OBSERVATIONAL LEARNING IN JAPANESE QUAIL

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ABSTRACT

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In spite of interest in the cultural transmission of animal behaviour, observational learning has not previously been demonstrated in Japanese quail. In the present experiment three groups of 10 quail were trained to peck for reinforcement under discriminative stimulus control. The group which was allowed to observe performance of skilled companions learned faster than a group observing no-pecking models and a group learning without observational experience. Furthermore, observation of no-pecking models can inhibit learning. A sensory—sensory conditioning model can account for the results.

INTRODUCTION

Interest in observational learning has a long tradition in psychology (Morgan, 1896; Thorndike, 1898; Watson, 1908) and provides a main basis for understanding processes underlying the cultural transmission of behaviour in animals. However, observational learning has been demonstrated clearly in only a few nonprimate species. With regard to this problem, positive laboratory findings are reported in mammals such as cats (Herbert and Harsch, 1944; John et al., 1968), mice (Mainardi and Pasquali, 1968) and rats (Will et al., 1974; Del Russo, 1975; Sanavio and Savardi, 1979); convincing evidence is also reported for the dolphin (Tayler and Saayman, 1973).

Learning by observation has been observed in naturalistic and seminaturalistic studies of certain birds: the greenfinch (Petterson, 1965), the budgerigar (Dawson and Foss, 1965), the fork-tailed flycatcher, the white-throated sparrow and the black-capped chickadee (Alcock, 1969), the great tit, the blue tit and the marsh tit (Sasvari, 1979). Neuringer and Neuringer (1974) and Bullock and Neuringer (1977) analysed social learning by "following" in pigeons previously trained to eat from the experimenter's hand. In particular, it was found that, when pigeons could follow the experimenter's hand approaching the area of an operant key, without demonstrating the key-peck response, they learned to peck discriminately for grain more rapidly than pigeons that could observe the hand demonstrating the key-peck response,

but could neither follow the hand nor eat grain during demonstrations (Bullock and Neuringer, 1977). Cronhelm (1970) found that 7-day-old domestic chicks were greatly facilitated in learning to discriminate between stimuli indicating different schedules of reinforcement, if they were allowed to observe well-trained companions. Unfortunately the design of the study did not permit the separation of observation from social facilitation effect, as both effects were presented to the subjects at the same time.

These effects were partially differentiated in pigeons by Zentall and Hogan (1976). Birds observing key-pecking models learned better than pigeons observing models that were eating but not pecking, or neither pecking nor eating. Furthermore, the presence of a companion in the contiguous compartment, i.e. eating models and naive models, facilitated key-pecking responses if compared with birds learning alone. This finding differs from results with rats and mice, that have shown that the mere presence of conspecifics leads to retarded learning of new responses relative to learning alone.

Recent studies of companion effects in Japanese quail (*Coturnix coturnix japonica*) have shown significant inhibition of operant key-pecking during periods of visual exposure to a conspecific (Deni, 1977a,b). The finding refers to well-established responses and contradicts the prediction of social facilitation theory (Zajonc, 1965).

The ability of a quail to learn a new response by observation has not previously been tested; the present experiment was designed to control the presence of observational learning phenomena in the Japanese quail. Models were removed after the observation periods and subjects were required to learn alone to peck discriminatively for grain, in order to avoid distraction and/or social facilitation effects connected to the mere presence of a conspecific in the apparatus.

MATERIALS AND METHODS

Subjects

Thirty male Japanese quail (*Coturnix coturnix japonica*), 40 days old at the beginning of the experiment, were used as subjects. Animals were housed in groups and maintained on a 23-h food deprivation schedule. Models were four male quail of the same age as the subjects. Fifteen days before the beginning of the experiment models were housed with their pupils.

Apparatus

Two identical standard pigeon operant chambers were modified and used as apparatus. Each chamber was divided lengthwise by a plexiglass partition, thus giving two areas: one was equipped with standard pigeon keys and food-tray, the other was the observation area. Solid state components controlled the running of experimental procedures and recording of the data.

Procedure

Subjects could obtain a 6-s access to a grain mixture by pecking the response key when the key light was on (S^D). The S^D was presented at irregular intervals, averaging 30 s, each presentation lasting 8 s. Key-pecks when the light was off were recorded but not reinforced.

Two animals were overtrained on the discrimination (skilled models) and two animals were trained not to peck when the light was on or off (no-pecking models). Subjects were divided into three groups of 10 animals:

Group S observed the skilled models, i.e. a quail pecking only in S^D;

Group N observed the no-pecking models;

Group W was the one without observational experience, i.e. subjects spent periods in the observation area without any model to observe, but exposed to key-light-grain sequences, and served as a control for key-pecks resulting from secondary conditioning.

All the subjects were trained to peck discriminately in daily sessions for 7 consecutive days. On days 1 and 2 each subject was placed in the observation area and exposed to the assigned condition for 30 min. On days 3—7 sessions consisted of a 30-min observational phase, after which the subject was removed to the operant area and tested in 50 discrimination trials.

RESULTS

Seven birds of Group S and three of Group W learned to peck for grain, i.e. they pecked the response key on at least 75% of the trials on the last training session. None of the birds of Group N reached similar performance; at the end of the training their responses ranged from 0 to 20%. The observation of a companion pecking only when the discriminative stimulus was on (S^D) facilitated learning more than observation of an inactive model; in fact, more birds pecked in Group S (7 of 10) than in Group N (0 of 10), $P = 0.002$. (The S vs. W and W vs. N comparisons showed, respectively, $P = 0.078$ and $P = 0.105$). (Table I).

A 3 (groups) × 2 (stimuli) × 5 (sessions) repeated measures analysis of variance was computed on response/min frequencies and revealed that all the main effects were present (see Table II). Observational treatment of the groups clearly affect total key-pecks frequency. The presence of the discriminative stimulus and the groups × stimuli interaction were significant and indicate differences in learning to peck discriminately. The expected session effect was also demonstrated and substantiated by significant groups × sessions and stimuli × sessions effects. The primary finding, however, was a reliable triple interaction, which indicates that the groups learned to discriminate during sessions at different rates. Subsequent tests on means differences showed that, in session V, the number of discriminative key-pecks of Group S was higher than in both Group W ($P < 0.01$) and Group N ($P < 0.01$) and the number of discriminative key-pecks of Group W was higher than in Group N ($P < 0.01$).

TABLE I

Means of the key-pecks/min on S^D (stimulus on) and on S^Δ (stimulus off) (standard deviations in parentheses)

Group	Session										Total
	I		II		III		IV		V		
	S^D	S^Δ	S^D	S^Δ	S^D	S^Δ	S^D	S^Δ	S^D	S^Δ	
S	0.20	0.03	1.27	0.13	4.82	0.84	5.95	1.12	8.25	1.92	2.43
	(0.03)	(0.07)	(1.73)	(0.22)	(5.41)	(0.97)	(4.24)	(1.96)	(6.28)	(2.90)	
N	0.00	0.02	0.20	0.10	0.07	0.07	0.10	0.02	0.72	0.05	0.14
	(0.00)	(0.06)	(0.35)	(0.17)	(0.22)	(0.18)	(0.22)	(0.05)	(1.35)	(0.14)	
W	0.17	0.03	1.10	0.05	0.85	0.46	4.45	0.29	3.35	0.57	1.13
	(0.27)	(0.07)	(2.45)	(0.00)	(2.30)	(1.30)	(7.32)	(0.63)	(4.62)	(1.09)	

TABLE II

Summary of the analysis of variance on key-pecks/min frequencies

Source	SS	df	MS	F	P
A (groups)	263.49	2	131.74	5.90	0.01
B (stimuli)	218.70	1	218.70	17.23	0.001
C (sessions)	235.41	4	58.85	9.70	0.001
S (A)	601.97	27	22.29		
AB	119.47	2	59.73	4.70	0.05
AC	164.29	8	20.53	3.38	0.01
BC	112.54	4	28.13	8.09	0.001
SB (A)	342.53	27	12.68		
SC (A)	655.10	108	6.06		
ABC	74.75	8	9.34	2.68	0.05
SBC (A)	375.44	108	3.47		

SS = variation. MS = mean square.

As subjects could respond more than once to each S^D presentation, we further considered as dependent variable the number of trials in which at least one key response was performed (see Fig. 1).

A 3 (groups) × 5 (sessions) repeated measures analysis of variance, computed on the number of trials in which each subject responded (one or more times), showed the significant effects of observational treatment of groups, sessions, and group × sessions interaction (see Table III).

Analysis of the interaction effect indicated that the observational treatments of groups affect learning of the key response in session IV ($P < 0.001$) and session V ($P < 0.001$). Post-hoc Newman Keuls comparisons showed S > W> N in both session IV ($P < 0.05$) and session V ($P < 0.01$).
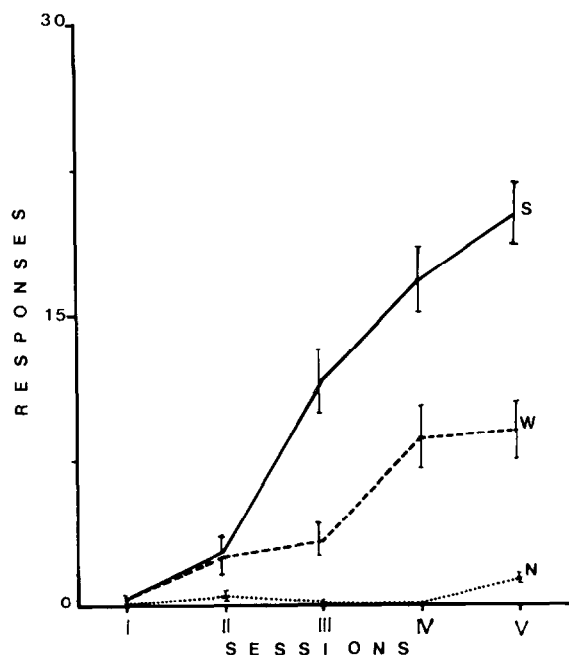
Fig. 1. Means of correct responses, i.e. key-pecking at least once on S^D of quails learning after observation of skilled models (Group S), naive models (Group N), without observational experience (Group W), on five sessions of 30 trials (vertical bars represent standard deviations).

TABLE III

Summary of the analysis of variance on number of trials in which quails responded (one or more times)

Source	SS	df	MS	F	P
A (groups)	2460.34	2	1230.17	5.92	0.01
B (sessions)	2098.58	4	524.64	15.77	0.001
AB	1410.46	8	176.31	5.30	0.001
S (A)	5607.64	27	207.69		
SB (A)	3591.76	108	33.26		

SS = variation. MS = mean square.

DISCUSSION

The results confirmed that even xenophobic animals like quails can learn faster a simple discriminative response by observing a trained conspecific. Group S which could have learned the relationship between discriminative stimuli and reinforcement from watching model trials, learned faster than both groups

N and W which did not have this opportunity. A sensory—sensory conditioning model can adequately account for this faster learning. When an observer is exposed to the repeated pairing of sensory events, a stimulus component of the observed sequence acquires the capacity to elicit in the observer the centrally aroused perception of the associated sensory events (Bandura, 1969; Mackintosh, 1974).

Moreover, observation of a quail which does not make any key-pecks in the apparatus can inhibit pecking of observers. The present finding differs somewhat from results with pigeons. Zentall and Hogan (1976) found that more pigeons pecked the response key when they could observe another pigeon neither pecking nor eating, than when no other pigeon was present. The different outcomes may indicate important species differences in the effects of conspecifics on social learning as well as differences in the procedure of the experiments. The present experiment avoided difficulties related to the confusion between social facilitation and observational learning. Subjects were tested alone, after models were removed, according to a narrow operational definition of the observational learning procedure (Pallaud, 1972; Del Russo, 1975; Mainardi and Sanavio, 1977). Moreover, animals had been housed with their models 15 days before the beginning of the experiment to limit/avoid distraction and arousal effects deriving from the mere visual exposure to a conspecific (Zajonc, 1965; Deni, 1977a,b).

Our findings are consistent with previous results in rats. In fact, on a visual pattern discrimination, observation of a model rat retarded learning in animals trained on the reversal of the observed discrimination (Kohn and Dennis, 1972). Sanavio and Savardi (1979) compared three groups of rats which received shuttlebox avoidance training after observation of either a trained model or naive model, or after adaptation and no model. It was found that observing a nonresponding model inhibits learning of the discriminative avoidance response. It is surprising that, in the study of observational learning the inhibitory effects have scarcely been considered.

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