

SOME MEASURES OF FEEDING BEHAVIOR IN CAPTIVE COMMON CROWS

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WHILE the feeding behavior of crows in the wild has been reported on extensively (Bent 1946, U.S. Natl. Mus. Bull. 191: 236), it has rarely been studied under controlled conditions (see Forbush 1907, cited in Bent 1946: 242). The present experiment was intended to provide information of the latter type, as the laboratory study of behavior permits manipulation and quantification of relevant variables.

It has recently been shown that captive Common Crows (*Corvus brachyrhynchos*) can be trained to respond (key-peck) for food reinforcement (Powell 1972, Auk 89: 738), using procedures and apparatus that are standard in operant conditioning experiments. The present experiment employed these methods to study the extent to which crows would respond for and eat a variety of foods. While the experiment was limited to foods that could be dispensed effectively by conventional operant conditioning apparatus, it is believed that inferences can be drawn relative to the crow's preferences for analagous types of food in its natural environment.

METHODS

Five adult crows were maintained between 80 to 85% of their free-feeding weights (FFW) during the deprivation phase, which constituted the major portion of the experiment. The crows received a supplemental feeding of dried dog food (Gaines Ken-L-Biskit) after each session as required to maintain their weight within these limits. As a follow-up, three of the crows (C8, 10, 11) were studied while at their free-feeding weights. The crows were housed in individual cages where they had free access to water and grit (crushed granite).

A Lehigh Valley pigeon test chamber, Model 1519C, modified for the crow as described earlier (Powell 1972), was employed. The time of food presentation was 3.0 seconds for each bird.

Each crow was trained (shaped) to key-peck through the method of successive approximation, with Gaines Prime (beef variety) as the reinforcer. The crows received additional training under a continuous reinforcement schedule (CRF) in which each response of the designated type is reinforced. This continued until responding was stable over five consecutive sessions. Then responding was studied under a CRF schedule for each of the following reinforcers—Noyes pigeon pellets (P. J. Noyes Co., Lancaster, New Hampshire 03584), Gaines Prime, shelled sunflower seeds, Mynah bird pellets (Modern Pet Foods Co., Torrance, California 90503), live mealworms, Purina mixed pigeon grain, Gaines Ken-L-Biskit (kibbled), and Niblets whole kernel yellow corn. Each food was studied until responding was stable over 5 consecutive sessions, providing that 10 sessions had been completed. The sequence of foods studied varied unsystematically between subjects. It was believed that this variation in

TABLE 1
NUMBER OF RESPONSES AND AMOUNT OF FOOD CONSUMED PER
SESSION UNDER THE DEPRIVATION PROCEDURE¹

Subject	Pigeon pellets	Prime	Sunflower seeds	Mynah pellets	Mealworms	Mixed grain	Ken-L-Biskit	Corn
Responses per session								
C6	51.4	191.8	115.0	71.2	198.4	130.6	192.2	107.2
C8	71.8	147.8	107.2	78.0	51.4	34.6	15.0	37.0
C10	39.0	47.0	53.0	57.6	86.0	13.3	94.0	49.0
C11	148.8	182.8	83.0	90.8	188.2	206.2	110.4	221.2
C12	57.2	200.0	62.6	51.0	99.2	4.3	117.4	0.0
Mean	73.6	153.9	84.2	69.7	124.6	77.8	105.8	82.9
Amount eaten per session (g)								
C6	11.4	10.0	10.4	15.4	34.4	9.6	11.6	25.4
C8	5.4	9.0	7.0	10.6	12.6	1.0	0.0	14.4
C10	16.8	10.6	7.6	18.4	26.0	0.0	10.8	33.4
C11	17.0	17.0	13.8	16.4	33.4	21.4	16.4	31.2
C12	5.4	11.8	6.2	11.4	22.2	0.0	12.8	0.0
Mean	11.2	11.7	9.0	14.4	25.7	6.4	10.3	20.9

¹ The results are based upon the mean performance over the last five sessions for each reinforcer.

sequence, plus the relatively long exposure to each food, would effectively control for order effects. In the follow-up phase of the experiment, responding for mealworms, Prime, and Mynah pellets was studied in three crows maintained at the free-feeding weights, and having free access to Ken-L-Biskit in their home cages. The purpose of this procedure was to determine whether differences in deprivation would influence the relative preference for several foods. All experimental sessions were 30 minutes in duration, which proved to be long enough for all responding to stop before this session ended. In addition to the number of responses, the amount of food eaten was regarded as a primary dependent variable. This was determined through pre- and postsession measurements of the amount of food, which took spillage within the test chamber into account.

RESULTS

The results presented in Table 1 show that the crows responded most often for Prime but ate larger amounts of mealworms than any other food. Mealworms produced the second largest number of responses, while corn was second in amount eaten, even though crow 12 did not respond for corn at all. The fact that number of responses and amount eaten did not correlate perfectly merely seems to indicate that the crows were able to obtain larger amounts per presentation of some foods than others, as presentation times were the same in all cases. For example, they were able to obtain approximately 0.25 g per presentation of corn but only 0.08 g per presentation of Prime. Marked individual variations also occurred in amount of food obtained per presentation, as exemplified by the large

TABLE 2
NUMBER OF RESPONSES AND AMOUNT OF FOOD CONSUMED PER
SESSION UNDER THE FREE-FEEDING PROCEDURE¹

Subject	Responses per session			Amount eaten per session (g)		
	Prime	Mynah pellets	Meal-worms	Prime	Mynah pellets	Meal-worms
C8	18.2	19.8	76.4	2.8	0.8	9.2
C10	5.4	0.0	8.4	1.0	0.0	1.4
C11	13.2	22.8	68.6	3.4	2.4	21.0
Mean	12.3	14.2	51.1	2.4	1.1	10.5

¹ The results are based upon the mean performance over the last five sessions for each reinforcer.

difference in responding between crows 10 and 11, where as the two birds generally ate similar amounts. The amount of food consumed per session generally corresponded to the weight of the crow. The largest crow (C11, FFW = 525 g) usually ate the most, while the smallest crow (C12, FFW = 330g) ate the least.

While there was substantial intersubject consistency in apparent preference for the different foods, individual birds showed several striking idiosyncracies. Most surprising, perhaps, was the failure of crow 12 to respond for corn. Similarly, three of the crows responded little or not at all for mixed grain, while crow 11 ate more grain than any other food except mealworms and corn. Mixed grain was clearly the least preferred food of those studied.

The results under the free-feeding procedure, which are presented in Table 2, show that the crows responded much more often and ate larger amounts of mealworms than either Prime or Mynah pellets. These results essentially agree with those presented in Table 1. No evidence indicates that the sequence of foods had any influence upon behavior during the experiment.

DISCUSSION

As a whole the present findings indicate that the live mealworm is the most preferred food of those studied. It should be noted that this preference may be based upon the mobility of this food item, as opposed to taste, nutrition, or other factors. From a practical standpoint there are reasons to favor either Prime or Mynah pellets for use in conditioning experiments. All of the crows responded frequently and consumed substantial amounts of these foods. Both foods are readily available, require no refrigeration, and will last more or less indefinitely. Mealworms, on the other hand, must be kept in a suitable medium, and sorting out the required number of worms each day is a time-consuming task.

As mentioned earlier, the crows always ceased responding before the

session ended, indicating that they had reached a temporary state of satiation. No directly comparable results with other birds are available, but the findings of an earlier experiment appear relevant. Reese and Hogenson (1962, *Analysis Behav.* 5: 239) found that pigeons, which ranged in weight from 63% to 92% of their free-feeding weight, responded 200 to 400 times under a CRF schedule for 4.0 seconds access to mixed grain. These authors did not present their results in terms of amount of food eaten, but we have noted that deprived pigeons usually eat 40 to 60 g of food in a short period of time under a CRF schedule. Thus it appears that deprived pigeons respond more and eat more food in a relatively shorter period of time than do crows. A possible basis for this difference is that pigeons have a crop, while crows do not, although crows do have an enlarged storage esophagus.

When conducting experiments involving food reinforcement with crows or other birds lacking a crop, these factors must be taken into consideration. Adjustments in food presentation time, session duration, or both must be made to avoid satiation effects.

The present results further confirm the omnivorous character of feeding behavior in crows, while showing that some rather marked individual differences in this behavior do exist. From an ecological standpoint, the most important finding appears to be the crows' preference for live insect larvae (mealworms). This finding again suggests (Bent 1946) that crows, which have generally been regarded by man as a pest, may contribute significantly to the control of insect populations, which is usually to man's benefit.

SUMMARY

The number of responses and amounts eaten for eight different foods (reinforcers) were studied with crows trained to key-peck under a continuous reinforcement schedule in standard operant conditioning apparatus. Live mealworms was generally the most preferred food, but Prime dog food and Mynah bird pellets were also effective when the crows were food-deprived. Several instances of individual differences in food preferences were noted, suggesting that some diversity occurs in this type of crow behavior.

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