SELF REINFORCEMENT
AS A FUNCTION OF BASELINE SCORE AND LEVEL OF TRAINING

PAMELA EASTERBROOK


CENTRE FOR NFLD. STUDIES
JUL 22 1974
MEMORIAL UNIVERSITY
OF NEWFOUNDLAND

Self Reinforcement

As A Function Of Baseline Score And Level Of Training

Thesis submitted to the Department of Psychology, Memorial University of Newfoundland in partial fulfillment of the requirements for the degree of Master of Science October 4, 1972.

Acknowledgements

The author expresses her appreciation and gratitude to Dr. A. Kozma, under whose supervision the project was completed. His encouraging comments and constructive direction became especially welcome in the finishing phases of the analyses. Appreciation is also directed towards Serap Maktav, living companion and fellow student, who managed to retain her objective orientation throughout all stages of the project.

Also thanks to Dr. T. Hannah for his constructive comments. Finally, thanks to Mrs. M. Lawlor and Mrs. B. Brocklehurst who typed the final draft.

ABSTRACT

The purpose of this study was to determine the effects of baseline self reinforcement scores and level of training on post training self reinforcement scores. Subjects were classified into low, medium and high self reinforcer groups during a baseline self reinforcement measuring period. Then, subjects were assigned to treatment groups in which they received either 40%, 60% or 80% training on a four choice, discrimination learning task. Following this phase, post training scores were taken in a self reinforcement testing period.

Results of the study showed that training served to increase self reinforcement scores over baseline self reinforcement scores, but only if training exceeded the original baseline self reinforcement score. Correct and incorrect applications of self reinforcement responses to actual task responses were also under examination, and it was found that the three baseline self reinforcer groups differed in discriminative self reinforcement behavior following training procedures.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Stimuli which increase the probability of a particular response are defined as reinforcers. Reinforcers are considered to have two characteristics by which they achieve their effect: information feedback and incentive feedback. The former indicates to the subject that his response is appropriate to the context, while the latter indicates to him how desirable the reinforcer is (c.f. Locke, Carteledge, & Koeppel, 1968).

At least three distinct reinforcement systems have been discussed in the literature: direct reinforcement, vicarious reinforcement, and self reinforcement. These systems differ in the manner in which feedback is provided to the subjects. In a direct reinforcement paradigm, both information and incentive feedbacks are administered directly by the experimenter. If a child makes a correct response he may receive a candy. The candy indicates not only that the response was correct, but also provides the child with additional pleasure derived from eating the candy.

In a vicarious reinforcement system the experimenter provided only information feedback directly to the subject. The incentive feedback has to be recalled by the subject himself (Bandura, 1969). Therefore, in a typical vicarious reinforcement paradigm, the subject obtains information feedback by watching someone else receive reinforcement for the correct response. Accordingly, he does not directly experience the incentive aspects of the reward.

In the self reinforcement paradigm, the experimenter provides neither incentive nor information feedbacks directly to the subject during the test phases. The subject, therefore, has to decide when to reinforce himself. A typical study of self reinforcement requires the subject to reinforce himself whenever he thinks his response is correct (c.f. Kanfer & Marston, 1963). According to this paradigm, (Bandura, 1971; Kanfer, 1970) the original behavioral context in which the response was acquired will release the subject's coded memory of both the correct response and the characteristics of the reinforcer which made the response desirable. Moreover, this recall will determine the rate at which the subject will provide self reinforcement in a particular setting.

One of the prime concerns of the self reinforcement studies has been with the effects of differential training procedures on the self reinforcing behavior of the subject. Marston & Kanfer (1963) trained subjects to 60% criterion on a discrimination learning task. Following training, subjects were instructed to activate the reinforcement light, in a post training self reinforcement period, when they judged their responses as correct. Subjects were reported to "administer self reinforcers to a response with a probability quite close to that with which the response was reinforced by the experimenter at the end of acquisition" (Marston & Kanfer, 1963, p.94). The mean number of self reinforcements given in the first block of the testing phase was 60%, a level which equalled training criterion (subjects matched self reinforcement rates with

training rates).

Kanfer & Marston (1963) trained subjects to either 50%, 70% or 90% criterion on the same learning task. During the test phase of the study they again found that amounts of self reinforcement approximated levels of training (65%, 81% and 93% self reinforcement, respectively).

Kanfer & Duerfeldt (1967) employed a different paradigm in their effort to evaluate self reinforcement behavior. Their subjects were trained with 60% random reinforcement on a tachistoscopoic matching to sample task, in which nonrepeated stimuli were employed. Despite task differences between this and previous studies, subjects were again reported to have matched self reinforcer rates with level of training (60% self reinforcement). On the basis of these and related findings, Kanfer & Duerfeldt concluded that subjects have a "tendency to match their self reinforcement rate to a rate at which external reinforcement is obtained" (Kanfer & Duerfeldt, 1967, p. 245). A closer inspection of the literature suggests, however, that such a conclusion is at best an oversimplification. At least two variables, other than training, appear to affect the rates at which subjects provide self reinforcement. The first of these is instructions to self reinforce. The second is differences in subjects' tendencies to self reinforce prior to training, i.e., baseline differences and pretraining effects.

In a second study of their 1963 paper, Kanfer & Marston trained subjects to a 60% criterion on a discrimination learning

task. Following training, they instructed one group of subjects to be lenient in their decisions to reward themselves, another group to reinforce themselves when confident (control group), and a third group to be extremely certain before they reward themselves. Posttraining self reinforcement levels for these three groups were 87%, 61% and 47% respectively. These results indicate that only the control group was matching. Accordingly, the matching of self reinforcing responses with training conditions can be modified by appropriate instructions.

Evidence for the differential effects of pretraining on post training self reinforcement responses is also readily found in the literature. In a study by Kanfer, Duerfeldt & LePage (1969), subjects were required to estimate the duration of various signals. They were instructed to reinforce themselves for all correct responses on which the experimenter failed to provide reinforcement. All subjects received 25% random reinforcement and the number of self reinforcement responses were recorded. Following this pretraining procedure the subjects were asked to respond with most imaginative associations to a series of stimulus words on a word association task. They received 50% random reinforcement. The number of self reinforcing responses obtained during a post training phase were recorded. The authors reported that their population was clearly dichotomized with respect to numbers of self reinforcing responses they made during the pretraining phase of the study. (45% made zero self reinforcing responses, while 45% made five or more self reinforcing responses out of

a possible 24). Moreover, the number of self reinforcement responses given by subjects on the time estimation task was related to the number of self reinforcement responses given by them during the test phase of the word association task.

Bartol & Duerfeldt (1970) obtained baserate self reinforcement measures in a study in which they employed the same word association task. Subjects were instructed to judge their performance for 20 trials prior to any feedback from the experimenter. The subjects were then trained with either 30% or 60% random reinforcement for the next 40 trials. Post training self reinforcement measures were taken during the next 40 testing trials. The study reported a grand mean of 52% base rate self reinforcement. This level increased significantly to 66% mean self reinforcement following the 60% training, but did not shift significantly following the 30% training (46% mean self reinforcement).

Statement of the Problem

On the basis of these studies by Kanfer et al (1969) and Bartol & Duerfeldt (1970) it may be predicted that when training levels exceed the subjects' baserate self reinforcing levels there will be changes in self reinforcement levels. If, however, training is lower than subjects' baserate self reinforcement levels, there will be no significant changes in self reinforcement levels. A primary aim of the present investigation will be to test this conclusion.

A study which seems to be consistent with the preceding conclusion is reported by Marston (1969). Marston varied both

baseline rates and levels of training in a "pseudo subliminal perception task in which accuracy of the evaluated verbal response was not permitted to vary" (Marston, 1969, p. 175). Baseline measures were obtained by asking subjects to judge their behavior for 15 trials on this task prior to the training phase. On the basis of baseline scores, subjects were divided into zero self reinforcers (0 self reinforcements), low self reinforcers (2-7 self reinforcement responses), and high self reinforcers (8-15 self reinforcement responses). An unequal number of subjects from each of the three baseline groups were randomly assigned to one or four training conditions: (1) 80% positive feedback after self reinforcement and 80% after non self reinforcement; (2) 80% positive feedback after self reinforcement and 20% after non self reinforcement; (3) 20% positive feedback after self reinforcement and 80% after non self reinforcement; and (4) 20% positive feedback after self reinforcement and 20% after non self reinforcement. Therefore, conditions 1 and 4 were arranged to manipulate the total amounts of reinforcement given, while conditions 2 and 3 were designed to manipulate actual contingencies of these reinforcements. Reinforcement rates administered during training and subsequent self reinforcements given by subjects during the test phase are reported in Table I.

Since only conditions 1 and 4 provided constant reinforcement for all baseline groups (80% and 20%), these conditions of the Marston study (1969), are the only ones that are even remotely comparable with groupings of previous studies.

Table I Mean percent of training rate and mean percent of post training self reinforcement rate per condition x baseline, Marston (1969)

	Condition 1		Condition 2		Condition 3		Condition 4	
	Training	SR	Training	SR	Training	SR	Training	SR
ZERO	80%	55%	24%	7%	71%	13%	20%	2%
LOW	80%	66%	56%	58%	51%	45%	20%	20%
HIGH	80%	80%	62%	73%	41%	52%	20%	40%

ZERO - Zero self reinforcers
LOW - Low self reinforcers
HIGH - High self reinforcers

Data from these two comparison conditions indicate matching for high self reinforcers on 80% training, and low self reinforcers on 20% training. Under 80% training his zero self reinforcers and low self reinforcers did not reach a criterion of matching, while under 20% training high self reinforcers maximize while zero self rewarders minimize. Therefore, these data indicated a baseline self reinforcement level by rate of training interaction, and raise the possibility that test rate changes in self reinforcement as a result of training depend upon whether or not the training rates exceed the baseline rates of self reinforcement.

If Marston is correct in his interpretation that contingent reinforcement is more important than noncontingent reinforcement in changing self reinforcement rates, it might be predicted that increases in self reinforcement rates on a learning task in which subjects can obtain accurate feedback on their decision to self reinforce should be greatest for those instances in which subjects reinforce themselves correctly. A second objective of the present study, therefore, is to determine if observed changes in self reinforcement responses are attributable to increases in discriminative applications of these reinforcers, when a learning task is employed during training.

In summary, the following two predictions are being evaluated in the present investigation: firstly that there will be changes in self reinforcement rates, as a result of training, only when amounts of training reinforcement exceed

the subjects' base rate self reinforcement levels (a baseline x training interaction); and secondly, that observed changes in self reinforcement rates, as a result of training, will be primarily attributable to the subjects' increased discrimination in applying self reinforcers to his own task behavior.

By dividing subjects into three baseline identity groups on the basis of baseline self reinforcement scores, and exposing equal numbers of subjects from these groups to either 40%, 60% or 80% task contingent feedback on a learning task, it is specifically predicted that:

(i) low self reinforcers will show a significant change in self reinforcement scores over training following each of the training conditions,

(ii) medium self reinforcers will show a significant change in self reinforcement scores over training following 80% training, and following 60% training, but only if this latter level significantly exceeds their base rate self reinforcement level,

(iii) high self reinforcers will not show a significant change in self reinforcement scores following training, since it is anticipated that there will be no training contingency that significantly exceeds their baserate self reinforcement level,

(iv) it is expected that changes in self reinforcement rates, as a result of training, will be attributable to an increased tendency on the part of the subject to reinforce himself for correct responses.

METHOD

Subjects

Subjects were 45 male and 45 female introductory psychology students attending Memorial University of Newfoundland. Each subject was paid one dollar per half hour of experimental participation.

Design and Analysis

The study involved the testing of three baseline self reinforcer groups (low self reinforcers, medium self reinforcers, and high self reinforcers), of both sexes, in three conditions of task contingent training (40%, 60% and 80%). This resulted in eighteen treatment cells, with five subjects per cell.

Defining limits for the three baseline groups were determined separately for each sex. To achieve the division, the distribution of raw baseline scores for each sex was divided into approximate thirds. Until this division was possible, an attempt was made to assign subjects with similar baseline scores randomly to each treatment condition.

Three measures were taken prior to and following training: self reinforcement scores, correct self reinforcement scores (correctly applied to task responses), and incorrect self reinforcement scores (incorrectly applied to task responses). Each measure was analyzed in a separate 3 (levels of training) x 3 (baseline scoring groups) x 2 (sex) x 2 (pre post measures) BALANOVA computerized analysis, with repeated measures on the last factor.

Apparatus and Materials

(i) Equipment

A Kodak Carousel 800 slide projector, producing a 14x21 inch image onto the screen was used to present the stimuli. Stimuli covered the center area of 7x11 inches.

The response panel was a 17x10x3 inch aluminum structure with four toggle switches, numbered one, two, three and four, mounted on its face. Each switch corresponded to a different quadrant of the screen and a diagram above each switch indicated the quadrant to which the switch referred. A red push button, centered above these four switches, was the subject's self reinforcement button. A similar button was attached to the experimenter's table. Both buttons activated the white reinforcement light (lamp size 1892) located at the top of the panel. The four toggle switches each activated a differently colored response choice light (lamp size 1892) located at the rear of the panel. These choice lights were observable only by the experimenter, and were used in taking task response measurements.

All timing for the slide durations was controlled by BRS logic.

(ii) Stimuli

Sixty 24x36 mm slides, each showing four nonsense syllables, were used as task stimuli. (The sixty slides constituted six copies of ten different slides). The syllables were consonant-vowel-consonant nonsense syllables with association value ranging from 49% to 51% (Archer, 1960). Combin-

ations of syllables on each slide, their positions on the slide, and the position of the correct syllable of each slide were chosen randomly. The six different orders for presenting the slides were also randomly determined (refer to Appendix A: Figure 5, for illustrations of the slides, and Figure 6 for list orders).

(iii) Task

The task was adapted after that used by earlier learning studies on self reinforcement (c.f. Marston & Kanfer, 1963). The subject was required to choose the "correct" syllable of four nonsense syllables presented onto the screen. Each slide of four syllables was projected for four seconds, following which the subject was allowed four seconds to make his decisions. This constituted one trial. Ten such trials, one presentation of each of the stimulus items, constituted one block of trials. There was a 10-second interblock interval.

Procedure

Subjects were tested in a 6x10 foot experimental room. Upon entering the room, the subject was directed to his seat in the middle of the room, and asked to read the instructions taped onto the table in front of him (refer to Appendix A, Figure 7 for the instructions used). After the subject indicated that he had read the instructions, the experimenter projected a numbered, sample slide, and two stimulus slides in order to clarify further the task. This clarification was necessary since the baseline phase of the study provided the subject no task feedback.

The baseline phase continued for two blocks of trials. After the second block, the subject was instructed to refrain from pressing the reinforcement button, since the light would go on automatically if his response was actually correct. Training continued until the end of the block of trials during which the subject attained either 40%, 60% or 80% correct choices on the task (the task criterion for each of the three treatment conditions). Following the last training block, the subject was instructed to provide his own reinforcement by pressing the reinforcement button if he deemed his choice to have been correct. The testing phase continued for four blocks of trials.

Order of slide presentations remained constant throughout the entire procedure for each subject. Thus, all subjects were presented with block orders one and two during the baseline phase, and they were presented with block order number three for the beginning of the training phase. However, each subject was presented with the block order of the one which immediately followed his training criterion block for the beginning of the testing phase.

Measures were taken of the subject's task response choices in all phases of the study, and measures were taken of his self reinforcement choices in the baseline and testing phases.

The mean baseline self reinforcement scores for each training condition by sex condition are given in Appendix B, Table III. Baseline self reinforcement scores were evenly distributed across the three training conditions, although the baserates for males and females differed.

Mean numbers of trails to criterion during training were 3.9, 6.4, and 8.9 for the 40%, 60% and 80% conditions, respectively. Differences in trials to criterion, either across baseline self reinforcement groups, or between sexes were not significant. Thus, prior to testing the only source of subject variability lay in the high self reinforcing behavior of the low celf reinforcement male subjects.

For the primary analysis of the study self reinforcement scores were compared for each sex x baseline x training x pre post measure treatment condition (BALANOVA, 1966). The results of this analysis showed significant baseline ($p<.01$), pre post ($p<.01$) and sex ($p<.01$) main effects, with the treatment effect, and treatment x baseline interaction approaching statistical significance (Table IVa). In addition, significant effects were obtained for sex x baseline ($p<.01$), sex x pre post ($p<.05$), and sex pre post x baseline (p .05, on a one tailed test) interactions.

An inspection of the data suggested that a lack of low scoring male self reinforcers served to weaken the pre-post x baseline x training interaction. For this reason, separate analyses were conducted on the pre post training self rein-

Table IV Summary of Balanova "Self Reinforcement, pre post" analysis, (a) Balanced

Source	d.f.	Mean Square	F	
Training (T)	2	1.66	3.04	
Baseline (B)	2	99.15	181.06	**
Sex (S)	1	5.27	9.6	**
T x B	4	0.2	<1	
T x S	2	1.04	1.9	
B x S	2	7.41	13.57	**
T x B x S	4	1.0	1.8	
Population (P)	72	0.5		
Measure (M)	1	34.45	92.7	**
T x M	2	1.82	4.9	*
B x M	2	35.45	95.42	**
S x M	1	2.0	5.4	*
T x B x M	4	0.43	1.16	
T x S x M	2	0.09	<1	
B x S x M	2	1.0	2.94	
T x B x S x M	4	0.5	<1	
M x P	72	0.37		

* $p < .05$

** $p < .01$

Table IV (b) Unbalanced groups

Source	d.f.	Mean Square	F	
Baseline (B)	2	108.0	139.7	**
Training (T)	2	3.64	4.7	*
T x B	4	1.39	1.8	
Population (P)	81	0.77		
Measure (M)	1	43.43	93.2	**
B x M	2	35.0	75.13	**
T x M	2	1.18	2.55	
T x B x M	4	0.81	1.75	
M x P	81	0.46		

* $p < .05$

** $p < .01$

Table V Summary of Balanova "Self Reinforcement, pre post" analysis

(a) Males

Source	d.f.	Mean Square	F	
Training (T)	2	<1	<1	
Baseline (B)	2	27.54	38.47	**
T x B	4	0.25	1	
Population (P)	36	0.71		
Measure (M)	1	9.90	24.73	**
T x M	2	1.12	2.82	
B x M	2	12.04	30.08	**
T x B x M	4	0.21	<1	
M x P	36	0.40		

(b) Females

Source	d.f.	Mean Square	F	
Training (T)	2	2.60	6.90	**
Baseline (B)	2	79.01	210.14	**
T x B	4	0.95	2.53	
Population (P)	36	0.37		
Measure	1	26.57	77.48	**
T x M	2	0.76	2.23	
B x M	2	24.50	71.45	**
T x B x M	4	0.27	<1	
M x P	36	0.34		

** p .01

forcement scores for each sex. Both analyses constituted 3 (training levels) x 3 (baseline groupings) x 2 (pre post measure) repeated measure BALANOVA designs.[1]

The analysis for the females showed significant training ($p < .01$) and baseline ($p < .01$) main effects, and a significant training x baseline interaction ($p < .01$, on a one tailed test, Table Vb), while the analysis for the males showed only the baseline main effect ($p < .01$, Table Va). The lack of an overall significant training x baseline interaction may thus be attributed to the considerably higher baseline self reinforcement scores of low self reinforcer males. These males appear to behave like medium females. To further evaluate this interpretation, a new overall analysis was performed in which all Ss were divided on baseline scores independent of sex. The new range applied was that originally used for females.

Results of this new analysis, a 3 (treatment groups) x 3 (baseline groups) x 2 (pre post measures) BALANOVA[1] analysis with repeated measures on the last factor, indicated training ($p < .05$), baseline ($p < .01$), and pre post measure (p .01) main effects, and a significant training condition x baseline group interaction ($p < .01$, on a one tailed test, Table IVb; Figure I).

To facilitate interpretation of the baseline x training interaction, a further analysis was performed on the self reinforcement data. Difference scores were computed by subtracting pretraining self reinforcement scores from post training self reinforcement scores. The new analysis, a 3 (treatment groups) x 3 (baseline groupings) factorial design

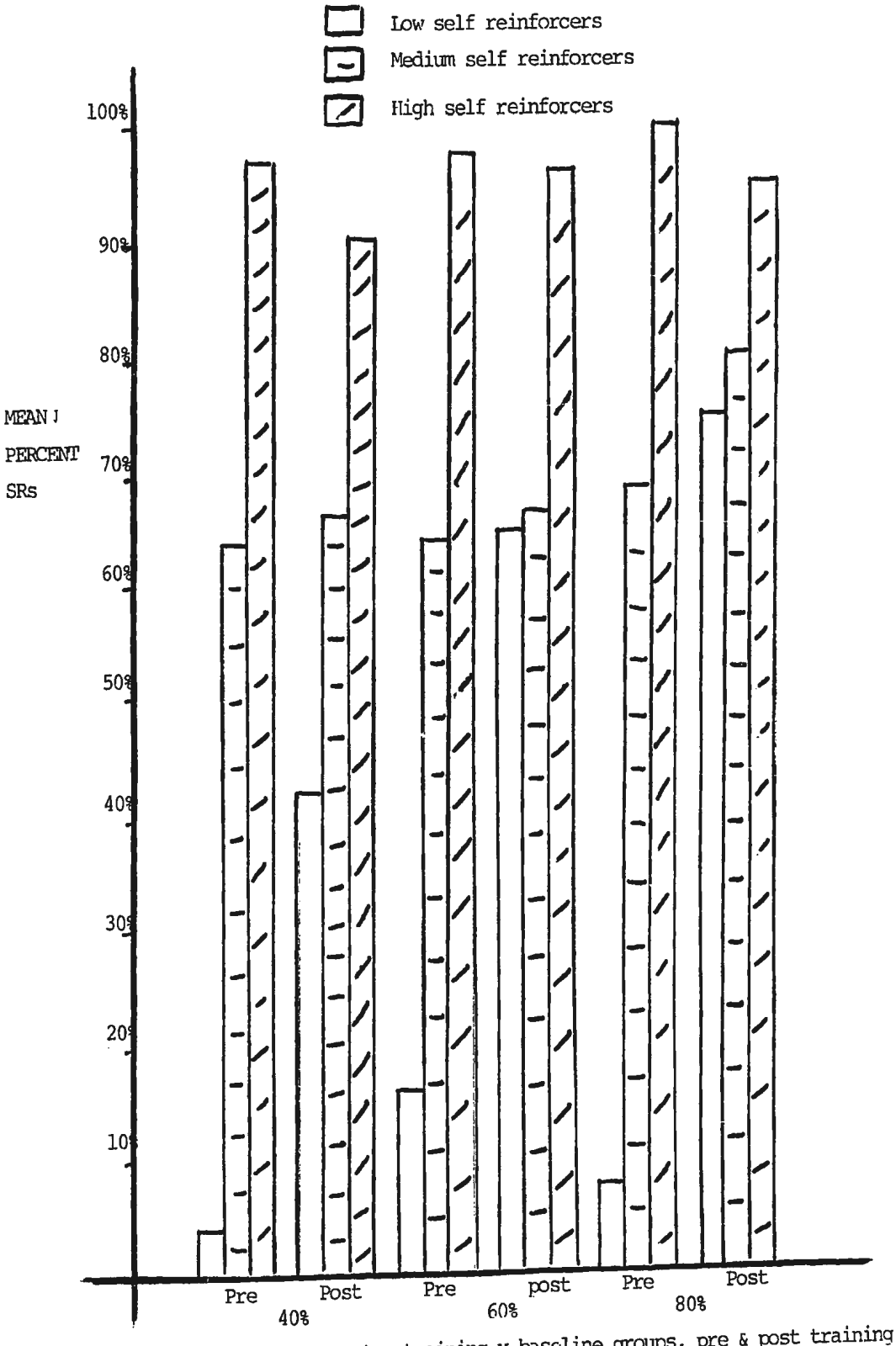

Figure 1 Mean self reinforcements, training x baseline groups, pre & post training

was analyzed by the BALANOVA[2] program. The analysis produced the significant baseline ($p < .01$) and training ($p < .01$) main effects, as well as a significant baseline x training interaction ($p < .05$, Table VI). A comparison of treatment means by the Newman Keuls procedure (Winer, 1962) showed that the low self reinforcers changed significantly more than the medium and high self reinforcers following all levels of training ($p < .01$), and that medium self reinforcers changed significantly more than high self reinforcers following 80% training only ($p < .05$). Also, the low self reinforcers changed significantly more following the 60% training than the 40% training conditions ($p < .05$) and significantly more following the 80% training than the 60% training conditions ($p < .01$). Medium self reinforcers changed more following 80% training than 60% training, ($p < .05$), and high self reinforcers did not significantly differ in changes recorded following any of the training levels (Appendix B, Table IX; Figure 2).

Secondary analyses of this study were concerned with the task performance contingencies accompanying the changes in self reinforcement rates following training. Increases in applications of self reinforcements for task performance were measured in two ways: increases in the incidences of correct applications of self reinforcement, and decreases in the numbers of incorrect applications of self reinforcements as a result of training. Separate 3 (training levels) x 3 (baseline groupings) BALANOVA[2] analyses were run on correct and incorrect self reinforcement difference data.

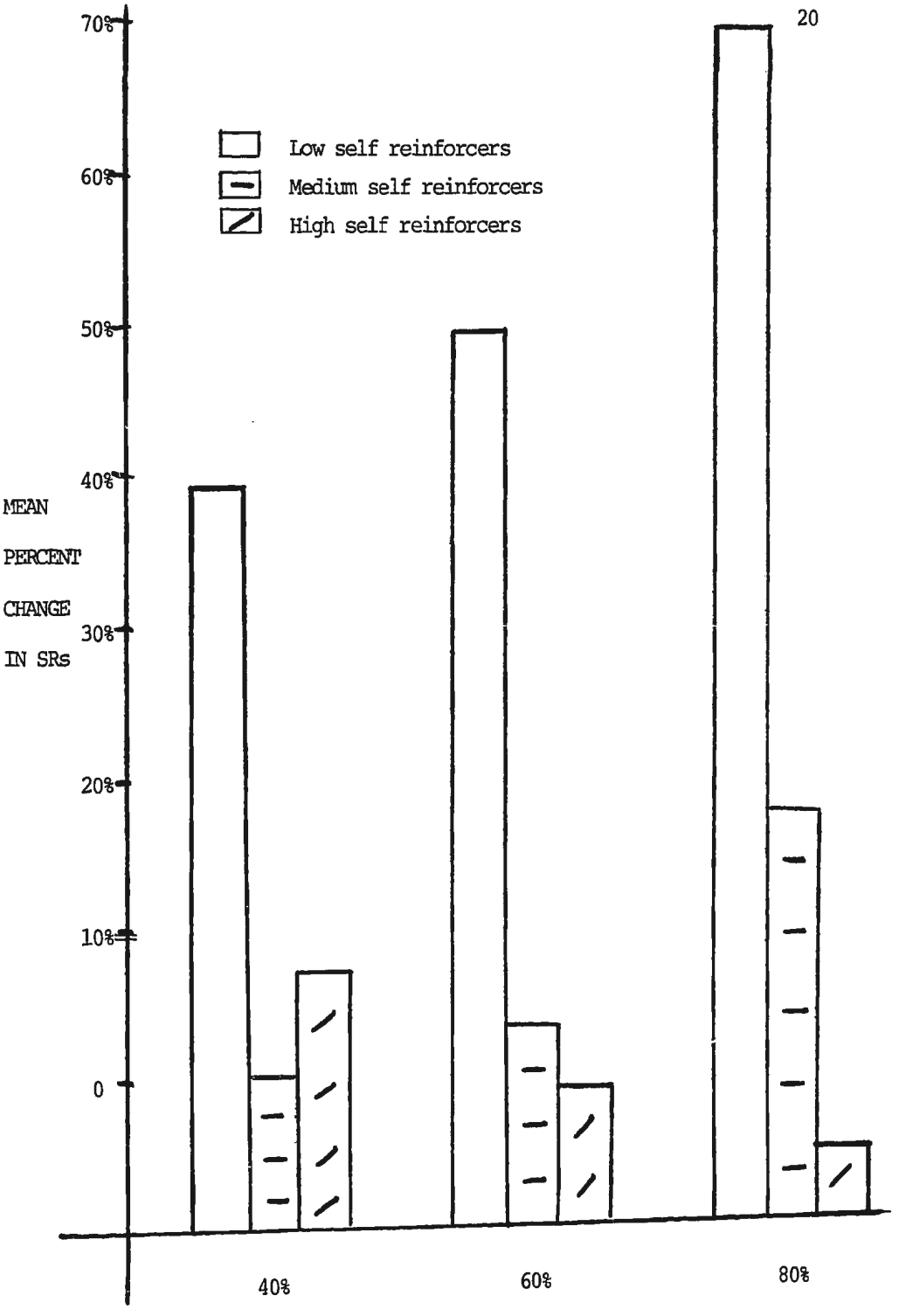

Figure 2 Self reinfofcement differences, training x baseline groups

Table VI Summary of Balanova "SR difference" analysis, unbalanced groups

Source	d.f.	Mean Square	F	
Baseline (B)	2	214.7	89.8	**
Training (T)	2	13.5	5.6	**
B x T	4	8.9	3.7	*
Population	81	2.39		

* $p<.05$
** $p<.01$

Table VII Summary of Balanova"CSR Difference" analysis, unbalanced groups

Source	d.f.	Mean Square	F	
Baseline (B)	2	8.49	4.1	*
Training (T)	2	131.63	63.5	**
B x T	4	2.36	1.14	
Population	81	2.07		

* $p<.05$
** $p<.01$

Table VIII Summary of Balanova "ISR Difference" analysis, unbalanced groups

Source	d.f.	Mean Square	F	
Baseline (B)	2	154.38	49.92	**
Training (T)	2	30.7	9.95	**
B x T	4	0.87	<1	
Population	81	3.09		

** $p<.01$

Results of the first analysis on correct self reinforcements scores revealed both baseline ($p<.05$) and training ($p<.05$) main effects (Table VII). Examinations of cell means disclosed that all subjects increased correct self reinforcements over training ($p<.01$, 40% versus 80%; Table X, Appendix B). Both low and medium self reinforcers increased correct self reinforcements significantly more than high self reinforcers ($p<.05$) following 60% and 80% training contingencies (Appendix B, Table X, Figure 3).

Results of the second analysis, decreases in incorrect self reinforcements resulting from training, showed both baseline ($p<.01$) and training ($p<.01$) main effects (Table VIII). Comparisons of cell means disclosed that all groups decreased incorrect self reinforcements across training levels ($p<.05$, 40% versus 80%; Figure 4). The high self reinforcers decreased incorrect self reinforcement significantly more than medium self reinforcers following 40% training. Both groups decreased incorrect self reinforcements significantly more than low self reinforcers following each training condition ($p<.01$). This measure of incorrect self reinforcement also isolated another effect. There were significant differences in incorrect self reinforcement changes between 60% and 80% ($p<.05$) training conditions for low self reinforcers, and there was a significant difference in incorrect self reinforcement changes between the 40% and 60% training levels ($p<.01$) for the medium self reinforcers, and a significant difference in incorrect self reinforcement changes between the 60% and 80% training levels for

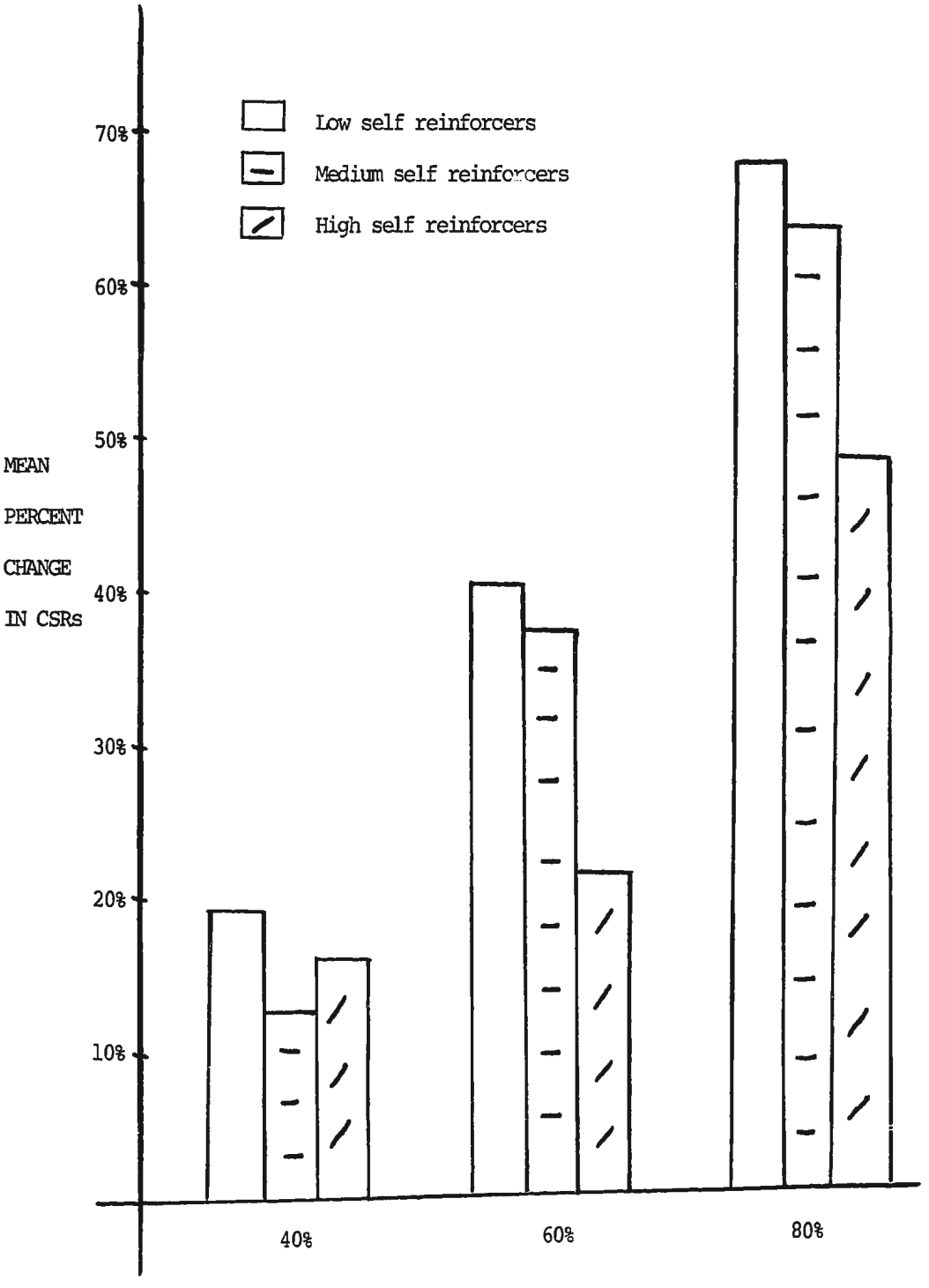

Figure 3 Correct self reinforcement differences, training x baseline groups

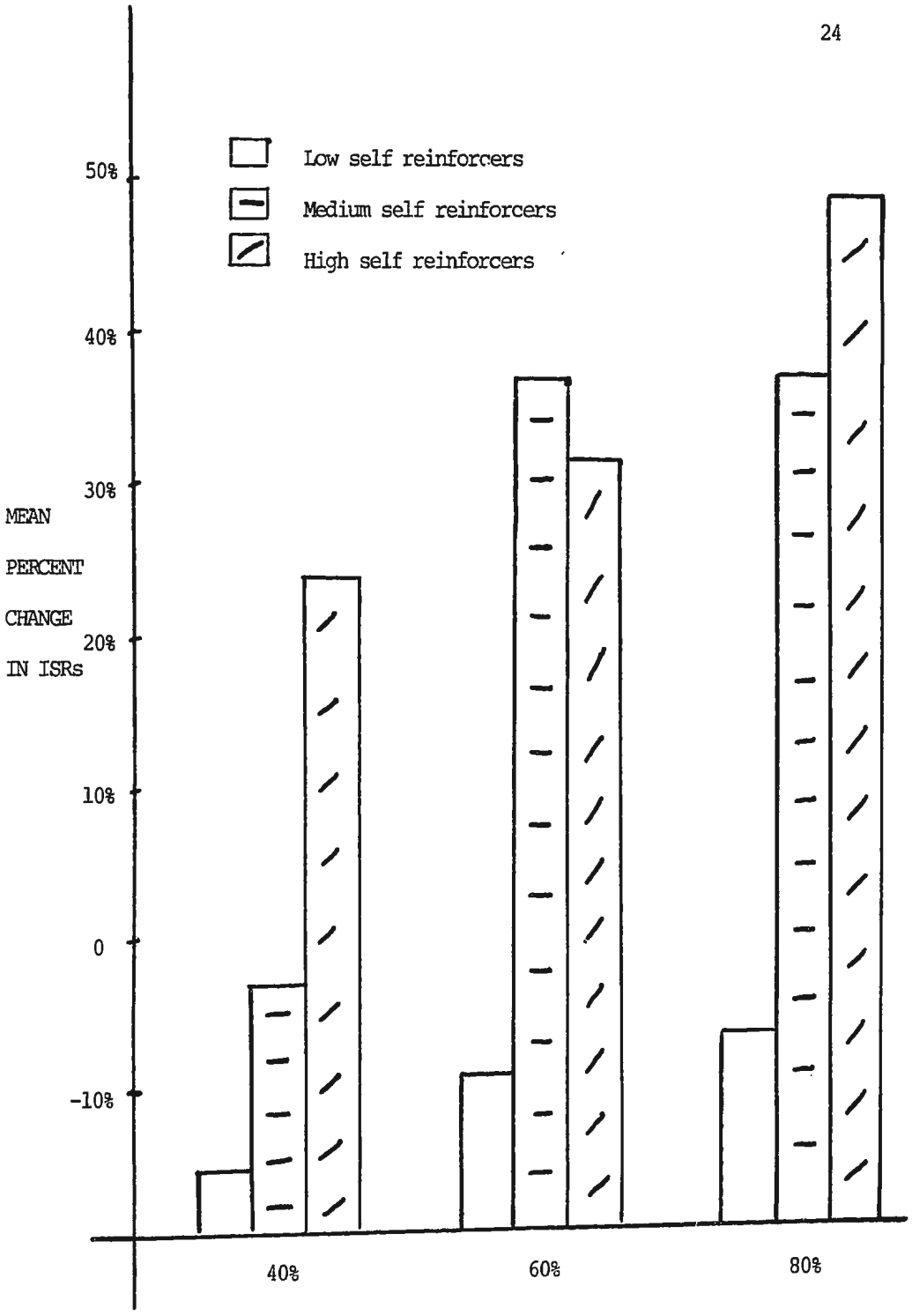

Figure 4 Incorrect self reinforcement differences, training x baseline groups

the high self reinforcers ($p < .05$, Appendix B, Table XI; Figure 4).

FOOTNOTES

1. It was found necessary, when running the BALANOVA program with these data, to convert all scores in order to reduce the numbers of zeros in the data, as zeros caused program interruptions. The conversion used was $(\sqrt{x} + \sqrt{x+1})$.

2. It was found necessary, when running the BALANOVA program with these data, to convert all scores in order to eliminate the negative scores in the data. A constant of k=10 was added to all difference scores.

DISCUSSION

A prime concern of this study was to evaluate baseline and training effects on a post training measure of self reinforcement. It was predicted that an interaction between these variables best accounts for the post training self reinforcement measurements.

The present data are consistent with such a prediction. An analysis of self reinforcement means supports the contention that subjects will not change their baseline self reinforcement level until the amount of training offered by the experimental setting will exceed such a level. The low self reinforcers, for whom all training exceeded their baseline level, were responsive to each of the training conditions, matching their self reinforcement levels with training levels. The medium self reinforcers, who had a mean of 65% baseline self reinforcement, were not found to change this level until training reached 80%, at which time they responded by matching training. The high self reinforcers, who had a mean of 95% baseline self reinforcement, were not found to change this level at all.

On the basis of these findings, it might be expected that overall matching of self reinforcement rates with training levels should be more likely under high levels than under low levels of training. Under low training conditions, subjects should maximize, since baseline rates will exceed training levels. Such an interpretation of findings is consistent with results obtained by Kanfer & Marston (1963), and Bartol &

Duerfeldt (1970). In the Kanfer & Marston study, subjects were reported to self reinforce at rates of 65%, 84% and 93% following 50%, 70% and 90% training, respectively, and in the Bartol & Duerfeldt study, subjects were reported to self reinforce at rates of 46% and 66% following 30% and 60% training, respectively.

A second concern of this study was to determine whether observed changes in self reinforcement rates were attributable to subjects' increases in correctly applying self reinforcement, or to indiscriminate increases in self reinforcement rates over training.

An analysis of correct self reinforcement scores showed significant increases with training for all baseline groups under all training conditions. Moreover, the more intense the training, the greater were the increases in correct self reinforcements. The greater increases for low and medium self reinforcers at 60% and 80% training may be attributable to the following two major factors: (a) initial baseline differences, and (b) ceiling effects at 80% training. All three groups showed moderate improvement after 40% training. At 60% training, both low and medium self reinforcers continued to improve, while improvement for high self reinforcers was not significantly different from 40% training. At 80% training, all three baseline groups reached the same level of correct self reinforcement rates (ceiling). These data suggest that training effectiveness for high self reinforcers remains moderate until the training conditions approach baseline self reinforcement

rates. Results for medium and low self reinforcers are consistent with such an interpretation. Their baseline correct self reinforcement rates were considerably lower than those of high self reinforcers (Table XIIa, Appendix B). They, the low medium self reinforcers, therefore, benefited relatively equally at all levels of training.

An analysis of incorrect self reinforcement scores showed significant decreases with training for all groups. Moreover, decreases were greater for high and medium self reinforcers than for low self reinforcers at all training levels. Performance of high self reinforcers on this measure was similar to their performance on the correct self reinforcement measure. An initial moderate change occurred with 40% training; 60% training did not lead to a significant change over 40% training, while further changes occurred with 80% training. It must be pointed out, however, that even after 80% training this group was still reinforcing itself for incorrect responses (Table XIIb, Appendix B).

The greatest change on incorrect self reinforcement scores for medium self reinforcers occurred at 60% training. This training rate was sufficient to eliminate almost all incorrect self reinforcement responses. Eighty per cent training could, therefore, not lead to much improvement in reducing incorrect self reinforcement scores.

The immediate effect of training on low self reinforcers appeared to be an indiscriminate increase in self reinforcement rate. Only the 80% training condition led to a drop in incorrect

self reinforcement responses for low self reinforcers. It was the combined effect of decreases in incorrect self reinforcement scores at 80% training and increases in incorrect self reinforcement scores at 60% (and 40%) training that led to a significant training effect between 60% and 80% training conditions.

Considering these two increases of discrimination measures together, very distinct trends appear between the three baseline self reinforcer groups. For low self reinforcers, training served primarily to increase the incidence of correct self reinforcement responses, and this effect was due to a gradual increase following each increment of training. With the introduction of 80% training, these low self reinforcers significantly reduced any remaining errors incurred in rewarding themselves. For the medium self reinforcer group, training served to actively increase correct self reinforcements and decrease incorrect self reinforcements. Increases in training levels led to increases in correct self reinforcements. Both of the 60% and 80% training conditions effectively reduced all incorrect self reinforcement responses. For the high self reinforcer group, on the other hand, training served primarily to reduce incorrect self reinforcement error, but not all levels of training were equally effective in this direction. The most significant reduction followed 80% training, the same level which produced the most significant increase in correct self reinforcement responses. Thus, for the high self reinforcers, vast amounts of training were necessary to produce increases

in self reinforcement discrimination. Moreover, even following 80% training, the high self reinforcers are still making incorrect self reinforcement responses.

The study has shown that increases in self reinforcement responding following training result only when training level exceeds self reinforcement baseline level. It further shows that increases in task discrimination in self rewarding behavior follows training, as Marston (1969) predicted. And, it is seen that the measure on which this increase in discrimination is reflected differs for each baseline group. For the low self reinforcers, more task discrimination changes are in the direction of increases in correct self reinforcements, for the medium self reinforcers changes are due to large increases in correct and moderate decreases in incorrect self reinforcement, while for the high self reinforcers most changes are due equally to increases in correct self reinforcement, and decreases in self reinforcement error, regardless of training level.

Thus, all three groups differed in their tendencies to self reinforce prior to training and this difference in turn determined the self reinforcement response levels following training. The present data indicate that these post training self reinforcement scores are artifacts of correct and incorrect self reinforcement responses.

If accuracy in self reinforcement is due to elimination of incorrect self reinforcement scores and increases in correct self reinforcement scores, then the medium group must be con-

sidered the most accurate. These subjects successfully eliminated all self reinforcement errors after 60% training, and significantly increased correct self reinforcement responses at this same training level. On the other hand, while low self reinforcers responded to training by showing increasing tendencies to self reinforce for correct task responses, elimination of incorrect self reinforcement responses did not occur until 80% training. Although the high self reinforcers significantly increased correct self reinforcement responses and decreased incorrect self reinforcement responses across training conditions, the latter responses were not eliminated even by 80% training.

In this study, the sampling distribution on baseline self reinforcement rates for males and females was significantly different. Very few low self reinforcing males were obtainable. This raised a problem of whether low males, as defined by the male distribution, behaved in the same way as low females, as defined by the female distribution. This problem would be one worthy of resolution by future researchers.

REFERENCES

ARCHER, E.J., "A Reevaluation of the Meaningfulness of all Possible Consonant Vowel Consonant Trigrams", Psychological Monographs, General and Applied, Vol.74 whole # 497, 1960

BALANOVA 5, from York University Institute for Behavioral Research, Data Analysis Section, writeup date 28/10/68

BANDURA, A., Principles of Behavior Modification, New York: Holt, 1969

BANDURA, A., "Vicarious and Self Reinforcement Processes", in The Nature of Reinforcement, New York: Academic Press, 1971,pp228-278

BARTOL, G. & DUERFELDT, P., "Self Reinforcing Behavior: the Effects of BaseRate and Dependency", Journal of General Psychology, 1970, (83), 151-161

KANFER, F., "Self Monitoring, Methodological Limitations and Clinical Applications", Journal of Consulting & Clinical Psychology, 1970, (35), 148-52

KANFER, F., DUERFELDT, P. & LePAGE, A., "Stability of Patterns of Self Reinforcement", Psychological Reports, 1969, (24), 663-670

KANFER, F. & MARSTON, A., "Determinants of Self Reinforcement in Human Learning", Journal of Experimental Psychology, 1963, (66), 245-254

LOCKE, E., CARTELEDGE, N., & KOEPPEL, J., "Motivational Effects of Knowledge of Results", Psychological Bulletin, 1968, (70), 474-485

MARSTON, A., "Effect of External Feedback on the Rate of Positive Self Reinforcement", Journal of Experimental Psychology, 1969, (80), 175-179

MARSTON, A., & KANFER, F., "Human Reinforcement: Experimenter and Subject Controlled", Journal of Experimental Psychology, 1963, (66), 91-94

WINER, B.J., Statistical Principles in Experimental Design, New York: McGraw Hill, 1962, pp 76-85

APPENDIX A

Figure 5. Stimuli: positions and association value of syllables on slides

* NEF (49)	GUK (50)
VID (50)	DOH (51)

Slide 1

FAH (50)	* NAZ (51)
NUS (49)	LOH (50)

Slide 2

* SYX (50)	VOD (49)
VIZ (51)	KYX (50)

Slide 3

* CEP (51)	JIS (49)
SAH (50)	LUF (50)

Slide 4

ROH (50)	KES (50)
* MUZ (49)	BYC (51)

Slide 5

WOH (50)	* HAX (51)
MAB (50)	LEB (49)

Slide 6

SUF (51)	FOW (50)
* MOX (49)	QIK (50)

Slide 7

JYN (50)	JOP (51)
BIV (49)	* BEM (50)

Slide 8

QIN (50)	SOQ (49)
* PIR (50)	YOM (51)

Slide 9

* CYR (50)	BYG (49)
HYQ (50)	TAQ (51)

Slide 10

* Correct syllable on each slide

Figure 6. Blocks of slides used: order of slides and numerical positions of correct syllables on each slide

Block I

#3	Slide 9
#4	Slide 8
#2	Slide 6
#1	Slide 1
#2	Slide 2
#1	Slide 4
#3	Slide 5
#1	Slide 10
#1	Slide 3
#3	Slide 7

Block II

#2	Slide 6
#1	Slide 4
#4	Slide 8
#1	Slide 1
#3	Slide 9
#3	Slide 5
#1	Slide 3
#2	Slide 2
#3	Slide 7
#1	Slide 10

Block III

#2	Slide 6
#4	Slide 8
#1	Slide 10
#3	Slide 9
#3	Slide 5
#1	Slide 4
#2	Slide 2
#3	Slide 7
#1	Slide 3
#1	Slide 1

Block IV

#1	Slide 1
#3	Slide 5
#1	Slide 4
#1	Slide 10
#1	Slide 3
#4	Slide 8
#3	Slide 7
#2	Slide 2
#3	Slide 9
#2	Slide 6

Block V

#4	Slide 8
#1	Slide 4
#2	Slide 6
#3	Slide 9
#1	Slide 3
#3	Slide 5
#3	Slide 7
#2	Slide 2
#1	Slide 10
#1	Slide 1

Block VI

#1	Slide 10
#3	Slide 9
#1	Slide 1
#2	Slide 2
#3	Slide 5
#3	Slide 7
#1	Slide 3
#2	Slide 6
#4	Slide 8
#1	Slide 4

Figure 7 Instructions

INSTRUCTIONS TO EPSILON 5 - READ CAREFULLY

Welcome to Epsilon 5

Soon, there will appear on the screen several slides, each of 4 nonsense syllables. Your job is to decide which one of these syllables on each slide is the correct one. There is only one right answer.

Each slide of syllables will be presented for 4 seconds. After this, you will be given a short period of time in which to make your decision (4 seconds). You will indicate your decision by pulling one of the switches on the panel in front of you. On this panel, the four switches, numbered 1, 2, 3, and 4 correspond with the four positions of the syllables on the screen:

1 2
3 4

So, after you have decided which syllable is correct, press the numbered switch that corresponds to the position of the syllable of your choice. Make your choice as quickly as possible.

After you have indicated your choice, and IF you feel that this choice was actually correct, press the red button towards the top of the panel. When you press

this button, the light will turn on. Why don't you try it? Whenever the light goes on then, this will indicate that you feel your choice is correct. Again, press this button, after you have pressed your choice switch, and as quickly as possible. Remember, you have only 4 seconds to make both decisions."

Appendix B

Table II

Pre and post training mean self reinforcement rates

(a) Balanced groups

		40%		60%		80%	
		Pre	Post	Pre	Post	Pre	Post
LOW	M	35%	58%	27%	78%	22%	70%
	F	0%	38%	5%	52%	7%	77%
MEDIUM	M	69%	62%	70%	68%	65%	78%
	F	68%	63%	58%	67%	67%	88%
HIGH	M	98%	87%	95%	93%	100%	96%
	F	96%	93%	100%	100%	100%	94%

(b) Unbalanced groups

		40%		60%		80%	
		Pre	Post	Pre	Post	Pre	Post
LOW		3%	42%	16%	65%	6%	75%
	N =	7		10		8	
MEDIUM		63%	63%	64%	67%	63%	81%
	N =	13		10		12	
HIGH		97%	90%	98%	97%	100%	95%
	N =	10		10		10	

Table III Limits and means for baseline groups, per sex

		LOW	MEDIUM	HIGH
MALES	Range	0 - 10	11 - 17	18 - 20
	Mean	5.6	13.6	19.5
FEMALES	Range	0 - 4	5 - 17	18 - 20
	Mean	1.0	12.9	19.7

Table IX Newman Keuls mean comparisons on "SR difference" T x B means

	H60	H80	M60	M40	H40	M80	L40	L60	L80
H60		1	4	5	6	16 *	36 **	50 **	69 **
H80			3	4	5	15 *	35 **	49 **	68 **
M60				1	2	12 *	32 **	46 **	65 **
M40					1	11 *	31 **	45 **	64 **
H40						10 *	30 **	44 **	63 **
M80							20 *	34 **	53 **
L40								14 *	33 **
L60									19 **

H = High self reinforcers
L = Low self reinforcers
M = Medium self reinforcers

* $p < .05$
** $p < .01$

Table X Newman Keuls mean comparisons on "CSR difference" T x B means

	M40	H40	L40	H60	M60	L60	H80	M80	L80
M40		3	6	8	24 **	27 **	35 **	50 **	55 **
H40			3	5	21 **	26 **	32 **	47 **	52 **
L40				2	18 **	24 **	29 **	44 **	49 **
H60					16 **	22 **	27 **	42 **	47 **
M60						6	11	26 **	31 **
L60							5	20 **	26 **
H80								15 **	21 **
M80									6

H = High self reinforcers

L = Low self reinforcers

M = Medium self reinforcers

* $p < .05$

** $p < .01$

Table XI Newman Keuls mean comparisons on "ISR difference" T x B means

	L40	L60	M40	L80	H40	H60	M60	M80	H80
L40		6	22 **	23 **	40 **	47 **	52 **	52 **	64 **
L60			16 *	17 *	34 **	41 **	46 **	46 **	58 **
M40				1	18 *N	25 **	30 **	30 **	42 **
L80					17 *	24 **	29 **	29 **	41 **
H40						7	12	12	24 **
H60							5	5	17 *
M60								0	12
M80									7

H = High self reinforcers

L = Low self reinforcers

M = Medium self reinforcers

* $p < .05$

** $p < .01$

Table XII Pre and Post training mean scores, unbalanced groups

(a) Correct Self Reinforcements

		40%		60%		80%	
		Pre	Post	Pre	Post	Pre	Post
LOW		1%	20%	3%	43%	1%	68%
	N =	7		10		8	
MEDIUM		13%	26%	18%	55%	11%	74%
	N =	13		10		12	
HIGH		25%	41%	28%	49%	29%	77%
	N =	10		10		10	

(b) Incorrect self reinforcements

		40%		60%		80%	
		Pre	Post	Pre	Post	Pre	Post
LOW		8%	24%	13%	23%	15%	8%
	N =	7		10		8	
MEDIUM		49%	43%	46%	10%	44%	8%
	N =	13		10		12	
HIGH		72%	48%	78%	47%	70%	22%
	N =	10		10		10	