*EFFECTS OF CONDITIONED REINFORCEMENT
FREQUENCY IN AN INTERMITTENT
FREE-FEEDING SITUATION^{1,2}*

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Key-pecking intermittently produced a set of brief exteroceptive stimulus changes under two-component multiple schedules of conditioned reinforcement. Throughout the study, free access to grain was concurrently provided on an intermittent basis via a variable-interval tape. Free food presentations scheduled by the tape were delivered if no peck had been emitted for 6 sec, and the brief stimulus changes produced by responding under the multiple schedules were those which accompanied food presentation. The second component of each multiple schedule was always associated with a 1-min, variable-interval schedule of conditioned reinforcement. The schedule associated with the first component was systematically varied and conditioned reinforcement was either absent (extinction) or programmed on a 1-, 3-, 6-, or 12-min variable-interval schedule. Under these conditions, rate of responding in the manipulated component decreased monotonically with a decrease in the frequency of conditioned reinforcement. In addition, contrast effects were often obtained in the constant, second component. These results are similar to those obtained with similar multiple schedules of primary reinforcement.

In their review of positive conditioned reinforcement, Kelleher and Gollub (1962) suggested and gave many illustrations of an experimental approach involving the study of conditioned reinforcement under conditions in which primary reinforcement is not removed from the experimental situation. This approach involves the application of chained schedules of reinforcement and related procedures. In a chained schedule, responding in the presence of a given exteroceptive stimulus is reinforced on a given schedule with a subsequent exteroceptive stimulus. A chained schedule can involve any number of exteroceptive stimuli, each one of which is correlated with a given member or component. Since primary reinforcement terminates the schedule, and since each of the other exteroceptive stimuli in the chain can potentially serve as a conditioned reinforcer for behavior in the respective preceding member, chained schedules can be employed to assess the con-

ditioned reinforcing function of exteroceptive stimuli under stable chronic conditions.

Zimmerman (1963) described a different procedure for studying conditioned reinforcement under conditions in which primary reinforcement is not removed from the experimental situation. This procedure differed from chained schedule procedures in that behavior which produced conditioned reinforcement was not explicitly chained to behavior which produced primary reinforcement. Pigeons performed in a standard two-key experimental space (Ferster and Skinner, 1957). Left-key responses were intermittently reinforced with access to grain on a variable-interval schedule. Concurrently, right-key responses were intermittently reinforced on an independent variable-interval schedule with a 0.5-sec magazine cycle. These latter responses, therefore, produced the set of stimuli which accompanied grain reinforcement, but not the grain. Under these conditions, pecking at the right key was sustained indefinitely at rates which were about one fifth to one twentieth as high as those obtained on the food key. This procedure was subsequently employed to assess the effects of schedule variables. Rates and patterns of responding on the right key were appropriate to the particular schedule in effect when the schedule was fixed-ratio, variable-interval, or extinction. These results were

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similar to those obtained by Kelleher (1961) who examined the effects of scheduling conditioned reinforcement after primary reinforcement was removed from the experimental situation.

In the Zimmerman (1963) study, and in several others performed later, Gerbrands-type magazines were used to provide both access to food and the magazine elements of the conditioned reinforcement cycle. Visual observation indicated that the birds were not able to obtain food during the 0.5-sec cycles. Infrequent magazine failures, which might have permitted access to food during or after these cycles, might have accounted, at least in part, for the long-term maintenance of behavior which produced the stimuli associated with food. To eliminate the possible contribution of such failures, the magazines were modified (Leckrone, Zimmerman, and Hanford, 1966). The aperture providing access to the grain was covered with a transparent lucite shutter. This was displaced only when food reinforcement was programmed. Performances of pigeons in several different experiments were not markedly altered by the introduction of the modified magazines.

Subsequent work in this laboratory has sought to develop additional procedures for studying conditioned reinforcement under stable chronic conditions. Zimmerman and Hanford (1966) recently described a single-key procedure in which access to food was automatically provided via a variable-interval tape if no peck was emitted for at least 6 sec. Concurrently, pecking at the single (blue) key intermittently produced conditioned reinforcement (the 0.5-sec magazine cycle with the shutter in its resting position). This procedure was employed to maintain key-pecking indefinitely (up to six months) in the three birds which served as subjects in the Zimmerman (1963) study, and in a fourth bird which was naive and originally trained to peck at the blue key on the basis of conditioned reinforcement only. Programming two-component multiple schedules of conditioned reinforcement on the key demonstrated that pecking was (a) sustained in any component associated with conditioned reinforcement, (b) markedly weakened or extinguished in any component in which conditioned reinforcement was removed or replaced with a set of neutral stimuli, and, (c) reinstated in any component in which con-

ditioned reinforcement was returned. The present report describes the results of a study in which this single-key, multiple-schedule procedure was employed to determine the behavioral effects of changes in the frequency of conditioned reinforcement.

METHOD

Subjects

Four adult, male, White Carneaux pigeons, three of which (76R, 77R, and 40B) were used in the Zimmerman and Hanford (1966) study, served. A fourth (23B) had a 1.5-yr history on several chained schedules of food reinforcement and a more recent five-month history on the single-key multiple-schedule procedure. During the latter months it was exposed to some of the conditions described in Zimmerman and Hanford (1966) and its performance was qualitatively similar to those reported for the birds in that experiment. In the present experiment, each bird was maintained at 80% of its free-feeding weight and performed daily in the one-key experimental space employed in the previous study.

Procedure

As in the Zimmerman and Hanford (1966) study, two-component multiple schedules were programmed on the key. In each schedule, a blue light and a yellow light were projected on the key during the first and second components, respectively, and the two components alternated every 24 min. A daily session was terminated after a bird was exposed to each component twice. A 1-min variable-interval schedule of conditioned reinforcement (0.5-sec magazine cycle) was programmed in the second component of each multiple schedule throughout the experiment; the schedule frequency of conditioned reinforcement in the first component was systematically varied. The first component was associated with a variable-interval schedule of 1-, 3-, 6-, or 12-min, or with extinction of conditioned reinforcement. Frequency of reinforcement was manipulated in the first component because each bird had shown a prior response bias toward that component when conditions in the two components were equal (see Zimmerman and Hanford, 1966). The feeding procedure used in the previous study was common to each of the multiple schedules. More specifically, a

Table 1
Multiple Schedules of Conditioned Reinforcement

<i>Successive Schedules (in minutes)</i>		<i>Number of Sessions</i>			
<i>Birds 23B, 40B, 76R</i>	<i>Bird 77R</i>	<i>23B</i>	<i>40B</i>	<i>76R</i>	<i>77R</i>
VI 1 VI 1	VI 1 VI 1	19	10	16	9
VI 3 VI 1	VI 3 VI 1	13	14	16	10
VI 1 VI 1	VI 1 VI 1	9	7	8	8
VI 6 VI 1	EXT VI 1	15	17	8	17
VI 1 VI 1	VI 1 VI 1	10	7	5	9
VI 12 VI 1	VI 6 VI 1	14	11	17	13
VI 1 VI 1	VI 1 VI 1	10	7	5	9
EXT VI 1	VI 12 VI 1	18	17	19	13
VI 1 VI 1	VI 1 VI 1	10	11	15	21

Code: VI—variable-interval schedule of conditioned reinforcement; EXT—extinction.

4-sec food cycle was intermittently presented via a 3-min variable-interval tape, provided that no peck had occurred for at least 6 sec. If the tape set up a food cycle less than 6 sec after a given peck, the cycle was saved and presented as soon as 6 sec of no-responding had occurred. For example, if a response had been emitted 3 sec before the tape set up a food delivery, the bird received food 3 sec after this event if it did not peck for 3 more sec.

Each bird was exposed to a given multiple schedule until its rates in each of the two components stabilized (showed no consistent trend) for at least four successive daily sessions. Table 1 presents the order and nature of each of the specific multiple schedules to which each bird was exposed, together with the number of sessions on each schedule. In each cell of the first two columns, the first schedule is the one programmed in the first component of the given multiple schedule. The multiple schedule in which a 1-min, variable-interval schedule (VI 1-min) was programmed in each component is referred to as the baseline schedule.

RESULTS

Figure 1 summarizes the results obtained for each bird under each multiple schedule. Each point presents the median response rate (in responses per minute) in the given component based on the last five sessions under a given multiple schedule.

Each bird, except 40B, showed a response-rate bias toward the first component in the initial baseline sessions. The results of each

subsequent experimental manipulation were qualitatively similar for each bird. In general, (a) rates in the first component decreased as the programmed frequency of reinforcement in that component was decreased to 12 min,

Fig. 1. Response rates, in responses per minute, for each of the four birds in each of the two components of the five different multiple schedules. B refers to the baseline schedule. Schedules 3,1; 6,1; and 12,1 are the schedules in which the value of the variable interval associated with the first component was 3-, 6-, and 12-min, respectively. Schedule Ext 1 is the schedule in which conditioned reinforcement was removed from the first component.

(b) these rates approached zero when conditioned reinforcement was removed from that component, and (c) these rates increased whenever the baseline schedule was reinstated.

In the case of Bird 77R, the introduction of the VI 3-min VI 1-min schedule resulted in a decrease in the first-component rate. This decline in rate was not great enough, however, to offset its extreme response-rate bias. That is, the first-component rates remained higher than those obtained in the unchanged second component. When the baseline schedule was reinstated, the first-component rates increased to values which were higher than the initial baseline rates and the bias favoring the first component was exaggerated. Bird 77R was subsequently exposed to a multiple schedule in which the first component was associated with extinction. As with the other subjects, rates in the extinction component eventually dropped to near zero. Subsequent results with 77R were qualitatively similar to those obtained with the other birds, but in spite of its early exposure to the extinction component, its extreme response-rate bias was strongly evi-

dent throughout the remainder of the experiment.

The above results are further illustrated by the cumulative records presented in Fig. 2 and 3 for Birds 23B and 77R, respectively. Each record represents the entire last-session or next-to-last-session performance for the given bird under the indicated multiple schedule. Performances presented from top to bottom are, from the first baseline, from each successive multiple schedule other than VI 1-min, and finally, from the final baseline. The bottom line is the event pen record which indicates the presentation of food during the session whose cumulative record lies immediately above it. The records for Bird 23B are similar to those obtained for Birds 40B and 76R. Those for Bird 77R show that (a) its first-component rates were markedly higher than its second-component rates when the baseline schedule was in effect, (b) the two rates were approximately equal when the VI 6-min VI 1-min schedule was in effect, and, (c) its first-component rates were markedly lower than its second-component rates only when

Fig. 2. Cumulative response records of final-session or next-to-final-session performance for Bird 23B in each of the multiple schedules. The response pen reset at the termination of a component. The schedule associated with the first component is indicated. B refers to the baseline schedule. The top record and the bottom record are from initial and final exposure, respectively, to the baseline condition. Pips on each record represent the delivery of conditioned reinforcement. The bottom event line pips represent the delivery of food during the session from which the record immediately above was taken.

Fig. 3. Cumulative response records of final-session or next-to-final-session performance for Bird 77R in each of the multiple schedules. The response pen reset at the termination of a component. The schedule associated with the first component is indicated. B refers to the baseline schedule. The top record and the bottom record are from initial and final exposure, respectively, to the baseline condition. Pips on each record represent the delivery of conditioned reinforcement. The bottom event line pips represent the delivery of food during the session from which the record immediately above was taken.

it was exposed to the multiple VI 12-min VI 1-min schedule or the multiple EXT VI 1-min schedule.

A second set of results is illustrated, in part, by the second-component data presented in Fig. 1. Contrast effects similar to those observed under multiple schedules of primary reinforcement were often observed in the present experiment. That is, when the programmed frequency of conditioned reinforcement in the first component was decreased, rates in the constant second component often increased above previous baseline values. Similar effects in the opposite direction were often observed when the baseline schedule was reinstated. These contrast effects were consistently obtained and sustained throughout exposure to a given multiple schedule in the case of Birds 40B and 23B and were of considerable magnitude in the latter case. Similar contrast effects were sometimes observed in 76R and 77R.

The observation of contrast effects, together with other changes in the second-component rates across successive experimental conditions, made it difficult to utilize the absolute rates

obtained in the two components to compare directly the behavioral effects of the different multiple schedules. To simplify such a comparison, relative rates were calculated for each bird from each of the five final daily sessions under each experimental condition, by dividing the response rate in the first component by the corresponding rate in the second component. Figure 4 summarizes the experiment in terms of averaged relative rates. Each open bar presents the median relative rate obtained under the multiple schedule indicated on the abscissa. Each adjacent (left) closed bar presents the corresponding relative rate averaged for the baseline conditions which immediately preceded and followed the indicated multiple schedule. Figure 4 shows that for each bird, relative rates decreased monotonically as the frequency of conditioned reinforcement in the first component decreased. The baseline values for all birds, except 77R, were usually slightly above 1.0. That is, they tended to respond slightly faster in the first component when the baseline conditions were in effect. The baseline values for Bird 77R were always close to 2.0, indicating that this bird tended

to respond approximately twice as fast in the first component. The effects of schedule changes in the first component on its relative rates across experimental conditions, however,

were strikingly similar to those obtained in the other birds.

DISCUSSION

In a previous study, Zimmerman and Hanford (1966) sustained pecking in pigeons indefinitely under conditions in which the intermittent brief presentation of stimuli associated with the delivery of food was the only immediate exteroceptive consequence of pecking. Performance was sustained even though food was presented freely on an intermittent basis with a variable-interval tape, and no response was ever followed by food within less than 6 sec after it was emitted. Pecking was, therefore, sustained with a procedure in which the delivery of food was actually contingent upon the absence of pecking. By subsequently programming multiple schedules of the brief exteroceptive stimulus changes, Zimmerman and Hanford demonstrated that the sustained performance could be accounted for only on the basis of the conditioned reinforcing properties of the brief exteroceptive stimulus changes. The sustained responding could not be accounted for on the basis of accidental food reinforcement, delayed food reinforcement, or reinforcement by stimulus change *per se*, since performance was markedly weakened or extinguished in a given component of the multiple schedule when the stimuli associated with food were removed from that component or replaced with a set of neutral stimuli.

The present study employed a similar procedure and systematically replicated the previous results both with respect to sustaining behavior indefinitely with conditioned reinforcement and markedly weakening or extinguishing behavior which did not produce conditioned reinforcement. In addition, the present study extended the application of the procedure to assess the effects of conditioned reinforcement frequency.

A major result of the present study was that rate of responding in the manipulated component of a multiple VI VI schedule decreased monotonically as the frequency of reinforcement was decreased. This result is qualitatively similar to those obtained by other investigators (*i.e.*, Ferster and Skinner, 1957; Nevin and Shettleworth, 1966) with similar multiple VI VI schedules of primary reinforcement. An additional present result was the contrast effects

Fig. 4. Relative response rates (second-component rate as standard) for each of the four birds under each of the multiple schedules. Open bars present the relative rates under the multiple schedules whose first components are associated with the variable-interval schedule indicated on the abscissa. The adjacent closed bars present the average relative rates for the immediately preceding and immediately following baseline schedules.

which were frequently observed. Increases and decreases in the constant-component rates were often observed immediately, and usually sustained, following decreases and increases, respectively, in conditioned reinforcement frequency associated with the other component. These results are qualitatively similar to those obtained by other investigators (*i.e.*, Reynolds, 1961; Nevin and Shettleworth, 1966) with similar multiple VI VI schedules of primary reinforcement.

The above results cannot be attributed to differential frequencies of food delivery associated with the different components of the multiple schedules. Our use of the 6-sec, no-response contingency with respect to food actually decreased this possibility. With this contingency obtaining, any marked increase or decrease in pecking rates under a given component would lead to a decrease or increase, respectively, in the frequency of food delivery associated with that component. Such changes in food frequency would be in directions opposite to those which would have to obtain in order to support the above interpretation. In fact, and as a probable consequence of the no-response contingency, absolute rates of pecking under all conditions of this investigation were relatively low; consequently, each component of each multiple schedule was associated with approximately the same frequency of food. The differential rates generated in the different components and the observed contrast effects, therefore, can only be attributed to the different frequencies of conditioned reinforcement within a given multiple schedule and across the different multiple schedules. Thus, these results extend previous findings obtained with multiple schedules of primary reinforcement to multiple schedules of conditioned reinforcement.

The results of the present study, and those previously reported in Zimmerman and Hanford (1966), may bear upon the question of what conditions are necessary and sufficient to establish a conditioned reinforcer. Kelleher and Gollub (1962) presented results of several studies which led them to (a) conclude that simply pairing a stimulus with a primary reinforcer is sufficient to establish it as a conditioned reinforcer, and, (b) reject the discriminative stimulus hypothesis of Keller and Schoenfeld (1950). The latter states that the establishment of a stimulus as a discriminative

stimulus is a necessary and sufficient condition for establishing it as a conditioned reinforcer. Among the studies cited by Kelleher and Gollub (1962) were several which examined performance under chained schedules in which the exteroceptive stimulus in the final component was associated with uncorrelated or non-contingent primary reinforcement. These studies showed that this exteroceptive stimulus served as a conditioned reinforcer which maintained behavior in the preceding component. It did so in spite of the fact that responding was not obtained in its presence (Ferster, 1953; Autor, 1960) and such responding postponed primary reinforcement (Ferster, 1953). These results suggested that establishing the exteroceptive stimulus in the final component as a discriminative stimulus was not a necessary condition for establishing it as a conditioned reinforcer. As in the above studies, responding generated by conditioned reinforcement in the present studies was not explicitly chained to performance which produced primary reinforcement. However, a chaining interpretation employed by Ferster (1953) to account for his results could also be applied to ours. Ferster suggested that the exteroceptive stimulus associated with uncorrelated food could have served as a discriminative stimulus for superstitious patterns of responding which could be accidentally reinforced, and reported the observation of stereotyped patterns in the presence of that exteroceptive stimulus. It could be similarly argued that the set of brief exteroceptive stimuli which sustained performance in the present studies could have served as brief discriminative stimuli which set the occasion for the emission of superstitious behavior. Such behavior could bridge the delays of 6 or more sec and be maintained by intermittent accidental food reinforcement. Periodic observation of the present subjects indicated, however, that the conditioned reinforcement cycles did not set the occasion for any bird to move down to the magazine and that these cycles were not consistently followed by a stereotyped pattern of behavior or behaviors of even brief duration. Each bird did, however, exhibit some repetitive, topographically stereotyped behaviors which were incompatible with pecking and which could have been accidentally reinforced. Observation suggested that the birds may accidentally have been intermittently re-

inforced with food after emitting stereotyped behaviors, but that the conditioned reinforcement cycle did not serve as a discriminative stimulus for this behavior. We conclude that the present results do not support the discriminative stimulus hypothesis but are in agreement with the conclusion of Kelleher and Gollub that pairing a stimulus with a primary reinforcer is sufficient to establish the stimulus as a conditioned reinforcer.

The results of the present study, together with those of two previous studies conducted in this laboratory (Zimmerman, 1963; Zimmerman and Hanford, 1966), demonstrate that appropriate rates and patterns of responding can be generated under multiple schedules of conditioned reinforcement. These results are qualitatively similar to those obtained by other investigators who scheduled conditioned reinforcement after primary reinforcement was removed from the experimental situation (*i.e.*, D. W. Zimmerman, 1957; Kelleher, 1961), or who used schedule procedures in which a conditioned reinforcer was briefly presented at the end of each component (*i.e.*, Kelleher, 1966).

D. W. Zimmerman (1957) and Kelleher (1961) obtained schedule effects with conditioned reinforcement using methods which Kelleher and Gollub (1962) refer to collectively as the extinction procedure. A neutral stimulus is paired with primary reinforcement and its behavioral effects are examined after primary reinforcement is removed from the experimental situation. The major advantage of employing an extinction procedure is that it eliminates the confounding effects of primary reinforcement. However, as pointed out by Kelleher and Gollub (1962), among others, extinction procedures examine the conditioned reinforcing power of stimuli under conditions in which their ability to reinforce behavior is being weakened. Thus, Kelleher's (1961) results, and those of many others who studied conditioned reinforcement with an extinction procedure, are obtained during the first two or three sessions after primary reinforcement is excluded from the experimental situation. Performances which produce conditioned reinforcement are seldom sustained under an extinction procedure for even two or three additional sessions in the continued absence of primary reinforcement. The absence of powerful conditioned reinforcement effects

in these studies has led many investigators and theorists to deemphasize the role of conditioned reinforcement in the maintenance of behavior (see Kelleher and Gollub, 1962).

An alternative approach to the study of conditioned reinforcement is the examination of the behavioral effects of stimuli paired with primary reinforcement under conditions in which the latter is not removed from the experimental situation. The methods employed in this laboratory adopt this general approach and generate responding which is sustained as long as it earns conditioned reinforcement. Another class of techniques within this approach involves the application of chained schedule procedures as suggested and illustrated by Kelleher and Gollub (1962). Kelleher (1966) illustrated the application of a particularly promising type of chained schedule which he termed a second-order schedule. Kelleher defined second-order schedules as those "in which the behavior specified by a schedule contingency is treated as a unitary response that is itself reinforced according to some schedule of primary reinforcement." One second-order schedule he utilized involved programming fixed-interval components, which were treated as unitary responses, under a fixed-ratio schedule of primary reinforcement. For example, pigeons were rewarded with access to grain only after completing a sequence of 15 successive fixed-interval schedules. Therefore, grain reinforcement was delivered on a fixed-ratio schedule of fixed-interval components. The completion of the ratio was followed by the brief presentation of a visual stimulus and food. No discriminative stimuli were differentially associated with each fixed-interval component, but the completion of each produced the brief visual stimulus. Under those conditions, the visual stimulus served as a conditioned reinforcer which generated typical fixed-interval response patterns in each of the interval components. Similar second-order schedules involving fixed-ratio components were studied by Findley and Brady (1965) and Thomas and Stubbs (1966). In these studies, brief stimulus presentations which followed each fixed-ratio component served as conditioned reinforcers which generated typical fixed-ratio patterns and increased average response rates.

The present procedures are similar to those described above in that they also make use of

brief exteroceptive stimuli and permit the study of this conditioned reinforcing function under stable chronic conditions. Our procedures, however, generate behaviors which are not explicitly chained to behaviors which produce primary reinforcement. Indeed, the very behaviors which intermittently produce conditioned reinforcement, continuously postpone primary reinforcement. This is a consequence of programming intermittent food presentations in conjunction with the no-response contingency. Although the no-response contingency is applied in order to eliminate the possibility of adventitious food reinforcement of key-pecking, it also decreases the possibility of maintaining high rates of responding with conditioned reinforcement. For example, the use of the no-response contingency may have accounted for our failure to obtain typical fixed-interval patterns of responding in the Zimmerman and Hanford (1966) study. In that study, conditioned reinforcements were programmed on a 1-min, fixed-interval schedule, but positively accelerated responding during the intervals was not often obtained. We suggested that as a consequence of the use of the no-response contingency, terminal rates in individual intervals may have been limited in magnitude, since high rates would never be associated with food delivery. This possibility is supported by results of Ferster and Skinner (1957) who observed that the typical response pattern generated in pigeons with a 1-min, fixed-interval schedule of food reinforcement was abolished and replaced by a linear response pattern when the fixed-interval contingency was modified by requiring that the reinforced response occur at least 6 sec after a previous response. Because the use of the no-response contingency may limit the rates generated by our procedures, at least under the present conditions, research presently in progress is being devoted, in part, to assessing its inhibitory contribution and to developing methods of averting or reducing its inhibitory effects. In any case, this feature does not prevent examination of some of the significant variables involved in the control and maintenance of behavior by conditioned reinforcement. Indeed, the fact that it mitigates against the maintenance of behavior makes our results all the more significant insofar as they represent sustained and differential performances maintained on the basis of different

schedules and frequencies of conditioned reinforcement.

One definite advantage of our procedures over the second-order schedule procedures is that stable performances can usually be achieved within relatively few sessions on a given schedule. A complete set of successive multiple schedules might be examined within fewer daily sessions than the total number sometimes required to achieve a final stable performance under a single second-order schedule.

Results recently obtained in this laboratory, and in several others with procedures which differ from the extinction procedure, demonstrate that conditioned reinforcement can, in fact, exert powerful effects on behavior over extended numbers of sessions. In light of the contrast between these findings and those produced with the extinction procedure we suggest (as did Kelleher and Gollub, 1962) that the role of conditioned reinforcement in the maintenance of behavior be carefully appraised in terms of the results generated by all the different methods of study.

Both the present procedures and the chained-schedule procedures offer a valuable alternative to the extinction procedure. Each enables the investigator to examine conditioned reinforcement effects in single organisms over extended numbers of experimental sessions. To the extent that each can represent models of environmental situations to which conditioned reinforcement interpretations are frequently applied, and to the extent that extinction paradigms are poor models of at least some of these situations, the continued and expanded use of these two alternatives should rapidly supply information of greater theoretical and practical significance in the area of conditioned reinforcement.

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