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ENFORCED OBSERVATION IN DELAYED RESPONSE
LEARNING OF FRONTAL MONKEYS

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

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* * * * *

The Ohio State University
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Approved by

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INTRODUCTION

The well-established failure of frontal monkeys on delayed response tasks (Jacobsen, 1935) can be prevented by making the pre-delay informational event a discrimination trial (Harlow, Davis, Settlage, and Meyer, 1952). This procedure differs from Jacobsenian trial setting in ensuring that the animal observes the bait and in enabling him to obtain it whenever he chooses correctly on the informational trial. Why the procedure permits frontal animals to learn is not clear. Campbell and Harlow (1945) and Meyer, Harlow, and Settlage (1951) have implicated the guarantee that frontal monkeys observe the location of the bait; they pointed to the difficulty that one has in getting such preparations to attend to demonstrated baiting. Finan (1942), on the other hand, has suggested that procurement of the bait is critical, that indicators of reinforcement are not adequate to establish approach responses in frontal monkeys.

Frontal studies separating these observation and reinforcement effects have been reported by Finan (1942) and Spaet and Harlow (1943). Finan ensured observation by requiring that the animal make a selective response before the delay to the foodwell which E was indicating to be

correct for that trial. Initially this response was reinforced and frontals performed well on the subsequent test trial. Later the bait was covered by glass before the delay. With this procedure one monkey dropped to chance performance, but the other remained at about 80 per cent correct. The animals refused to respond at all after 184 and 249 trials respectively. Spaet and Harlow ensured observation by randomly interspersing trials with baited and unbaited samples in a matching-from-sample task. Their two animals were successful on trials with unbaited samples, but later also learned in the classical Jacobsenian situation (Campbell and Harlow, 1945). Thus it can be argued that the lesions of these monkeys were too small to prove the point.

The present experiments are an attempt to settle whether frontal animals that fail delayed response in the classical situation can learn it when they are forced to locate the bait before the delay. After unsuccessful preliminary observations with a hooded apparatus, a testing unit similar to the traditional formboard was used for all three experiments. Foodwell inspection was ensured throughout by randomly interspersing free trials with obtainable bait and trials with bait under plastic on the first presentation. In the first experiment three foodwells were used to permit meaningful correctional responses of the type observed in frontal cats by Lawicka and Konorski (1961).

In the second experiment the hypothesis was tested in a matching-from-sample task, and in the third experiment in a situation approximating that of Jacobsen.

SUBJECTS

The subjects in this study were twelve naive female rhesus Macaque monkeys, six normals and six with fronto-lateral sub-pial decortications 4-5 months before the experiment. The decortication intended was that specified by Brush, Mishkin, and Rosvold (1961). All but one of the operates satisfied behavioral criteria for adequate lesions.

APPARATUS

A WGTA was used in this study with two new testing units. The first was a 21 x 20 1/2 in. sliding frame supporting three sliding wooden trays and a black plastic hood which moved independently over the top of the trays (Fig. 1). The hood, as wide as the frame but not as deep, was 7 1/2 in. high at the back and slanted to a point at the front with a 15 x 5 1/2 in. door on this sloping surface. The 4 3/4 x 11 in. trays were red, green, and blue and each had a same-colored 1 1/4 in. diameter foodwell. To move the trays there was a vertical handle at the back of each for E and a horizontal handle at the front for the monkey (Fig. 4).

At the beginning of a trial the hood was at the front of the frame, covering the trays completely. The monkey could now raise the hood door and expose the foodwell portions of the trays, lighted from the side panels of the hood (Fig. 2). The front handles of the trays were hidden beneath a white plastic panel built into the front of the hood. The baited foodwell could be plugged with a transparent disk, enabling the animal to locate the bait, but not to take it. When the animal then dropped the hood door, a timer began counting a set delay during which E removed the disk covering the bait. At the end of the delay E pulled

the hood back to expose the horizontal handles in front of it (Fig. 3). The foodwells were now hidden under the ledge that formerly covered the handles and could not be seen even if the animals managed to open the hood door again. The monkey could get the bait by pulling out the correct tray.

The second testing unit was a $23 \frac{1}{2} \times 14 \frac{1}{4} \times 5$ in. grey wooden box on runners with a white formica top in which were three grey $1 \frac{1}{4}$ in. diameter foodwells, 7 in. apart. These foodwells were covered by displaceable objects, 2 in. wooden cubes painted red, green, or blue in the first procedure (Fig. 6) and pairs of dime store objects differing in form and texture as well as color in later procedures (Fig. 9). The foodwells could be plugged by horizontally bisecting transparent plastic panels which were manipulated by E inside the box (Fig. 7). This operation was unseen by the monkey. When a panel was pushed forward it covered a foodwell and permitted the animal, as with the hooded apparatus, to locate the bait but not obtain it.

Fig. 1.--Hooded apparatus before monkey initiates trial and during delay.

Fig. 2.--Hooded apparatus as monkey initiates trial by lifting hood door. transparent disks plug left and right foodwells. Peanut partly visible in right foodwell.

Fig. 3.--Hooded apparatus after monkey has pulled out correct tray.

Fig. 4.--Hooded apparatus with hood removed and trays fixed to base for testing standard delayed response. E baiting left foodwell.

Fig. 5.--E covering two foodwells for delay and test in standard delayed response.

Fig. 6.--Second testing unit as used in experiment one. Monkey displaced blocks on both informational and test trials.

Fig. 7.--Second testing with top removed to show transparent panels. Center foodwell is open, outside wells are covered.

Fig. 8.--Single cue displaced by monkey on informational trial of experiment two.

Fig. 9.--Display for test trial of experiment two and both informational and test trials of manipulation problems in experiment three.

Fig. 10.--E baiting left foodwell in standard delayed response problems of experiment three.

Fig. 11.--E covering two foodwells for delay and test in standard delayed response.

PROCEDURE

Experiment 1 (See Figures 1-7)

The first experiment began with the hooded apparatus. It was carried out in 9-day blocks with each animal completing 27 trials per day. On 18 of these trials the bait was covered by a plastic disk and thus visible but not accessible when the animal raised the hood door at the beginning of a trial. This informational event was followed by the delay and test presentation. The other nine trials, randomly interspersed, were free trials. The bait was in an uncovered foodwell and when the animal raised the hood door he could take the bait. No delay or test followed.

To shape the responses necessary to perform this task, the animals were first trained to obtain bait by opening the hood door whenever the hood was forward and pulling trays whenever the hood was back. Eighteen days of shaping followed which were like the experiment except that the hood was pulled back so far after the delay that a corner of each foodwell was visible in front of it and with contortion the animals could thus locate the bait again before making their choice response of pulling out one of the trays. Most animals reached 100 per cent performance on this task; the poorest finished at 83 per cent correct.

The first three blocks of the experiment differed from shaping only in the complete covering of the foodwells at the moment of tray pulling. In the fourth and subsequent blocks the screen between monkey and apparatus was left up during the delay on the basis of the 50 per cent facilitation this produced in normal monkeys for Meyer and Harlow (1952). The hypothesis that the animal made no association between the portion of the tray which he observed through the door and the portion which he later pulled out, suggested that trays be pulled out on both parts of the trial. This was done in the fifth block along with reducing the delay to 5 sec. In the sixth block the number of choice responses was reduced to one on the hypothesis that the animals were receiving too many reinforcements for chance performance to learn. The animals were required to displace tray-colored objects after opening the hood door in blocks seven and eight, following Schuck's notion (1960) that cue manipulation may facilitate discrimination learning in monkeys. In the eighth block only, one of the trays, randomly determined, was removed before each trial, reducing the alternatives to some two of the original three, on the possibility that monkeys could not cope with three in a delayed response task.

In the eighth block then, the animals lifted the hood door and displaced cue-colored objects from two foodwells, obtaining the bait on one-third of the trials. On other trials where a disk covered the bait, the animals dropped

the door and waited 5 sec. with the apparatus in full view, after which they pulled out one of the trays, getting the bait on nine trials of the remaining 18 by chance.

A procedure patterned after Jacobsenian delayed response was used in the ninth through thirteenth blocks to get a standard measure of the performance of these monkeys while a second testing unit was being built. The hood was removed and the three trays screwed down to the frame making a trisectional formboard (see Fig. 4). With this formboard pulled back, E initiated each trial by conspicuously baiting one of the foodwells at a moment when the animal appeared to be looking. E then simultaneously covered this and one other foodwell with the tray-colored objects used in earlier procedures (see Fig. 5). After a 5 sec. delay with the screen left up, the formboard was pushed forward and the animal allowed to displace one of the objects to obtain the bait. There were no free trials and one trial was added to the 27 per day to balance left and right baiting irrespective of foodwell pair in use.

The second testing unit, a three foodwell formboard, was used to test the experimental hypothesis in blocks 14 through 16. By displacing differentially colored wooden blocks which covered the foodwells the animal could obtain food on nine of 27 daily trials. As in the initial procedure with the hooded apparatus, no delay or test followed these free trials. On the other 18 trials the baited foodwell was

plugged by a transparent plastic panel. The animal was permitted to displace all three of the blocks on these trials, but most animals turned away from the formboard after locating the baited foodwell. E then pulled the formboard out of reach and replaced the blocks over the foodwells for a 5 sec. delay during which she retracted the transparent panel to free the bait. The formboard was then pushed forward and the animal permitted to displace one of the three blocks. If incorrect, the animal was permitted a second choice after another 5 sec. delay. This choice was between the two foodwells still covered and was reinforced if correct.

Experiment 2 (see Figures 8 and 9)

For the second experiment the second testing unit was used to present delayed matching-from-sample problems. Fifty pairs of dime store objects (each pair being a problem) were reversed as to sample member and reused each day for ten days. On trial one the sample covered the baited center foodwell. By displacing this object the animal could obtain the bait on 25 of the 50 problems and see it under plastic on the others, as determined by Gellerman series. Unlike experiment one, both types of informational trial were followed by a 5 sec. delay with the screen dropped between monkey and formboard. During this delay E removed the sample object and bait, if unobtained by the monkey, from the center

foodwell and set up the test presentation with the object pair over the outside foodwells. The screen was then raised and the animal allowed one choice, obtaining the bait if he displaced the sample object.

Experiment 3 (see Figures 9-11).

In experiment three the formboard and object pairs from the second experiment were used for two-trial object discriminations. On trial one the formboard was presented with positive and negative object covering the two outside foodwells. The animal was allowed to displace both, finding obtainable bait under the positive object on 12 of the 24 problems and bait under plastic on the other problems, randomly interspersed. When the animal turned away from the formboard after obtaining or locating the bait, E dropped the screen between monkey and formboard for a 5 sec. delay, during which she set up trial two, the test trial. Gellerman series determined whether the placement of the objects on trial two reversed or remained the same. After the delay the screen was raised and the animal permitted one choice, obtaining the bait if he displaced the object which had covered bait in trial one.

In addition to these 24 problems, 12 problems were presented daily with standard E baiting to re-test the lesions in view of demonstrated delayed response learning in the frontal animals. To simplify the task and thus maximize

the sensitivity of the lesion test the screen was left up during the delay and dissimilar dime store objects were used to cover the foodwells after one had been baited by E. These problems could then be solved either as spatial or object discriminations.

This experiment was conducted by two new experimenters under the supervision of the author.

RESULTS

All of the animals remained at chance after almost 2000 trials with the hooded apparatus. There was evidence of learning on the first day with the second testing unit, however, and on the third nine-day block four normals and one operate averaged well over 90 per cent correct. The other two normals and five frontals did not differ significantly from chance (chi-square test) on either their first choices or their corrections (see Fig. 12). These results, representing 486 trials per animal, are in perfect agreement with performances obtained in 1276 trials with the standard E baited delayed response task shown in Figure 13.

In 500 trials of delayed matching-from-sample (experiment two) and 1152 two-trial discriminations (experiment three) frontals and normals alike reached near perfect performance whether they obtained the bait on the informational trials or only saw it (see Figs. 14 and 15). On the standard delayed response problems of experiment three, in which observation of bait location was not enforced, four of the frontals remained at 60 per cent correct after 576 trials. At this time the six normals and the frontal who had performed like a normal animal on the earlier test of the lesions had attained 99.5 and 100 per cent correct respectively. The sixth frontal monkey mastered the task late in the testing series (see Fig. 16).

Fig. 12.--Performance of normal and frontal monkeys on delayed response task in which the bait was located but not obtained in the informational event. Three-cue display (Experiment 1).

Fig. 13.--Performance of normal and frontal monkeys on delayed response task with experimenter-baiting as the informational event (Experiment 1).

Fig. 14.--Performance of normal and frontal monkeys on delayed matching-from-baited-sample task in which a transparent panel covered the sample bait on half of the trials (Experiment 2).

Fig. 15.--Performance of normal and frontal monkeys on two-trial discrimination problems. On the informative first trial of half the problems the usual obtainable bait was replaced by bait under plastic (Experiment 3).

Fig. 16.--Performance of normal and frontal monkeys on experimenter baited delayed response task with differential foodwell covers during the delay (Experiment 3).

DISCUSSION

The rapid learning of most normal animals with the second testing unit after utter failure with the hooded apparatus seems best explained in terms of spatio-temporal separation of critical cues. With the hooded apparatus, tray handles were hidden during observation, foodwell portions of the trays were hidden during choice, and both were out of sight during the delay. Nothing but the bait was ever hidden in the second testing unit. Such an explanation relates this failure to the milder decrement induced in both normal and frontal monkeys by dropping a screen between S and testing unit during the delay (Meyer and Harlow, 1952).

The failure of the frontal monkeys to learn in experiment one showed, contrary to expectation, that they retain a deficit in a delayed response situation in which they have control of presentations of the information they require. Observation of bait placement was a virtual certainty since the animals never missed the bait on free trials and on other trials many of them consistently pawed at the plastic covering it. Yet this observation was not adequate preparation to enable them to choose the baited locus after a very brief delay.

The fact that the foodwell containing bait under plastic was neither approached nor avoided with any consistency on the subsequent test presentation indicates that the frontals did not regard it as equivalent to either the baited or the unbaited foodwell of a discrimination task. Frontal success on two-trial discriminations implies a capacity to avoid unbaited foodwells as well as to approach baited ones. The failure of the frontal animals in this study to assign any valence to the bait under plastic suggested a value in further investigating, in a simpler situation, the effectiveness of bait under plastic as a discriminative cue for frontal animals. Possibly the frontal monkey could learn to select from two objects the object which had earlier covered obtained bait, but could not similarly learn to select an object which had covered bait under plastic. Such a result would be decisive in refuting the hypothesis that the frontal problem is attentional and in supporting the alternative hypothesis that the deficit reflects some inability to establish secondary reinforcers.

However, in experiment two, the frontal monkeys learned as well when they uncovered bait under plastic for the informational event as when they actually obtained the informational bait. In both instances they were undiscriminable from the normal monkeys. The experimental hypothesis was thus not refuted, but neither was it supported. The informational event in this experiment was always the presentation

of the positive cue and the animal could therefore master the task by always selecting on the test presentation the member of the object pair which had been presented alone before the delay. This relationship characterized all trials and could have been learned in trials in which the object presented before the delay covered obtainable bait and then generalized to the trials with bait under plastic before the delay.

This possible basis for accurate frontal performance was eliminated in the third experiment by simultaneous presentation of both positive and negative cues before the delay on all trials. Frontal animals again showed no deficit. This result appears to contradict the outcome of the first experiment and create a dilemma. When the frontal monkey's choice is between two objects different from each other and from every other object pair presented on the same day, enforced observation is adequate to permit learning of delayed responses. When his choice is rather between three objects differing from each other in color, but re-used each trial and thus continually reversing, enforced observation is not adequate.

This disagreement is interpreted as indicating that the frontal monkey has a basic attentional problem in the Jacobsenian situation which can be corrected by enforcing observation, but that in addition he has difficulty setting apart the correct member of an object group when this designation has at some recent moment been appropriate for each

member of the group. The basis for this interpretation is that neither enforced observation alone (experiment one) nor the use of discriminable trial-unique objects alone (Meyer, Harlow, and Settlage, 1951, and the second lesion test in this study) brings frontal monkeys to normal performance levels on the Jacobsenian task. But combinations of these two procedures (Harlow, Davis, Settlage, and Meyer, 1952, and experiment three in the present series) have done so. Normal performance of frontal monkeys on go-no go tasks (Mishkin and Pribram, 1956; Pribram and Mishkin, 1956) may similarly have resulted from enforcing observation through the use of a single locus for informational presentations and by using discriminable displays for go and no-go trials which never reversed.

The present study goes beyond the Harlow, et al. result in showing that secondary reinforcement is an adequate indicant of the correct alternative for frontal learning when the cues do not reverse from trial to trial. Whether primary reinforcement would have facilitated frontal learning in experiment one, where the cues continually reversed as to which was correct, is not known since there was no delay or test presentation when the bait was actually obtained on the informational event. Gross (1963) has suggested that the effectiveness of the reinforcement does influence the distinctiveness of the correct cue in delayed response problems for monkeys.

SUMMARY

This study was designed to determine whether frontal monkeys can learn Jacobsenian delayed response problems if they are forced to locate the bait before the delay. Six normal and six frontal monkeys were tested at a formboard with delayed response tasks in which there was partial reinforcement of searching for the bait before the delay. Subsequent choices of frontals and normals were compared on the trials without reinforcement of the informational manipulation.

In a task with the same differentially colored blocks covering three foodwells every trial, normals were successful but frontals failed both first choices and corrections. In a two-alternative task, with different pairs of dime store objects covering the foodwells every trial of the day, frontals performed as well as normals. The apparent contradiction of these two outcomes is interpreted as indicating that both enforced observation and the use of different foodwell covers each trial are necessary to correct the frontal deficit in the Jacobsenian task.

In the two-alternative task, performance of both frontals and normals was the same whether they actually obtained the bait during the informational event or only saw it. Secondary reinforcement was thus, in this task, adequate designation of the correct alternative for frontal animals.

APPENDIX

Tables 1-4 contain the raw data of experiment one, which began on day 19 after 18 days of shaping. Each score represents the number of correct choices in 18 test trials completed by one monkey in one day. Since there were three alternatives on each trial, chance performance would be six correct. The "f" column represents first choices, the "c" column correctional choices.

TABLE 1.--Performance of frontal monkeys with the hooded apparatus in experiment one

Block	Day	No. 1 Karen		No. 2 Moppet		No. 3 Annie		No. 4 Elsa		No. 5 Patsy		No. 6 Myrtle	
		f	c	f	c	f	c	f	c	f	c	f	c
I	19	7	6	5	5	8	7	12	3	10	4	5	8
	20	7	5	7	6	5	9	7	3	8	5	7	7
	21	8	5	5	7	6	7	6	9	6	6	7	7
	22	8	4	7	7	5	5	8	6	5	7	4	9
	23	7	3	8	6	7	5	9	6	8	4	6	4
	24	5	6	7	5	8	5	5	5	5	7	5	6
	25	9	5	8	5	7	5	6	5	6	6	8	5
	26	6	4	5	5	3	8	6	7	6	6	5	7
	27	6	7	3	6	5	7	8	4	6	6	5	7
II	28	7	6	6	6	6	6	5	6	6	5	4	7
	29	3	7	6	5	6	6	6	6	4	8	6	6
	30	7	5	7	7	6	6	4	4	5	7	4	6
	31	6	7	8	6	6	6	6	7	7	6	7	6
	32	6	6	8	7	6	6	4	6	7	4	8	9
	33	6	5	4	8	6	6	7	6	6	7	6	6
	34	6	6	5	6	6	6	9	3	13	2	6	7
	35	5	7	6	6	6	6	5	7	9	4	7	6
	36	6	5	7	6	6	6	3	6	4	6	5	7
III	37	6	6	6	6	6	6	7	5	6	5	9	7
	38	6	3	8	7	6	6	6	6	8	3	5	7
	39	5	6	5	8	6	6	5	6	6	3	6	5
	40	12	1	7	6	6	6	7	6	7	7	9	6
	41	5	7	5	7	6	6	2	10	7	6	3	6
	42	5	9	6	4	6	6	5	7	6	6	8	4
	43	6	6	7	6	6	6	8	5	4	8	7	6
	44	8	7	5	7	6	6	2	6	4	5	6	6
	45	5	8	5	8	6	6	8	6	4	7	7	6

TABLE 1--Continued.

Block	Day	No. 1 Karen		No. 2 Moppet		No. 3 Annie		No. 4 Elsa		No. 5 Patsy		No. 6 Myrtle	
		f	c	f	c	f	c	f	c	f	c	f	c
IV	46	5	5	7	6	4	7	6	5	3	7	6	5
	47	9	1	8	3	5	7	2	7	1	11	6	6
	48	7	5	8	7	7	6	6	5	7	5	7	5
	49	4	8	5	6	6	6	6	5	6	6	6	5
	50	6	6	3	7	6	6	6	6	7	5	7	5
	51	8	4	4	7	6	6	2	7	6	6	6	5
	52	7	5	7	5	6	6	6	7	6	6	6	6
	53	7	5	6	6	6	6	4	5	6	6	6	7
	54	6	6	7	4	6	6	7	5	6	6	6	6
V	55	9	6	8	4	7	5	7	6	8	5	5	6
	56	7	8	5	7	8	7	8	6	6	7	6	6
	57	4	7	7	6	7	7	7	6	6	5	8	6
	58	5	6	6	7	7	5	6	5	6	6	5	7
	59	5	6	6	6	4	6	6	5	6	6	6	6
	60	5	5	5	7	6	6	5	6	7	5	5	5
	61	6	7	6	8	7	6	3	6	5	6	6	6
	62	4	6	6	6	7	6	4	9	4	8	6	6
	63	6	5	6	5	6	5	5	8	3	7	6	6
VI	64	4		6		5		6		5		6	
	65	8		5		9		10		5		5	
	66	6		5		4		6		4		8	
	67	8		6		5		7		6		8	
	68	5		6		6		6		8		6	
	69	4		6		5		4		6		6	
	70	7		6		6		8		6		6	
	71	7		6		7		6		6		5	
	72	6		6		6		5		6		6	
VII	73	7		6		5		7		7		5	
	74	4		6		6		4		6		6	
	75	3		6		6		4		6		6	
	76	10		6		7		5		6		6	
	77	3		6		6		7		6		6	
	78	8		6		6		9		6		6	
	79	6		6		6		6		6		6	
	80	6		6		6		7		6		6	
	81	6		6		6		5		6		7	

TABLE 1--Continued.

Block	Day	No. 1 Karen		No. 2 Moppet		No. 3 Annie		No. 4 Elsa		No. 5 Patsy		No. 6 Myrtle	
		f	c	f	c	f	c	f	c	f	c	f	c
*VIII	82	10		10		11		10		10		11	
	83	10		10		8		10		10		10	
	84	9		12		8		11		12		12	
	85	10		10		8		10		11		10	
	86	10		10		11		10		10		10	
	87	10		10		11		11		10		10	
	88	10		10		9		9		10		10	
	89	10		10		10		9		10		10	
	90	10		11		12		9		12		9	

*The number of alternatives in each trial was reduced from three to two in block VIII, making the chance score nine rather than six.

TABLE 2.--Performance of normal monkeys with the hooded apparatus in
experiment one
(See explanation before Table 1)

Block	Day	No. 7 Dagne		No. 8 Punkin		No. 9 Heidi		No. 10 Cleo		No. 11 Briget		No. 12 Sasha	
		f	c	f	c	f	c	f	c	f	c	f	c
I	19	6	8	4	6	7	5	3	6	6	7	3	8
	20	5	4	5	6	5	5	7	5	5	8	8	6
	21	6	7	4	6	6	7	6	4	7	7	3	6
	22	2	9	5	7	4	7	7	5	5	9	7	6
	23	6	4	5	8	6	5	8	5	7	5	5	6
	24	8	5	4	8	4	9	4	7	4	7	6	8
	25	6	7	5	8	6	10	7	6	6	9	6	6
	26	7	4	6	5	6	4	7	4	5	7	7	5
	27	7	4	6	6	6	7	6	5	4	6	6	6
II	28	5	7	7	5	4	7	5	9	4	7	6	6
	29	7	5	5	8	6	8	5	6	4	5	5	6
	30	4	7	7	4	9	5	9	6	5	5	6	7
	31	4	7	5	6	7	7	4	8	6	5	6	5
	32	7	6	8	6	5	7	9	6	7	3	5	8
	33	6	6	7	6	3	8	8	7	3	8	3	9
	34	6	8	3	7	8	4	9	8	5	7	6	6
	35	6	6	6	7	6	5	6	7	8	5	5	6
	36	7	6	6	6	7	4	3	7	7	4	6	5
III	37	6	6	4	8	6	6	4	6	6	4	6	6
	38	6	5	4	4	6	7	7	5	5	5	6	6
	39	6	8	3	7	4	4	8	5	6	7	6	6
	40	6	6	6	6	5	5	3	9	2	6	6	6
	41	6	6	6	6	5	8	5	6	8	7	5	8
	42	6	6	5	7	8	8	8	7	5	7	7	6
	43	6	6	6	6	8	6	8	6	8	4	7	6
	44	6	6	6	6	8	6	8	6	8	4	7	6
	45	6	6	6	6	8	4	8	6	6	7	7	5
IV	46	10	4	5	7	8	3	7	5	2	7	8	4
	47	9	5	6	6	6	7	6	6	6	5	6	6
	48	10	5	5	7	9	3	8	6	6	6	6	7
	49	8	4	5	7	3	7	6	7	6	5	8	3
	50	9	6	6	6	5	5	4	6	4	5	10	5
	51	7	5	6	6	4	7	6	6	7	7	6	5
	52	7	6	6	6	5	8	4	9	5	7	9	3
	53	9	7	6	6	8	5	5	8	7	5	5	8
	54	6	5	6	6	2	9	6	8	5	7	5	6

TABLE 2--Continued.

Block	Day	No. 7 Dagne		No. 8 Punkin		No. 9 Heidi		No. 10 Cleo		No. 11 Briget		No. 12 Sasha	
		f	c	f	c	f	c	f	c	f	c	f	c
V	55	8	6	6	5	7	6	6	5	5	7	9	5
	56	7	5	6	6	7	8	6	6	3	8	11	5
	57	5	6	6	5	6	6	6	5	5	7	6	5
	58	5	7	6	5	4	2	5	6	7	6	7	6
	59	6	5	6	6	7	8	5	8	7	6	6	6
	60	6	6	6	7	8	5	7	5	5	6	8	4
	61	7	5	6	6	4	8	7	6	2	7	7	3
	62	5	8	6	6	5	9	6	6	11	4	8	4
	63	5	6	6	7	6	7	6	5	7	7	7	8
VI	64	5		6		4		5		7		9	
	65	6		5		5		5		4		5	
	66	4		6		6		6		3		7	
	67	8		6		8		6		5		5	
	68	7		6		9		6		5		3	
	69	6		6		6		7		9		7	
	70	7		6		10		6		3		7	
	71	7		6		5		5		4		6	
	72	7		7		5		6		5		5	
VII	73	6		6		7		7		5		5	
	74	6		6		9		5		5		6	
	75	7		6		8		7		6		2	
	76	6		6		5		6		6		8	
	77	6		6		6		8		5		6	
	78	6		6		6		6		6		5	
	79	6		6		8		7		6		7	
	80	6		6		5		6		6		9	
	81	6		6		7		6		6		8	
*VIII	82	10		10		7		10		10		7	
	83	11		10		5		9		10		9	
	84	10		12		10		12		11		6	
	85	10		10		5		10		9		7	
	86	10		10		10		9		9		9	
	87	10		10		9		9		10		8	
	88	10		10		8		10		10		12	
	89	10		10		9		10		10		10	
	90	10		10		8		10		10		9	

*The number of alternatives in each trial was reduced from three to two in block VIII, making the chance score nine rather than six.

TABLE 3.--Performance of frontal monkeys at the formboard in experiment one
(See explanation before Table 1)

Block	Day	No. 1 Karen		No. 2 Moppet		No. 3 Annie		No. 4 Elsa		No. 5 Patsy		No. 6 Myrtle	
		f	c	f	c	f	c	f	c	f	c	f	c
XIV	136	7	7	6	3	8	4	9	3	8	5	7	5
	137	9	6	7	5	11	5	8	4	5	5	6	6
	138	8	7	7	7	9	6	6	7	7	3	9	4
	139	3	11	8	5	9	5	8	4	7	6	7	7
	140	11	5	5	7	8	7	4	9	4	10	6	5
	141	5	9	6	5	11	3	10	2	7	7	5	5
	142	7	7	13	3	13	4	4	8	6	8	10	7
	143	10	4	9	5	16	2	5	5	5	4	6	9
	144	4	8	8	5	15	3	9	3	5	8	9	3
XV	145	6	7	8	8	16	1	8	6	7	4	7	6
	146	8	7	10	3	15	2	8	7	6	8	6	8
	147	5	5	6	4	16	2	7	7	7	5	5	10
	148	6	6	8	5	15	3	6	8	9	3	8	5
	149	3	5	6	8	15	0	8	5	4	9	5	2
	150	4	4	6	5	12	5	6	7	0	11	8	6
	151	9	4	5	6	14	3	7	6	5	8	6	7
	152	5	9	10	4	16	0	5	8	7	5	7	5
	153	5	7	7	5	18	0	11	3	7	4	8	5
XVI	154	7	7	6	8	16	2	6	5	6	5	8	7
	155	6	5	6	7	17	1	8	7	6	7	7	7
	156	6	8	7	8	13	3	9	5	6	8	7	4
	157	5	6	6	6	17	1	7	4	6	6	7	10
	158	8	9	8	4	17	0	4	6	5	7	6	4
	159	4	9	6	5	18	0	6	4	5	7	8	2
	160	7	8	6	6	16	1	7	5	6	6	5	5
	161	5	7	6	7	18	0	7	6	6	6	8	5
	162	4	9	6	7	18	0	3	8	4	8	9	5

TABLE 4.--Performance of normal monkeys at the formboard in experiment
one
(See explanation before Table 1)

Block	Day	No. 7 Dagne		No. 8 Punkin		No. 9 Heidi		No. 10 Cleo		No. 11 Briget		No. 12 Sasha	
		f	c	f	c	f	c	f	c	f	c	f	c
XIV	136	13	3	9	5	8	4	8	4	9	4	6	4
	137	10	5	6	4	10	3	10	5	6	4	3	10
	138	10	6	7	6	8	6	12	3	7	6	7	6
	139	12	5	8	4	9	4	14	2	10	1	12	4
	140	9	7	6	4	9	7	15	0	5	9	13	3
	141	11	6	9	6	10	3	15	2	8	3	9	7
	142	12	5	9	6	16	1	17	0	10	5	14	2
	143	13	1	10	4	13	2	15	2	8	5	14	1
	144	13	3	10	7	14	3	13	3	9	5	15	3
XV	145	14	2	10	4	12	5	11	5	7	7	16	2
	146	17	1	7	6	16	1	14	4	6	7	16	0
	147	16	1	10	6	17	1	10	6	6	9	16	2
	148	17	0	12	4	18	0	10	5	9	5	17	1
	149	18	0	12	5	17	1	15	0	8	7	17	1
	150	17	1	8	8	18	0	16	2	6	6	18	0
	151	15	3	9	7	18	0	15	3	5	6	17	1
	152	17	1	7	7	18	0	16	2	8	6	17	1
	153	18	0	9	6	17	1	16	2	7	6	17	1
XVI	154	17	1	6	8	17	1	16	2	5	8	17	1
	155	17	1	11	4	16	2	17	1	9	4	18	0
	156	17	1	11	4	18	0	16	0	14	3	17	1
	157	18	0	12	2	18	0	15	2	8	5	17	1
	158	18	0	10	3	18	0	18	0	10	6	18	0
	159	18	0	12	2	18	0	18	0	10	5	17	1
	160	18	0	11	4	17	1	14	1	5	8	17	1
	161	16	2	12	5	18	0	17	0	8	7	18	0
	162	17	1	7	5	18	0	15	1	9	5	18	0

Tables 5 and 6 contain the raw data from the experimenter-baited delayed response task which was the first test of the lesions. The testing unit used was the base of the hooded apparatus with the three trays screwed down. Each score represents the number of correct choices in 28 daily trials. Only two of the foodwells were used at a time, so the chance score is 14.

TABLE 5.--Performance of frontal monkeys on the first lesion test

Block	Day	No. 1 Karen	No. 2 Moppet	No. 3 Annie	No. 4 Elsa	No. 5 Patsy	No. 6 Myrtle
IX	91	15	12	11	18	14	18
	92	14	16	13	15	9	20
	93	14	12	13	17	14	13
	94	15	10	17	12	12	15
	95	14	12	10	15	12	12
	96	13	14	19	15	14	16
	97	11	16	18	13	14	14
	98	18	13	19	14	13	13
	99	12	14	19	14	14	19
X	100	14	14	21	15	14	16
	101	12	13	20	16	15	13
	102	13	14	20	18	14	14
	103	15	14	23	16	14	11
	104	16	12	22	16	14	13
	105	16	13	24	15	13	14
	106	11	14	24	15	14	14
	107	16	13	21	13	14	20
	108	13	14	26	13	14	14
XI	109	11	15	26	17	13	12
	110	11	14	25	15	14	16
	111	15	14	28	20	14	15
	112	14	14	25	15	14	17
	113	17	16	24	16	14	15
	114	14	14	24	17	14	11
	115	18	16	22	18	17	13
	116	12	15	22	12	13	12
	117	16	15	26	21	14	16
XII	118	13	11	24	15	14	16
	119	15	16	24	19	16	15
	120	16	14	26	10	16	16
	121	16	15	25	14	13	14
	122	12	14	24	13	14	16
	123	10	17	25	18	14	17
	124	14	13	25	15	13	14
	125	16	15	23	15	16	15
	126	15	19	27	15	14	15

TABLE 5--Continued.

Block	Day	No. 1 Karen	No. 2 Moppet	No. 3 Annie	No. 4 Elsa	No. 5 Patsy	No. 6 Myrtle
XIII	127	13	16	26	12	15	16
	128	15	15	26	15	17	17
	129	13	15	24	15	17	18
	130	15	14	26	17	14	18
	131	13	20	28	15	12	13
	132	14	17	28	16	15	13
	133	15	12	26	18	13	18
	134	19	14	26	19	18	19
	135	10	18	27	15	16	15

TABLE 6.--Performance of normal monkeys on the first lesion test
(See explanation before Table 5)

Block	Day	No. 7 Dagne	No. 8 Punkin	No. 9 Heidi	No. 10 Cleo	No. 11 Briget	No. 12 Sasha
IX	91	20	16	16	20	18	21
	92	18	15	17	17	16	25
	93	15	13	15	15	13	24
	94	20	14	13	15	14	19
	95	14	14	14	13	15	25
	96	19	16	20	13	14	28
	97	18	15	14	18	15	26
	98	19	16	15	14	15	22
	99	17	15	18	15	15	24
X	100	17	12	16	13	14	27
	101	17	15	14	15	15	24
	102	16	16	17	15	15	26
	103	17	13	15	15	14	25
	104	20	9	21	15	14	23
	105	16	14	12	16	15	28
	106	21	15	14	17	16	25
	107	20	14	16	19	15	24
	108	24	14	19	17	19	25
XI	109	20	13	20	23	16	26
	110	24	14	14	19	14	24
	111	23	15	21	17	15	26
	112	24	13	19	21	17	24
	113	23	14	18	16	16	25
	114	27	17	12	21	18	25
	115	26	17	18	19	18	27
	116	27	20	21	24	16	24
	117	24	20	21	18	13	27
XII	118	24	16	19	16	19	24
	119	26	16	19	21	15	25
	120	25	16	16	23	13	26
	121	26	17	24	20	17	26
	122	27	17	20	22	16	22
	123	25	22	22	22	14	26
	124	21	13	23	23	14	27
	125	25	20	24	21	18	26
	126	27	16	25	24	14	25

TABLE 6--Continued.

Block	Day	No. 7 Dagne	No. 8 Punkin	No. 9 Heidi	No. 10 Cleo	No. 11 Briget	No. 12 Sasha
XIII	127	25	11	22	22	15	26
	128	27	16	25	23	18	27
	129	23	13	25	23	17	27
	130	28	19	28	23	13	28
	131	27	19	27	24	18	27
	132	28	16	27	26	17	26
	133	28	13	27	26	21	28
	134	28	13	27	25	17	28
	135	26	16	28	25	12	28

Tables 7 and 8 contain the raw data of experiment two. The "v" column represents the number of correct matchings made in 25 daily matching-from-sample problems in which the sample bait was under plastic. The "o" column represents the number of correct matchings made in 25 daily matching-from-sample problems in which the sample bait was obtained. Chance score in both columns is 12.5.

TABLE 7.--Performance of frontal monkeys in experiment two

Block	Day	No. 1 Karen		No. 2 Moppet		No. 3 Annie		No. 4 Elsa		No. 5 Patsy		No. 6 Myrtle	
		v	o	v	o	v	o	v	o	v	o	v	o
I	163	11	10	16	13	11	8	13	19	15	9	12	14
	164	7	13	14	15	17	13	13	14	7	7	17	20
III	165	15	11	14	14	19	19	19	14	9	14	21	20
	166	14	15	20	19	18	19	18	15	15	14	22	24
III	167	17	18	23	20	22	14	16	16	14	14	22	19
	168	18	17	24	17	24	18	16	20	20	21	23	22
IV	169	22	23	18	19	17	21	21	19	21	23	24	24
	170	23	22	20	25	22	23	18	24	24	25	23	25
V	171	23	21	22	20	24	22	23	24	23	23	22	24
	172	20	25	24	22	25	24	22	24	25	25	23	25

TABLE 8.--Performance of normal monkeys in experiment two

Block	Day	No. 7 Dagne		No. 8 Punkin		No. 9 Heidi		No. 10 Cleo		No. 11 Briget		No. 12 Sasha	
		v	o	v	o	v	o	v	o	v	o	v	o
I	163	19	12	7	9	14	14	16	12	18	11	16	13
	164	18	16	8	11	16	8	14	15	16	15	15	12
II	165	22	20	13	10	13	19	16	15	12	19	14	15
	166	24	21	15	10	22	24	21	20	21	25	16	15
III	167	25	20	13	13	22	20	22	18	23	22	16	8
	168	24	22	16	21	22	22	24	24	22	22	21	15
IV	169	25	22	16	14	24	24	24	24	21	22	22	19
	170	25	24	18	21	24	24	22	24	25	24	25	23
V	171	24	23	21	19	25	25	25	24	25	21	25	22
	172	25	24	23	24	25	25	25	25	24	25	21	21

Tables 9 and 10 contain the raw data of experiment three. The "v" column represents the number of correct choices on trial two in 12 daily two-trial discriminations in which the bait was under plastic on trial one. The "o" column represents the number of correct choices on trial two in 12 daily two-trial discriminations in which the bait was obtainable on trial one. Chance score in both columns is six.

TABLE 9.--Performance of frontal monkeys in experiment three

Block	Day	No. 1 Karen		No. 2 Moppet		No. 3 Annie		No. 4 Elsa		No. 5 Patsy		No. 6 Myrtle	
		v	o	v	o	v	o	v	o	v	o	v	o
I	175	8	9	10	10	7	8	6	6	6	7	6	9
	176	9	11	6	7	5	8	5	7	8	7	8	7
	177	9	7	7	6	9	7	7	7	4	7	6	6
	178	8	8	5	6	7	8	8	8	8	5	7	6
	179	5	7	8	6	6	8	8	7	8	9	6	7
	180	6	9	3	9	10	10	5	7	6	9	7	9
	181	9	10	6	8	7	8	7	6	4	5	6	7
	182	8	9	4	6	7	8	7	8	6	5	4	9
II	183	10	10	6	9	7	9	4	8	9	8	8	7
	184	11	11	2	6	10	8	6	7	8	8	5	9
	185	9	8	5	10	8	8	9	8	9	8	2	6
	186	10	11	8	6	8	9	7	7	8	6	5	8
	187	11	12	9	8	9	9	9	9	7	3	8	7
	188	10	11	6	8	9	9	6	7	9	6	11	9
	189	11	12	7	11	9	11	9	11	3	10	7	11
	190	11	11	5	4	10	10	6	9	7	10	10	11
III	191	10	10	10	10	11	10	5	10	6	9	9	10
	192	10	11	6	9	10	11	4	8	5	9	9	8
	194	10	11	10	11	11	10	7	10	6	8	11	12
	194	9	12	10	11	10	11	7	7	8	8	10	12
	195	12	9	9	12	11	9	8	10	10	10	8	10
	196	11	11	5	9	10	11	9	8	8	10	7	12
	197	8	12	12	12	9	9	9	11	8	10	10	12
	198	9	12	9	10	11	11	9	9	8	10	9	11
IV	199	12	12	9	12	9	8	9	9	10	12	11	10
	200	7	11	6	10	7	12	9	8	9	8	10	11
	201	12	11	10	10	11	12	8	7	9	12	11	12
	202	10	11	7	10	10	9	9	10	7	10	7	7
	203	12	12	8	11	10	12	9	9	10	11	11	12
	204	11	11	9	11	11	11	9	10	10	9	9	11
	205	12	12	10	11	11	11	11	11	10	11	11	11
	206	9	11	10	10	11	12	8	12	8	9	10	11

TABLE 9--Continued.

Block	Day	No. 1 Karen		No. 2 Moppet		No. 3 Annie		No. 4 Elsa		No. 5 Patsy		No. 6 Myrtle	
		v	o	v	o	v	o	v	o	v	o	v	o
V	207	11	12	11	12	10	12	10	11	10	11	11	12
	208	10	11	12	11	11	12	8	8	9	11	10	12
	209	11	11	10	12	12	12	9	10	11	10	9	11
	210	12	12	11	10	12	12	10	10	9	11	12	11
	211	10	11	11	11	10	11	10	9	10	12	10	12
	212	10	11	9	11	11	11	8	10	9	10	11	10
	213	11	11	10	11	12	12	12	10	10	11	8	8
	214	12	11	9	8	12	12	10	9	10	11	11	11
VI	215	11	12	8	12	12	12	12	12	11	11	12	10
	216	11	12	12	12	11	12	8	12	7	10	10	11
	217	11	12	11	11	12	12	11	12	10	11	6	11
	218	10	12	12	11	12	12	12	10	8	10	11	12
	219	12	12	11	11	11	12	11	10	11	12	10	10
	220	12	11	10	11	12	12	10	11	9	9	12	12
	221	12	12	10	11	12	12	12	11	9	7	9	11
	222	11	12	11	11	12	12	11	11	10	10	12	12

TABLE 10.--Performance of normal monkeys in experiment three
(See explanation before Table 9)

Block	Day	No. 7		No. 8		No. 9		No. 10		No. 11		No. 12	
		Dagne		Punkin		Heidi		Cleo		Briget		Sasha	
		v	o	v	o	v	o	v	o	v	o	v	o
I	175	7	8	11	8	7	11	5	6	8	6	8	9
	176	7	7	9	6	7	9	7	6	5	7	5	7
	177	7	7	9	10	8	10	4	9	8	6	6	7
	178	7	5	11	8	9	9	10	7	5	7	6	7
	179	10	10	6	8	8	9	7	5	5	7	7	11
	180	8	8	6	9	6	10	6	8	4	9	3	9
	181	7	10	6	6	9	9	6	6	6	9	8	5
	182	7	3	9	8	7	9	8	7	6	9	10	4
II	183	7	10	9	8	7	9	8	9	7	6	8	8
	184	9	9	10	8	11	10	2	8	7	9	5	7
	185	5	9	11	6	6	9	6	7	7	8	9	7
	186	5	8	9	10	6	11	8	7	8	11	4	5
	187	11	10	11	12	6	7	6	6	8	11	8	7
	188	8	9	11	9	10	10	8	8	5	10	5	7
	189	6	12	11	10	10	11	6	9	8	11	9	6
	190	8	7	8	10	10	10	7	9	9	9	7	8
III	191	11	11	10	7	9	11	6	6	10	9	8	9
	192	9	10	11	12	10	12	8	10	5	8	9	9
	193	9	12	9	10	9	10	8	8	6	11	9	10
	194	8	11	11	11	7	11	7	9	9	10	6	6
	195	11	8	8	10	10	11	8	8	7	10	9	10
	196	12	11	10	8	10	12	7	9	8	12	8	9
	197	10	9	8	9	9	12	6	7	10	11	8	9
	198	11	12	12	9	11	11	9	8	11	11	6	10
IV	199	11	12	8	11	10	12	6	8	12	9	11	9
	200	11	12	10	10	12	11	7	9	8	11	7	6
	201	12	12	10	12	10	12	9	10	11	11	9	10
	202	11	12	10	10	11	12	7	11	11	12	6	10
	203	12	12	12	11	12	12	8	10	12	11	11	8
	204	11	12	11	11	9	12	8	11	11	12	7	9
	205	10	11	10	11	11	12	11	10	9	13	12	10
	206	12	11	10	12	10	10	10	9	10	10	11	10
V	207	11	10	10	12	11	10	11	9	11	10	11	11
	208	10	8	11	11	9	12	6	6	11	10	10	10
	209	9	11	11	11	12	11	11	10	12	12	11	10
	210	11	11	11	11	10	11	11	10	9	10	10	11
	211	10	8	9	11	11	11	11	9	10	10	11	7
	212	12	10	11	10	9	12	11	10	10	10	9	10
	213	11	10	11	11	12	11	9	8	10	11	11	8
	214	10	11	12	11	11	11	10	11	11	11	11	12

TABLE 10--Continued.

Block	Day	No. 7 Dagne		No. 8 Punkin		No. 9 Heidi		No. 10 Cleo		No. 11 Briget		No. 12 Sasha	
		v	o	v	o	v	o	v	o	v	o	v	o
VI	215	11	8	11	12	11	10	12	12	10	11	12	10
	216	12	12	11	11	11	11	12	11	11	11	9	10
	217	9	10	12	11	12	12	10	9	9	12	11	10
	218	11	11	11	12	12	12	7	9	10	11	9	10
	219	12	11	12	11	12	12	11	10	10	11	12	11
	220	12	12	11	12	10	12	10	11	11	12	11	11
	221	11	11	12	12	11	11	12	8	12	11	11	10
	222	11	12	11	11	11	12	11	10	11	10	11	10

Tables 11 and 12 contain the raw data of the second test of the lesions, run concurrently with experiment three and utilizing the same testing unit and differential foodwell covers. Each score represents the number of correct choices in 12 daily trials of a delayed response task in which bait locus was demonstrated by E. Chance score is six.

TABLE 11.--Performance of frontal monkeys on the second lesion test

Block	Day	No. 1 Karen	No. 2 Moppet	No. 3 Annie	No. 4 Elsa	No. 5 Patsy	No. 6 Myrtle
I	175	6	10	8	7	5	7
	176	5	5	11	4	5	8
	177	6	6	8	5	7	9
	178	6	5	12	7	8	6
	179	7	7	12	9	8	4
	180	6	6	12	5	5	6
	181	7	9	12	5	6	7
	182	5	8	12	7	6	6
II	183	8	7	12	8	6	6
	184	8	7	12	8	6	6
	185	6	8	12	8	7	6
	186	5	6	11	5	3	8
	187	9	8	12	6	7	4
	188	6	7	8	5	5	9
	189	6	3	10	7	9	8
	190	7	7	12	4	4	8
III	191	8	8	12	7	8	3
	192	8	7	12	5	6	6
	193	6	7	11	8	7	6
	194	7	9	12	3	5	5
	195	10	8	11	6	10	7
	196	10	3	9	7	10	8
	197	7	7	11	5	11	10
	198	5	6	11	3	9	9
IV	199	7	7	12	8	11	8
	200	4	7	11	5	7	9
	201	8	10	12	5	8	9
	202	8	4	12	6	6	5
	203	9	9	11	5	12	5
	204	6	8	12	5	12	8
	205	11	9	12	7	12	12
	206	5	4	12	5	12	9

TABLE 11--Continued.

Block	Day	No. 1 Karen	No. 2 Moppet	No. 3 Annie	No. 4 Elsa	No. 5 Patsy	No. 6 Myrtle
V	207	9	10	12	8	11	9
	208	6	9	12	3	7	5
	209	7	10	12	8	12	10
	210	3	2	12	5	12	8
	211	10	10	12	11	12	7
	212	5	3	12	4	11	9
	213	10	7	12	11	12	9
	214	7	4	12	2	11	6
VI	215	9	9	12	9	11	9
	216	4	5	12	6	11	6
	217	9	8	12	8	12	11
	218	7	3	12	4	12	6
	219	9	10	12	8	12	9
	220	8	5	12	5	12	6
	221	11	6	12	8	11	9
	222	8	5	12	6	12	5

TABLE 12.--Performance of normal monkeys on the second lesion test
(See explanation before Table 11)

Block	Day	No. 7 Dagne	No. 8 Punkin	No. 9 Heidi	No. 10 Cleo	No. 11 Briget	No. 12 Sasha
I	175	10	11	10	10	9	12
	176	9	8	12	10	7	12
	177	12	11	12	11	6	12
	178	12	10	12	10	7	12
	179	11	11	10	11	7	11
	180	11	10	11	10	7	12
	181	12	11	11	10	8	12
	182	11	10	11	10	8	11
II	183	12	10	12	11	8	12
	184	12	9	11	11	9	11
	185	11	12	12	10	9	12
	186	12	11	12	12	9	12
	187	12	9	12	12	7	12
	188	12	10	12	12	12	12
	189	12	11	12	11	10	12
	190	12	10	12	12	8	12
III	191	12	10	12	10	9	12
	192	12	11	12	12	12	12
	193	12	10	12	11	10	12
	194	12	11	12	11	12	12
	195	12	12	12	12	11	12
	196	12	11	12	10	10	12
	197	12	9	12	12	12	12
	198	12	9	12	11	12	12
IV	199	12	11	12	10	12	12
	200	12	12	12	11	11	11
	201	12	12	12	12	12	12
	202	12	11	12	12	10	12
	203	12	12	12	12	10	12
	204	12	12	12	12	11	12
	205	12	12	12	12	12	12
	206	12	12	12	12	11	12
V	207	12	11	9	10	11	12
	208	12	12	12	12	12	12
	209	12	12	12	12	12	12
	210	12	12	12	11	12	12
	211	12	12	12	12	11	12
	212	12	12	12	12	11	12
	213	12	12	12	11	12	12
	214	12	12	12	12	12	12

TABLE 12--Continued.

Block	Day	No. 7 Dagne	No. 8 Punkin	No. 9 Heidi	No. 10 Cleo	No. 11 Briget	No. 12 Sasha
VI	215	12	12	12	12	12	12
	216	12	12	12	12	12	12
	217	12	12	12	12	11	12
	218	12	12	12	12	12	12
	219	12	12	12	12	10	12
	220	12	12	12	12	12	12
	221	12	12	12	12	12	12
	222	12	12	12	12	12	12

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I, Mary Otteson Blake, was born in Owatonna, Minnesota, April 27, 1937. I received my secondary-education in the public schools of Owatonna, Minnesota, and my undergraduate training at St. Olaf College, which granted me the Bachelor of Arts degree in 1959. I was granted a pre-doctoral fellowship by the United States Public Health Service in 1959 for study in the Psychology Department of the Ohio State University under Professor Donald R. Meyer. This fellowship was continued for four years while I completed the requirements for the Master of Arts degree, granted in 1961, and the Doctor of Philosophy degree.

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