

DISCRIMINATIVE AND REINFORCING PROPERTIES OF TWO TYPES OF FOOD PELLETS¹

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In Experiment I some discriminative functions of food pellets were studied by developing a multiple schedule of reinforcement (*mult* FR 30 FI 3) in which the delivery of a standard laboratory food pellet as a reinforcer set the occasion for reinforcement on every 30th response (FR 30), and the delivery of a sucrose food pellet as a reinforcer set the occasion for reinforcement after a 3-min interval (FI 3). Discriminative stimulus control by the type of pellet was also demonstrated by reversing the operant discrimination and having the standard pellet control the FI 3 and the sucrose pellet control the FR 30. In Experiment II a *mult* FR 30 FR 30 with two bars was developed; a standard food pellet was followed by an FR 30 on Bar 1 and extinction (*ext*) on Bar 2, while a sucrose pellet was followed by an FR 30 on Bar 2 and *ext* on Bar 1. A control rat was placed, for comparison, on a mixed (*mix*) FR 30 FR 30 schedule with two bars, but neither bar correlated with the type of food pellet. In Experiments I and II the similarity between pellet controlled multiple schedules and multiple primed schedules was discussed, as was the comparability of transitions and effectiveness of control between pellet controlled multiple schedules and multiple schedules providing continuous exteroceptive stimuli.

The purpose of this study was to investigate some discriminative functions of reinforcing stimuli by using two types of food pellets as reinforcers and following each with a different schedule of reinforcement. These procedures involve the differential reinforcement of responses as a consequence of the prior type of pellet. If the discrimination is effective the process results in changes in the rate of responding occasioned by stimuli correlated with presentation of the reinforcer and with the appropriate consummatory behavior.

EXPERIMENT I

A multiple schedule of reinforcement is characterized by programming reinforcements on two or more schedules, each schedule being correlated with an appropriate controlling stimulus (Ferster and Skinner, 1957). The first two-ply multiple schedule developed in this study involved presenting a standard formula (*St*) pellet and following it with a reinforce-

ment on every 30th response (FR 30), or presenting a sucrose (*Su*) pellet and providing a reinforcement after a 3-min interval (FI 3). The pellets were presented one at a time.

Such a schedule of reinforcement may be called *mult St* FR 30 *Su* FI 3 because the standard pellet precedes and is correlated with the following ratio schedule, while the sucrose pellet precedes and is correlated with the following interval schedule. There is similarity between a multiple schedule with correlated pellets and a multiple schedule with a prime. In a *mult* FR *primed* FI (Ferster and Skinner, 1957, p. 630), for example, the stimulus initially controlling the FI performance is withdrawn, whereas in a *mult St* FR 30 *Su* FI 3 schedule the stimulus initially controlling the FI and FR performance is consumed.

Subjects

One experimentally naive male pigmented rat, four to five months old at the beginning of the experiment, was maintained at 80% or less of free feeding weight.

Apparatus

A standard type experimental enclosure, placed in an ice box, was used. Two Model D Gerbrands pellet dispensers were provided,

¹This work was supported in part by a grant from the National Science Foundation to the University of Miami. Appreciation is expressed to Paul Kleinginna for invaluable assistance in carrying out portions of Exp II. Reprints may be obtained from Daniel B. Cruse, Dept. of Psychology, University of Miami, Coral Gables, Florida 33124.

one to dispense Noyes 45 mg standard formula pellets and another to dispense Noyes 45 mg sucrose pellets. For the first 28 days, the two dispensers were in the box, but were removed and placed on top of the box for the remainder of the study. One feeder was on the rat's left side and one on the right. Although no evidence of a differential response to the dispensers was found when the feeders were in the box, they were removed and placed on top of the box to minimize association between type of pellet and feeder location. The feeders were switched from side to side each week when both in and on top of the box. The type of pellet associated with each feeder mechanism was also alternated, but independently of the feeder position. Relays, counters, and control circuitry in an adjacent room programmed the schedules and recorded the responses. Water was not available to the subject during experimental sessions.

Procedure for Rat 100

Daily sessions began with free delivery of a standard or a sucrose pellet. The initial type of pellet was alternated daily. Daily sessions typically lasted for 60 reinforcements. After weight reduction and magazine training, Rat 100 was placed on continuous reinforcement (CRF) with standard pellets. The response ratio was gradually increased to an FR 30 over a 13-day period. After four days on the FR 30 with standard pellets the subject was placed on *mult St FR 30 Su FI 3*, in which a standard pellet was followed by FR 30 and a sucrose pellet was followed by an FI 3 requirement. Within 60 pellets, standard and sucrose occurred an equal number of times. The sequencing of pellets provided for some runs of one, two, and three similar pellets in a row.

Results

Figure 1 A shows a segment of the FR 30 schedule on the 17th day of conditioning, one day before switching to a multiple schedule of reinforcement. The rates of responding in Fig. 1 A are fairly high with relatively little pausing after the standard pellet reinforcement. On the 18th day, Rat 100 was switched to a multiple schedule. The arrow in Fig. 1 B, after the beginning FR 30 segment, marks the transition from the FR 30 with standard pellets to the *mult St FR 30 Su FI 3*. On initial FI 3 components, as at *a* and *b*, the response rate is

high and occurs at a rate found on the FR 30 schedule before the transition. The FI components at *c* and *d* show lower rates and irregularities characteristic of a transition from an FR to a *mult FR FI* (Ferster and Skinner, 1957).

Figure 1 C shows several segments of fairly well developed *mult St FR 30 Su FI 3* from the 16th day on the multiple schedule. The occurrence of standard pellets, as at *e* and *f*, is followed by an FR performance. The standard pellet reinforcement functions as a discriminative stimulus and controls a substantial rate soon after reinforcement. The stimulus control of the standard pellet is, however, sometimes attenuated, as at *g*, and there is a pause on the FR component comparable in length to those sometimes found on the FI schedule.

In Fig. 1 C the occurrence of sucrose pellets is followed by a distinct pause with an increase in rate later in the 3-min interval. The sucrose pellet also functioned as a discriminative stimulus. On the FI 3 schedule the sucrose pellet was an occasion for nonreinforcement of immediately following responses and thereby controlled a low or zero response rate after the pellet.

Figure 1 D shows a separate recording of FI 3 components from the 16th day on the multiple schedule. These FI 3 recordings emphasize the zero or low rates controlled by the sucrose stimuli. The pauses are sometimes terminated with an abrupt increase in rate, as at *h*, or by a slower transition, as at *i*. Figure 1 E shows a separate recording of FR 30 and emphasizes the high rates of responding which follow the standard pellet and the brevity of the pause after reinforcement.

On the 34th day the schedules following the standard and sucrose pellets were reversed. After the reversal, a standard pellet was followed by the FI 3 and a sucrose pellet by FR 30. Reversing the schedules of reinforcement after each type of pellet separates the fixed-ratio and fixed-interval contingencies from the discriminative stimulus control previously developed at reinforcement. This reversal should elucidate the factors that had been controlling the two discriminative performances.

Figure 2 A shows segments of the first session after the relations between the schedules of reinforcement and type of pellet were reversed, *i.e.*, *mult Su FR 30 St FI 3*. Pauses after reinforcement, characteristic of the prior sucrose

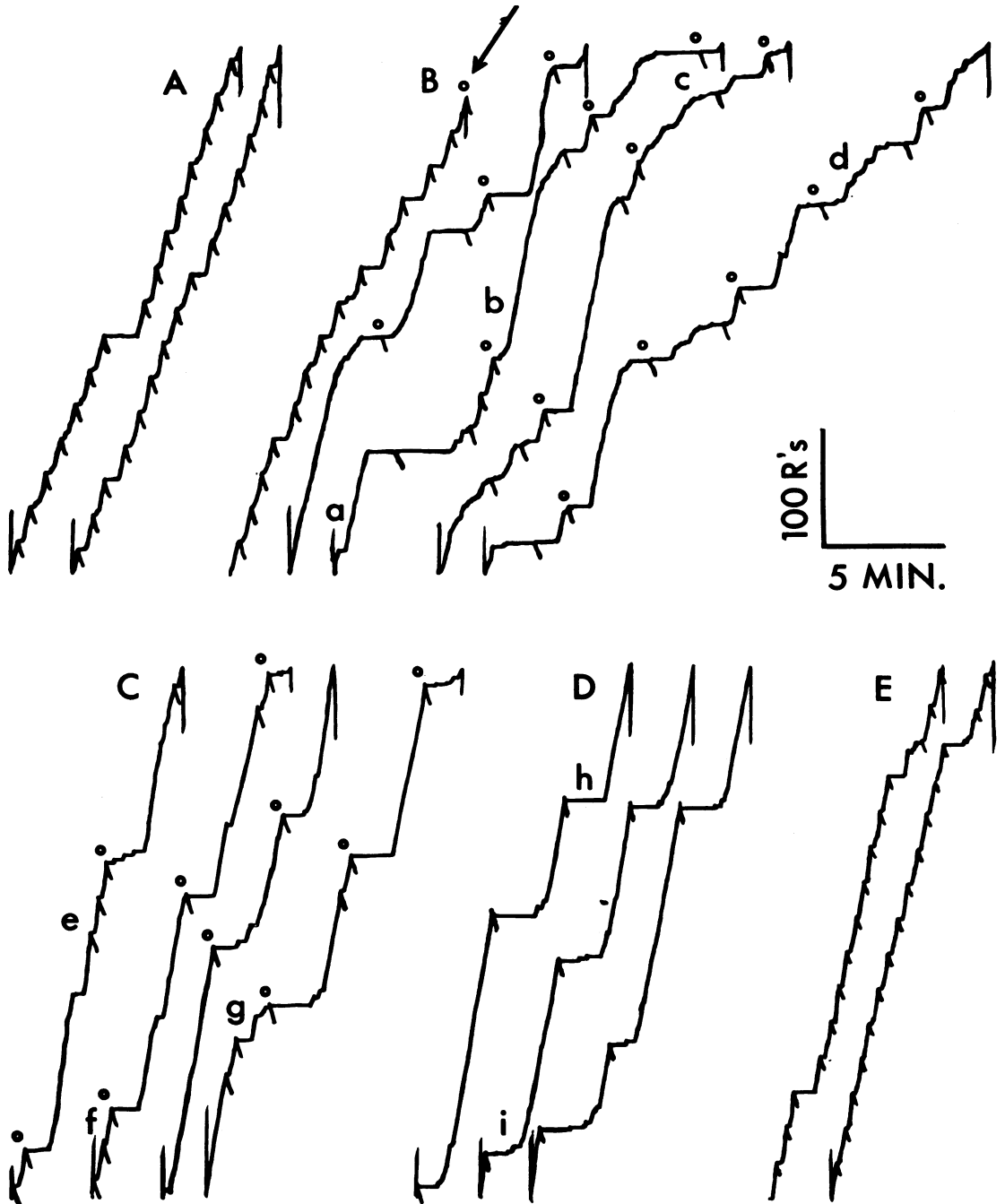


Fig. 1. Cumulative response curves for Rat 100 with the delivery of sucrose pellets circled and the delivery of standard pellets not circled. (A) *St* FR 30 from the 17th day. (B) Segments from the 18th day. *St* FR 30 before the arrow and *mult St* FR 30 *Su* FI 3 after the arrow. (C) Segments from the 33rd day, 16th day on *mult St* FR 30 *Su* FI 3. (D) Separately recorded segments of *Su* FI 3 from the 33rd day. (E) Separately recorded segments of *St* FR 30 from the 33rd day.

FI 3 schedule, are seen at *a* and *b*, but now occur during the FR 30 schedule. High rates, characteristic of the prior standard FR 30

schedule, are seen at *c* and *d*, but now occur during the FI 3 schedule.

Separately recorded FI 3 segments from the

first session on *mult Su FR 30 St FI 3* are given in Fig. 2 B. It shows the high rates and minimal pauses which are controlled by the standard pellet. Figure 2 C shows the separately recorded FR 30 segments, each segment preceded by a sucrose pellet, with the pellet controlling relatively long pauses characteristic of the FI 3 performance before the reversal.

Figures 2 D, E, and F show records from the 11th day on *mult Su FR 30 St FI 3*. Segments of the total performance are given in Fig. 2 D, a performance which does not represent a steady state or a complete reversal of earlier effects. The FI 3 records in Fig. 2 D are of several varieties, with the segment at *e* showing a slow acceleration and somewhat lower rate than is found on ratio segments. The FI 3 segment at *g* shows that the standard pellet now controls a pause appropriate to an interval performance, yet also controls an abrupt acceleration and run of about 30 responses with a shift to a fixed-interval rate during the last part of the segment. The separately recorded segments of the FI 3 seen in Fig. 2 E give several examples of the gradual acceleration and also the abrupt acceleration with a shift to a fixed-interval rate.

Figure 2 F shows a separate recording of the complete session for the sucrose FR 30 performance. The sucrose pellet continues to control an FR performance characterized by an initial pause followed by an abrupt increase to a high rate. The postreinforcement pauses shown in Fig. 2 F on the fixed ratio are in general shorter in length than those shown in Fig. 2 E on the fixed interval. Eleven days on the reverse multiple was not sufficient to reduce the pause after reinforcement on the ratio component to the pre-reversal pause length seen in Fig. 1 E, and not sufficient to produce positive acceleration (scallop) on the interval component with the same frequency as seen in Fig. 1 D.

The performance seen in Fig. 2 D, E, and F was followed by three changes between the schedule of reinforcement and type of pellet, *i.e.*, four days on *mult St FR 30 Su FI 3*, six days on *mult Su FR 30 St FI 3* and one day on *mult St FR 30 Su FI 3*. Each successive change in discriminative control was followed by a more rapid change in rates of response under the presented conditions. The *St FR 30* component of the *mult St FR 30 Su FI 3* continued to set the occasion for very brief pauses after

standard pellet reinforcement as in Fig. 1 E. The *Su FR 30* component of the *mult Su FR 30 St FI 3*, however, set the occasion for a pause of several seconds duration, as in Fig. 2 F. The postreinforcement pause persisted on the *Su FR 30* component of the multiple schedule of reinforcement.

Discussion

The presentation of food pellets has been considered to have both reinforcing and discriminative functions in operant conditioning (Skinner, 1938, p. 242). The effects of the pellet as a reinforcing stimulus upon rates of responding can be seen in the developed *mult St FR 30 Su FI 3* schedule of reinforcement. Because the *St FR 30* and the *Su FI 3* schedules were followed equally often by both types of pellets, the independence of the response rates from the type of pellet presented may be seen.

The effects of the pellet as a discriminative stimulus upon rates of responding can also be seen in the developed *mult St FR 30 Su FI 3* schedule of reinforcement. The pellet may produce two distinct rates of responding in these operant chains (Ferster and Skinner, 1957; Kelleher and Gollub, 1962; Keller and Schoenfeld, 1950). The use of two types of pellets and correlated succeeding schedules of reinforcement in the present experiment demonstrates these effects. On the *St FR 30* component of the *mult St FR 30 Su FI 3* schedule the standard pellet controlled a high rate of responding after reinforcement, while on the *Su FI 3* component of the *mult St FR 30 Su FI 3* schedule the sucrose pellet controlled a low rate of responding after reinforcement.

When the relation between the type of pellet and the following schedule of reinforcement was changed to *mult Su FR 30 St FI 3*, the discriminative control was reversed. On the *mult Su FR 30 St FI 3* schedule the sucrose was followed by a fixed-ratio performance, although with a longer pause than usual, and the standard was followed by a fixed-interval performance. The contingent relation between the type of pellet and the following schedule of reinforcement illustrates the correlation between the pellet as a discriminative stimulus and the responses for which it is an occasion.

The control obtained with pellet stimuli on the *mult St FR 30 Su FI 3* in Fig. 1 C, D, and E compares favorably with the degree of multiple schedule control obtained with light

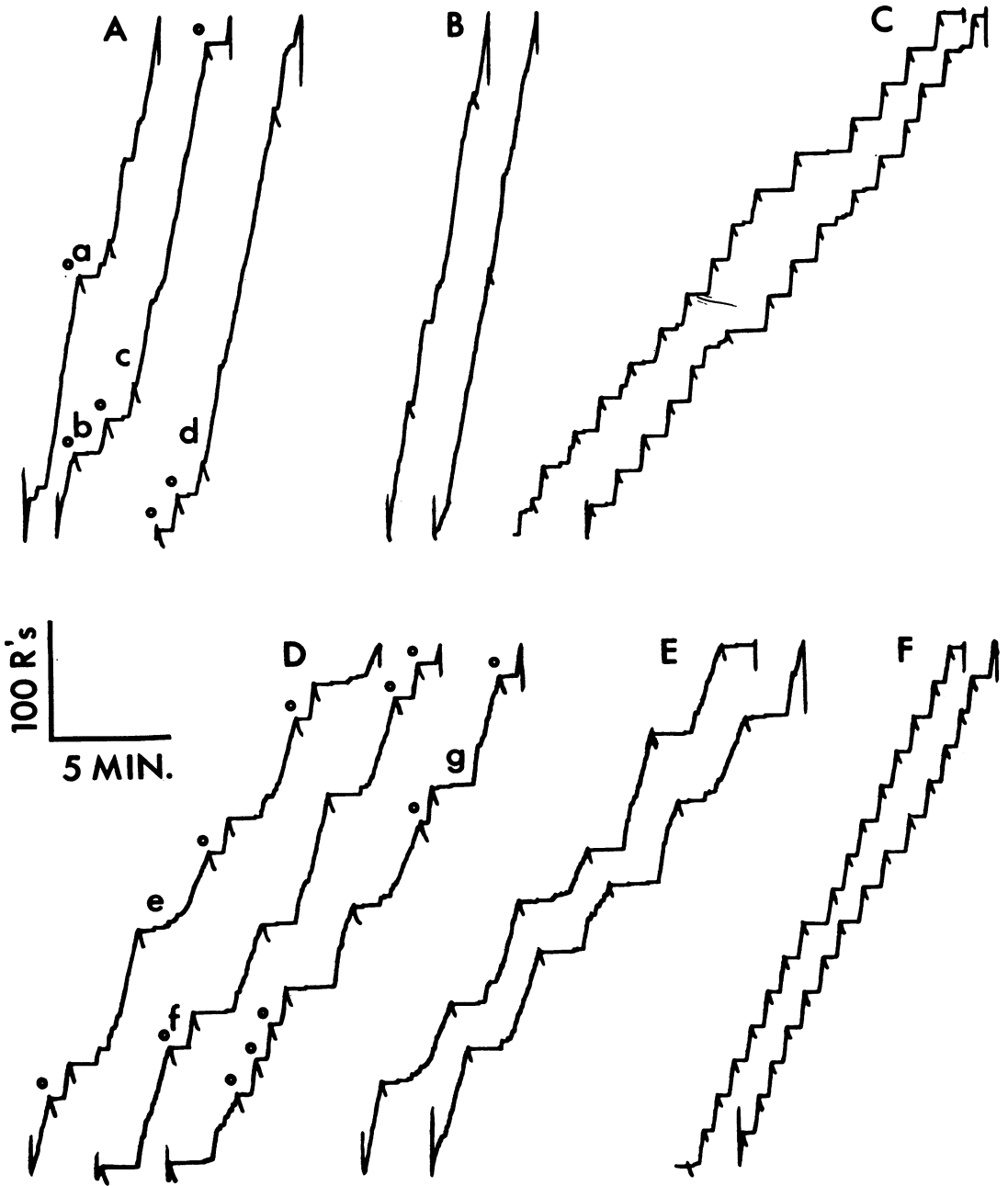


Fig. 2. Cumulative response curves for Rat 100 with the delivery of sucrose pellets circled and the delivery of standard pellets not circled. (A) Segments from the 34th day, first reversal, on *mult Su FR 30 St FI 3*. (B) Separately recorded segments of *St FI 3* from the 34th day. (C) Separately recorded segments of *Su FR 30* from the 34th day. (D) Segments from the 44th day, 11th day on the first reversal, of *mult Su FR 30 St FI 3*. (E) Separately recorded segments of *St FI 3* from the 44th day. (F) Separately recorded segments of *Su FR 30* from the 44th day.

stimuli. The fixed-ratio rates, the degree of the fixed-interval scallops, the postreinforcement pauses, and the presence of fixed-ratio rates on the fixed-interval components are comparable to a *mult FR 30 FI 5* in which a flashing

light was correlated with the fixed ratio and a steady light with the fixed interval (Ferster and Skinner, 1957, p. 509). The similarity between a multiple schedule with food pellet discriminative stimuli and one with light discrim-

inative stimuli shows the possibility of control without continuously presented stimuli.

The multiple FR *primed* FI schedules (Fester and Skinner, 1957, pp. 630-643) also show that a considerable part of the control in *mult* FR FI schedules can occur with something less than continuous stimulus presentation. In one case a multiple-type performance was obtained on a *mult* FR 120 *primed* 120 sec FI 10 schedule during which a steady green light accompanied the FR 120, while a flashing green light accompanied the first 2 min on the fixed interval and a steady green light (as on the FR 120) accompanied the remaining 8 min of the FI 10. In another case, control was maintained and a multiple-type performance obtained on a *mult* FR 125 *primed* 120 sec FI 10, control which continued to some degree even though the prime was reduced to 15 sec. As noted before, the *mult St* FR 30 *Su* FI 3 is similar to a *mult* FR *primed* FI, and may, of course, be called a *mult primed FR primed FI*.

EXPERIMENT II

This study sought to investigate further the discriminative functions of two types of food pellets. A multiple schedule of reinforcement was developed with two concurrent operants, rather than one as in Exp I. A standard pellet set the occasion upon which an FR 30 on Bar 1 was reinforced with a standard or a sucrose pellet, and responses on Bar 2 were not reinforced. A sucrose pellet set the occasion upon which an FR 30 on Bar 2 was reinforced with a standard or a sucrose pellet, and responses on Bar 1 were not reinforced.

A control subject received a mixed version of the above reinforcement schedule. On the mixed schedule only one type of reinforcer was used and it served no discriminative functions for the FR 30 reinforcement schedules on Bar 1 or Bar 2.

Subjects

Two experimentally naive male rats (103 and 104), four to five months old at the beginning of the experiment, were maintained at 80% or less of free feeding weight.

Apparatus

As in Exp I, a standard type experimental enclosure, placed in an ice box, was used. The instrument panel was changed to provide for

a bar on the subject's right (Bar 1), or on the left (Bar 2), or on both. The centers of the Gerbrands bars were 5 in. apart. The Model D Gerbrands feeders were outside the enclosure throughout the experiment.

Procedure

Sessions began with free delivery of a standard or a sucrose pellet, alternating daily, and usually lasted for 72 singly presented pellets. After magazine training and two days of CRF, Rats 103 and 104 were given 11 days of fixed ratio training with Bar 1 and standard pellets. During the first 7 of these 11 days, the schedules were gradually changed from an FR 20 to an FR 30. On the remaining four days Rats 103 and 104 received an FR 30 on Bar 1 with standard pellets.

Rat 103 was then given six days of FR 30 on Bar 2 with sucrose pellets. For the next nine days the FR 30 was developed on both bars, one or the other being present during each daily session. Standard pellets always accompanied Bar 1 and sucrose pellets always accompanied Bar 2. The bar and session order for Rat 103 was: 1, 2, 2, 2, 1, 2, 2, 1, 2.

Rat 104 received the same bar presentation sequence as Rat 103, except that standard pellets were used with both Bar 1 and Bar 2.

Both bars were simultaneously presented on the 29th day of conditioning. Simultaneous presentation placed Rat 103 on a *mult St* (FR 30 Bar 1 *ext* Bar 2) *Su* (FR 30 Bar 2 *ext* Bar 1) schedule of reinforcement, in which a standard pellet was followed by an FR 30 schedule on Bar 1 and extinction (*ext*) on Bar 2, and a sucrose pellet was followed by an FR 30 schedule on Bar 2 and extinction on Bar 1.

Within the daily 72 singly-presented pellets, standard and sucrose occurred an equal number of times. The alternation of the components of the multiple schedule was also arranged to provide for some runs of one, two, and three similar pellets. The *mult St* (FR 30 Bar 1 *ext* Bar 2) *Su* (FR 30 Bar 2 *ext* Bar 1) schedule with concurrent operants provides no correlation between the FR 30 requirement on Bar 1 and the following pellet, or between the FR 30 requirement on Bar 2 and the following pellet, since each bar was followed equally often by both types of pellets.

Rat 104 received the same bar presentation sequence as Rat 103, but with only standard pellets. Simultaneous presentation of both bars

constituted a *mix St* (FR 30 Bar 1 *ext* Bar 2) *St* (FR 30 Bar 2 *ext* Bar 1) schedule of reinforcement.

Results

Before placing Rat 103 on the multiple schedule with two bars, FR 30 performances were separately developed on each bar. During these, response rates were around 100 responses per min with small postreinforcement pauses.

Figure 3 A shows segments of the first day for Rat 103 on the *mult St* (FR 30 Bar 1 *ext* Bar 2) *Su* (FR 30 Bar 2 *ext* Bar 1) schedule. During the initial parts of the session, as seen in Fig. 3 A, the rate was disrupted in several places, but was unbroken by the end of the session. Figure 3 B is a separate recording of responses on the nonreinforced bar from the Fig. 3 A record.

Figure 3 B shows that responses on the non-

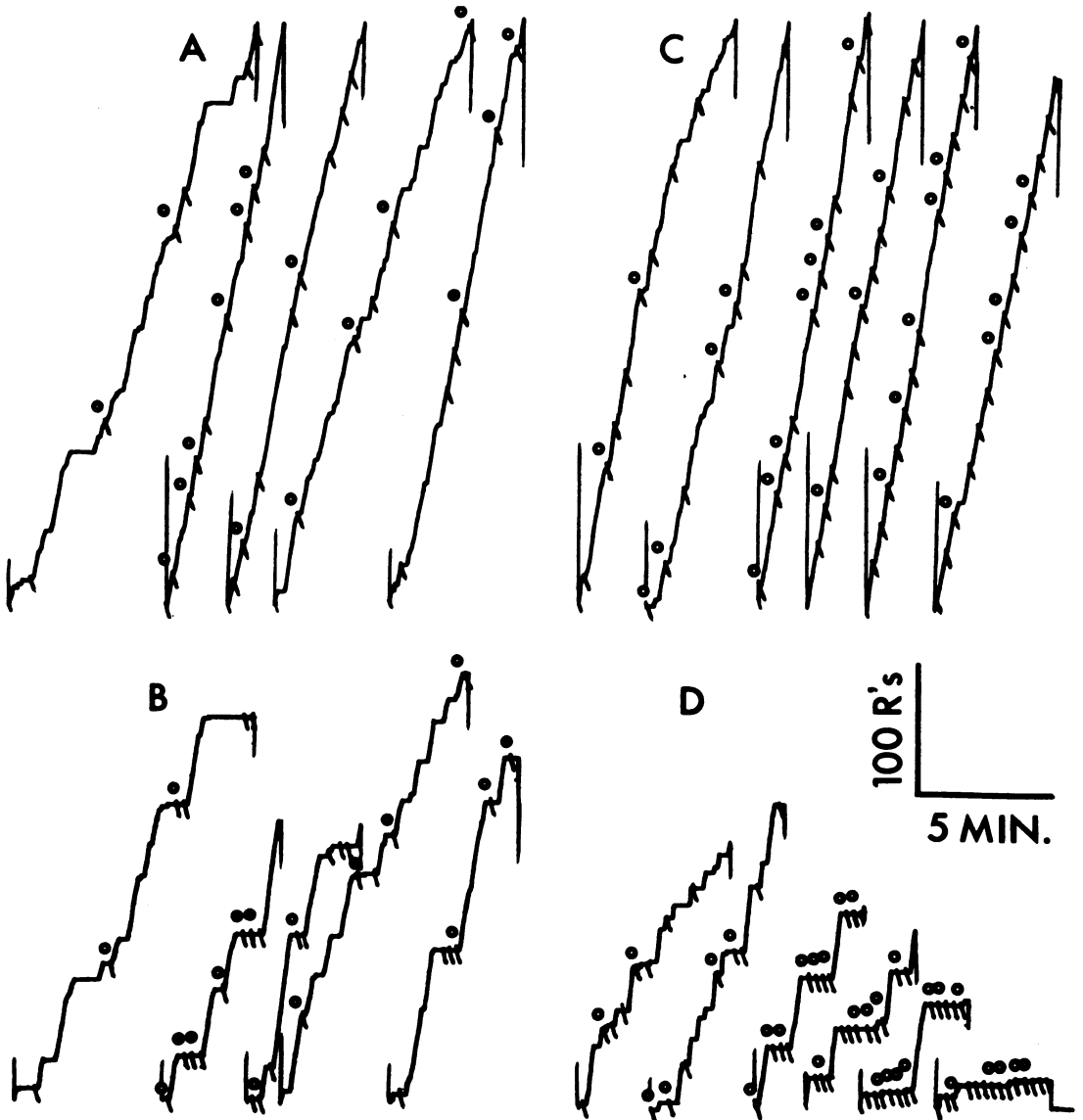


Fig. 3. Cumulative response curves for Rat 103 with the delivery of sucrose pellets circled and the delivery of standard pellets not circled. (A) Segments from the first day, and (C) segments from the second day on *mult St* (FR 30 Bar 1 *ext* Bar 2) *Su* (FR 30 Bar 2 *ext* Bar 1). (B) and (D) are separate recordings of responses on the nonreinforced bars from the records above, *i.e.*, B from A, and D from C. Each excursion of the pen in B and D matches the excursion directly above.

reinforced bar predominately occurred with a change in reinforcement from standard to sucrose or sucrose to standard, but there were few responses on the nonreinforced bar when standard followed standard or sucrose followed sucrose. The (standard pellet—FR 30 Bar 1—standard pellet) and the (sucrose pellet—FR 30 Bar 2—sucrose pellet) sequences were the discriminative chains developed during the single bar training and which later occurred with few responses on the nonreinforced bar. Development of the multiple discrimination with concurrent operants requires the addition of the (standard pellet—FR 30 Bar 1—sucrose pellet—FR 30 Bar 2), and the (sucrose pellet—FR 30 Bar 2—standard pellet—FR 30 Bar 1) sequences.

Figure 3 C shows the second day on *mult St* (FR 30 Bar 1 *ext* Bar 2) *Su* (FR 30 Bar 2 *ext* Bar 1) for Rat 103, while Fig. 3 D presents a separate recording of responses on the nonreinforced bar from the Fig. 3 C record. These figures indicate that by the latter part of this session Rat 103 was making few responses on the nonreinforced bar and was switching to the appropriate bar after changes in the type of pellet presented. The last 19 or so pellets were followed by a very low rate on both nonreinforced bars.

Figure 4 A shows the first day on the *mix St* (FR 30 Bar 1 *ext* Bar 2) *St* (FR 30 Bar 2 *ext* Bar 1) schedule of reinforcement for Rat 104. Figure 4 B is a recording of responses on the nonreinforced bars for the record shown in Fig. 4 A. During the initial parts of the performance shown in Fig. 4 A and B, numerous responses were made on the nonreinforced bars. The rates on the nonreinforced bars did not decline appreciably towards the end of the session. There were, however, some instances in which an FR 30 was reinforced on the same bar several times in a row and Rat 104 remained on the reinforced bar. On these occasions response rates on the nonreinforced bar were low, otherwise Rat 104 made over 30 responses on the nonreinforced bar and then switched to the reinforced bar. The same type of performance is shown in Fig. 4 C, the overall response rates for Rat 104 on the second day of the mixed reinforcement schedule, and in Fig. 4 D, a separate recording of the responses on the nonreinforced bars.

Figure 5 A shows the *mult St* (FR 30 Bar 1 *ext* Bar 2) *Su* (FR 30 Bar 2 *ext* Bar 1) for Rat

103 during the 35th day on this schedule, and Fig. 5 B shows the response rates on the nonreinforced bar. As seen in Fig. 5 B, responses on the nonreinforced bars were made after three of the initial pellets and about 200 responses were emitted. After these initial instances of poor stimulus control the multiple performance was run off with very few responses on the nonreinforced bar. The standard pellet functions as a discriminative stimulus and is the occasion upon which Rat 103 makes 30 responses on Bar 1, while the sucrose pellet functions as a discriminative stimulus and is the occasion upon which Rat 103 makes 30 responses on Bar 2.

Some indication of the degree of control shown on the *mult St* (FR 30 Bar 1 *ext* Bar 2) *Su* (FR 30 Bar 2 *ext* Bar 1) for Rat 103 may be obtained by comparing it with the *mix St* (FR 30 Bar 1 *ext* Bar 2) *St* (FR 30 Bar 2 *ext* Bar 1) for Rat 104.

Figure 5 C shows the *mix St* (FR 30 Bar 1 *ext* Bar 2) *St* (FR 30 Bar 2 *ext* Bar 1) schedule of reinforcement for Rat 104 during the 35th day on this schedule. Figure 5 D shows responses during the nonreinforced periods for Bar 1 and 2, and is separately recorded from the record in Fig. 5 C. There was a reduction in the number of responses on the nonreinforced bars. Rat 104 developed a performance in which a standard pellet was almost always followed by pressing Bar 1. If a reinforcement did not occur after 30 or so responses on Bar 1 the subject switched to Bar 2 and continued until reinforced. Most of the responses on the nonreinforced bar were, therefore, made on Bar 1, before the switch to Bar 2. This pattern may be seen in Fig. 5 D where the circles adjacent to the reinforcement pips, which signal an FR 30 on Bar 2, are almost invariably followed by 30 or so responses on the nonreinforced bar, in this case Bar 1.

Discussion

The developed performance on the *mult St* (FR 30 Bar 1 *ext* Bar 2) *Su* (FR 30 Bar 2 *ext* Bar 1) schedule of reinforcement shows how the pellet serves as a discriminative stimulus and occasions an FR 30 performance on Bar 1 after standard pellets, and an FR 30 performance on Bar 2 after sucrose pellets. The developed performance also shows how the pellet serves as a reinforcing stimulus and maintains FR 30 performances on both bars.

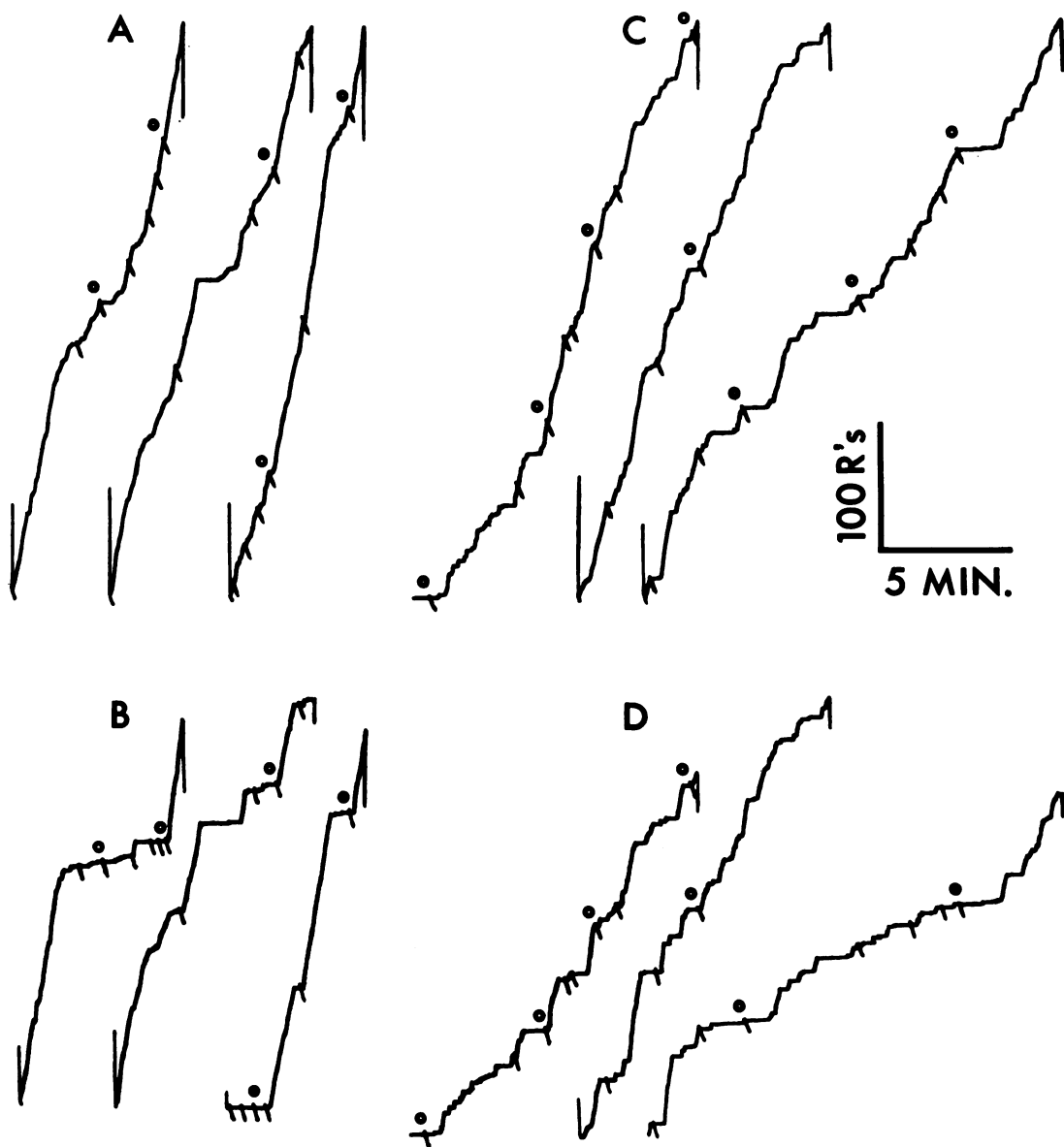


Fig. 4. Cumulative response curves for Rat 104. The circled reinforcements mark delivery of standard pellets followed by FR 30 on Bar 2, while the uncircled reinforcements mark delivery of standard pellets followed by FR 30 on Bar 1. (A) Segments from the first day, and (C) from the second day on *mix St* (FR 30 Bar 1 *ext* Bar 2) *St* (FR 30 Bar 2 *ext* Bar 1). (B) and (D) are separate recordings of responses on the nonreinforced bars from the records above, *i.e.*, B from A, and D from C.

The discrimination developed as a function of the type of pellet compares favorably with discrimination developed with exteroceptive stimuli. Rat 103 showed a multiple performance with relatively few responses on the nonreinforced bar with 35 days on the multiple schedule.

The relation between the pellet as a discriminative stimulus and as a priming stimulus was

noted in Exp I. In that study the type of pellet primed a brief pause and an FR 30 performance, or a longer pause and an FI 3 performance. In Exp II the type of pellet primed going to the left bar and an FR 30 performance, or going to the right bar and an FR 30 performance. In both experiments the pellets present when performance began were consumed, yet the scheduled performance continued.

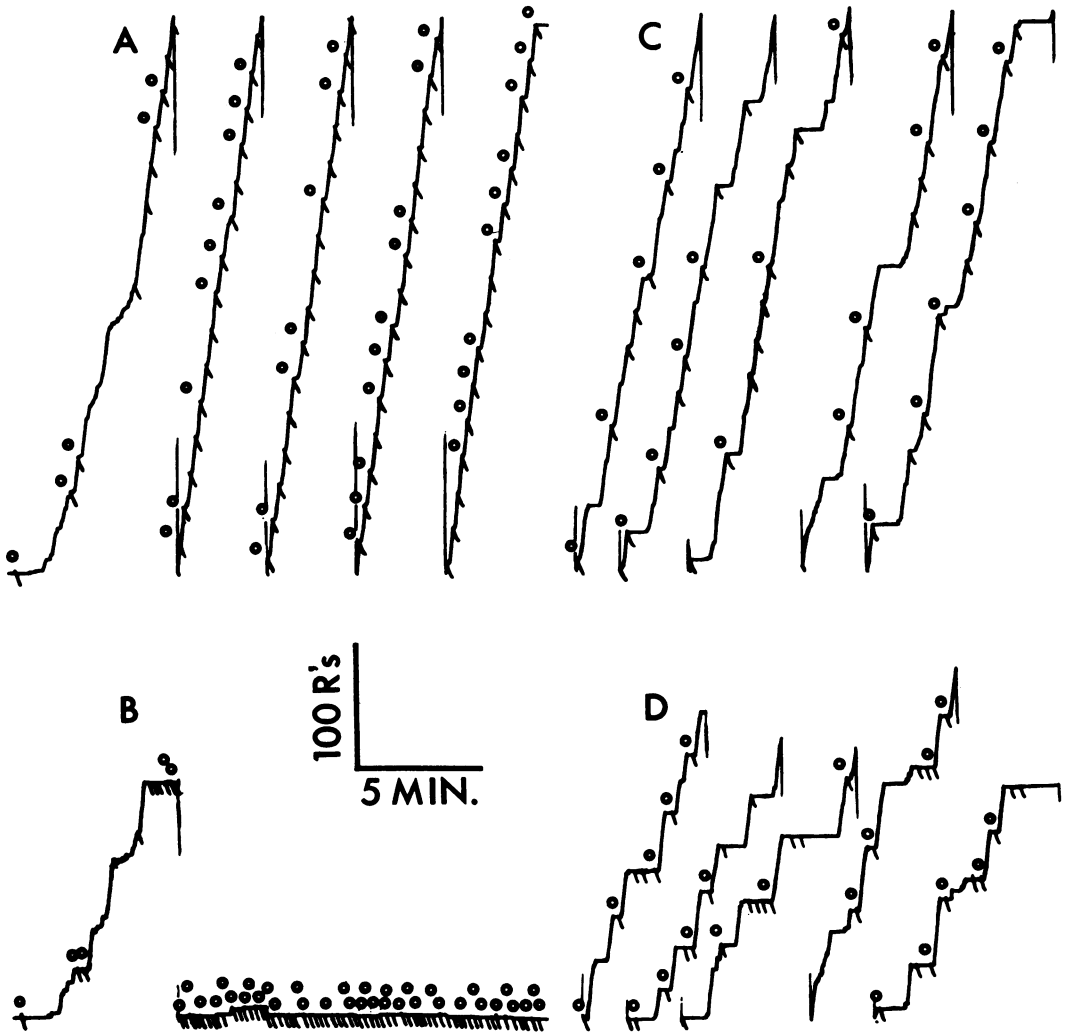


Fig. 5. Cumulative response curves for Rats 103 (A and B) and 104 (C and D). (A) Segments from the 35th day on *mult St* (FR 30 Bar 1 *ext* Bar 2) *Su* (FR 30 Bar 2 *ext* Bar 1), with the delivery of sucrose pellets circled and the delivery of standard pellets not circled. (B) Separately recorded responses on the nonreinforced bar from A directly above. (C) Segments from the 35th day on *mix St* (FR 30 Bar 1 *ext* Bar 2) *St* (FR 30 Bar 2 *ext* Bar 1). The circles mark delivery of standard pellets followed by FR 30 on Bar 2 and the noncircled reinforcements mark delivery of standard pellets followed by FR 30 on Bar 1. (D) Separately recorded responses on the nonreinforced bar from record C directly above.

A comparison between the multiple and mixed schedules of reinforcement, as in Fig. 5, emphasizes some of the important controlling features of both schedules. On the multiple schedule the type of pellet controls the concurrent operants. On the mixed schedule the pellet presentation and the response count on one or the other bar controls the concurrent operants. In both cases the pellet has discriminative functions; however, in the case of the mixed schedule they are paired with the response count rather than operating directly

with one or the other operants as is the case in the multiple schedule.

Experiments I and II both demonstrate discriminative stimulus functions by pellets also serving as reinforcing stimuli. These functions have been acknowledged for some time, and have frequently been used to account for behavior under various schedules of reinforcement. Discriminative stimulus effects correlated with reinforcing events have also been extensively used to account for behaviors contingent upon reinforcers, both unconditioned

and conditioned (Kelleher and Gollub, 1962; Keller and Schoenfeld, 1950; Ferster and Skinner, 1957).

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Received May 24, 1965