Autoshaping in Japanese Monkeys (*Macaca Fuscata*)

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ABSTRACT

Three Japanese monkeys were exposed to autoshaping and omission procedures. The Japanese momkeys seemed to be more sensitive to response-reinforcer contingency than to stimulus-reinforcer contingency. These results were compared with pigeons and squirrel monkeys in the previous reports.

It was thought that response-reinforcer contingency was the defining characteristic of operant conditioning. However, in 1968, Brown and Jenkins reported that pigeons rapidly acquire the key pecking response if the illumination of a pecking key is paired with food (autoshaping).Since that time the effects of stimulus-reinforcer contingency has been reconsidered.

In addition to demonstrating autoshaping, Brown and Jenkins (1968) also performed most of the experiments necessary to show that stimulus-reinforcer contingency was an important factor in autoshaping, e. g. presenting the key light without grain, presenting the grain just before the key light, presenting the grain with a constant key light, etc. None of these procedures was as successful as forward pairing of key-light and food in generating key pecking behavior .

Williams and Williams (1969) reported that when the conditional stimulus is a lit key and reinforcer is grain, pigeons will not only come to peck the lit key; this behavior will persist even when key pecking is programmed to prevent the delivery of food (the omission procedure). Peden, Browne, and Hearst (1977) separated the position of the stimulus and food during omission training. Even under these conditions the pigeons approached the stimulus, thereby failing to obtain food on many trials. These two experiments dramatically illustrate the importance of stimulus-reinforcer contingency in eliciting key pecking in pigeons.

Autoshaping in species other than the pigeon has been studied less extensively . Gamzu and Schwan (1974) demonstrated that squirrel monkeys can be trained to press an illuminated key when a 10-sec. key light is followed immediately by food . When the omission procedure was introduced key pressing diminished.

The omission procedure has been used as a means of assessing the relative importance of response- and stimulus-reinforcer contingencies in the control of behavior. Compared to pigeons, monkeys appear to be more sensitive to the consequences of their behavior.

The purpose of the present study is to provide further data on the effects of the omission procedure on autoshaped behavior in the monkey. Gamzu's and Schwan's (1974) squirrel monkeys autoshaped much more slowly than rhesus monkeys trained under similar conditions (Sidman and Fletcher, 1968). Perhaps factors other than the relative importance of the response-reinforcer contingency were responsible both for the slower conditioning and the decrease in key pressing under the omission procedure. The present study will examine both autoshaping and omission training in squirrel monkeys under conditions similar to those used by Sidman and Fletcher (1968).

METHOD

Subject

The subjects were three 2 -year-old naive male Japanese monkeys (Macaca fuscata fuscata) M923, F921 and F903 maintained at free-feeding weights. They were deprived of food for 22 hours before each session.

Apparatus

The subjects were studied in an experimental chamber with internal measurements of 70 x 70 x 70 cm. A square translucent plastic key (4.5cm) was located in the center of the working panel surrounded by 12 additional translucent plastic keys (3 cm diameter) located around the center key like a clock. The diameter of the circle formed by the center of each of the circular keys was 24 cm. Only the five keys on the lower half of circle were used in this experiment. Pilot lights and red filters located behind these keys could transilluminate them with red Light. Delivery of a piece of apple or a piece of potato was accompained by the sound of the feeder mechanism as it moved into position and by lighting of the food tray. The food tray was located on a panel ajacent to the working panel 10 cm above the floor with its front edge 15cm from the working panel. A dim white house light, positioned above the ceiling of the chamber and low amplitude masking noise were on throughout the session. Control of experimental contingencies and recording of key presses were under computer control and the behavior of the monkeys was monitored by closed circuit television.

Procedure

(1) AUTOSHAPING. Following magazine training all monkeys were exposed to the autoshaping procedure. This procedure consisted of the illumination of one of the five lower keys followed by the presentation of food. If any key was pressed while the key was illuminated, the trial ended immediately with the delivery of a piece of apple or a piece of potato. If the monkey failed to respond within 8 seconds, the reinforcer was delivered and the light was turned off. This was followed by the intertrial interval (ITI). The ITI varied randomly from 1 to 120 sec. with an average of 30 sec. (VT30″) . An additional specification was that no trial could begin unless at least 5 sec. had elapsed without an internal response to any keys. If the monkey responded to an irrelevant key (one of the seven keys on the upper half of the circle), this response was recorded but had no scheduled consequences. A session consisted of 60 trials.

(2) OMISSION TRAINING. The omission procedure exactly duplicated the autoshaping procedure described above except in trials on which the lit key was pressed. On such trials, the key press turned off the key, but the reinforcer was not presented . Neither the intertrial interval nor the onset of the next trial was altered by a response; the key was off and the reinforcer was not presented. Responses during the ITI had no scheduled consequences.

Both autoshaping training and omission training were conducted in three sessions each.

RESULTS

(1) AUTOSHAPING. The autoshaping data are summarized in Table 1 , Table 2 , and Figure 1.

Table 1: Ratio of discrimination

		923M	921F	903F	Mean
Autoshaping	session 1	100	80.0	81.1	87.0
	2	100	85.7	83.9	89.9
	3	93.8	98.2	74.0	88.7
	Mean	97.9	98.2	79.7	88.5
Omission	session 1	100	100	88.1	96.0
	2	100	100	100	100
	3	100	100	100	100
	Mean	100	100	96.0	98.7

Table 2: Mean responses in ITI

		923M	921F	903F	Mean
Autoshaping	session 1	0.37	1.50	1.23	1.03
	2	0.80	2.20	2.72	1.91
	3	1.07	0.52	2.32	1.30
	Mean	0.73	1.41	2.09	1.41
Omission	session 1	0.13	0.27	0.33	0.24
	2	0.00	0.12	0.23	0.12
	3	0.07	0.15	0.07	0.09
	Mean	0.07	0.18	0.21	0.15

All three monkeys pressed a lit key within the first 60 trial sessions. Response rates remained high throughout the three sessions (see Figure 1) .

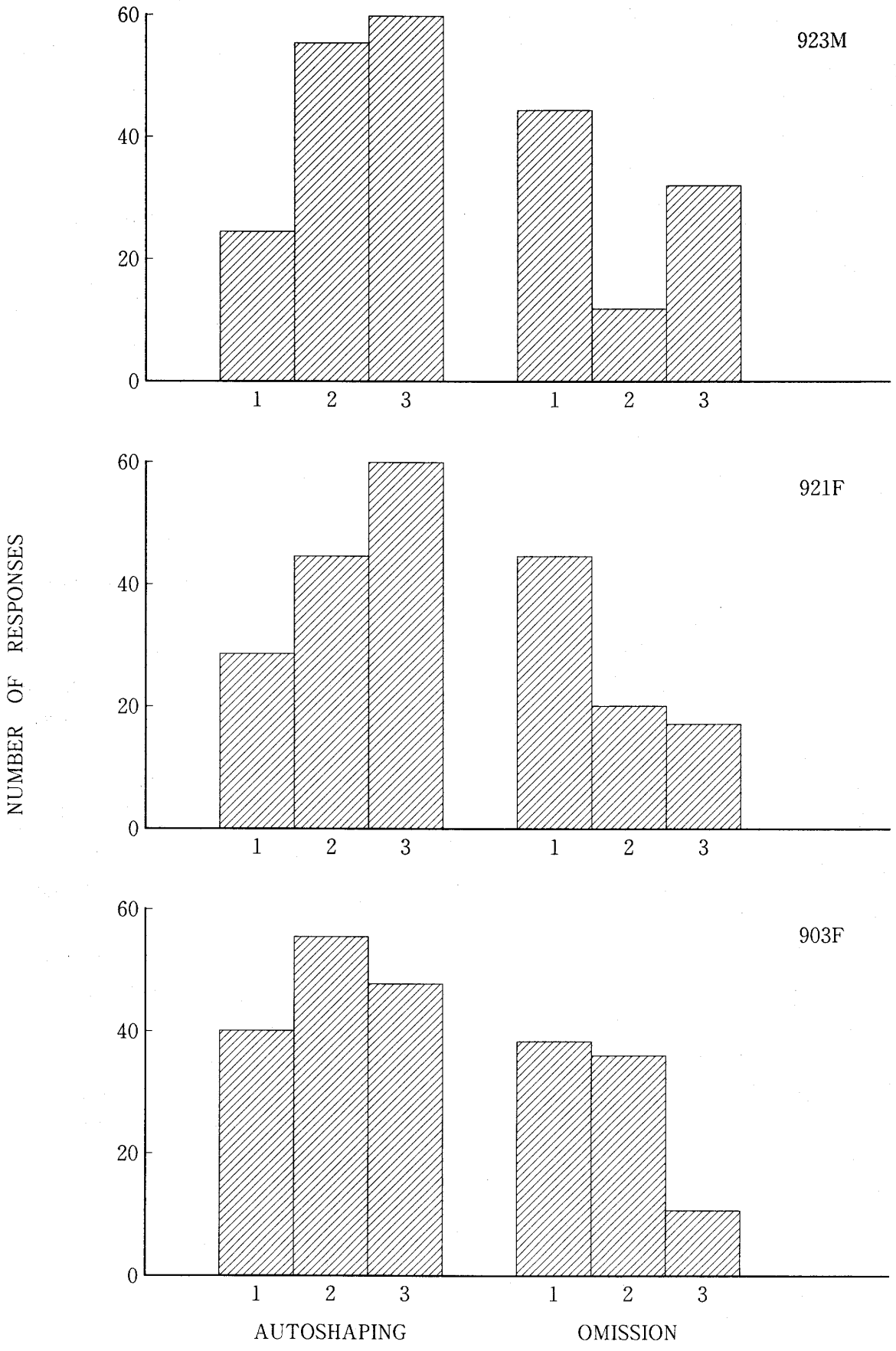
Almost all key presses were made on illuminated keys. Few responses were made during the ITI (see Table 2) and, even during the trial, the illuminated key was pressed far more frequently than any of the other four relevant keys (the keys that could be illuminated preceding food delivery). The discrimination ratio, the number of responses to the illuminated key divided by the number of responses to the five relevant keys during the trial,exceeded 80% for all monkeys (see Table 1) .

(2) OMISSION TRAINING. All three monkeys responded to the change in response -reinforcer contingency introduced by the omission procedure (see Figure 1). Response latencies increased and the number of trials without a response increased as training continued.

The discrimination ratio remained high (see Table 1) . Responses, when they did occur, were almost exclusively directed towards the illuminated key. Very few responses occurred during the ITI (see Table 2) .

DISCUSSION

Japanese monkeys, like rhesus monkeys (Sidman and Flecher, 1968) and squirrel monkeys (Gamzu and Schwan, 1974) respond to a manipulandum when exposed to the autoshaping procedure. The Japanese monkeys in the present study acquired the key pressing response quickly and showed an excellet discrimination be-


NUMBER OF RESPONSES
60
40
20
0
923M
921F
903F
1
2
3
AUTOSHAPING
OMISSION

tween the illuminated and dark keys.

These results are similar to those of Sidman and Flecher (1968) in that autoshaping differed markedly from those of Gamzu and Schwan (1974) whose monkeys required more than 14 sessions of light-food pairing before key pressing was autoshaped. Since these studies differ in a number of important ways direct comparison is not possible. It is worth noting, however, that in the study of Sidman and Flecher and in the present study members of the macaque genus served as subjects while in the Gamzu and Schwan study squirrel monkeys (Saimiri sciureus) were used. Relative sensitivity to stimulus-reinforcer and response-reinforcer contingencies may provide a means of classifying species in terms of level of cognitive development. Since increased ability to manipulate the environment implies a higher level of development, animals that are more sensitive to response reinforcer contingencies may be classified as higher on the evolutionary scale than those more responsive to stimulus -reinforcer contingencies. The omission training procedure seems to provide an excellent means of making such an assessment since it puts stimulus-reinforcer and response-reinforcer contingencies into direct conflict. In the present study autoshaping proceeded rapidly, as is generally reported in studies using pigeons as subjects. The monkeys in the present study seemed as sensitive as pigeons to the light-food pairing. Yet, when the omission procedure was introduced, the monkeys readily learned that their responses resulted in the omission of food. Pigeons, on the other hand, continue to respond for much longer. The squirrel monkeys studied by Gamzu and Schwan (1974) continued to respond longer than the Japanese monkeys when key presses prevented the delivery of food. These results suggest that Japanese monkeys may be more sensitive to response- reinforcer contingencies than both pigeons and squirrel monkeys.

In conclusion, comparison of the data of the pigeon (Williams and Williams, 1969), the squirrel monkey (Schwan and Gamzu, 1979), and the Japanese monkey (the present study) suggest that acquisition of the response in autoshaping and the decrease of the response in omission training are dependent upon the sensitivity of the subjects to both the stimulus-reinforcer and response-reinforcer and contingencies. In pigeons the stimulus-reinforcer contingency appears to be dominant in both autoshaping and omission training. On the other hand,in the monkey,response-reinforcer contingencies appear to be dominant in both procedures. These results suggest that it may be possible to order animals in terms of relative sensitivity to stimulus-reinforcer and response-reinforcer contingencies.

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