The effect of enriched environment and handling on the learning of a visual discrimination task¹

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To assess the effect of environment and handling on the learning of a visual discrimination task, four groups of rats were raised under the following conditions: enriched environment home cage with or without handling and sterile environment home cage with or without handling. Significant differences were obtained on the visual discrimination task as well as on emotionality and exploratory tests between handled and unhandled groups regardless of environment.

Hebb (1949) saw the basis of the excessive exploratory activity, immature emotional responses and deficiencies of responses to pain in Scottish terriers in their need for a long period of "perceptual learning" for the organization of the central nervous system. Fuller (1967) has hypothesized in his emergency-stress model that animals reared in isolation fail to habituate to multitudinous stimuli and therefore would have more difficulty in learning a complex discrimination. In a visual black/white discrimination task puppies who had been isolated performed more poorly than those who had been reared as pets. Although the differences between the two groups was not significant, Fuller felt that on a more complex discrimination, the differences would be higher.

Fuller (1967) also found that puppies whose isolation was broken only once a week played with a ball and towel significantly less than those whose isolation was broken four times a week. However, there was no significant difference in the amount of locomotion on a closed field test between the groups. Weininger (1956) and Denenberg et al (1962) found that handled rats did show increased locomotion on an open field test.

The finding that handled rats are less emotional than unhandled rats appears to be almost a universal finding (Eels, 1961; Ades, 1966; DuPres, 1964; Weininger, 1956; Bell, 1964).

The purpose of this experiment was to determine the effect handling and environment had on the emotional and exploratory behavior in rats and how this correlated with the performance on a visual discrimination.

METHOD

Subjects.

Eight male albino rats of the Sprague-Dawley strain which were shipped from Simonsen Laboratory, Gilroy, California, at 30 days of age were used for this study.

Apparatus.

The Thompson-Bryant Box (1955) used in the visual discrimination portion of this experiment consists of a startbox, runway, two entryways and a goalbox. There is a guillotine door between the startbox and runway.

Procedure.

The rats were divided into four groups of two rats each and individually caged as follows: Group A was housed in the "enriched environment" cages (which contained a yellow rattle; painted toy turtle, painted airplane; and mirror with bell attached to the end of the mirror) and received no handling; Group B was housed in the "enriched environment" cages and received handling daily; Group C was housed in normal cages and received no handling prior to experimentation; and Group D was housed in normal cages and received handling daily prior to experimentation. "Handled" animals were handled by the experimenter for several minutes daily prior to experimentation.

Forced Exploratory Test: At the end of 60 days a "forced exploratory test" was performed. This consisted in placing a staple remover into the home cage and observing the behavior emitted. Specific measures were taken to determine the amount of time sniffing the staple remover and the amount of time handling it.

Closed Field Study: At the end of 60 days each animal was placed separately in a cylinder which had 4 in. squares marked on

the bottom. Independent observers followed the path taken by each rat during a 3 min period and the number of squares entered by the rat was calculated.

Emotionality Test: At the end of 60 days a King Emotionality Test (1958)² was performed. This consisted of the following measures: (a) putting a pencil to the nose of the rat and measuring his reaction; (b) tapping the rat 24 times on the back (alternating six times each side); (c) capturing and handling the rat to determine his reactions (vocalization, defecation and movement).

Visual Discrimination Learning: Ss were pretrained in a Thompson-Bryant (1955) box to run to the goalbox in order to avoid shock and to knock over grey stimulus cards which blocked the goalbox entryways. The Ss were then trained at the rate of 25 trials a day on a discrimination of a horizontal/vertical pattern until a criterion of 18 out of 20 consecutive trials had been met. The stimuli doors were alternated according to a Fellows (1967) series. Training was then initiated on a pattern discrimination which was tilted 45 deg to the right or left until a criterion of 18 out of 20 trials correct was obtained. The third discrimination which was the reverse of the second discrimination was undertaken until a criterion of 18 out of 20 correct trials was met or until 300 trials had elapsed (whichever came first).

RESULTS³

Forced Exploratory Test: The handled group sniffed and handled the object significantly more than the unhandled group ($p < .001$ $F = 91.2$, $df = 1,4$). They handled and sniffed the staple remover a mean of 157 sec as opposed to a mean of 61 sec for the unhandled group. The handled group also handled the object significantly more ($F = 15.7$, $df = 1,4$ $p < .05$). One rat in the unhandled group failed to handle the object at all. (See Table 1)

Closed Field Study: The handled group entered a mean of 24 sq while the unhandled group entered a mean of 14 sq. This difference, however, was not significant at the .05 level (See Table 1).

Emotionality Test: The unhandled group exhibited significantly more emotion than the handled group ($F = 16.51$, $df = 1,4$, $p < .025$). The unhandled group had much higher scores on capture and handling measures. (See Table 2)

Visual Discrimination Task: There were no significant differences between handled nor unhandled groups on the first discrimination task (See Table 3). The handled group reached criterion in a mean of 42 trials as opposed to 53 trials to criterion for the unhandled group. However, there was a significant difference at the .05 level for trials to criterion ($F = 9.69$, $df = 1,4$) and errors to criterion ($F = 14.65$, $df = 1,4$) on the second

Table 1
Exploratory Studies: Results

	HANDLED		UNHANDLED	
	Sterile Environ-ment	Enriched Environ-ment	Sterile Environ-ment	Enriched Environ-ment
Forced Exploratory Test				
Mean No. Sec Sniffed and Handled Object	162	153	62	60
Mean No. Sec Handled Object	153	104	21	23
Closed Field Exploration				
Mean No. of Squares Explored	35	15	8	21

N = 2 subjects per group

Table 2
Emotionality Test Results

	HANDLED		UNHANDLED	
	Sterile Environ-ment	Enriched Environ-ment	Sterile Environ-ment	Enriched Environ-ment
Reaction to Pencil Presentation	1.5	2	1	2
Reaction to Pencil Tapping	1.3	1.5	1.3	2.5
Reaction to Capture and Handling	1.5	2.5	7.3	7.0
Vocalization and Urination during Handling	0	0	6	4.3
Total Emotionality Score	4.3	6	15.5	16.3

N = 2 subjects per group

discrimination task. The handled group had a mean of 73 trials to criterion while the unhandled group had a mean of 116. The handled group had a mean of only 32 errors to criterion and the unhandled group a mean of 53. On the third discrimination the handled rats had significantly less trials to criterion ($F = 10.1$, $df =$

Table 3
Mean Visual Discrimination Task Results

	HANDLED		UNHANDLED	
	Sterile Environ-ment	Enriched Environ-ment	Sterile Environ-ment	Enriched Environ-ment
<u>First Discrimination Task</u>				
Trials to Criterion	40	44	68	53
Errors to Criterion	19	18	27	24
<u>Second Discrimination Task</u>				
Trials to Criterion	59	87	95	132
Errors to Criterion	25	39	58	48
<u>Third Discrimination Task</u>				
Trials to Criterion	132	171	252+	231
Errors to Criterion	81	100	149+	144

N = 2 subjects per group

+ One rat did not reach criterion after 300 trials

1,4; $p < .05$). The mean trials to criterion were 152 for the handled group and 244 for the unhandled group. The mean errors to criterion for the handled group were 90 while those of the unhandled group was 148. This was just under significance at the .05 level.

DISCUSSION

In order to learn a visual discrimination task the animal must bring certain elements into the situation: his emotional behavior, his perceptual ability and his ability to attend to the relevant cues of the situation. It would appear from this study that the rats whose environment was such as to give early perceptual stimulation did not perform significantly better on the discrimination. However, those who were handled showed less emotionality under situations similar to those of the learning situation and explored and manipulated a novel object more when it was placed in their cage. These rats performed significantly better on the complex discriminations.

It would appear that this experiment confirmed the emergency-stress model of Fuller (1967) and that it failed to confirm the "perceptual learning" theory of Hebb (1949).

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NOTES

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2. The author wishes to thank Dr. Patricia Meyer for sending her a copy of the emotionality scale.
3. All ps in the 2 by 2 factorial ANOVA based on Environment and the Handling by Environment interaction were $>> .05$.