

# OPERANT EXTINCTION AFTER FIXED-INTERVAL SCHEDULES WITH YOUNG CHILDREN<sup>1,2</sup>

SIDNEY W. BIJOU

University of Washington

The purpose of this paper is to present some findings on operant experimental extinction in young children after conditioning on three fixed intervals of reinforcement. Observations reported here have been obtained from investigations in progress during the past two years.

## APPARATUS

A detailed account of the methodology employed has been presented in a previous paper (2). Essentially, the apparatus consists of a lever as the manipulandum, a universal-type reinforcer dispenser, and two standard toys available for play at any time. There is an adult who brings the child to the laboratory and takes him out. During the session she remains in the room behind an opaque screen. There is also an E in an observational room who operates the controls and makes notations on changes in behavior.

## SUBJECTS

Behavior during extinction was observed in four youngsters following training on fixed-interval schedules of reinforcement of 20, 30, and 60 seconds. The initials of each child, sex, age at the time of the first observation, and previous experimental experience are as follows:

Subject	Sex	Age	Previous Experience
M. G.	F	4-3	Yes
B. K.	F	4-1	Yes
M. M.	F	4-2	No
T. B.	M	4-1	No

<sup>1</sup> These investigations were supported by a grant from the National Science Foundation.

<sup>2</sup> I wish to express my gratitude to Robert Sharply and Persis Sturges for their assistance in these ventures.

The children were attending the University Nursery School, which is made up of preschoolers with a mean I. Q. of about 116 (Revised Stanford-Binet), and came from families with fathers in the upper three occupational categories of the Minnesota Scale for Occupational Rating (1). They are therefore slightly above average in intelligence and definitely above average in socio-economic status.

Previous experimental experience of M. G. and B. K. consisted of three sessions, each during the previous academic year and involving dropping-a-ball-in-hole operant. For M. G. the first session consisted of 30 responses reinforced with 6 trinkets and motor hum on a 20% basis followed by extinction with hum; the second session involved 30 responses reinforced with 6 trinkets and buzzer on a 20% basis followed by extinction without buzzer; and the third, 6 responses for 6 trinkets and motor hum followed by extinction with motor hum. B. K. 's first and second sessions were the same as M. G. 's except that the first extinction was without hum and the second was with buzzer. Her third run consisted of 25 responses reinforced with 5 trinkets and buzzer on a 20% basis followed by extinction with buzzer.

#### PROCEDURE

On the first day of the study each child is brought into the laboratory by a young lady and told: "Here are some toys (pointing to the apparatus on one table and the standard toys on another); you may play with them as long as you like." The child is then left to do as he wishes while the assistant retires to a chair behind a screen and reads a book. Questions and comments addressed to her are answered with the statement: "You may play with the toys as long as you like." Upon instruction from E, through an ear-piece speaker, she terminates the session and returns the child to his group. Succeeding sessions are conducted the same way except that instructions are reduced to: "You may play with the toys as long as you like."

The first experimental day was devoted to observing the operant level, or the number of responses to the lever without experimental reinforcers. Here are the essential findings:

Subject	Length of Sessions (Min.)	Number of R's	Number of R's per Min.
M. G.	36.0	268	7.4
B. K.	20.8	59	2.8
M. M.	15.2	128	8.5
T. B.	19.0	56	2.9

T. B. was given a second operant session because the first was terminated before he expressed a desire to leave. The next day he stayed in the laboratory for 32.4 minutes and emitted 80 responses, yielding a rate of 2.6 responses per minute. This is roughly the same as was found in the first session.

On the first conditioning day, experimental reinforcers were introduced and the method of approximation was used to "stretch out" the intervals between reinforcements. M. G. was placed on a 60-second interval, B. K. and M. M. on a 30-second interval, and T. B. on a 20-second interval. Plastic trinkets served as reinforcers, delivered at intervals 1, 2, 4, 7, 11, 15, and 19. The sound of the dispenser motor was given during intervals 3, 5, 6, 8, 9, 10, 12, 13, 14, 16, 17, and 18. Each

child, therefore, was on a fixed interval with trinket reinforcers distributed according to an increasing ratio schedule. This program, compared with others in which trinkets were consistently presented in accordance with a fixed interval or ratio, proved difficult. However, explorations were continued because of interest in this type of schedule and because of the desire to learn more about obtaining stable behavior in children of this age with the minimum number of reinforcers.

The following table summarizes information on the conditioning sessions.

Subject	Schedule	Sessions			No. of R's	No. of SR's
		No.	Av. Duration (Min.)	Av. Interval (Days)		
M. G.	FI 60	3	12.2	22.0	2985	31
B. K.	FI 30	3	13.4	29.0	2234	45
M. M.	FI 30	4	12.8	25.0	1878	68
T. B.	FI 20	4	10.0	25.3	1762	73

The average time per training trial ranged from 10 to 13.4 minutes, and the average number of days between observations ranged from 22 to 29 days. M. G. made the highest number of lever presses and received the lowest number of reinforcements (trinket and motor hum), and T. B. had the opposite experience.

The procedure on the day of extinction was to bring the child into the laboratory, and trinkets and motor hum were dispensed according to the child's training schedule as usual. After three trinkets and one motor hum (trinket, trinket, hum, trinket) were dispensed, extinction began. Sessions ended for three of the children when they indicated in a clear and persistent manner that they were finished and wanted to return to their nursery school group. For one child, T. B., the period was shortened by E because it was time for his mother to take him home.

### RESULTS AND DISCUSSION

Figure 1 shows the extinction performances on cumulative curves. M. G. had the highest rate (84.3 R's per minute), and T. B. the lowest (10.0). B. K. and M. M. gave intermediate rates (32.1 and 22.7, respectively). Although T. B. might have made more responses had time allowed, his total probably would not have come up to the others. Other changes in behavior accompanying the shift from training to extinction were:

- M. G. - mumbling to herself; hitting the lever in a variety of ways.
- B. K. - playing with trinkets; sucking thumb during last 8 minutes of period.
- M. M. - increased amount of manipulation of toys and trinkets; increased activity about the room.
- T. B. - increased activity in room; resting head on arms; leaving trinkets in tray at end of session.

Data from these four children may be summarized as follows: (a) the rate of the cumulative extinction curves appears to be related in rank-order fashion to the size of the fixed interval over the range observed, and (b) there is no clear-cut relationship between base-line performance and extinction. These findings cannot be directly compared with those on infrahuman subjects such as the Wilson and Keller study (3) since here two classes of reinforcers, trinket plus hum and hum only, were varied in a programmatic manner. On the basis of general findings,

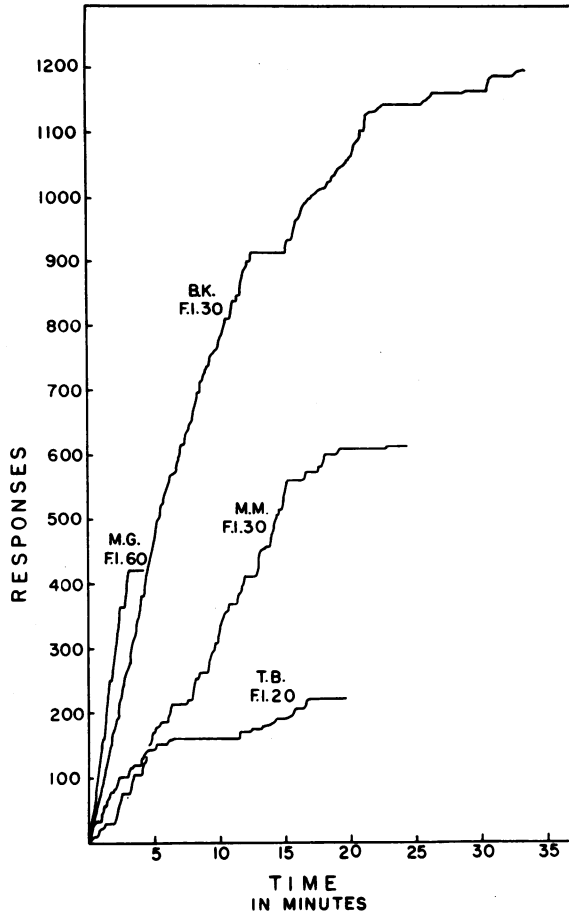


Fig. 1. Extinction after fixed-interval schedules of 60, 30, and 20 seconds.

FI 60 might be expected to yield a relatively greater number of responses. Further observations in children will undoubtedly clarify the relationship in question; however, it may be of interest to discuss briefly operant experimental extinction in children.

It is our impression that, compared with infrahumans, children show tremendous variability in the number of responses during extinction for a given schedule of reinforcement. In all probability, relevant antecedent factors are stimuli produced by the subject in emitting other operants. In other words, humans appear to alter experimental extinction by introducing stimuli not under the control of the E. The results may go in either direction. If the response-produced stimuli have positive discriminative or reinforcing properties, such as beating time, producing vibrations, counting, or singing, the response rate and number increase. If they have discriminative functions leading to competitive or aversive behavior, such as saying, "No more are going to come out," or "I'm sorry I broke the machine," the response rate and number decrease. Even though the responses emitted will, of course, depend upon the history of the individual in similar nonreinforcing situations, the hypothesis can be evaluated in a series of systematic experiments in which some of these responses are brought under experimental control.

## REFERENCES

1. Bijou, S. W. Patterns of reinforcement and resistance to extinction in young children. *Child Developm.*, 1957, 28, 47-54.
2. Bijou, S. W. Methodology for an experimental analysis of child behavior. *Psychol. Rep.*, 1957, 3, 243-250.
3. Wilson, M. P., and Keller, F. S. On the selective reinforcement of spaced responses. *J. comp. physiol. Psychol.*, 1953, 46, 190-193.