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## Bar Press Behavior Reinforced by Pup Retrieval<sup>1</sup>

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*Abstract.* A method was developed to test the reinforcing effects of pup retrieval on the behavior of lactating female rats. A modified bar press chamber was employed. One section of the chamber served as the nest area for the mother and young. The female was taught to bar press in order to be admitted to a retrieving area containing a pup which the female could retrieve and return to the nest. The results indicated that high and sustained rates of bar pressing could be obtained using pup retrieval as the reinforcing event. The data obtained using this method were discussed in relation to bar press conditioning employing conventional reinforcers.

Part of the maternal behavior pattern in the rat consists of retrieving pups that are found outside the nest. Some combination of stimuli which the pup presents is sufficient to evoke this response, which consists of the female leaving the nest, approaching the pup, grasping it with the teeth behind the head, and depositing it back in the nest area. The retrieving response persists in most lactating females up until about the time the pup's eyes are opened. At this developmental stage, the pups are capable of considerable locomotion and the female typically ceases any vigorous retrieving activity.

The retrieving response, as well as other aspects of the maternal pattern, has been of continuing interest to students of animal behavior, who have investigated many of the variables which control or influence it. In the present work, a technique was devised for studying the reinforcing properties which an opportunity to retrieve the young may provide.

The first attempt was to bring the retrieving response under the control of a light. This was done by pairing light onset with the opportunity for pup retrieval. The time between light onset

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and seizure of the pup was recorded. After about 30 trials the latencies reached a low and stable value. Although this discrete trial procedure suggested that conditioning was possible using pup retrieval as a reinforcer, a rate measure seemed more desirable since it would probably be more sensitive and perhaps more convenient in terms of research that was planned for the future. To obtain a rate measure, a bar press situation was chosen.

## METHOD

### *Apparatus*

The initial apparatus was an enclosed alley 36 in. long, 8 in. wide, and 8.5 in. deep. It had a hardware cloth top and bottom. The sides and ends were made of wood. One end of the alley served as a nesting area and the opposite end was employed as a retrieving area. Three inches above the floor, mounted on the wall next to the nesting area, was a bar. A removable partition between the nest and the bar blocked the animal from the bar except during experimental sessions. A guillotine door separated the bar and the nest area from the retrieving area. There was also a fold-down door used for pup presentation at the end of the retrieving area, and a sliding door which permitted *E* access to the nest area. A 15-watt incandescent light which could be turned on and off by *E* was situated directly above the bar.

### *Procedure*

*Operant level.* The typical procedure was to place the mother and the young in the nest area one to three days following parturition. The animals were given approximately 24 hours to adapt to the new surroundings, during which time the partition which separated the bar from the nest was left in place. On the day following, the pups were separated from the female and placed outside the apparatus. At the same time, the partition was removed, providing the female access to the bar area. If a bar press occurred at any time during this experimental session, the light was turned on, the guillotine door was raised, and the animal was permitted to explore the retrieving area. If the female entered the retrieving area, the guillotine door remained in the up position until the animal returned to the bar area, at which time the door closed until another bar press occurred. In this manner, an operant level for bar pressing was obtained when this response produced light onset plus the raising of the guillotine door. A pup was never presented during determination of the operant level.

*Acquisition.* On the day following determination of the operant level, acquisition training was begun. The procedure for acquisition was essentially the same as that used in determining

the operant level, except that a bar press turned on the light, the guillotine door was raised, *and* a pup was present behind a small block in the retrieving area and could be seized and returned to the nest.

Bar pressing was initially conditioned on a continuous reinforcement schedule (i.e., each bar press led to light onset, raising of the door, and pup presentation). After approximately two 45-minute sessions, a variable ratio schedule was begun, during which only multiple bar presses produced the light, door raising, and pup presentation. While the female was retrieving or bar pressing, *E* quietly removed the pups that had accumulated in the nest, thereby providing a continuous supply of pups to use as reinforcers. Whenever possible, each pup was removed as soon as it had been retrieved. This procedure had the advantage of discouraging the female from spending excessive time in the nest cleaning or nursing the young.

*Extinction.* At first, extinction was identical to the procedure used in determination of the operant level. However, most females soon began to spend periods of several minutes in the retrieving area, necessitating a procedural change to eliminate these interruptions in the response chain. Under the changed procedure, door opening occurred only with every fifth light onset.

#### RESULTS AND DISCUSSION

Using a variable ratio schedule, the best performance to date was obtained from a hooded rat that emitted 780 bar presses for 99 pup reinforcements in a 45-minute session. This contrasts sharply with the three bar presses which the same female emitted in the same length of time as an operant level.

From the extinction data obtained thus far, it appears that the momentary rate of pressing does not decline sharply, at least in the early part of extinction, but, following a "burst" of responses, there are increasingly longer delays before the animal returns to press again.

There seems to be little doubt that bar press behavior can be conditioned using pup retrieving as the reinforcing event. The work completed so far suggests some interesting similarities and differences in behavior conditioned in this way as compared with conditioning obtained using conventional reinforcers. For example:

1. Magazine training, during which the light and pup are repeatedly paired prior to the start of bar press training, appears to be unnecessary.
2. It appears that behavior can be shaped in this situation just

as in other operant conditioning situations where conventional reinforcers are used.

3. It has been possible to produce very high and stable bar press rates for brief periods, but pauses invariably occur between retrievings and the next bar press. The shorter pauses can be attributed to the time required to retrieve the pup. Occasionally longer pauses occur during which grooming, eating, and other irrelevant activity takes place. The cumulative record, Figure 1, illustrates both types of pauses.

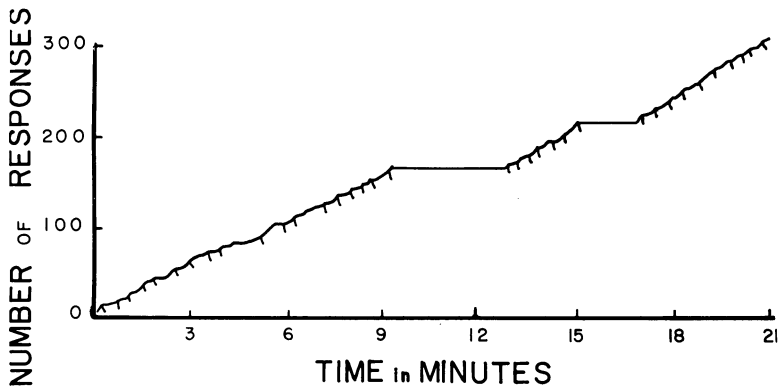


Figure 1. Cumulative record for a 21-minute segment of a bar press session for one hooded rat.

4. Some notable failures have been encountered in attempting to condition bar pressing with this type of reinforcer. In some cases only very low and highly variable bar press rates were obtained, or in other cases, complete failure resulted. In each of these cases to date, however, the female did not retrieve at all, or, if it did, retrieving was very erratic and highly unpredictable. At present, if a female does not exhibit strong retrieving initially, no attempt is made to work with it.

5. Once bar pressing has been conditioned, a female will sometimes continue to press and run to the retrieving area for some time after it stops retrieving its young altogether. That is, the pup is "examined" but not seized and returned to the nest.

Our work to date has been exploratory in nature and has been concerned chiefly with the development of a method for the investigation of this form of behavior. We have been encouraged by the progress thus far, and hopefully this technique, or a modified version of it, will make possible the investigation of a wide range of variables which affect this portion of the maternal pattern.