The preference of rats for free or response-produced food*

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Three experiments were performed to investigate the preference of rats for either free or response-produced food. Rats were trained to free feed in an operant chamber and then to leverpress for food. Subsequently, they were given a choice between continuing to leverpress for food on CRF, FR 2, and FR 10 schedules or free feeding. In three experiments the independent variable was the method of free-food presentation: A fixed free-food dish was used in the first experiment, a movable dish in the second, and a large flat dish in the third experiment. The results of the three experiments were very similar, with most of the rats showing a preference for the free food. This preference increased further when more than one response was required to produce a food pellet. These results contradict any conclusion that rats have a generalized tendency to prefer response-produced to free food but provide no answer to the question of why rats do on occasion respond for food in the presence of free food.

A number of recent experiments have shown that rats and pigeons will respond for food in the presence of free food. Carder and Berkowitz (1970), for example, reported that rats given a choice between obtaining food pellets by leverpressing or by free feeding from a bowl of pellets in the experimental chamber showed a strong preference for the response-produced pellets. Even when two responses were needed to produce a food pellet, five of the six rats continued to earn most of the pellets they ate. Only when the work requirement was increased to 10 responses did the preference for response-produced food weaken. When retested with each response producing a food pellet, five of the rats again preferred response-produced food. Similar results have been reported for pigeons given a choice between keypecking for food and free feeding (Neuringer, 1969, 1970) and for children who could obtain marbles either by barpressing or by free-loading (Singh, 1970).

Singh (1972) has suggested that such results show the pervasiveness of the "Protestant ethic" as a determinant of behavior, i.e., that rats, pigeons, and children prefer to work rather than to free-load. The experiments reported in this paper were undertaken to examine the strength and generality of such preferences for work.

EXPERIMENT I

In our first experiment, we investigated the effects of a change in the method of free-food presentation. Carder and Berkowitz (1970) presented free food in a small movable dish. They report that the rats frequently moved the dish and that: "On more than one occasion the rat pushed the dish in front of the food magazine and then later pressed the lever [Carder & Berkowitz, 1970, p. 1273]." We hypothesized that the physical proximity of the free-food dish, food magazine, and lever might have contributed to the tendency of the rats

to continue leverpressing in the presence of free food. Had the free-food dish been fixed away from the lever, making free feeding and leverpressing physically discrete and separate, it is possible that fewer responses would have been emitted in the presence of the free food. We investigated this possibility in our first experiment.

Method

Subjects

Eight male hooded rats of the Long-Evans strain were used. The rats were from 100 to 120 days old at the start of the experiment and were naive. Twenty-four hours prior to the start of training they were placed on a 22-h food-deprivation schedule. Once training began, they received food only in the operant chamber.

Apparatus

Two operant chambers (Gerbrands, Model C), housed in sound-attenuating research chests (Grason-Stadler, Model 1101), were used as experimental chambers. The earned food reinforcement consisted of one 0.045-g Noyes food pellet. Free food was presented in a dish, 7.9 cm in diam and 4.0 cm deep, that was clipped into a holder bolted to the rear wall of the operant chamber, directly opposite the food magazine and diagonally opposite the lever. The free-food dish could not be moved by the rats. Free food consisted of 300 of the 0.045-g food pellets.

Procedure

Except for the method of free-food presentation, the training and test procedures were identical to those employed by Carder and Berkowitz (1970). On each of the 3 days of training, the rats were placed individually in an operant chamber for 75 min and allowed to eat from the 300 pellets in the free-food dish. The number of these pellets eaten each day was counted and recorded. They were then given six daily 75-min leverpress training sessions with every response reinforced (CRF), followed by two 60-min free-food test sessions. This was followed by 2 days of training with every second response reinforced (FR 2), 2 days of free-food testing on FR 2, 2 days of training with every tenth response reinforced (FR 10), 2 days of free-food testing on FR 10, and, finally, 2 free-food test days on CRF. On the free-food test days, the free food was introduced after 25

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Table 1
Percentage of Free-Food Pellets Eaten

S	CRF	FR 2	FR 10	CRF
F12	99	100	100	100
F9	92	100	100	93
F8	74	61	91	76
F13	70	82	96	72
F14	62	83	80	59
F15	49	61	80	100
F11	9	9	68	10
F7	5	66	100	0

responses on CRF and after 50 responses on FR 2 and FR 10. All training sessions were 75 min, while test sessions lasted 60 min. The behavior of the rats was monitored using closed-circuit television and was recorded on the free-food test sessions.

Results

The number of pellets earned by leverpressing after the introduction of the free food and the number of free-food pellets eaten were recorded for each of the test sessions. The percentage of all pellets eaten that were free-food pellets was then determined. These percentages were ranked and are shown in Table 1. Five of the eight rats ate a majority of free-food pellets on all of the reinforcement conditions; two of the rats preferred response-produced food on all of the CRF tests, and on FR 10 all of the rats preferred the free food. All 300 of the free-food pellets were eaten during 13 of the 64 free-food test sessions. The group mean numbers of free-food pellets eaten during the CRF, FR 2, FR 10, and CRF free-food tests were 125, 179, 220, and 152 pellets, respectively.

Discussion

Five of the six rats tested by Carder and Berkowitz (1970) showed a strong preference for response-produced over free food when tested on CRF and FR 2. Although two of the rats we tested showed a similar preference for response-produced food, the majority of the rats in our experiment clearly preferred the free food. The major procedural difference between the two experiments concerned the method of free-food presentation. Carder and Berkowitz used a movable free-food dish, whereas we used a fixed dish. To test whether this difference in the methods of free-food presentation was responsible for the dissimilar experimental results, we undertook a second experiment using training and free-food test procedures identical to those used by Carder and Berkowitz (1970).

EXPERIMENT II

Subjects

Eight male hooded Long-Evans rats, 100 to 120 days old at the beginning of the experiment, were used. One of the rats died

during training, so results will be reported for the remaining seven Ss.

Procedure

The apparatus, training, and test procedures were identical to those of the first experiment, except that free food was introduced in a movable dish, 6.5 cm in diam and 2.5 cm deep. When introduced, the dish held 300 pellets. As in the Carder and Berkowitz (1970) experiment, the dish was placed against the back wall of the operant chamber and could be moved by the rats.

Results

Table 2 shows the results of this experiment. Four of the rats clearly preferred the free food under all of the reinforcement conditions; two of the rats showed an initial preference for response-produced food, but this preference changed when the ratio requirement was increased. All 300 of the free-food pellets were eaten during 17 of the 56 free-food test sessions. The group mean numbers of free-food pellets eaten during the free-food tests were: 153 pellets on CRF, 208 on FR 2, 215 on FR 10, and 184 pellets on the CRF retest. The rats frequently moved the free-food dish around the operant chamber, and on four occasions the free-food dish was tipped over by the rat. When this happened, the pellets were collected from the tray under the chamber at the end of the session and were counted as uneaten free-food pellets.

Discussion

The results of this experiment represent a failure to replicate the findings of Carder and Berkowitz (1970). The results also show that the method of free-food presentation was not responsible for the free-food preference shown by most of the rats in our first experiment. With both a movable and a fixed free-food dish, a majority of the rats in both of our experiments consistently preferred free over response-produced food.

Observations of the rats during the free-food test sessions suggested one possible explanation of our results. In both experiments the rats were observed to spend a great deal of time climbing into and around the free-food dishes. This exploratory and manipulatory behavior may have reinforced approach responses to the free-food dishes and, consequently, increased the probability that the rats would free feed. Possibly the

Table 2
Percentage of Free-Food Pellets Eaten

S	CRF	FR 2	FR 10	CRF
M16	100	72	97	87
M8	79	76	84	71
M10	78	94	100	93
M9	71	98	100	82
M15	42	62	61	37
M11	26	79	93	81
M7	21	75	96	11

free-food dishes were more "intrinsically attractive" to the rats than was the lever, so they preferred to free feed. To test this possibility, we conducted a third experiment in which a large, flat, and possibly less attractive, free-food dish was used.

EXPERIMENT III

Subjects

Six naive male hooded rats were used.

Procedure

The apparatus, training, and test procedures were identical to those of the second experiment, except that on free-food test sessions the free food was introduced in a movable flat dish, 12 cm in diam and 1 cm deep. Preliminary observations showed that the rats seldom moved such dishes.

Results

The results of this experiment are shown in Table 3 and are very similar to those of the previous two experiments. On CRF four of the six rats preferred the free food; on FR 2 and FR 10 all of the rats preferred to free feed; when retested on CRF, four of the rats again preferred to free feed. All 300 of the free-food pellets were eaten during 10 of the 48 free-food test sessions. The group mean numbers of free-food pellets eaten during the free-food test sessions were: 169 pellets on CRF, 221 on FR 2, 249 on FR 10, and 189 on CRF retest.

Discussion

As in the previous two experiments, most of the rats clearly preferred the free food. A Kruskal-Wallis one-way analysis of variance showed that the differences among the results of our three experiments were not significant. Consequently, we concluded that the methods of free-food presentation we used did not affect the rats' food preferences. Although a small number of rats continued to work for food in the presence of free food, the majority of the Ss in all three experiments showed a preference for the free over the response-produced food.

A number of reasons for the differences between our results and those of Carder and Berkowitz (1970) must be considered. Although we attempted to replicate the training and test procedures used in the earlier experiment, it is quite possible that there were subtle, but important, differences in the procedures used. One clear difference was that we used hooded rats, whereas Carder and Berkowitz (1970) used albinos. However, the likelihood that strain determines the preferences of rats

Table 3
Percentage of Free-Food Pellets Eaten

S	CRF	FR 2	FR 10	CRF
F5	93	91	89	81
F2	80	99	100	99
F6	74	68	82	77
F1	63	70	71	77
F4	53	69	95	27
F3	0	98	100	2

for either free or earned food is considerably weakened by the results of an experiment recently reported by Taylor (1972). Using albino rats, Taylor found strong and consistent preferences for both free food and water. Similar results have been reported by Koffer and Coulson (1971). They investigated the preferences of cats for free or response-produced food and reported that their "felines" are "indolent," in that they consistently preferred free to earned food.

Although 6 of the 21 rats tested on CRF in our experiments continued to earn a substantial number of pellets in the presence of free food, the majority of the rats tested showed a preference for free food, with such preferences being particularly marked when more than one response was required to produce food. Three different methods of free-food presentation did not affect the preferences of the rats for either free or response-produced food. Our results, together with those of Koffer and Coulson (1971) and Taylor (1972), indicate the prematurity of any conclusion that rats have a generalized tendency to prefer earned to free food. However, the question of why some rats will continue to respond for food in the presence of free food should certainly be subjected to further experimental analysis.

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