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RESPONSE COST AND FIXED-RATIO PERFORMANCE

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The effects of several conditions of response cost (response-produced point loss) upon FR 50 performance maintained by 100-point reinforcements were investigated. Post-reinforcement pauses did not appear under no-cost (no points deducted per response) conditions. Such pauses were effected, however, by introducing 5-sec periods of one-point and two-point costs after each reinforcement. Continuous response cost did not affect responding as long as the cost was less than the 100-point reinforcements. Rapid cessation of responding occurred when continuous response cost was made equal to reinforcement.

Marked changes in operant behavior have been produced by temporal alternations of response cost conditions under fixed-interval (FI) and variable-interval (VI) schedules of positive reinforcement (Weiner, 1962). The present study examined the effects of several response cost conditions upon fixed-ratio (FR) performance.

METHOD

Subjects

Four normal humans, ages 19-32, were used. The subjects (*Ss*) were paid $4.00 for the first hour of testing and $1.50 for each additional testing hour of each day.

Apparatus

Similar to one reported previously (Weiner, 1963b), the apparatus consisted of a microswitch key mounted in a table top in front of a display. The display consisted of a five-digit, add-subtract counter and different colored lights (S^Ds) which provided discriminative stimuli for the various experimental contingencies.

The *Ss* began each 1-hr session with five zeros showing on the counter. Their task was to get as high a score as possible by pressing the microswitch key (with a force of approximately 20 g through a distance of 1 cm). Holding down the key had no effect upon the programmed experimental contingencies. Repeated responses required repeated closures of the microswitch key.

Procedure

The experimental program consisted of five phases, each lasting 4 hr, during which the key presses of the *Ss* were conditioned on an FR 50 schedule under different response cost conditions. Every 50th key press was reinforced by the addition of 100 points to the *Ss'* score.

In Phase 1, FR 50 performance was conditioned under continuous no-cost (no points deducted per response). Phase 2 consisted of FR 50 conditioning under two randomly alternating 30-min components, *i.e.*, no-cost with and without a 5-sec one-point cost (one point deducted per response) introduced after each reinforcement. In Phase 3, FR 50 conditioning was continued under three components, *i.e.*, the two components of Phase 2 plus a third component in which a one-point cost per response was in effect continuously between reinforcements. In Phase 4, a 5-sec two-point cost component (two points deducted per response), which was introduced after each reinforcement, was added to the three components of Phase 3. Similar to the 5-sec one-point cost period, the 5-sec two-point cost period was followed by no-cost until the next reinforcement. FR 50 conditioning continued as usual. Finally, Phase 5 consisted of FR 50 conditioning under the four cost com-

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ponents of Phase 4 plus an additional two-point cost component in effect continuously between reinforcements.

The duration of each component in Phases 1-5 was 60-min, 30-min, 20-min, 15-min, and 12-min, respectively. Distinctive S^Ds (*i.e.*, colored lights) were associated with the no-cost and the one-point and two-point response cost periods of 5-sec duration. When the one-point and two-point response cost periods were in effect continuously between reinforcements, the S^D lights associated with their respective 5-sec counterparts were illuminated continuously between reinforcements. In addition to these S^Ds, a spatially distinguishable, differently colored, S^D light was also associated with the FR 50 schedule.

The FR 50 schedule and cost conditions were programmed by transistorized digital elements and networks (Weiner, 1963a). Response rates and patterns were recorded continuously on a Gerbrands Cumulative Recorder.

Instructions

At the beginning of the first hour of conditioning, the following instructions were read to each *S*.

"Your task is to score as many points on the counter as possible. You can score points only by pressing and releasing this button in some fashion. You will not be able to score points by continuously holding down the button. Every time you press the button you must release it immediately. Remember, your task is to score as many points as possible.

"From time to time there will be different conditions. Do not think that the machine is broken or not functioning properly. If the machine does break, I will tell you that such is the case.

"Under some conditions, you will do better, that is, get a higher score, than under others. In fact, under some conditions you may go below zero in your score. Just try to get the highest score you can under all conditions."

At the beginning of each session, the *S*s were told to "keep the score as high as possible". They received no other instructions.

RESULTS AND DISCUSSION

Figures 1 and 2 present the final performances of two *S*s under Phase 5. Comparable data have been obtained from the other two *S*s.

It will be noted that FR 50 performance under continuous no-cost (Component 1) was characterized by relatively high response rates without post-reinforcement pauses. Post-reinforcement pauses analogous to those observed occasionally in humans (Holland, 1958) on comparable FR schedules were produced by introducing either a one-point cost (Component II) or a two-point cost (Component IV) for 5-sec after each reinforcement. These findings suggest that post-reinforcement pauses on an FR 50 schedule may be produced by alterations in response cost conditions.

The length of the post-reinforcement pauses in both Component II and Component IV were identical, indicating that, under the conditions of the present study, the duration of the cost and not the amount of cost per response was the controlling factor. Furthermore, these cost-produced post-reinforcement pauses had negligible effect upon the terminal response rates.

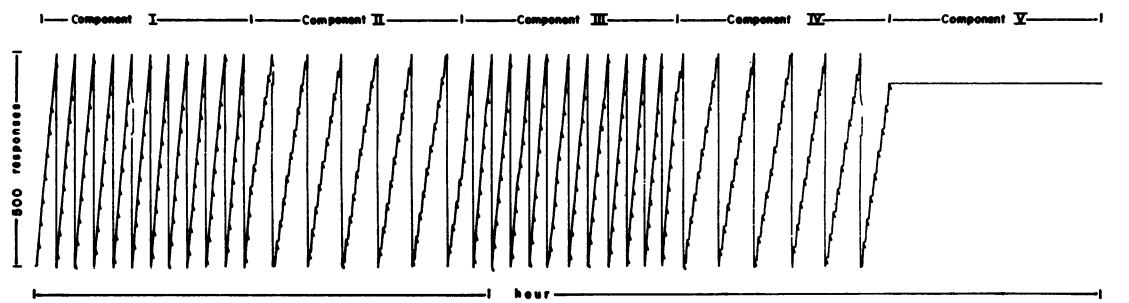

Fig. 1. FR 50 performance of *S*77 under continuous no-cost (Component 1), under no-cost with a one-point cost for 5-sec after each reinforcement (Component II), under a continuous one-point cost between reinforcements (Component III), under no-cost with a two-point cost for 5-sec after each reinforcement (Component IV), and under a continuous two-point cost between reinforcements (Component V). Vertical marks on the cumulative response curve indicate the occurrence of 100-point reinforcements.

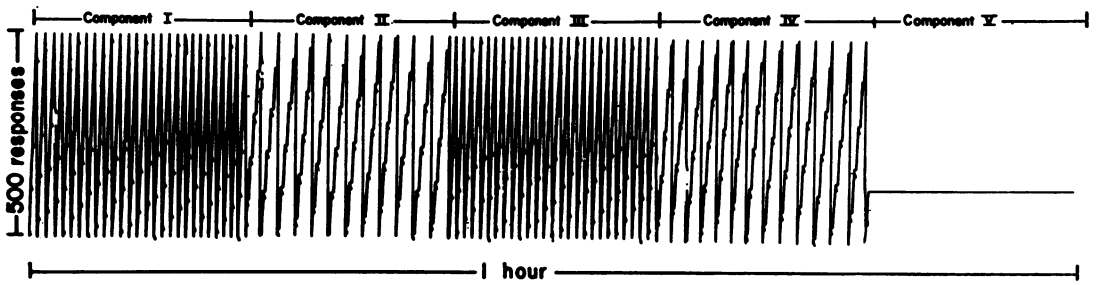

Fig. 2. FR 50 performance of S80 under continuous no-cost (Component I), under no-cost with a one-point cost for 5-sec after each reinforcement (Component II), under a continuous one-point cost between reinforcements (Component III), under no-cost with a two-point cost for 5-sec after each reinforcement (Component IV), and under a continuous two-point cost between reinforcements (Component V). Vertical marks on the cumulative response curve indicate the occurrence of 100-point reinforcements.

FR 50 performance under a continuous one-point cost between reinforcements (Component III) was similar to continuous no-cost performance. A high constant response rate without post-reinforcement pauses characterized both performances. It should be pointed out, however, that under a continuous one-point cost, the total response cost per reinforcement (50 points) was less than the reinforcement (100 points) itself (*i.e.*, there was a net gain of 50 points). When a continuous two-point cost between reinforcements was introduced (Component V), the total response cost per reinforcement (100 points) was made equal to the reinforcement itself (100 points). Under these conditions, there was fairly immediate suppression of responding even during the initial introduction (*i.e.*, during the first hour of Phase 5 conditioning) of the continuous two-point cost.

These data are, in general, consistent with those reported previously (Weiner, 1962) concerning the importance of response cost for the development and maintenance of "characteristic" fixed-interval (FI) performance. In both studies, post-reinforcement pausing was produced under certain conditions of response cost. Unlike the FI results, however, a one-point continuous cost under the FR 50 schedule in the present study did not attenuate responding between reinforcements. These differential effects are understandable when one considers the fact that, unlike responding under the FI schedule, suppression of responding between reinforcements on the FR 50 schedule (where response cost was less than reinforcement) would have resulted in a net loss of points (positive reinforcement).

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