

RELATIVE EFFICACY OF SELF-MONITORED AND EXTERNALLY IMPOSED REINFORCEMENT SYSTEMS¹

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This experiment was designed to test the behavior maintenance capabilities of self-monitored reinforcement and to compare it to that of an externally-imposed system of reinforcement. 1 group of children selected their own performance standards and rewarded themselves whenever they attained their self-prescribed level. For a 2nd group of children the same behavioral standards were imposed and the reinforcers were externally administered. Ss in the control groups performed either without any incentives, or received rewards on a non-contingent basis. The results disclose that self-monitored and externally applied reinforcement were equally efficacious, but both reinforcement systems sustained substantially more responsivity than did the control conditions. Contrary to expectation from reward-cost theories, most of the children imposed upon themselves highly unfavorable schedules of reinforcement which incurred high effort costs at minimum self-reward.

It has been abundantly documented by research that behavior is governed to some extent by its consequences. However, investigations of reinforcement processes have involved limited forms of reinforcing feedback, characteristically produced by externally controlled operations in which an experimenter imposes a particular contingency upon an organism and delivers reinforcing stimuli whenever the appropriate responses are displayed. While this system of behavioral control may be adequate in accounting for responsivity in infrahuman organisms, it is considerably less efficacious when applied to human functioning which is self-regulated to a greater degree. Unlike rats or chimpanzees, persons typically set themselves certain standards of behavior, and generate self-rewarding or self-punishing consequences depending upon how their behavior compares to their self-prescribed demands.

In recent years there have been numerous investigations of the conditions governing the acquisition of behavioral standards and self-reinforcing responses (Bandura, Grusec, & Menlove, 1967; Bandura & Kupers, 1964; Bandura & Whalen, 1966; Marston, 1965;

Mischel & Liebert, 1966). Although these studies have shown that after persons adopt a self-monitoring system their performances arouse positive and negative self-evaluative reactions, there has been no adequate demonstration that self-administered consequences do, in fact, possess reinforcing capabilities. The major purpose of the present study was therefore to test the efficacy of self-monitored reinforcement, and to compare it to that of an externally imposed system of reinforcement.

A self-reinforcing event includes several subsidiary processes, some of which have been extensively investigated in their own right. First, it involves a *self-prescribed standard of behavior* which serves as the criterion for evaluating the adequacy of one's performances. The standard-setting component has received considerable attention in studies of aspiration level.

In the case of most performances, objective criteria of adequacy are lacking and hence, the attainments of other persons must be utilized as the norm against which meaningful self-evaluations can be made. Thus, for example, a student who achieves a score of 120 points on an examination, and whose aspirations are to exceed modal levels, would have no basis for either positive or negative self-reactions without knowing the accomplishments of others. A self-reinforcing event,

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therefore, often involves a *social comparison process*.

Third, the *reinforcers are under the person's own control*; and fourth, *he serves as his own reinforcing agent*. These various defining characteristics guided both the form of the self-monitored reinforcement system and the types of controls that were instituted.

The capacity to maintain effortful behavior over time is perhaps the most important attribute of a reinforcement operation, and consequently it was this property that was tested in the present investigation. Children performed a task in which they could achieve progressively higher scores by turning a wheel on a mechanical device. Subjects in the self-monitored reinforcement condition selected their own performance standard and rewarded themselves whenever they attained their self-prescribed criterion. Children assigned to an externally imposed reinforcement condition were yoked to the self-reward group so that the same performance standard was set for them and the reinforcers were automatically delivered whenever they reached the predetermined level.

In order to ascertain whether subjects' behavioral productivity was due to the operation of contingent self-reinforcement or to gratitude for the rewards that were made available, children in an incentive-control group performed the task after they had received the supply of rewards on a noncontingent basis. A fourth group worked without any incentives to estimate the response maintenance value of the task itself.

It was predicted that both self-monitored and externally imposed reinforcement systems would sustain substantially more behavior than conditions in which rewards were bestowed noncontingently or were absent altogether. No hypothesis was put forward concerning the relative efficacy of the two systems of reinforcement, since there exists no adequate theoretical basis for a differential prediction.

METHOD

Subjects

The subjects were 40 boys and 40 girls drawn from two elementary schools in a lower middle-class area. The children's ages ranged from 7 to 10 years.

Apparatus

The apparatus consisted of a rectangular box, the front face of which contained a vertical plastic-covered aperture $\frac{1}{2}$ inch wide by 16 inches high divided into four equal sections. Contained within this upright column were four score-indicator lamps, each one capable of illuminating one and only one of the translucent sections. Directly adjacent to the sections were mounted, in ascending order, the corresponding numbers 5, 10, 15, and 20, signifying four performance levels.

The score indicator lamps were activated in an ascending order by turning a wheel located at the bottom of the apparatus. It required eight complete rotations of the wheel to advance 5 points, so that a total of 32 cranking responses was necessary to attain a 20-point score.

A criterion-selector switch, which could be turned to any one of four positions corresponding to the scores next to the lights, was mounted on the front panel of the apparatus. The electrical circuit was so designed that whenever the selected performance standard was attained a chime sounded and the lights were automatically extinguished, signifying the completion of the trial. For example, in the case where a 20-point standard was chosen, the lamps adjacent to the numbers 5, 10, 15, and 20 would be illuminated after 8, 16, 24, and 32 rotations of the wheel, respectively, and then all of them would simultaneously extinguish.

Contained within the upright section was an automatic chip dispenser which delivered plastic tokens into a bowl mounted in front of the apparatus. The bountiful supply of tokens was hidden from view since their public display would not only provide children with a basis for comparing their earned rewards with the maximum possible, but it might also produce erroneous hypotheses about normative performance on this task. These factors, if uncontrolled, could have served as extraneous determinants of responsivity in the contingent-reinforcement conditions.

Located above the chip receptacle was a button which, when pressed, released a token into the bowl. A remote control device was constructed that was capable of performing the same operations as the selector switch and the token delivery button, and when necessary, rendering them inoperative.

Procedure

The introductory phase of the experiment was the same for all subjects. The children were brought individually to a mobile laboratory, ostensibly to test some game equipment. After the experimenter explained and demonstrated the operation of the apparatus, the children were given a practice trial to familiarize themselves with the task.

Small plastic tokens served as the reinforcers or incentives in those treatment conditions that required them. Children who received contingent reinforcement—either self-administered or externally applied—were informed that the tokens would later be

exchanged for prizes, and the more tokens they obtained the more valuable the redeemable prizes. The incentive control subjects, who were given tokens on a noncontingent basis, were also informed that the chips they possessed would be traded later for prizes.

Several procedures were instituted in order to remove any extraneous social influences on subjects' responsiveness. It was explained to children in all groups that they would perform the task alone in the room because the experimenter had some other work to do, and they might work at it as long as they wished. They were asked to notify the experimenter, who was in another room of the mobile laboratory, after they no longer wished to continue the activity. Moreover, children in the self-reinforcement condition selected their performance standard after the experimenter had departed. To remove any concern that the experimenter might evaluate their behavioral productivity from the number of tokens accumulated, the children were instructed to place the banks in which they deposited their tokens in a sealed paper bag; a second experimenter would collect the banks later that day and return with the prizes in a few weeks. Finally, to control for the possibility that children's response output might be partly determined by the classroom activities they were missing, subjects in all four conditions were tested during the same instructional periods.

Children in the *self-monitored reinforcement* condition were informed that they would have to decide which performance standard they wished to set for themselves, and then to turn the selector switch to that level. In addition, they were instructed to treat themselves to tokens whenever they attained their self-imposed standard. Since these subjects had full control over the token rewards, they were free to choose their own magnitude of self-compensation on any given trial.

The children were further told that after they had selected the performance level they desired to attain, they could, if they wished, change it once, but only once, during the remainder of the session. This procedure was employed for two reasons: first, observation of self-reinforcing behavior occurring under naturalistic conditions reveals that individuals rarely shift their behavioral standards capriciously. Rather, persons usually adhere to their adopted standards and change them only as a result of cumulative feedback experiences. Therefore, an effort was made to elicit from children criterion-selection behavior which could be somewhat analogous to that occurring in everyday life.

The second reason for allowing the self-reinforcement group only one modification in their standards was related to the yoking requirement of the experiment. In order to control for the influence of behavioral standards upon responsiveness across the four treatments, the performance requirements adopted by a child in the self-reward group were applied to the subject paired with him in each of the remaining conditions. Thus, for example, if a particular child in the self-monitoring group initially selected a criterion of 15 and after 20 trials

lowered it to 10, this same pattern of standards was set for his yoked counterpart in each of the three comparison groups.

It is possible that any one of the children in the other conditions might persist longer than the self-reward subject to whom he was matched. If the standard selection had been highly changeable, there would be no basis for deciding that criterion to impose upon him for the remainder of the session. The limitation that standards be modified only once created a situation in which most self-reward children effected their allotted change before terminating the session, thus establishing the final performance requirement. In fact, 16 of 20 subjects had made the change before discontinuing the task. Therefore, it was meaningful to apply the standard last employed by the self-reward subject to children in the other conditions who might display more endurance than their matched partner.

After the instructions were completed, the children were handed a token bank, and left alone to perform the task as long as they wished.

Children in the *externally imposed reinforcement* system were yoked according to the procedure described above, so that the performance standard was fixed for them and the tokens were automatically delivered by the machine whenever they reached the prescribed performance level. They also received the same magnitude of reward as children in the self-reinforcement condition, that is, if a subject in the self-reward group treated himself to two tokens on a given trial, the machine would dispense two chips on the same trial to the paired counterpart in the external-reinforcement condition.

Subjects in this group were told that the machine determined the performance standard, and upon reaching it the tokens were automatically delivered. The token dispenser and the standard setting were, in fact, controlled by the experimenter from a remote console in an adjoining observation room.

Children in the "inheritance" or *incentive-control* condition were given at the beginning of the session the entire amount of tokens accumulated by their partner in the self-reward group. As in the previous treatment, the children were told that the machine regulated the performance standards operative at any given time. Another *control group* of subjects performed the task without receiving any tokens whatsoever to evaluate the response maintenance capacity of the game itself.

There are two important elements within a self-reinforcing event whose independent effects must be assessed before persistence of self-reinforced behavior can be meaningfully interpreted. These are (a) the self-imposition of an achievement standard, and (b) the self-administration of rewards. In order to examine the performance increments, if any, due to imposing a standard alone, a second study was conducted. The behavioral output of 10 children allowed to select the performance standard for which they endeavored was compared to that of 10 yoked subjects for whom the same standard was externally imposed; neither group, however, received any token rewards.

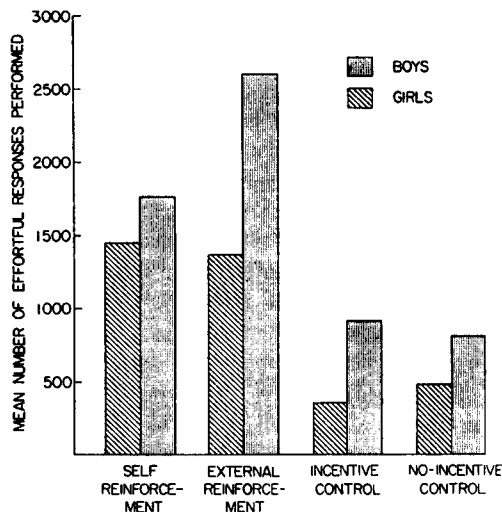


FIG. 1. Mean number of responses performed as a function of sex and type of reinforcement system.

Dependent Measures

The number of cranking responses performed by the children, which constitutes the major dependent variable, was mechanically recorded. In addition, the experimenter recorded the performance standards selected by the self-reward children, and the number of reinforcers that they administered to themselves on each trial. A second observer, who scored independently the latter responses of 15 subjects, was in perfect agreement with the experimenter.

RESULTS

Behavioral Productivity

Figure 1 presents the mean number of effortful cranking responses performed by boys and girls in each of the four conditions of the main experiment. Analysis of variance of these data disclosed a highly significant main effect due to reinforcement conditions ($F = 15.56$; $p < .001$).

In order to determine the specific differences contributing to the overall treatment effect, separate t tests were computed for pairs of conditions. These analyses revealed that self-monitored and externally imposed reinforcement were equally efficacious ($t = 1.62$), but both reinforcement systems sustained substantially more behavior than either noncontingent rewards or a nonreward condition. Children who reinforced their own behavior generated significantly more responses than

children in the incentive-control group ($t = 3.91$; $p < .001$), or the no-incentive condition ($t = 3.87$; $p < .001$). The corresponding t values for comparisons between external reinforcement and the incentive-control and no-incentive-control groups were $t = 5.53$ ($p < .001$) and $t = 5.49$ ($p < .001$), respectively. It is also interesting to note that rewarding subjects noncontingently did not produce a significant increment in performance as revealed by comparison with the behavior of children who performed the task without any external incentives ($t = 0.04$).

The analysis also revealed that boys generated more responses than girls ($F = 13.09$; $p < .001$). Although no significant interaction effect was obtained between sex and treatment conditions, external reinforcement produced more behavior in boys ($t = 2.45$; $p < .05$) than the self-monitored system.

Children who set their own performance standards without engaging in self-reinforcement produced a mean number of 369 cranking responses, whereas the corresponding mean for the yoked controls was 586. Statistical analysis of these scores yielded no significant difference ($F = 1.56$) between the groups, thus indicating that self-imposition of

TABLE 1

SELF-IMPOSED STANDARDS AND ASSOCIATED MAGNITUDE OF SELF-REWARD

Ss	1st standard	Mean no. rewards	2nd standard	Mean no. rewards
Boys				
1	10	1.00	No change	
2	10	1.00	5	1.09
3	15	1.00	20	1.18
4	15	1.00	20	1.00
5	15	0.98	No change	
6	20	1.11	5	1.02
7	20	1.00	10	1.06
8	20	1.00	10	0.90
9	20	1.00	15	1.00
10	20	1.00	No change	
Girls				
1	10	1.00	15	1.00
2	10	1.11	20	1.14
3	15	1.00	5	1.04
4	15	1.00	20	1.00
5	15	1.04	20	1.12
6	15	1.00	No change	
7	20	1.00	5	1.05
8	20	1.00	5	0.93
9	20	1.21	5	1.02
10	20	1.00	10	1.00

a standard alone has no response maintenance value.

Self-Imposition of Performance Demands

The four performance standards employed in the present experiment essentially correspond to advancing fixed-ratio schedules of 8, 16, 24, and 32 responses for each self-reinforcement. Table 1 presents the standards initially adopted by children in the self-monitoring condition, the performance demands that they imposed upon themselves in later phases of the experiment, and the average magnitude of self-reward associated with the achievement of each standard.

It is apparent from these data that the children did not behave in ways that would maximize rewards. Not a single child chose the lowest ratio schedule, and approximately half the children self-prescribed the most austere schedule of self-reinforcement (i.e., 32 responses for each self-reward). Moreover, a third of the children subsequently altered their initial standard to a higher level, without a significant commensurate increase in amount of self-reward, thereby imposing upon themselves a more unfavorable work-to-reinforcement ratio.

It is also interesting to note that three children occasionally did not reward themselves after attaining their chosen criterion. In two of the three cases this occurred after they had reduced their performance standard drastically. At times these children apparently did not regard their low performances as sufficiently meritorious to warrant self-reward.

DISCUSSION

Results of this study disclose that self-monitored reinforcement possesses considerable behavior maintenance value. Moreover, the high response productivity engendered by this system was not due to merely the self-imposition of a performance standard, or availability of positive incentives.

Although self-regulated and externally imposed reinforcement did not differ in their capacity to sustain behavior, there was some suggestive evidence that, within the age range studied, boys might be more responsive under conditions of externally determined than of

self-governed reinforcement, while for girls both systems are equally efficacious. These findings are consistent with those of developmental studies (Sears, Rau, & Alpert, 1965), showing that sex differences in adult-role behavior and various indexes of self-control generally favor the girls. The obtained sex difference in response productivity under all treatment conditions is most likely due to the fact that the task required some physical effort, and consequently the boys' higher output simply reflects their greater strength.

A supplementary finding of considerable interest is the prevalence with which children imposed upon themselves highly unfavorable schedules of reinforcement. This behavior is all the more striking considering that the self-imposition of high performance demands occurred in the absence of any social surveillance and under high permissiveness for self-reward. Evidence obtained from experiments investigating the acquisition of self-reinforcing behavior (Bandura & Kupers, 1964; Bandura & Whalen, 1966; Bandura et al., 1967) throws some light on the probable mechanism governing this apparently irrational behavior.

The above studies demonstrate that after a person has adopted a standard of what constitutes a worthy performance, attainments that fall short of self-prescribed norms generate negative self-evaluative reactions, whereas those that match or exceed the guiding standard give rise to positive self-evaluations. Hence, under conditions where persons are provided with ample opportunities to optimize their material outcomes by engaging in behavior which has low self-regard value, strong conflicting tendencies are likely to be aroused. On the one hand, individuals are tempted to maximize rewards at minimum effort costs to themselves, but on the other hand, low quality performances produce negative self-evaluative consequences which, if sufficiently strong, may inhibit generous self-compensation. Indeed, many of the children in the experiment set themselves performance requirements that incurred high effort costs at minimum material recompense. These findings are at variance with predictions from reward-cost theories unless these formulations are extended to include the self-esteem costs of rewarding devalued behavior.

The foregoing discussion has been primarily concerned with conflicts that might arise between two forms of self-reinforcing tendencies and how their resolution results in selective self-reinforcement under the discriminative control of performance standards. Of equal importance is the recurring phenomenon in which self-generated consequences conflict with externally occurring outcomes, as when certain behaviors are reinforced by particular social agents, but if carried out would give rise to self-critical reactions. Conversely, response patterns may be effectively maintained by self-reinforcement operations under conditions of minimal external support. It is perhaps due to the stabilizing effects of self-reinforcement that persons do not ordinarily behave like weathervanes in the face of conflicting patterns of external contingencies which they repeatedly encounter in their social environment.

In view of the demonstrated efficacy of self-monitored systems, it would be of interest to explore further the extent to which self-reinforcement may substitute for, supplement, or override the effects of externally occurring outcomes. It would likewise be of considerable import to determine the degree to which overt behavior can be regulated by covert self-reinforcing operations which rely upon self-generated symbolic consequences in the form of self-satisfaction, esteem-enhancing reactions, or self-deprecation.

Although many children selected unusually high performance standards for themselves and did not lower them to enhance their fortunes, other children self-imposed equally lofty standards of achievement but later settled for a relatively mediocre level of productivity. Further research is needed to establish the conditions determining both the initial imposition of behavioral requirements for self-reward, and the direction in which self-reinforcement contingencies might subsequently be altered.

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