A Comparison of the Effects of Generalized Conditioned Reinforcement and Discrete Conditioned Reinforcement on Human Lever Press Responding Under Different Deprivation Conditions

Steven I. Zlutnick

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A COMPARISON OF THE EFFECTS OF
GENERALIZED CONDITIONED REINFORCEMENT AND
DISCRETE CONDITIONED REINFORCEMENT ON
HUMAN LEVER PRESS RESPONDING UNDER
DIFFERENT DEPRIVATION CONDITIONS

by

Steven L. Zlutnick

A Thesis
Submitted to the
Faculty of the School of Graduate
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of the
Degree of Master of Arts

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Steven I. Zlutnick
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A very obvious difference between twentieth century economies and ancient ones, is that the tradition of bartering and direct exchange of some one good or goods for another is now conspicuously lacking. Today, man possesses units of exchange and reward known as currency and coinage, or more colloquially, "money," which are redeemable for an almost unlimited amount of goods and services and are dispensed for services rendered. It is interesting to note, however, that although it is generally agreed that money (tokens) appears to be one of the most powerful variables used to control behavior, some of its specific functional relationships with human behaviors remain as yet undocumented in the experimental literature.

The quest for the empirical verification of this phenomenon, technically known as a generalized conditioned reinforcer (GCR) has now been underway for some years. Skinner (1953) is generally given credit for describing the GCR in an attempt to explain the effectiveness of attention, approval, affection, submissiveness, and tokens (or money) in controlling behavior.

A discrete conditioned reinforcer (DCR) is a stimulus (originally neutral in effect) which, when paired with a primary reinforcer acquires reinforcing properties. According to Skinner, a conditioned reinforcer is generalized when it is paired with more than one primary reinforcer. A more relevant definition, however, might be stated such that a conditioned reinforcer is generalized when it allows access to more than one primary reinforcer.

Further, as Skinner pointed out, the GCR is useful because the
momentary deprivation condition of the organism is not likely to be important. In short, the effectiveness of the GCR in terms of behavioral control lies in the fact that it is less sensitive to single deprivational states of the organism. Because it has been paired with a variety of primary reinforcers, the GCR will continue to exert control over behavior even though an organism may be satiated for one particular primary reinforcer. If tokens allowed access only to M&Ms, and a subject were then satiated on chocolate, the tokens would probably not serve as effective reinforcers.

Kanfer and Matarazzo (1959), in their work with human subjects, reported that generalized conditioned reinforcement appeared to facilitate verbal learning, and that a parameter of prime importance appeared to be the fact that the subjects could choose from a variety of primary reinforcers when it was time to exchange their tokens. However, only the rate of learning with the conditioned reinforcer was statistically significant over that of the control group. There was no significant difference between the effectiveness of the GCR and the DCR.

Kanfer (1960) further maintained that not only was the multiple pairing of the stimulus with a number of primary reinforcers important, but how they were paired also seemed significant. One group of students in this study were allowed access to a variety of reinforcers and, in addition, an opportunity to choose them at every token exchange. Kanfer pointed out that this GCR group remained at the task longer without reinforcement than the DCR group, the control group, and also longer than a GCR group in which the experimenter
determined the variety of reinforcers rather than the subject.

Consistent with the above, Ferster and DeMyer (1962) also pointed out the apparent advantages of the subject selecting his reinforcers rather than their being selected by the experimenter.

Wunderlich (1961) suggested that the multiple drive reduction notion (Wicke & McNamara, 1955) is not a sufficient condition to produce the GCR effect, and that the changes in response rate might in fact be due to one reinforcer being relatively more powerful than another.

Steinman (1966) demonstrated quite effectively that it was not merely one powerful primary reinforcer that was responsible for changes in rate. A discriminative stimulus \( S^D \) correlated with a random variety of primary reinforcers produced higher rates of responding than the \( S^D \) correlated with the single most powerful primary reinforcer.

It is interesting to note that in all of the heretofore mentioned investigations of the GCR phenomenon, one of the most important aspects of its definition - the relative insensitivity to singular changes in the organism's deprivation state - has not been verified empirically. Kanfer and Matarazzo used the rate of acquisition and resistance to extinction as a dependent measure while Steinman used response rate, or a "strength" measure. No one, however, has as yet developed a GCR and, at the same time, controlled deprivation conditions. In addition, most of the work has been of intersubject design, with little chance to observe individual changes in response rates, durations, etc.
Thus, two major problems seem to emerge from the research cited above. (1) What are the specific functional effects of the GCR upon ongoing rates of behavior? Is there a "strength effect"; i.e., does the GCR somehow generate higher rates of responding than any single DCR? (2) What are the important aspects of the GCR's insensitivity to moment-to-moment changes in deprivational states in relation to human behavior?

The concept of the GCR and its practical application is rapidly becoming a methodological problem which must be answered promptly and precisely. The increasingly numerous reports of "token economies" in the behavior modification literature (Ayllon & Azrin, 1965; Atthowe & Krasner, 1965) all seem to accept as matter of fact an implicit assumption that the GCR is somehow more effective and desirable than a DCR when employing tokens as reinforcers.

In an effort to resolve the questions raised above, this study was designed to compare the effects of a GCR and a DCR with deprivation and no-deprivation procedures on human lever press responding.

**METHOD**

**Subjects**

Two adult psychotic males, ages 36 and 24 years old and institutionalized for periods of 15 and 11 years respectively, served as subjects.

**Apparatus**

A subject was taken from the hall on which he resided and placed
in an experimental room which measured 15 x 15 feet, with one door and one window. The houselights were off and the window shade was drawn. Masking noise was supplied from a Grayson and Stadler white noise generator.

The subject was then seated in front of a black sloping metal console (Fig. 1) which had six momentary response switches, spaced 3 inches apart. Three inches above each switch was a white light, ½ inch in diameter. Only response switches one and six and their corresponding white lights were functional throughout the experiment. Above the white lights were two Presin Model F206 counters with 9/32 inch numerals. Located directly above each counter was a green light, 1 inch in diameter. A reinforcement was discerned as a number registered on one of the counters, accompanied by an audible click and a ½ second flash from the green light above it. Standard electro-mechanical equipment programmed the console and counters, and a Ralph Gerbrands cumulative recorder monitored the local response rates from the control room.

Procedure - All Subjects

The subject was seated in front of the sloping panel console and given the following instructions:

"You see in front of you a console with six levers. Above each lever is a small white light. When one of these lights comes on, you may press the lever directly underneath it and earn points. A point will register as a number on one of these counters. You may then exchange the points you earn for cigarettes."

Lever press responses were then reinforced on a multiple VI
Figure 1 - Schematic view of the sloping panel console. The component parts of the console are labeled A through D.
A. Reinforcement Lights
B. Counters
C. $S^D$ Lights
D. Response Switches
30-second, VI 30-second schedule of reinforcement; that is, at irregular periods of time averaging 30 seconds.

The subject was tested over four 8-minute components, always beginning with the left lever in the first component, and then alternating to the right lever, to the left, to the right, and terminating the session at the end of the fourth component. When a reinforcement was delivered, the green light over the counter flashed along with an audible click and a point registered on the counter. At the end of each 8-minute component, the experimenter (E) entered the room, turned the houselights on, and allowed the subject to exchange his component points for cigarettes at the rate of four points each. With an 8-minute component and a VI 30-second schedule, the S regularly earned between 15 and 17 points per component; i.e., three to four cigarettes. In this manner, points were established as a conditioned reinforcer. The S was not allowed to smoke the cigarettes until after the entire session terminated.

When the subject's response rate had stabilized on both levers, a further manipulation was introduced. The same contingencies remained in effect on the right lever; that is, at the end of the component, the S was allowed to exchange his points for cigarettes only. On the left lever, however, the S could now choose from a number of items in addition to the cigarettes. (Table 1 indicates exchange values of points.) For S1, these additional items included coffee and hard candies; for S2, orange juice, cookies, and soft candies were added. The differences between primary reinforcers for the two Ss were dictated by their verbal reports.
TABLE 1

Point Values Of Primary Reinforcers

<table>
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<tr>
<th>Item</th>
<th>Points</th>
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<tr>
<td>½ Cup Coffee</td>
<td>4 points</td>
</tr>
<tr>
<td>½ Glass Orange Juice</td>
<td>4 points</td>
</tr>
<tr>
<td>Cigarettes</td>
<td>4 points each</td>
</tr>
<tr>
<td>Cookies</td>
<td>3 points each</td>
</tr>
<tr>
<td>Assorted Hard &amp; Soft Candies</td>
<td>1 point each</td>
</tr>
</tbody>
</table>
For both Ss, the method of exchanging points was initially the same. As in the sessions prior to the introduction of additional reinforcers, the E entered the experimental room at the end of each component and allowed the S to exchange his points. Following the right component, the S was given his cigarettes and told to again wait for a white light to appear on the console. The cigarettes could not be consumed at this time. At the completion of the left component, the S was allowed to choose from the previously listed primary reinforcers according to their point values and his total points for the component. Anything not consumed during this short intercomponent period (cigarettes, hard candy) was saved for consumption at a later period in the day.

Procedures - Subject

For eight of the 11 baseline sessions (i.e., sessions during which the baseline level of lever pressing was recorded with points exchangable for cigarettes only on both levers), the S was denied access to all programmed reinforcers for ½ hour prior to the start of the session. This deprivation period was increased to a 1-hour period for the last three baseline sessions.

During the GCR-1 phase (the sessions immediately following baseline during which coffee and candy were added to the cigarettes on the left lever), the S remained on 1-hour deprivation for all reinforcers.

Following the GCR-1 phase, there was a return to baseline procedures with the 1-hour deprivation on all reinforcers remaining in effect.
For the final (GCR-2) phase, coffee and hard candy were again added to the cigarettes on the left lever, with a further change to a non-deprivation procedure in which S was allowed free access to cigarettes for 1\frac{1}{2} hours prior to running time. (Table 2 indicates the number of sessions per condition for each S.)

Procedures - Subject

This S was denied access to all primary reinforcers described previously for 1 hour prior to baseline sessions and GCR-1 sessions, which were the same as for S_1, with the addition of orange juice, cookies, and soft candy to the cigarettes on the left lever for S_2. There was no reversal to baseline procedures for S_2, the third and final phase for this S being GCR-2 procedures as described above.

RESULTS

Subject

During baseline, lever pressing for S_1 stabilized at an average of 1,520 responses in the left components and 1,590 responses in the right components (Fig. 2). These figures were arrived at by adding the number of responses in a session for the two right components together and the two left components together. The variability of responding between successive presentations of the right components and successive presentations of the left components was slight (Fig. 3). During the GCR-1 phase (Fig. 2) responding in the left, or generalized conditioned reinforcement (GCR), components increased to
<table>
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<th></th>
<th>Baseline</th>
<th>Deprivation GCR-1</th>
<th>Return to Baseline</th>
<th>No-Deprivation GCR-2</th>
<th>Total Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_1$</td>
<td>10</td>
<td>11</td>
<td>9</td>
<td>11</td>
<td>41</td>
</tr>
<tr>
<td>$S_2$</td>
<td>10</td>
<td>10</td>
<td>---</td>
<td>5</td>
<td>25</td>
</tr>
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Figure 2 - The rates of responding emitted by Subject_1 in the right and left components for the four experimental conditions. Left component responding is indicated with hollow squares and right component responding with solid circles.
Figure 3 - Cumulative record of a baseline session for Subject 1.
an average of 1,760 responses per session while responding in the right, or discrete conditioned reinforcement (DCR) components decreased to an average of 1,460 responses. Thus, responding during the GCR components increased on the average of 230 responses per session over baseline and differed from the DCR components (during the GCR-1 phase) by over 300 responses per session. The decrease in responding in the DCR components during this phase was characterized by periods of pausing rather than a decrease in local rate (Fig. 4). The increase in rate following the initiation of the GCR-1 conditions was transitory, however, and by sessions 21 and 22, the rates had essentially decreased to those observed during baseline.

When the baseline procedures were reinstated (Fig. 2), responding in the DCR components stabilized at 1,535 responses per session, while responding in the GCR components decreased gradually to an average of 1,320 responses. Response rates in the DCR components approximated baseline while the mean response rates in the GCR components were 200 responses per session lower than during baseline.

Upon the introduction of GCR-2 (non-deprivation) conditions, responding in both components increased slightly. The average response rate for the right component (1,670 responses) was higher in this phase than that of the left component (1,480 responses), yet there was less disparity between the two component rates than in the second baseline phase in which responding in the DCR components averaged 215 more responses per session than responding in the GCR components. This figure was reduced to 190 responses in GCR-2.
Figure 4 - Cumulative record of a GCR-1 session for Subject 1.

Arrows indicate time in session when the subject paused.
Subject 2

During baseline, lever pressing for $S_2$ stabilized at an average of 1,527 responses per session in the left components and 1,742 responses in the right components (Fig. 5). Again, for each session, the number of responses from the two left components were totaled, as were the number of responses from the right components. As with $S_1$, $S_2$ showed slight variability in response rates between presentations of the right and left components (Fig. 6).

During the GCR-1 phase (Fig. 5), responding in the DCR components increased slightly to an average of 1,810 responses per session (an average increase of 72 responses per session over baseline), whereas the average rate of responding in the GCR components increased by approximately 225 responses per session over baseline.

In the GCR-2 phase, responding in the DCR components decreased very slightly to an average rate of 1,743 responses per session (from 1,810 responses in GCR-1 condition), while responding in the GCR components dropped sharply to an average of 1,390 responses per session (from 1,756 responses in the GCR-1 condition).

All Subjects

Figure 7 shows the average response rates for $S_1$ and $S_2$ for both components for the various experimental conditions. Both $S$s show an increment in responding in the GCR-1 phase over baseline responding.
Figure 5 - The rates of responding emitted by Subject 2 in the right and left components each session for the three experimental conditions. Left component responding is indicated with hollow squares and right component responding with solid circles.
Figure 6 - Cumulative record of a baseline session for Subject 2.
Figure 7 - The averaged response rates for Subjects 1 and 2 for the various experimental conditions. Left component responding is indicated with hollow squares and right component responding with solid circles.
AVER. RESPONSES / CONDITION

$S_1$

$S_2$

A - BASELINE
B - GCR-1
C - BASELINE
D - GCR-2

• RIGHT COMPONENTS
□ LEFT COMPONENTS

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DISCUSSION

The present study attempted to clarify two major problems relevant to the analysis and definition of a GCR. The first question concerned itself with the GCR's specific functional effects upon ongoing rates of behavior. With both subjects, the introduction of a GCR on the left lever in the GCR-1 phase did indeed produce moderate, though transitory, increments in responding on the GCR lever. This increase in rate is consistent with the results of previous research (Steinman, 1966; Wunderlich, 1961).

In addition to the increase in response rate during the GCR-1 phase, another interesting change in rate was observed in the data for $S_1$; that is, the concomitant decrease in rate in the DCR components. This phenomenon has been described by Reynolds (1961) as a negative contrast effect. He defined negative contrast as a change in the reinforcement rate in one component producing a decrement in responding in the constant component. The occurrence of a negative contrast effect in relation to the GCR is in agreement with Steinman (1968), who is reporting similar effects with children.

Given that both subjects were exposed to identical deprivation conditions and received points allowing access to a number of primary reinforcers, it may well be that the different changes in responding were due to their reinforcement histories prior to participating in the experiment. It would not seem reasonable at this point to assume that access to a number of primary reinforcers and 1-hour deprivation would be sufficient conditions to produce
systematic changes in response rates.

The second problem under consideration was that of a change in deprivation conditions concomitant with the introduction of a GCR. It was felt that satiation, or at least a non-deprivation condition, for cigarettes would most effectively demonstrate the assumption of the insensitivity of the GCR to temporary changes in deprivation on one reinforcer, since organisms have a low probability of responding for reinforcers on which they have been satiated (Holland & Skinner, 1961). Thus, in the GCR-2 condition, both Ss were allowed free access to cigarettes for 1 hour prior to the start of each session. S1 would generally consume a minimum of one full pack (20) of cigarettes. S2 would usually consume 10 to 15.

With S1, overall responding increased slightly in the GCR-2 condition, but response rates in the right components continued to dominate rates in the left components by an average of 190 responses per session. For S2, the obtained response rates for the GCR-2 phase were entirely unexpected. Even though both Ss were non-deprived on cigarettes, they continued to perform at the same rate (and often at a higher rate) in the DCR components than in previous conditions. No explanation is offered for this phenomenon. It does appear that, at least under the conditions stated here, that changes in deprivation, specifically as they related to the right component (i.e., with the DCR) had little expected effect on response rates. In one case (S2), non-deprivation during the GCR-2 phase seemed to facilitate responding in the DCR components. It is interesting to note that the increase in response rate in the GCR components during
the GCR-1 phase was essentially unreplicable in the GCR-2 phase. Whether or not this was a result of deprivation procedures is as yet undetermined.

Thus, although much about the GCR (i.e., multiple pairings with primary reinforcers, insensitivity to singular changes in deprivation, etc.) would seem to indicate its added usefulness and superiority in controlling behavior, only one of its supposed effects (higher response rates) was empirically demonstrable in this study; this effect was, however, of a transitory nature. The only exception to previous research was a moderate, but again transitory, contrast effect with S₁ in the first GCR condition.

There appear to be a number of improvements, modifications, and changes which could be made in future research. First, the counters with points should be replaced with a token dispenser. The two subjects who participated in this study had a difficult time calculating how many points they had spent and how many they had yet to spend. It would greatly simplify matters, and possibly be a controlling variable, if such a token procedure were implemented.

Secondly, it might be profitable to proceed to a concurrent rather than a multiple schedule of reinforcement, since concurrent schedules might be more useful in detecting changes in responding. With a concurrent schedule, the possibility of the S responding because there is no other means of earning points (as in the multiple schedule) might be eliminated. Changes in rate might then be considered in terms of response distribution between the GCR lever and the DCR lever.
A greater variety of primary reinforcers might also be effective in maintaining long term changes in response rates. Steinman (1968) is reporting this to be effective, particularly in pre-school subjects.

It would also seem prudent to deny subjects the opportunity to take whatever reinforcers they have not consumed back to the hall after the completion of a session. Given the existing deprivation conditions for cigarettes, etc. in institutional settings, it is conceivable that the subjects might trade these remaining reinforcers for other commodities, thus allowing for the creation of another GCR. This could certainly confound the data.

CONCLUSION

In an attempt to demonstrate the specific functional effects of generalized conditioned reinforcement upon ongoing behavior, and further, to determine the effects of deprivation and non-deprivation upon behavior in conjunction with the generalized conditioned reinforcer, this study provides tentative evidence that the generalized conditioned reinforcer: (1) does indeed appear to facilitate higher rates of responding (at least for short periods of time); and, (2) might also produce negative contrast effects. Further, it might well be complete satiation on the discrete conditioned reinforcer which will prove to be a primary controlling variable, rather than simple non-deprivation conditions. Certainly more research is needed on the generalized conditioned reinforcement.
phenomenon, particularly with the subject as his own control, in
order to more clearly specify the functional relationships between
the generalized conditioned reinforcer and behavior.
REFERENCES


Steinman, W. M. Personal communication, 1968.


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