there was a correlation of 0.197 between the same two measures. Although these two correlations are no doubt an estimation of some small positive correlation since both are calculated across trials and therefore are on related data, this does not seriously hinder the interpretation of a comparisons between their magnitudes. If one has two measures of a Ss performance, both indicative of learning but each measuring a different aspect of performance, such as latency and per cent correct, and these two measures correlate highly with one another, one can be reasonably certain that the S is oriented to the task in at least two ways. If, however, in a different situation these two measures do not correlate highly then there is a possibility that either or both are reflective of some other type of non-task oriented performance which would lessen the strength of the correlation. The pattern of results, observation of the Ss during testing and reference to the literature (Cotton, 1953; King, 1955) favour an interpretation of the effects of D, in this post-hoc analysis, in terms of the elimination of random variations in performance. It appeared to decrease both fast inappropriate responses and slow interfered with responses perhaps (in view of Figure 8) more of the former than the latter. These random variations may have been producing a low correlation ratio between the two measures of acquisition under the low drive condition.

An attempt was made to analyze the position tentencies by several different methods. However there were too many ties in both the learning and position preference data for any reasonably powerful analysis. Inspection of the data did appear to indicate a trend toward a direct relation between number of

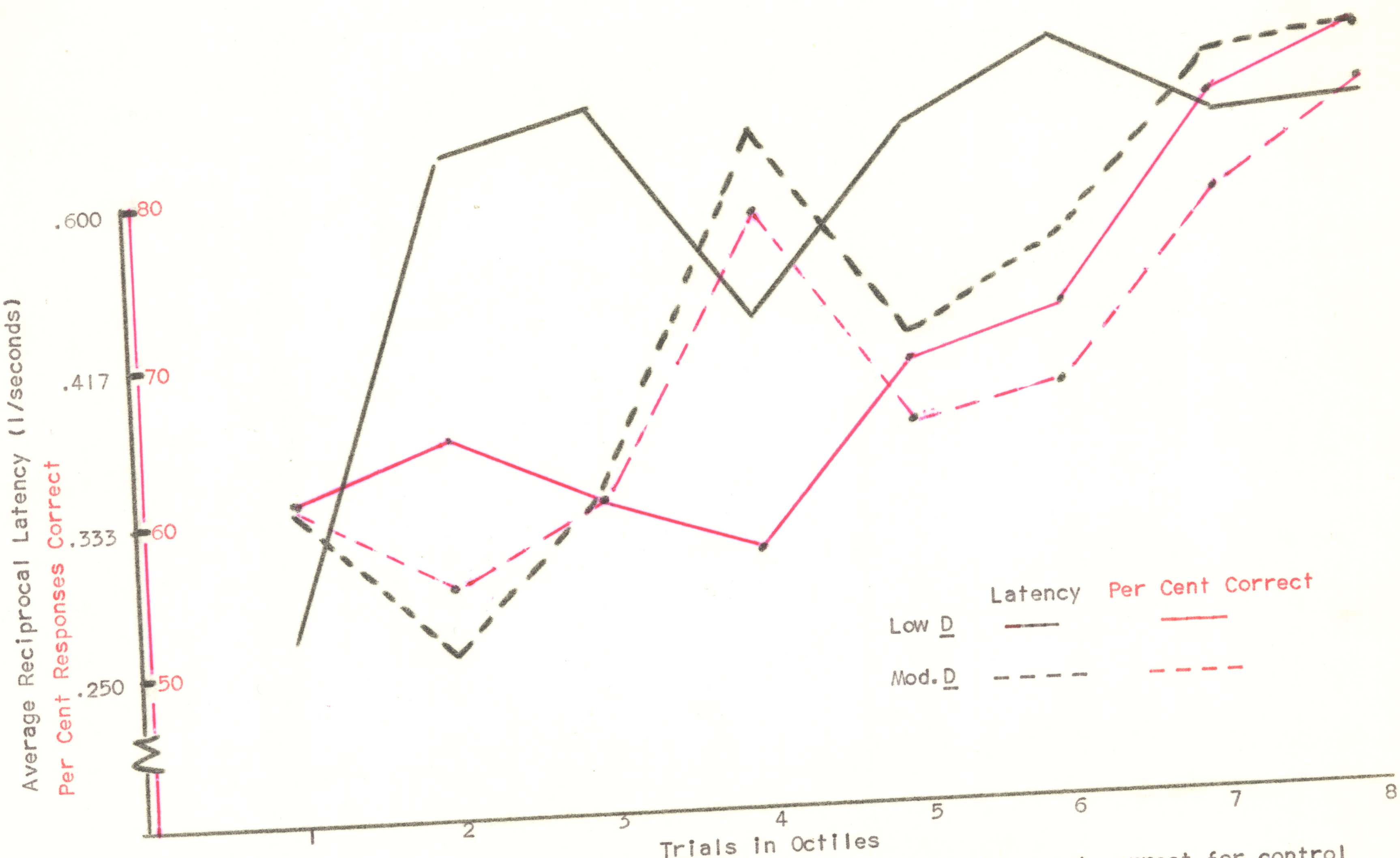


Figure 8. Distribution of average reciprocal latency scores and percent correct for control (low D) and experimental (moderate D) conditions as a function of Vincentized trials to criterion

trials to criterion and extent of position preferences (the trend found in Experiment I).

CHAPTER V

DISCUSSION: EXPERIMENT II

Although there were no significant group differences in the trials to criterion data, the relationships in the data suggested that food deprivation tended to improve performance (see Figure 6 and 6a). However this improvement was only apparent in Group 1, the group which received deprivation on the first testing session and not in the second. This is in contrast to Group 2 where there was a slight non-significant decrement in performance under the deprivation condition. The reason proposed for these differential trends is that there was something intrinsically associated with the first administration (not first tasks as tasks were counterbalanced) that made its solution easier. It was perhaps a motivational effect caused by an interaction between (1) novelty of the hypothesis needed to learn the discrimination; (2) temporal variables associated with task administration; and (3) the accumulation of exploratory drive as a function of performing the same motor skill for a large number of trials. It may also have been attributable to the fact that four of the twelve _S_s did not reach criterion, therefore differential learning data was lost for these four _S_s.

Although the assignment of _S_s to groups did not appear to be random with respect to latency scores this bias did not show as a main effect in the analysis of the reciprocal latency scores. The performance of both Groups 1 and 2 did not appear to change over deprivation conditions or task administration sessions (see Figure 7). Perhaps this is an indication of the relative insensitivity of latency as a measure of discrimination learning. In summary, measures on latency could not be considered as supportive of any but the null hypothesis.

The post-hoc correlations between latency and per cent correct over Vincentized trials indicated that there was a greater but non-significant correspondence between these two measures in the experimental than in the control condition. If this trend is valid, it can be interpreted as evidence that the deprivation tended to decrease the effects of random variations in performance in the experimental group. It can also be interpreted in terms of attentiveness of the Ss to the task. A high correlation might indicate that the Ss were oriented to the task and attempting to learn it. A low correlation might indicate that they were periodically emitting responses other than those required to demonstrate acquisition. They may have been exploring the situation as a rat does an alley or they may have been placing other controls on their responding such as speed or accuracy. Perhaps the reason why these effects were not apparent in the other analyses of trials to criterion and latency scores was either because they were not strong enough or because faster learning is not a necessary result of stable (consistent across two measures) performance.

CHAPTER VI

GENERAL DISCUSSION

The effects of drive on trials to criterion and latency

Neither 18 hours (high D) nor 4 hours (moderate D)[2] food deprivation significantly increased the speed of acquisition of a simple discrimination task over that recorded under 0 hours (low D) deprivation. Also there were no group differences in reciprocal latency scores. Vincentizing both latency and percent correct data (Figures 4, 5, and 8) yielded what appeared to be a weak trend toward a superiority of the deprived Ss.

Although this lack of differences may reflect the actual effects of D on discrimination learning several other possibilities can be explored. Certainly the number of Ss employed could have been too small to show the effects of D. The interruption of the eating schedule involved in the high D manipulation may have disrupted performance and thereby prevented the effects of D from being operative. The moderate D manipulation may have been too weak to produce any group differences. Because of the differential learning ability and differential anxiety (Mednick, 1955, 1958) of the Ss, D may have facilitated acquisition of some but actually inhibited acquisition in others. Exploratory drive, resulting from the increased boredom from continually making the "right" same motor response may have produced inhibition especially in the acquisition data collected in the latter

[2]It is not proposed that these two manipulations of D are comparable as two levels of a drive manipulation. Moderate D attempted to employ a more adequate statistical design.

tasks. Ss may have been "responding to the stronger motives afforded them by the (situational) impedementa" as is characteristic of "all human children" (Harlow, 1959, p.530).

Comparisons of response measures as indications of drive

It is possible that D affects performance measures more than it affects the actual acquisition of a habit required in a discrimination task. This is analagous to Hull's differentiation between the effects of D on learning and performance variables. The mechanism through which this may take place is the reduction of competing responses, but not exactly in the way Cotton (1953) and King (1955) state. It appears that rather than reducing choice time or increasing speed of acquisition D increases the correlation between latency and the more direct measures of acquisition. If this possibility is valid it would allow one to concentrate on examining the effects of D on the interrelations of a series of measures taken during acquisition. If this series of measures were highly correlated then one could assume that a S is oriented to a task at least in the ways the performance measures indicated. That is, if one had two measures of a S's performance and they were highly correlated then it could be inferred that the S was primarily oriented to that task. If they did not correlate then it could be inferred that S was not completely oriented to the task, because his performance was not consistent across two response measures defined by the task.

Although this explanation is theoretically feasible, one might expect from an increased orientation, a decrease in latency. This did not occur because, (1) it may not be a valid deduction, or (2) the effects of D were not strong enough to produce such differences in so few Ss. It was interesting to note that a correlation between trials to criterion and latency across Ss indicated a very weak relation, but the relation was much stronger in a comparison between per cent correct and latency. This raises the possibility that what was found was a spurious correlation, a rather high estimation of a reliable but small correlation between acquisition measures over trials.

In a series of post-hoc analyses, it was found that in Experiment I latency was correlated with trials to criterion in both Group E and Group C. Neither correlation was significant but Group E had a higher coefficient. Using the same two measures on the data of Experiment II there was a weaker trend but in the same direction. However, in Experiment II a correlation between reciprocal latency and per cent correct over Vincentized trials was significant in the experimental condition but not in the control condition. These correlations are interpreted as demonstrating an increase in task oriented responses or a decrease of randomly occurring non-task-oriented competing responses which could increase or decrease the average latency of response.

The role of position preferences in a two-choice situation

Before learning occurred each S was responding to the apparatus and presumably attempting to reach criterion. House and Zeaman (1948) and Lobb (1966) have found that retarded Ss respond primarily to one position choice during this period before acquisition. The results of the present study appear to show that the psychotic Ss employed were responding to one position choice depending upon how long it took them to learn the task. In Experiment I there was a high correlation between speed of acquisition and extent to which Ss responded to one position choice. In Experiment II the same trend appeared although there were too many ties to apply an analysis. This trend toward making position responses may have been the result of a gradual strengthening of position habits which would occur more noticeably in the slower learning Ss as they had been administered a greater number of trials. Frustrative non-reward theory would predict this result in that a position hypothesis, once chosen by a S, would be reinforced on a partial reinforcement schedule and therefore be quickly strengthened (Amsel and Ward, 1965). Position responses predominated (greater than 95 per cent) in several Ss who did not reach criterion. This suggests, that contrary to Harlow's statement (1959) position responses are a large source of error variation. The difference between Harlow's statement and these data may be that Harlow uses an elaborate analysis that excludes a large number of responses which are considered here as demonstrative of position preferences.

Suggestions for further research

1. The results suggest that further investigations should be conducted to determine the effects of D on a series of performance measures. Perhaps D affects acquisition in such a way that there would occur higher intercorrelations between all response measures.

2. During the administration of testing it appeared that a number of Ss were responding to aspects of the stimuli and apparatus other than the ones required for learning. As well as this, Group 1 of Experiment II appeared to perform better on the first administration session than in the second. These aspects of performance were interpreted as indicative of an attempt on the part of the Ss to find novel characteristics in the testing situation. Perhaps this search for novelty might be used in combination with hunger or alone as a manipulable drive variable.

3. An attempt must be made to keep the testing internally consistent. In the present study Ss developed a positive attitude to the testing situation; only one showed any resistance to testing. However, successful completion of the task ended testing. This appeared to produce a conflict which was decremental to performance especially in the faster learning Ss.

4. Despite failure to show any significant changes in

direct measures of acquisition as a result of the deprivation manipulation, it is possible that a different method might have been successful. From the experience of the present study, interruption of a S just before he was going to eat would appear potentially successful.

5. Introduction of interpolated intervals during which exploratory behavior, arising from repeated performance of the same motor response, could be satisfied would probably aid in the measurement of any motivational manipulation.

CHAPTER VII

SUMMARY AND CONCLUSIONS

Twelve psychotic children (ages 5.7 to 8.25) from Thistletown Hospital were administered a series of simple discrimination tasks in an attempt to evaluate the role of food deprivation as a variable in acquisition. Ss were required to choose the correct stimulus from two lighted panels presented and press it to receive a food reward of one Corn Chex.

The hypothesis that food deprivation would increase the rate of acquisition of a simple discrimination task was not upheld. A number of non-significant trends in the data appeared to indicate that D may increase the intercorrelation between response measures and thereby improve performance. The mechanism through which this takes place may be a reduction in non-task oriented responses.

A number of suggestions were made concerning the need to examine (1) the role of position preferences; (2) comparisons of performance measures under various D conditions; (3) the role of exploratory behavior as a motivational variable in discrimination learning; and (4) a less anxiety provoking but more powerful manipulation of hunger.

It is concluded that D may affect performance through an orientation factor, but the measurement of such effects was beyond the scope of this study.

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APPENDICES

APPENDIX A

Instructions to subjects: Experiment I

Pretraining. "Hi (name of child). How are you today? (pause) Come over here and sit down, okay. (A short conversation was carried on with S depending on how S reacted to the testing situation) I want you to play a game with me, okay? See this tree? (point) I want you to hide your eyes while I put the tree under one of these boxes (pointing). Then I want you to open your eyes and guess which box the tree is under. Okay?

Now you hide your eyes while I hide the tree. Close them tightly. (E_1 then placed the tree beneath one of the boxes and slid the boxes into place in front of S.) Okay, now open your eyes _____. Which box is the tree under? (When S had made a choice by lifting or pointing at one of the boxes, E_1 said, in appropriate terms .....) Yes (No), that's the right (wrong) one."

Paragraph two of the instructions was repeated for each trial administration.

Response Training. "Hi _____. Come in and sit down here, okay. What have you been doing today? (pause) Remember what we did yesterday? (pause) Well today we are going to do something almost the same, but with this (pointing to the apparatus). You see these two windows? Well I want you to look at them and when the light comes on I want you to press your finger against one of the windows. Press either window you want. It doesn't matter which one you press. Do it like this (demonstrate). Now you try it. Remember, push either window when the light comes on."

$\underline{E}_1$ responded to each choice by saying, "Good. That's it. Here's a piece of cereal." If S was slow to respond in any trial, $\underline{E}_1$ said, "Press one of the windows."

Fifteen trials were administered and then $\underline{E}_1$ said, "Now we are going to do something just a little bit different."

Response Differentiation. "You wait till the light comes on and then you press one of the windows. Push the one you think is right, okay? (pause) If you push the right one, I'll give you a piece of cereal."

$\underline{E}_1$ repeated the instructions to push the right one on any trial in which S was slow to respond. $\underline{E}_1$ responded to correct choices by saying, "That's the right one, and here's a piece of cereal." $\underline{E}_1$ responded to incorrect choices by saying, "That's the wrong one. There's no piece of cereal for that one."

Trials were administered until S attained 7 successive correct responses.

Initial Discrimination. "Hi _____. How are you today? (pause) Remember what we did before? Well today we are going to do something just a little bit different. You watch the windows and when the light comes on you push the one you think is right. Each time you push the right one, I'll give you a piece of cereal. Okay? Now wait till the light comes on."

Slow responders were told on subsequent trials to press the right one. Right and wrong responses were treated the same as in Response Differentiation. Administration of trials stopped according to Table 2.

Extinction. "Hi _____. (pause) Remember what we did before? Well today it is going to be just a little bit different. When the light comes on I want you to play with the windows for as long as you like, but I'm not going to give you any cereal. You play with the windows for as long as you like. When you want to stop tell me or come over here."

E_1 stepped over to one side of the room. Ss were asked every 20 trials whether they wanted to stop. When Ss stopped they had to walk away from the apparatus when some stimuli were on the panels and the projector was on.

Instructions to subjects: Experiment II

Instructions to Ss were the same for all tasks in Experiment II. They were as follows:

"Hi _____. Remember what we did before? (pause) Well today it is going to be just a little bit different. When the light comes on you press the window you think is right. I'll give you a piece of cereal for every one that you get right. When you find out which is the right one you keep pressing it until I tell you to stop. Okay? Wait till the light comes on."

APPENDIX B

Description of tasks and stimuli: Experiment I

Pretraining. S covered his (her) eyes and E_1 placed a toy evergreen tree beneath a yellow box and shuffled the position of the two boxes (one black and one yellow). S was then asked to uncover his (her) eyes and to "find the tree". A maximum of 20 trials was administered.

Response Training. White light was projected onto both panels of the display unit. S was required to press either panel for a food reward.

Response Differentiation. A bright yellow hue was projected onto one of the two panels in a random order. Nothing was projected onto the opposite panel. S was required to press the bright yellow panel for a food reward.

Initial Discrimination. Shaded and unshaded triangles varying in size from one half inch in area to one and one half inches in area (each pair was equal in size) displayed on red and green backgrounds were projected onto the panels in simultaneous pairs. S was required to choose the shaded triangle irrespective of the colour of the background for a food reward.

Extinction. The stimuli of Task DI were projected in the same manner onto the panels. Ss were told to "play as long as they liked" and "to tell E_1 when they did not want to play anymore." Ss were also told that correct responses would not be rewarded, therefore, no response was rewarded, verbally or with food.

Description of tasks and stimuli: Experiment II

Task I. Red and yellow stars and squares (approximately one and one half square inches in area) were projected onto the panels in simultaneous pairs. S was required to choose the square irrespective of the colour of the background and the specific panel on which it was displayed for a food reward.

Task 2. Circles and hearts (approximately one and one half square inches in area) displayed on blue and green backgrounds were projected onto the panels in simultaneous pairs. S was required to choose the circle irrespective of the colour of the background and the specific panel on which it was displayed for a food reward.