

*OBSERVATIONAL LEARNING IN MONKEYS*WILLIAM A. MYERS¹

MINNEAPOLIS VETERANS HOSPITAL

Observer monkeys were housed next to demonstrator monkeys that were conditioned to respond on a multiple reinforcement schedule whose components were fixed-ratio 32, variable-interval 3-min, and extinction 5-min followed by an additional 30 sec of extinction during which every response started a new 30-sec interval. After observational periods from 113 to 210 hr long, during which observers could not perform the response and were given no extrinsic reinforcers, their first-response latencies to fixed ratio and variable interval were as short as the demonstrators; and their rates of responding were well above pre-observational baseline levels. About 8 hr later, a temporal pattern of responding appropriate to the multiple schedule emerged, including non-emission of responses during extinction. Controls lacking the chance to observe did not develop typically patterned responding after 60 hr in one case and, in two other cases, after 80 hr during which, on two occasions, every one of 50 responses was reinforced. In a second experiment, the stimulus lights associated with fixed ratio and variable interval were presented simultaneously. Subjects chose one of the schedules by responding to one of the levers beneath the lights. All subjects initially chose fixed ratio. Seeing the demonstrators switch to variable interval, due to increases in the fixed-ratio requirement, had no effect upon observers, which continued to choose fixed ratio.

Students of animal behavior have long been aware that behavior in an individual may change as a result of observing members of its own or, less frequently, other species. The phenomenon has not always been accepted as genuine. Thorndike (1898, 1901) and Watson (1908) were among those who found no evidence for it. Beginning with Yerkes' attempts (1927, 1934) to show imitation (the accepted name for the phenomenon at that time) in primates, however, evidence of this behavioral process has steadily grown, culminating in a recent group of experiments that establish the phenomenon beyond reasonable doubt.

The species used and the tasks employed have been quite varied. There have been studies with cats learning motor skills (Herbert and Harsh, 1944) and lever pressing and shuttlebox avoidance (John, Chesler, and Bartlett, 1968); rats learning to lever press (Corson, 1967); and birds learning to remove the lid of a food cup (Dawson and Foss, 1965).

The history of experimental work in this area, though long, is inconclusive. Beyond a sterile belief that some species have an instinct

to imitate, there has been practically no agreement on a descriptive meaning for the term observation learning. Mimicry, imitation, copying, modeling, and observation learning came to be used interchangeably, though their users were often referring to widely divergent phenomena. Imitation of response topography, for example, has been taught to a chimpanzee (Hayes and Hayes, 1952) and to retarded children (Baer, Peterson, and Sherman 1967), but the procedures are very different from those used in studying observation learning as the term is used in this report.

Herbert and Harsh (1944) diminished the confusion by making several elementary distinctions that had been blurred in the procedures of earlier work. They pointed out that it makes a difference whether the demonstrator is present or absent when the observer first attempts the target response. They also noted as important the extent of delay between the last demonstration and the observer's first opportunity to perform. Finally, they distinguished topographical similarity in the behavior of demonstrator and observer from the question of whether the observer's behavior achieved the same result as the demonstrator's.

Except for a study by Gilbert and Beaton (1967), in which no numerical data were reported, there have been no attempts to employ

¹I am thankful to Lee Levitan for assistance in data collection and analysis. Reprints may be obtained from the author, Department of Psychology, Macalester College, St. Paul, Minnesota 55101.

moderately complex reinforcement schedules as a tool for investigating observation learning. Reinforcement schedules are ideally suited to this purpose, because they focus attention on changes in behavior, rather than, the acquisition of motor movements of particular topography, thus making unnecessary the discussion of such currently confused topics as mimicry, modeling, and imitation.

In the present experiments, the question asked was whether any change would occur in the behavior of an observer, which was prevented from making the target response during the observational period, after being in a cage adjacent to a demonstrator that was taught to respond by the usual operant procedures on a moderately complex reinforcement schedule.

EXPERIMENT 1: THE EFFECTS OF OBSERVATION ON ACQUISITION IN A MULTIPLE SCHEDULE

METHOD

Subjects

Two male stump-tail monkeys (*Macaca speciosa*) approximately 1-yr-old comprised one demonstrator-observer pair and two male rhesus (*Macaca mulatta*) aged 8 and 4 yr comprised the other pair. The older pair was kept between 85 and 90% of their free-feeding weight, while the younger pair was fed enough to maintain them at the weight that prevailed at the beginning of the experiment, but not enough to permit the normal weight gain in animals their age. The dominant animal of each pair became the demonstrator, although it was later discovered that the divider panel between the animals eliminated the pattern of dominant and submissive behaviors that might have interfered with the willingness of the observer to watch the demonstrator. Dominance was determined according to the four most reliable criteria reported by Maslow (1936): (1) preempts all or most of a limited food supply, (2) frequently mounts the subordinate animal, (3) is almost never . . . bullied by the subordinate animal, and (4) never cringes under aggression.

Apparatus

A 12-in. (30.5 cm) square transparent plastic shield was attached to one side of a dual cage over the space normally covered by the escape

door. Embedded in the shield and projecting away from the cage were a pair of rods on which a work panel was mounted. The panel featured a stimulus light, a toggle rod, and a food cup. A hole in the shield provided access to the work panel. The demonstrator occupied the side of the dual cage with the work panel attached. The observer was separated from the demonstrator by a 1-in. (2.54 cm) square mesh panel. As the apparatus was positioned about 6 in. (15.2 cm) from the front of the demonstrator's cage, the observer could see the apparatus and the demonstrator through either the front of the cage or through the mesh divider.

Electro-mechanical equipment operated the stimulus light and feeder, recorded behavior, and manipulated the variables described below.

Procedure

The schedule employed was a multiple fixed-ratio 32, variable-interval 3-min, extinction 5-min, followed by an additional 30 sec of extinction during which each response initiated a new 30-sec interval. (*mult FR 32 VI 3-min EXT 5-min + 30 sec without responding*). Each session was begun with the FR 32 in force. After that, in order for any given component of the schedule to be in force, the preceding component had to be completed whether during baseline, training of the demonstrators, or testing of the observers. Each of the four monkeys was individually exposed to this schedule for 4 hr without food reinforcement. Then, with the observer present, responding to the toggle rod was shaped in each demonstrator in the presence of the green stimulus light later correlated with VI, using 45-mg sucrose pellets. In the same session with shaping, the schedule was shifted from reinforcement for every response to a variable-interval 40-sec in two increments of 20 sec each. In succeeding sessions, the VI was increased in four additional increments to a terminal value of 3 min using 97-mg Noyes sucrose pellets. When behavior on VI was stable, FR training was begun.

Responding was reinforced in the presence of a red stimulus light on a fixed-ratio schedule that progressed to a terminal value of 32 in steps of four. When stable ratio performance developed, the two schedules alternated until responding in both schedules was under good

stimulus control, at which time EXT was added. At that point, the components of the multiple schedule always followed the same order: FR VI EXT. The measures taken were rate of responding in FR, VI, and EXT, and latency of the first response in FR and VI.

When FR and VI schedules were first combined, the FR rate for the rhesus demonstrator (107) carried over into VI. As a remedial measure, the requirements for this animal were reduced to FR 16 and VI 74-sec and gradually increased until the terminal values were reached, when EXT was again added. Once on the full schedule, the FR rate dropped drastically, due to long pauses before beginning a ratio, and this persisted for 83 experimental hours. The size of the food pellet was increased for both demonstrators at this point to 197 mg, but without effect on pausing. To eliminate pausing, a limited-hold contingency was added such that if the monkey had not begun a ratio within 3 min after the onset of the red light, EXT followed non-contingently. Pausing was quickly eliminated and the FR rate, with a few exceptions, remained well above the VI-rate for the next 31 experimental hours. The stump-tail demonstrator rarely experienced the limited hold, but it was part of the training schedule for both demonstrators. It was dropped at the end of the observational period, before the observers were tested.

Due to the difference in the performance of the demonstrators, the experience of the observers during this period was not identical, but each observer was able to see its demonstrator perform in a pattern appropriate to the terminal schedule for many hours (about 31 for the rhesus observer and 55 for the stump-tail observer). The observer was thus given ample time to observe, but no special measures were taken to see that it did.

There exists a more or less continuous process of visual scanning in *macaques*, particularly if any member of the group is eating. This process insures that the observer will frequently see the demonstrator. It does not, however, provide a measure of how much time is spent observing. The observers' actual behavior during observational periods was about equally divided between pacing in circles and sitting in a corner. Whether pacing or sitting, the observer would frequently glance into the demonstrators' cage.

When the behavior of both demonstrators

was at asymptote, each observer was exposed to the full multiple schedule with the demonstrator absent. The demonstrators were run alone during this period to determine the effect of running an animal with its partner absent. The observers were run until their behavior was stable. The animals in each pair were housed together when not working, hence there was minimal social deprivation.

There were three controls; a mature rhesus female (Pete), a 1.5-yr-old female stump-tail (#3), and a 1.5-yr-old male yellow baboon (*Papio cynocephalus*), designated #4. First they were put on the full schedule without reinforcement for a 4-hr baseline period. Then, with reinforcement available, Pete continued on the full schedule for four 15-hr sessions. The other two had only 20 hr on the full schedule with reinforcement available, followed by shaping of the toggle response and 50 consecutively reinforced responses in the presence of the green light. They were returned to the full schedule in the same session. After another 10 hr on the full schedule, every response was again reinforced with the red and green lights alternating on each response. They were returned to the full schedule in the same session after earning 50 reinforcements. They remained on the full schedule for a final 10 hr.

RESULTS

The first effect of observation on the observers' behavior was present on the first day, which is shown as Session 1 in Fig. 1. Compared to the unreinforced baseline rates, which were between 0 and 1 over a period of 4 hr, the rates of both observers in all three components of the multiple schedule (EXT and the 30-sec reset period were combined to yield a single rate) were substantially increased. Records for the two demonstrators on the same calendar day (also marked Session 1 in Fig. 1) are included to show examples of behavior under good schedule control. Disregarding the individual schedule components, the overall rates for the stump-tail observer on the first four days of testing, before schedule control emerged, were 3.8, 3.4, 3.0, and 6.2 responses per minute. On the first five days of testing, before patterns appropriate to the schedule components emerged, the overall

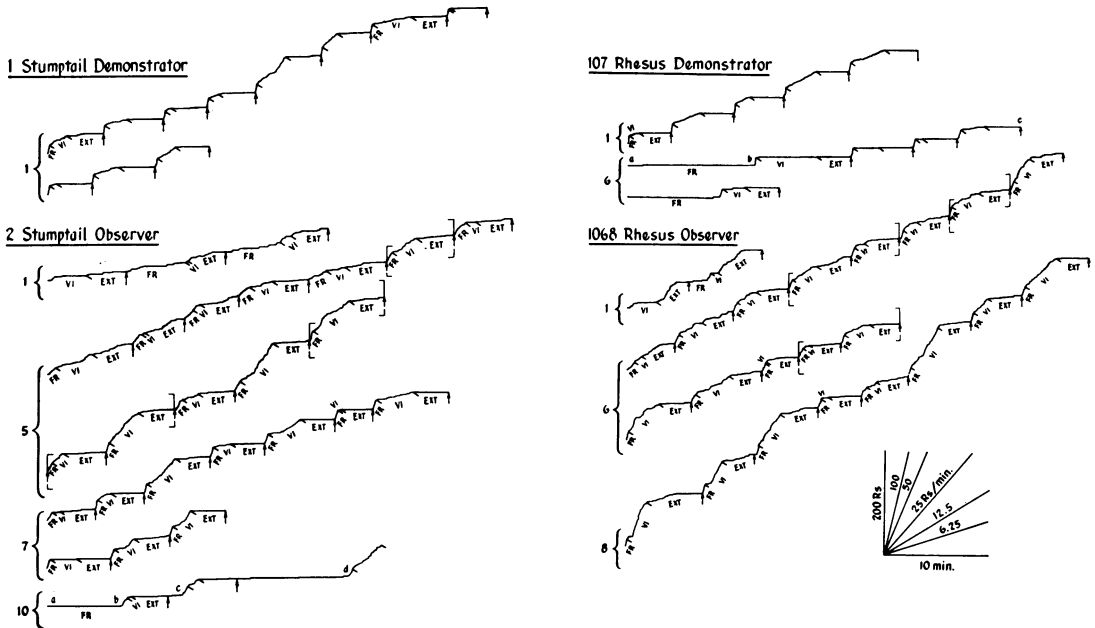


Fig. 1. Segments of cumulative records from two observers and two demonstrators. The number to the left of each segment locates it within the series of experimental sessions that followed observation. Oblique, downward pips on the record indicate reinforcement; upward-pointing arrows mark the end of extinction periods, which were always followed by FR and VI, in that order. In Session 6 for no. 107 the portion of the record between a and b shows a long pause before beginning an FR run. A similar pause is shown between a and b in Session 10 for no. 2; in the same session, c and d mark FR runs containing momentary pauses.

rates for the rhesus observer were 2.1, 17.7, 15.6, 3.85, and 10.9 responses per minute.

The second effect, also shown in Fig. 1, is the emergence of patterns of responding appropriate to the various components of the multiple schedule. This began to happen in the sixth session (see bracketed segments) after 8.5 testing hours for the rhesus observer and was consistent by Session 8. For the stumptail observer, schedule control first emerged in the fifth session (see bracketed segments) after eight testing hours and was fairly consistent by Session 7.

Rate of responding is another reflection of schedule control. The rates for each animal for the first 10 post-observational days are shown in Fig. 2. The expected order of rates (FR-VI-EXT) for the rhesus observer appeared on Day 4, several days before the first appearance of schedule control. In the stumptail observer, the expected order of rates and the first appearance of schedule control both appear on day five.

Thirdly, the observers' first-response latencies to the stimulus lights correlated with FR and VI compared favorably with the demonstrators' latencies. Figure 3 shows the average

latency per session to each stimulus light for each animal.

There were sizable changes in responding for two of the animals over the test sessions shown in Fig. 1 and 3. Latencies in FR for the rhesus demonstrator increased greatly (e.g., a to b spans one long pause and c marks the beginning of another one in Session 6 of Fig. 1; Days 2, 5, 6, and 7 of Fig. 3) causing a sharp drop in FR rate (Fig. 2) from Day 5 onward. A similar increase in FR latencies occurred for the stumptail observer (e.g., a to b in session 10 of Fig. 1; Day 7 of Fig. 3) causing a precipitous drop in FR rate beginning on Day 8 of Fig. 2. The presence of grain in some of the ratio runs (e.g., at c and d in Session 10) suggest that the stimulus consequences of responding were also somewhat weak.

Figure 2 shows the rates for the demonstrators during post-observational testing. Except for the decrease in FR rate for the rhesus demonstrator, the demonstrators' performance was about the same in the post-observational period, when all animals were run individually, as it had been during observation, when the animals were run in pairs. The variability in FR rates seen in Fig. 2, caused mainly by

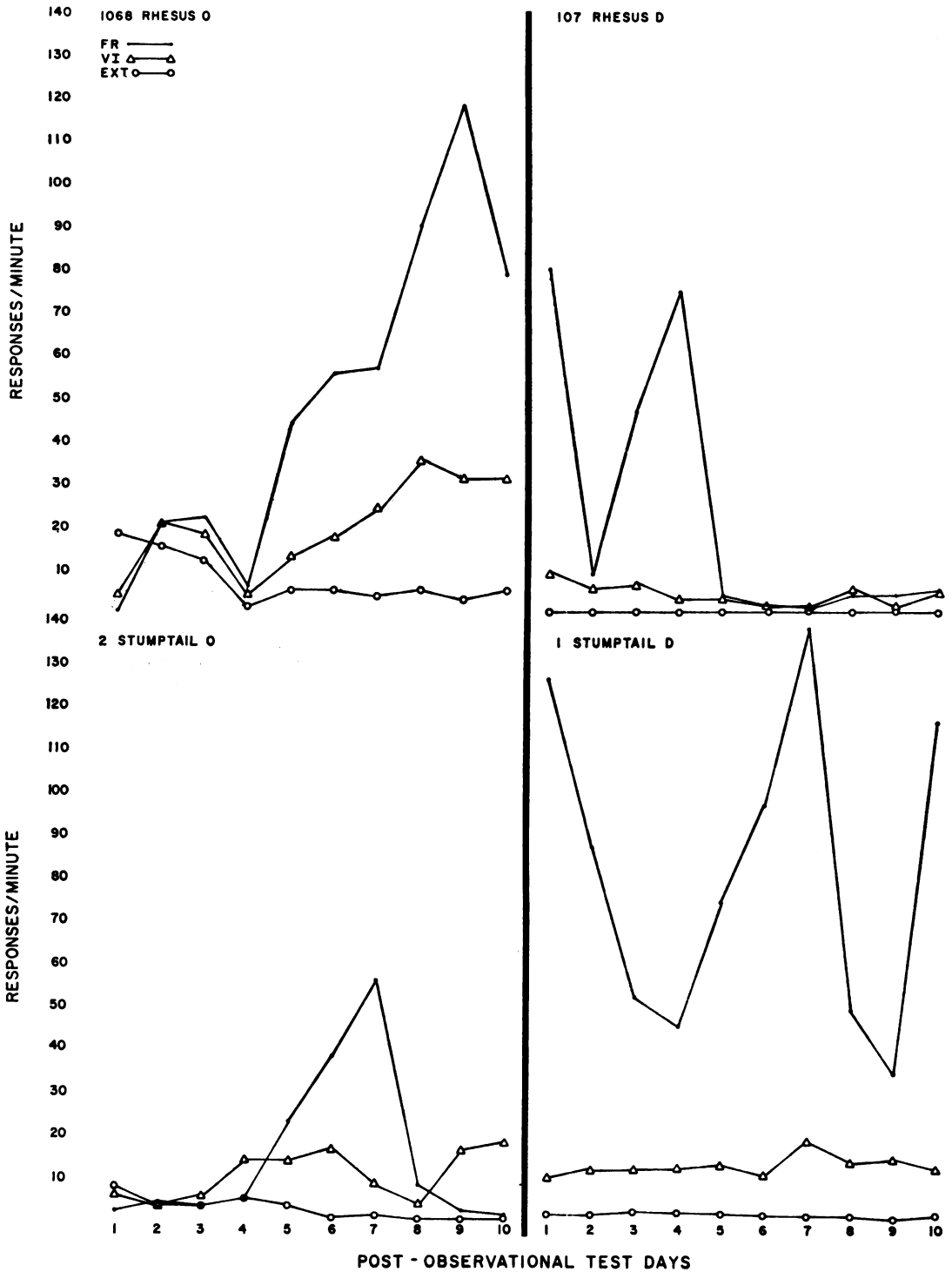


Fig. 2. Rates of responding for two demonstrators (right-hand panels) and their observers (left-hand panels) in a multiple schedule (fixed-ratio, variable-interval, extinction, and differential reinforcement for other behavior) following a period of observation.

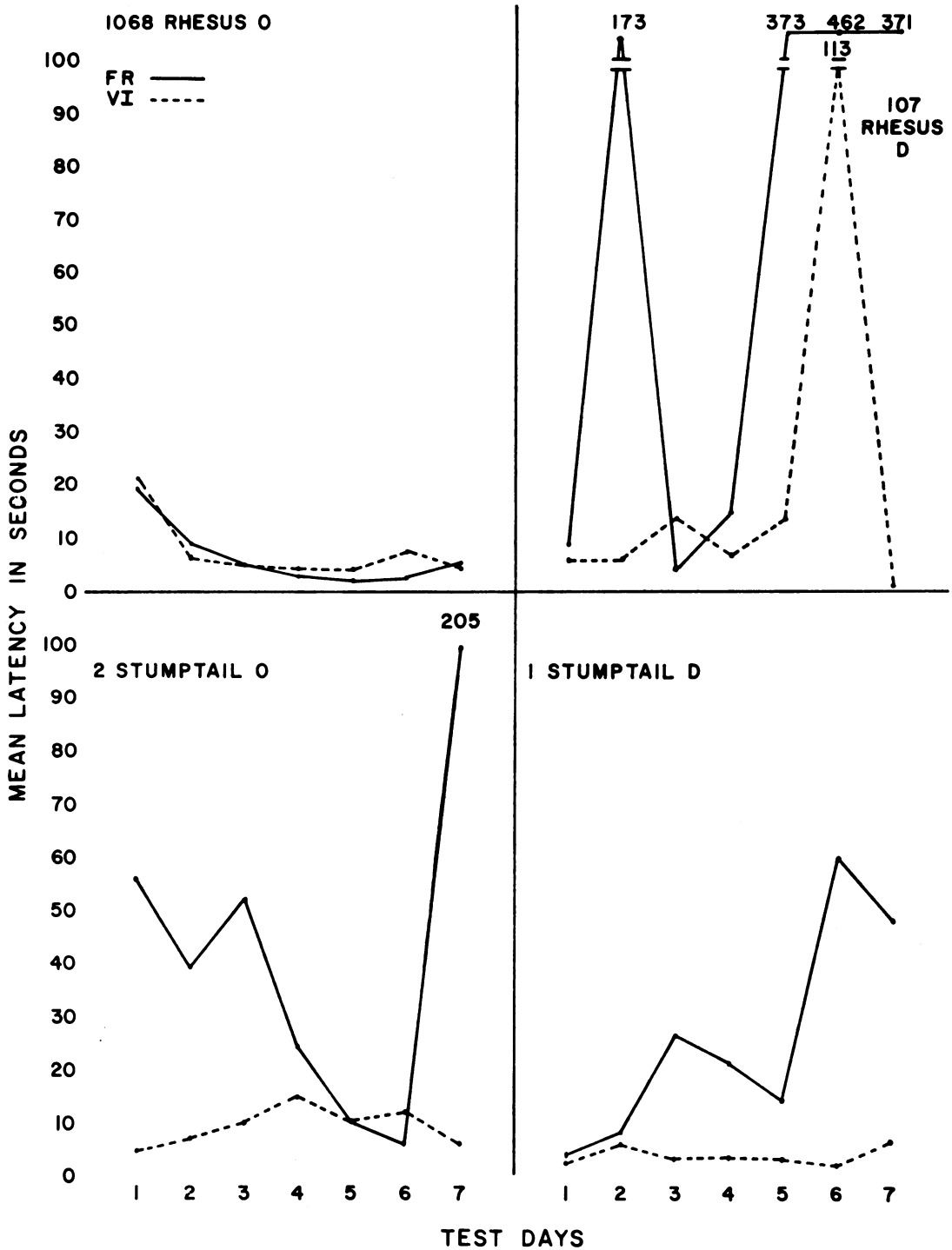


Fig. 3. Mean latency per session of the first response to the appearance of stimulus lights associated with the fixed-ratio and variable-interval components of a multiple schedule. Latencies for demonstrators and observers are shown in the two right and the two left-hand panels, respectively.

unexplained fluctuations in FR latency (Fig. 3), was typical of the entire observational period.

After a scattering of responses in the baseline period, the controls rarely responded while on the full schedule with reinforcement. None of the controls completed a ratio within the first 20 hr, hence they were continuously in FR without reinforcement. After 50 continuous reinforcements, #3 completed nine cycles of the schedule in three sessions, but each session ended in an uncompleted ratio. Its rate of responding increased substantially in VI and EXT, but remained less than one response per minute in FR. Number four received no pellets in four sessions, each of which ended in an uncompleted ratio. Its rate was zero in VI and EXT and less than one in FR.

After the second 50 continuous reinforcements, #3 completed 10 cycles of the schedule over three sessions. Number four completed no ratios over three sessions and, therefore, did not experience any other part of the schedule. Rates for both controls were about the same as they had been after the first 50 reinforcements.

Number three continued to make progress, however, and was continued for another 40 hr spread over six sessions. Rates and latencies for these final six sessions are shown in Fig. 4. In the final sessions, after 80 hr spread over 20 sessions during which 100 pellets were given on continuous reinforcement and 298 more were earned by completing 149 cycles through the schedule, this animal was still performing poorly relative to the observers. Figure 4 shows that the rate in FR was low and FR latency was correspondingly long. The rate in EXT remained high relative to the overall rate. The one part of the schedule on which this control animal compared favorably with the observers was VI. On this component, its performance on all measures (rate, latency, and slope of the cumulative records) was similar to the observers'.

EXPERIMENT 2: THE EFFECTS OF OBSERVATION ON SCHEDULE PREFERENCES

METHOD

Subjects and Apparatus

The two pairs of monkeys from Exp. 1 were used. A new response panel of the same over-

all dimensions but having two toggle rods side by side and equidistant from the edge of the panel was used. There was a stimulus light above each rod.

Procedure

The aim of this study was to measure the effects of observation on schedule preference. In order to record an animal's preference, the stimulus lights associated with the FR and VI schedules of Exp. 1 were presented simultaneously. The stimulus light above the toggle rod to which the first response was made stayed on and its associated reinforcement schedule was in force until completed. The other light was turned off and responding on the other rod was not reinforced. Responding on the chosen schedule was reinforced with 190-mg sucrose pellets followed by the combined EXT plus 30-sec reset period used in Exp. 1.

After 50 choices had been recorded for each monkey individually, the observer was put in the adjacent cage while the FR component of the option was gradually increased until the demonstrator had made a total of 105 VI choices with fewer than five intervening FRs. Then, with the FR and VI requirements restored to their original values of 32 and 3-min, respectively, another 50 choices were individually recorded from each observer.

RESULTS

Table 1 summarizes the behavior of the demonstrators during the observational period. The shift to a preference for the VI schedule was abrupt in both animals and was clearly a function of the increased FR requirement. The rhesus demonstrator began choosing VI consistently when its FR requirement reached 63; the stump-tail observer did not shift until its FR had been raised to 1000. The two observers, therefore, had different experiences during the observational period.

There was a large decrease in latency of the choice for all animals, but that decrease occurred within the first 50 choices, before observation.

Figure 5 shows the pattern of choices before and after observation. Neither observer altered its preference after observing the demonstrator do so. Instead, both continued choosing FR almost exclusively.

Table 1

The fixed-ratio requirement and the number of times the demonstrators chose either an FR or a VI schedule of reinforcement during a period when observer monkeys were able to see them.

Observational Session	<i>Rhesus Demonstrator</i>			<i>Stumptail Demonstrator</i>		
	FR Requirement	No. of FR Choices	No. of VI Choices	FR Requirement	No. of FR Choices	No. of VI Choices
1	40	11	0	40	19	0
2	40	19	0	40	24	0
3	40, 48	9	1	40, 48	19	0
4	48	20	3	48	8	0
5	63	11	15	48, 56, 63	20	0
6	63	0	25	78, 93	25	0
7	78	0	17	108, 123	22	0
8	78	0	27	123, 138	25	0
9	78	0	2	153, 183, 213	15	1
10	78	0	18	213, 243, 273, 303		
				353, 403, 453, 553	31	1
11				553, 653, 800	24	2
12				850, 1000	8	0
13				1000	2	31
14				1000	0	22
15				1000	1	6
16				1000	1	11
17				1000	1	0
18				1000	1	0
19				1000	1	0
20				1000	0	8
21				1000	0	23

DISCUSSION

It has been suggested that much of what passes for observational learning is really social facilitation (Thorpe, 1951, p. 254). If an observer performs a response, which is either novel or part of an instinctive pattern of behavior, in the presence of one or more conspecifics immediately after the emission of the same response by another conspecific, Thorpe terms it an instance of social facilitation. Observation learning, as it is used in this report, differs from social facilitation on the following counts: there was no requirement that the behavior of the observer and the demonstrator be similar in topography (though, as a matter of fact, it was); the observers were alone when tested for the effects of observation; the observers could not perform the response or receive extrinsic reinforcement while conspecifics were demonstrating the pattern of behavior to be learned; the to-be-learned behavior was not part of an instinctive pattern.

Of the three effects reported, increased rates (Fig. 1 and 2) and relatively short latencies

(Fig. 3) are directly attributable to the observation period. The third effect, rapid emergence of schedule control, could have been due to massed experience with the schedule that the observers obtained simply because their rates were high enough to cycle them through the full reinforcement schedule at a critical frequency. This view entails the assumption that there is a minimal quantity and/or rate of experience with the schedule such that if the animal exceeds one or both of these values, schedule control will develop quickly. If these critical values are not exceeded, then schedule control would develop more slowly.

Table 2 shows the number of full cycles of the schedule completed per hour by the two observers and control #3. The observers had more experience of the schedule contingencies per unit time from the first day of post-observational testing until schedule control began to emerge (on day six for the rhesus observer and day five for the stumptail observer).

If the emergence of schedule control is a joint function of amount and density of experience with the reinforcement schedule,

Table 2

The number of times per hour two observers and one control (#3) experienced the full reinforcement schedule, beginning with the first day of post-observational testing

<i>Observer 1068</i>		<i>Observer #2</i>		<i>Control #3</i>	
<i>Day of Testing after Observation</i>	<i>Full Schedule Cycles per Hour</i>	<i>Day of Testing after Observation</i>	<i>Full Schedule Cycles per Hour</i>	<i>Day of Testing after Observation</i>	<i>Full Schedule Cycles per Hour</i>
1	0.87	1	2.40	1	0.00
2	4.92	2	3.20	2	0.92
3	5.19	3	3.00	3	1.60
4	4.24	4	3.69	4	0.00
5	5.73	5	9.63	5	0.88
6	6.32	6	6.18	6	0.73
7	6.13	7	6.00	7	1.40
8	5.99			8	2.05
				9	3.91
				10	2.22
				11	3.69
				12	3.58
				13	4.55

then it might have been expected to appear in control #3 on Day 11, or subsequently, when its cumulative experience was roughly comparable to that of the two observers. But Sessions 4, 5, and 6 of Fig. 4 (corresponding to Days 11, 12, and 13 in Table 2) show little evidence of schedule control. The VI rate was higher, rather than lower, than FR; there was still frequent responding during extinction, and the FR latency was consistently long and irregular. In addition, the response curves on the cumulative records for these days display a single undifferentiated rate for both FR and VI and many long pauses both before and during ratio runs.

Before being shifted to the VI component of the multiple schedule, the demonstrators had several sessions in which each response was reinforced. Yet progress toward typical VI performance was slow and the same was true when the FR and EXT components were added. The demonstrators may have achieved schedule control more quickly if, as is sometimes done (Ferster and Skinner, 1957, p. 503), they had been placed on the full schedule immediately after the initial training period in which every response was reinforced.

Perhaps demonstrators on continuous reinforcement for extended periods before exposure to the full schedule would come under schedule control as quickly as the observers. Such a demonstration would make the period of observation roughly equivalent to a period

of continuous reinforcement without observation. Until this is done, it is an open question how schedule control developed in the observers.

The direct effects of observation, increased rates and short latencies, also require explanation. The variables that control these outcomes have not been isolated from the total set operative during the observational period. Traditional formulations that contain the postulate that responses are acquired to stimuli only as a result of consequences that follow the response are of no help. While the observers emitted a lot of behavior during the observational period that undoubtedly had consequences for them, it was not the behavior emitted in testing, nor were the consequences those experienced in testing. In a purely descriptive sense, being housed next to another monkey that was emitting the target response and experiencing the consequences produced effects in the observers similar to actually having the experience themselves.

While there is no generally accepted explanation of observational learning, it seems evident that the process is enhanced if the observer is exposed to aspects of the demonstrator's performance that facilitate discriminations later useful to the observer's own performance. Seeing the demonstrator make errors may therefore be an aid to an observer. Herbert and Harsh (1944), Presley and Riopelle (1959), and John, Chesler, Bartlett, and Victor (1968)

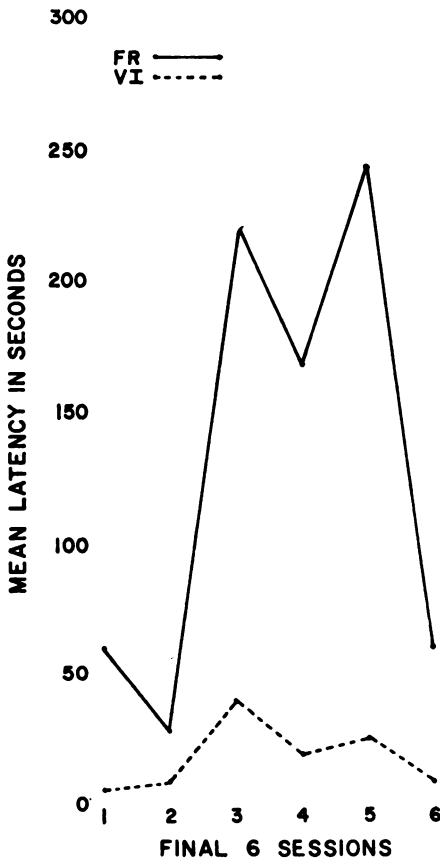
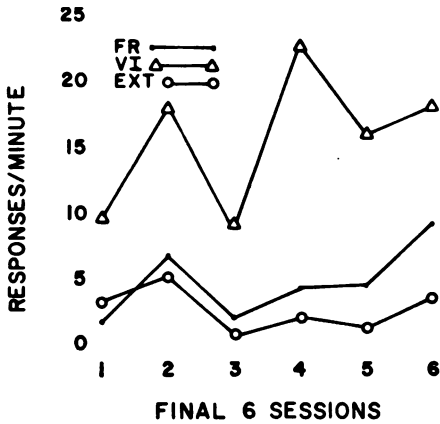


Fig. 4. Rates (top panel) in the fixed-ratio, variable-interval, and extinction components of a multiple schedule in the final six sessions for a control monkey that had previously received 398 reinforcements but no opportunity to observe a demonstrator. Latencies (bottom panel) of the first response to the appearance of the stimulus lights associated with the fixed-ratio and variable-interval components for the same control monkey.

all obtained clear evidence of learning from observation when observers were paired with their demonstrators throughout training. A further instance is provided here by the rhesus observer (1068).

In Exp. 1 of the present report, remedial measures were taken twice before the rhesus demonstrator performed appropriately in all components of the multiple schedule. Its observer (1068) developed appropriate patterns of responding faster, maintained them much longer, and had more consistent and slightly shorter latencies than the stump-tail observer (#2) whose demonstrator progressed smoothly through the training phase. Observer 1068, therefore, not only had a greater opportunity to observe unreinforced or "incorrect" responding, but also had more total time for observing (210 hr) than observer 2. The latter, however, had a much longer time (55 hr) in which to observe correctly patterned behavior than did 1068 (31 hr). With these extended periods of observation, it appears that the quality of the demonstrator's performance is more important than length of the observational period.

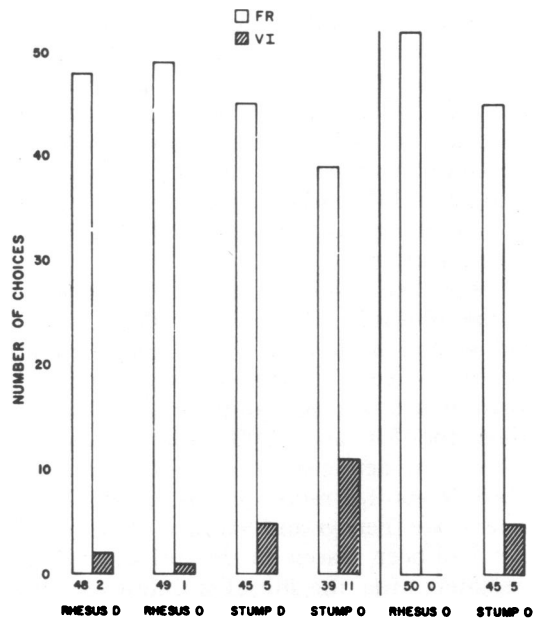


Fig. 5. The pattern of choices between the fixed-ratio and variable-interval components of a multiple schedule when the two components were presented simultaneously. Fifty choices for demonstrators and observers before observation are shown to the left of the vertical line. A second 50 choices, shown on the right, were recorded from the observers after they had seen their demonstrators consistently choose VI.

The data from Exp. 2 suggest a limit to the effects of observation. The schedule preference of the two observers was not influenced at all by seeing the demonstrators shift their preferences from red (FR) to green (VI). Direct experience in Exp. 1 with the FR schedule, in which the density of reinforcement is much higher than in VI, is the most likely reason that observing had no effect on schedule preference in Exp. 2. If the two stimulus colors had been correlated with the same reinforcement schedule in Exp. 1, it is possible that observing the demonstrator shift its preference in Exp. 2 would then have caused a shift in the observer's preference too. That possibility is being studied in a new experiment employing a *mult* FI 2-min FI 2-min reinforcement schedule. The major purposes of the new experiment will be (1) the effects of observation on the acquisition of behavior reinforced on fixed-interval schedules, and (2) an attempt to produce the rapid emergence of schedule control in demonstrators by means of extensive training with continuous reinforcement before exposing the animal to the full schedule.

REFERENCES

- Baer, D. M., Peterson, R. F., and Sherman, J. A. The development of imitation by reinforcing behavioral similarity to a model. *Journal of the Experimental Analysis of Behavior*, 1967, 10, 405-416.
- Bandura, A. and Walters, R. H. *Social learning and personality development*. New York: Holt, Rinehart & Winston, 1963.
- Corson, J. A. Observational learning of a lever pressing response. *Psychonomic Science*, 1967, 7, 197-198.
- Dawson, B. V. and Foss, B. M. Observational learning in budgerigars. *Animal Behavior*, 1965, 13, 470-474.
- Ferster, C. B. and Skinner, B. F. *Schedules of reinforcement*. New York: Appleton-Century-Crofts, 1957.
- Gilbert, R. and Beaton, J. Imitation and cooperation by hooded rats: a preliminary analysis. *Psychonomic Science*, 1967, 8, 43-44.
- Hayes, K. J. and Hayes, C. Imitation in a home-raised chimpanzee. *Journal of Comparative and Physiological Psychology*, 1952, 45, 450-459.
- Herbert, M. J. and Harsh, C. M. Observational learning by cats. *Journal of Comparative Psychology*, 1944, 37, 81-95.
- John, E. R., Chesler, P., Bartlett, F., and Victor, I. Observation learning in cats. *Science*, 1968, 159, 1489-1491.
- Maslow, A. H. The role of dominance in the social and sexual behavior of infra-human primates: I. observations at Vilas Park Zoo. *Journal of Genetic Psychology*, 1936, 48, 261-277.
- Miller, N. E. and Dollard, J. *Social learning and imitation*. New Haven: Yale University Press, 1941.
- Presley, W. J. and Riopelle, A. J. Observational learning of an avoidance response. *Journal of Genetic Psychology*, 1959, 95, 251-254.
- Spence, K. W. Experimental studies of learning and the higher mental processes in infra-human primates. *Psychological Bulletin*, 1937, 34, 819-822.
- Thorndike, E. L. Animal intelligence. *Psychological Review Monograph*, 1898, 2, 47-64.
- Thorndike, E. L. Mental life of monkeys. *Psychological Review Monograph Supplement*, 1901, 15.
- Thorpe, W. H. The learning abilities of birds. *Ibis*, 1951, 93, 252-256.
- Watson, J. B. Imitation in monkeys. *Psychological Bulletin*, 1908, 5, 169-178.
- Yerkes, R. M. The mind of the gorilla. *Genetic Psychology Monograph*, 1927, 2, 1-193.
- Yerkes, R. M. Suggestibility in the chimpanzee. *Journal of Social Psychology*, 1934, 5, 271-282.

Received 20 October 1969.