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A Component Analysis of Behavioral Procedures for Increasing Work Rate in Mentally Retarded Adults

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A COMPONENT ANALYSIS OF BEHAVIORAL PROCEDURES FOR INCREASING WORK RATE IN MENTALLY RETARDED ADULTS

by

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A COMPONENT ANALYSIS OF BEHAVIORAL PROCEDURES FOR INCREASING WORK RATE IN MENTALLY RETARDED ADULTS

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This study was a component analysis of several procedures commonly employed in behavioral vocational rehabilitation programs. The work rate of retarded subjects was assessed under four conditions: 1) baseline; 2) verbal prompts; 3) verbal prompts and social reinforcement; and 4) verbal prompts, social reinforcement, and monetary reinforcement. Subjects were four, moderately retarded, male clients of a sheltered workshop. The experimental task involved assembly of a metal knife composed of four separate pieces. Treatment effects were analyzed within a mixed multielement reversal design where each subject served as his own control. Results showed that baseline sessions, all started with the simple instruction, "Begin work," generated substantial, steady work rates. Verbal prompts, given independent of the subject's ongoing performance and uncorrelated with reinforcement, failed to increase subject work rate above baseline levels. Verbal prompts and social reinforcement produced a higher rate than verbal prompts alone in all four subjects. Verbal prompts, social reinforcement, and tangible reinforcement advanced work rate above that for verbal prompts and social reinforcement in only one out of four subjects.

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CHAPTER I

INTRODUCTION

Behavioral researchers in vocational rehabilitation have often examined procedures for increasing client work rate. Improvement of client productivity has been viewed as a means of teaching clients to self-sufficient while also allowing them to make a useful contribution to society (Brown, Bellamy, Perlmutter, Sackowitz, & Sontag, 1972; Brown, Frank, Fox, Voekler, York, & Sontag, 1974). Investigators have applied various techniques, alone and in combination, to achieve this end. One treatment package that has been tested in a number of programs is token or monetary reinforcement.

Token reinforcement involves the contingent delivery of discrete items (e.g., poker chips, points on a tally sheet) that, like money, are exchangeable for consumables, desired objects, or preferred activities. Supervisory staff have strengthened behaviors by administering tokens, or weakened behaviors by withdrawing tokens contingent on their performance. A seemingly simple procedure, token reinforcement is composed of several more fundamental operations that can each control behavior. In addition to the delivery of tangible reinforcement, Kazdin (1977) has identified specific instructions, social reinforcement, performance feedback, and modeling stimuli as factors that could add to the effectiveness of a token program. Much of the research in token reinforcement programs, however, has evaluated the efficacy of entire programs rather than analyzing

individual component procedures. This has also been true of experimental token programs introduced in vocational rehabilitation settings.

Token Reinforcement Programs in Vocational Rehabilitation

Early applications of token or monetary reinforcement in vocational rehabilitation obtained results that were either disappointing or inconclusive. Treating 53 moderately and severely retarded adults, Tobias and Gorelick (1963) measured work rate in sessions for which there was either no payment or piece-rate payment for items assembled. They found that monetary pay generated a brief increase in work rate that only occurred in the first session in which it was used. An exploratory project by Baroff and Tate (1966) later attempted to augment work rate by dispensing token reinforcement according to various interval and ratio schedules. Unfortunately, the report of this program gave no data on the efficacy of these procedures.

Subsequent research on this topic came in the form of controlled between- or within-subject experiments. Using a traditional groups design, Huddle (1967) tested the impact of monetary reward versus no reward on the productivity of trainable mentally retarded adults. He found that the monetary reinforcement condition generated a significantly higher work rate than the no-reward condition. Employing a within-subject ABA experimental design, Hunt and Zimmerman (1969) assessed the effectiveness of token reinforcement for increasing work rate of mildly retarded clients in a simulated sheltered workshop. Presentation of tokens was associated with a higher work rate, but when the baseline condition was reinstituted client productivity remained above pretreatment levels. Because of the

failure to obtain a reversal and the inability to demonstrate experimental control, results of this study were only suggestive.

In a recent study, Martin, Pallotta-Cornick, Johnstone, and Goyos (1980) applied monetary reinforcement in conjunction with instructions, picture prompts, praise, and a low-distraction work environment to enhance productivity in a group of severely and moderately retarded clients. The intensive supervisory package of Martin et al. was evaluated within a complex set of manipulations including aspects of multielement, multiple-baseline-across groups, and reversal designs. The treatment produced gains in work rates across groups and settings which were readily reversed when supervisory procedures were withdrawn. Although effective, complex treatment packages such as this one can be inefficient. A disadvantage of any package treatment is that some of the constituent procedures may be nonfunctional, and costly materials and staff time might be allocated to unnecessary operations. Component analyses are needed to evaluate the relative contribution of individual procedures to the overall impact of the program.

Research on Component Procedures in Token Programs

As mentioned earlier, token reinforcement programs introduce a number of different stimuli that can affect work rate. Among these are instructions, performance feedback, social reinforcement, and tangible reinforcement. The influence of each of these variables has been documented to some extent by either specific component analyses or by studies evaluating entire token programs which indirectly revealed effects of individual procedures. We will briefly review the information currently

available on each of these factors.

Instructions

Evans and Spradlin (1966) were among the first to note the potency of verbal instructions for controlling large amounts of effortful behavior in retarded subjects. They obtained thousands of knob-pulling responses on an analogue work task by telling subjects to "pull the knob as many times as you can", even though subjects were also told that they would receive no reinforcement (i.e., money) for engaging in the task. In a more realistic work situation Hunt and Zimmerman (1969) observed the facilitative impact of instructions that promised rather than negated future rewards. After announcing the start of a new token program for a simulated sheltered workshop, these experimenters recorded immediate increases in productivity that occurred before any workers contacted the reinforcement contingency. Bellamy, Peterson, and Close (1975) also successfully applied frequent verbal prompts with a severely retarded man. During one set of experimental sessions they told their subject to return to work whenever he was observed off-task. This simple procedure generated a 80% increase in productivity over baseline sessions in which "reminder" prompts were not used.

Thus, instructional control of work rate has been repeatedly demonstrated. Although operant theory suggests that instructions exert control over behavior as antecedents in a reinforcement contingency, the previous studies increased work rate with instructions that were independent of reinforcement. It should be noted, however, that the previous research may not have arranged for conditions that would clarify the relationship

between reinforcement, instructions, and work rate. Laboratory studies with animals have shown that the effect of reinforcement magnitude on response rate is more pronounced if subjects are shifted between different levels of reinforcement (Schrier, 1958; Kessey & Kling, 1961). Therefore, a more meaningful test of the influence of reinforcement might have been accomplished by alternately exposing clients to discriminable conditions in which they were or were not reinforced for following instructions to work fast.

"Performance Feedback" and Social Reinforcement

Stimuli which function as conditioned reinforcers, such as signs of good performance or verbal praise, might also partially account for the effectiveness of previous token programs. In one phase of their experiment, Zimmerman, Stuckey, Garlick, & Miller (1969) conducted "practice" sessions in which multiply handicapped clients were told how many points they would have earned if a token program had been operating (after 2 weeks of practice sessions, this program was actually instituted). Several clients were more productive in this feedback condition than under the usual arrangement of weekly pay with no daily work-related consequences. Brown, Van Deventer, Perlmutter, Jones, and Sontag (1972) later tested performance charts as a device to increase work rate in a mixed group of handicapped students. Posting personal production rates in the students' view proved to be a successful method for augmenting productivity in a majority of the students, even before other reinforcers were associated with the charting procedure.

Two studies have assessed the additive effects of feedback and social

reinforcement when combined with other behavioral procedures. Trybus and Lacks (1972) joined immediate feedback with token reinforcement to increase work rate in a moderately retarded woman. Feedback consisted of a yellow light that was switched on whenever the client completed an assigned task within a certain time period, and a buzzer and red light that were briefly turned on whenever the client took longer than a specific time to complete the task. Results showed that work rate with feedback and token reinforcement was substantially higher (50-100%) than with token reinforcement alone. Bellamy et al. (1975) tested the relative effect of verbal praise, and the additive effect of praise when combined with verbal prompts. They found that praise was slightly less effective than prompts, and that praise plus prompts was no more effective than prompts alone for increasing work rate in their client.

In sum, previous feedback interventions have consisted of verbal stimuli, visual displays, lights, and buzzers. Some of these procedures have produced a separate effect when used alone, and others an additive effect when combined with tangible reinforcement. One study has evaluated the effect of social reinforcement on work rate. Social reinforcement was found to be slightly less efficacious in increasing work rate than prompts, and it furnished no additive effect when combined with prompts.

Tangible Reinforcement

This is probably the most well-recognized component of behavioral programs -- the delivery of material reinforcers, such as edibles, or tokens exchangeable for material reinforcers contingent on the performance

of desired behavior. Zimmerman et al. (1969) evaluated the effect of material reinforcement in an experiment containing three conditions, all of which included monetary piecerate pay given on a weekly basis: daily point reinforcement for high-rate work (points exchangeable for a variety of goods and activities); daily performance feedback (verbal information on personal performance during practice sessions); and weekly pay alone. These investigators found that productivity with point reinforcement was significantly higher than that with performance feedback, while productivity with performance feedback was significantly higher than that with weekly pay alone. In the same vein, Brown, Johnson, Gadberry, and Fenrick (1971) compared work rates engendered by performance feedback and social reinforcement versus that produced by social reinforcement and tangible reinforcement (earned portions of a banana split). Subjects in this study were a group of retarded and schizophrenic adolescents in a special education class who worked on an envelope-stuffing task. Results showed that the condition including tangible reinforcement controlled substantially higher work rates. Unfortunately, a shortcoming of the Brown et al. experiment obscures its findings. The investigation lacked a baseline phase and did not demonstrate that its feedback and social reinforcement condition produced a faster work rate than a no-treatment condition (i.e., proving that effective feedback and social reinforcement were instituted as purported). Hence, the validity of the feedback and social reinforcement condition is questionable, as is the subsequent comparison involving this condition.

Although the preceding two studies indicated that tangible reinforcement is a potent procedure for increasing client work rate, other research

has yielded the rather surprising result that large quantities of tangible reinforcement can actually lower client productivity. Using four mentally retarded adults who worked for money under a variety of different reinforcement schedules, Schroeder (1972) showed that increases in pay produced lower work rate in all subjects and schedules studied. Offering an explanation for his unexpected finding, Schroeder speculated that his subjects were inexperienced in earning great sums of money, and therefore adjusted their work rates downward to acquire amounts which they were accustomed to spending. Whatever the cause for his results, Schroeder's data identified one difficulty that can accompany attempts to augment work rate through tangible reinforcement, especially when employing monetary rewards.

Behavioral studies in vocational rehabilitation for improving client productivity have been briefly reviewed. Much of this research primarily evaluated model programs and only secondarily assessed the contribution of separate program components. The information available on component procedures is sketchy, but can be summarized here. Instructions appear to have a facilitative impact on work rate, even when uncorrelated with reinforcement. Performance feedback has a separate effect on client productivity, as well as an additive effect when combined with tangible reinforcement. Social reinforcement has produced a separate effect on work rate, but fails to provide an additive effect when combined with verbal instructions. Finally, tangible reinforcement has an additive effect when combined with performance feedback, and may have an additive effect when combined with social reinforcement.

The present study examined the additive effects of three component

procedures commonly used in behavioral programs for accelerating client work rate. The procedures investigated were: instructions or verbal prompts, social reinforcement, and tangible reinforcement. These component procedures have sometimes been combined as if a stronger treatment package might be created by joining multiple techniques (Brown et al., 1971; Martin et al., 1980). This assumption of additive beneficial effects, however, has not been systematically tested. This research assessed the work rate of mentally retarded subjects under four conditions; 1) baseline; 2) with verbal prompts; 3) with verbal prompts and social reinforcement; and 4) with verbal prompts, social reinforcement, and tangible reinforcement. Subjects served as their own controls and encountered all four conditions in a sequence that analyzed the individual contribution of each procedure toward client productivity.

CHAPTER II

METHOD

Subjects

Participants were four male clients enrolled in a community-based vocational training facility. Clients' ages ranged from 29-34, and all were diagnosed as moderately retarded with their most recent I.Q. scores ranging from 43-52. None of the clients suffered from any known physical handicap beyond their developmental disability. Subjects were selected on the basis of three criteria: an expressed willingness to participate in the study, a record of regular attendance at the center, and a history of exceptionally low work-rate. Institutional records showed that the four subjects performed within the lower 33rd percentile of average work-rates for all clients at the facility. Informed consent was obtained from the subjects and their legal guardians before participants were exposed to experimental procedures.

All subjects had been taught the experimental assembly task by facility staff before participating in the study. The knife assembly task was an often-used training simulation and subjects were proficient in the assignment. The exact number of trials needed to teach individual subjects this task and the number of practice sessions they had undergone before taking part in the present experiment were not known.

Setting

Research was conducted in the Work Activity Program (WAP) of the McKercher Rehabilitation Center, Galesburg, Michigan. The WAP served approximately 30 moderately and mildly retarded clients, and occupied the entire floor of a medium-sized building. Contained within the building was industrial equipment such as worktables, tools, and production machinery. Clients in the program were taught prevocational and occupational skills while performing various simulation tasks or assembly jobs for piecerate wages. When participating in the study, subjects sat before large tables in the usual WAP work areas, alongside of other clients given regular assignments.

Dependent Measures

The primary response measure was work rate on a single assembly task. Subjects assembled "Adams Knives" (Adams Company, Batavia, Illinois), joining a wingnut, a screw, and a metal plate to a knife handle. This task required a minimum of five manual operations. An experimenter collected and counted all knives assembled by subjects during each 15-minute session.

Correct assembly of an Adams Knife was defined as follows: 1) metal plate placed in handle with both knobs aligned in guide slit; 2) wingnut fastened on inside of handle; 3) metal plate not extending beyond edge of knife handle; and 4) wingnut tightened sufficiently so that no noise occurred when the knife was shaken. An error was defined as the failure to meet one or more of the above criteria for correct assembly. All knives assembled, including those with errors, were counted and used in calculating work rate. The number of errors per session were recorded separately.

Reliability

The principal investigator, a graduate assistant, and 10 undergraduate assistants served as experimenters. The reliability of dependent measures and the consistency of experimental procedures were assessed throughout the study. For 140 of the sessions, two experimenters independently counted and recorded the number of knives assembled and the number of assembly errors. At least one reliability check was done within each phase encountered by each subject. Reliability coefficients were calculated by dividing the smaller number of knives counted over the larger and multiplying by 100. The mean percentage of agreement, averaged across conditions, phases, and subjects was 99.7% for number of knives assembled and 83.2% for number of assembly errors.

During sessions in which a reliability check was conducted, either the principal investigator or the graduate assistant observed one of the other experimenters to check that procedures constituting the current condition were being correctly implemented. If the observer judged that prompts and consequences had been properly applied during the session, an agreement was scored; conversely, an error in administering prompts or consequences was scored as a disagreement. Reliability coefficients were computed using the same formula mentioned earlier. The mean percentage of agreement on implementation of the independent variables averaged across conditions, phases, and subjects was 96.0%.

Experimental Design

This study employed a mixed intra-subject design (Wong & Liberman,

1981) incorporating aspects of both reversal (Baer, Wolf, & Risley, 1968) and multielement designs (Sidman, 1960; Ulman & Sulzer-Azaroff, 1975). Following an initial baseline phase, experimental sessions of one type were alternated with baseline sessions in a random order (with the qualification that no more than three sessions of the same type were presented consecutively). This alternation of conditions permitted a comparison of work rate under experimental conditions versus that under baseline while controlling for acquisition over trials, subject fatigue, time of day, and sequence effects (Ulman & Sulzer-Azaroff, 1975). Comparisons between experimental conditions were accomplished with ABA or ABAB manipulations conducted across phases. Table 1 shows the sequence of experimental conditions assigned to each subject.

A distinctive sign accompanied all sessions of a given experimental condition to facilitate the development of a differential response pattern controlled by that stimulus. At the start of each session, a piece of colored cardboard bearing the name of the prevailing experimental condition was placed on the worktable in front of the subject. He was required to read the printed name, and the sign was left on the table during the entire session. Because preliminary investigations with this population showed that merely reading the signs failed to produce differential responding, subjects were also taught a verbal rule describing the contingencies for each experimental condition and they were questioned about this rule prior to the start of a session. A minimum of two questions were given about consequences scheduled for the session, these questions requiring nonidentical answers (e.g., "What will I give you if you work fast when this sign is here?", and "Will I

Table 1

Sequence of Experimental Conditions Scheduled for Each Subject

Subject	Design
Mel	ABCBCDC(C)[a]
James	ADCDCBC(C)
Carl	ACBCDCDC(C)
Gary	ADCDCBCD(D)

Note. A = baseline; B = verbal prompts; C = verbal prompts and social reinforcement; D = verbal prompts, social reinforcement, and monetary reinforcement. During all but first and last phases, experimental sessions alternated randomly with baseline sessions.

[a]Letters in parentheses indicate experimental condition for final maintenance phase.

give you anything if you work fast when this sign is here?").

Phases for each treatment condition except maintenance contained approximately 10 experimental sessions. The decision to change conditions was based on an ongoing visual analysis of the data, and responsiveness to demands within the workshop setting. Phases were extended if the data were judged to be variable or if collection of additional data might clarify comparisons between phases.

Procedure

Three to six sessions, each 15 minutes long were conducted 5 days per week. All sessions began in a similar manner. Subjects were brought to a prepared worktable on which rested a four-section tray containing wingnuts, screws, and metal plates, as well as a large cardboard box filled with knife handles. A second large box was also provided in which to place assembled knives. Subjects were then asked to identify the sign for that session and questioned as described above. If a subject gave an incorrect reply, he was told the correct answer, and questioning continued until he produced two consecutive correct answers. After this introduction, subjects were instructed to "begin work."

Sessions were timed with a programmable electronic device that produced an audible signal at the end of a 15 minute interval (Wong, 1979). To terminate sessions for which no reinforcement was scheduled, the experimenter would merely tell the subject that he could take a 5 minute break. No comment was made regarding how fast or slow the subject had worked, and inquiries by a subject on how well he had done were given an ambiguous reply ("We can talk about that later."). During breaks

subjects were allowed to go to the rest area adjoining the production section of the WAP, or could remain at their bench, depending on their preference.

To terminate sessions for which reinforcement was scheduled, the experimenter would tell the subject that his time was up, and ask him to remain seated while his knives were being counted. Assembled knives were taken to a separate table and counted as quickly as possible. Reinforcement was delivered according to a conjunctive fixed time and fixed ratio schedule (Reynolds, 1975), incorporating a 15 minute interval and individualized ratio criteria for reinforcement. A subject's criterion was determined during the initial reinforcement condition encountered and remained at that level for all subsequent conditions. In the first sessions of the initial reinforcement phase, the criterion was the highest number of knives assembled during any of the baseline sessions. Halfway through this phase, the criterion was increased to the mean number of knives assembled during the preceding reinforcement sessions. If the subject achieved his criterion, the experimenter would return to the subject's workbench, deliver the reinforcer, and give the subject a 5 minute break. If the subject failed to reach his criterion, the experimenter would return and, in a matter-of-fact tone of voice, inform the subject that he did not work fast enough to earn reward available for that session. The subject was then permitted to take a 5 minute break.

Baseline

Each session began with the experimenter asking the subject to

identify the "Baseline" sign. The verbal rule accompanying this condition was that no praise or money would be given, no matter how fast the subject worked during the session. On the same schedule at which verbal prompts were delivered in the following condition, an experimenter would approach the subject and briefly glance at his table without saying anything. No instructions to work fast or reinforcement of any kind were administered during these sessions.

Verbal Prompts

Each session began with the experimenter asking the subject to identify the "Instructions" sign. The rule associated with this condition was that the subject would be told to work fast, but that no praise or money would be given, regardless how fast the subject worked during the session. The same verbal prompt, "I want you to work as fast as you can," was used with all subjects and delivered without regard for the subject's ongoing work rate. Instructions were administered approximately half-way through the session for Gary and Carl. Because Mel and James were easily distracted, they were prompted more frequently. These latter two subjects received three prompts per session, one delivered approximately every 4 minutes.

Verbal Prompts and Social Reinforcement

Each session began with the experimenter asking the subject to identify the "Praise" sign. The rule accompanying this condition stated that the subject would be told to work fast, and would be praised if he worked quickly during the session. Instructions to work fast were

delivered at the same frequency for each subject as in the previous condition. If the subject attained his work rate criterion, he was reinforced with smiles, pats on the back, handshakes, and compliments (e.g., "Nice job! You really worked fast!") at the end of the session.

Verbal Prompts, Social Reinforcement, and Monetary Reinforcement

Each session began with the experimenter asking the subject to identify the "Money" sign. The rule associated with this condition was that the subject would be told to work fast, and would be praised and rewarded with money if he worked quickly during the session. Instructions to work fast were delivered at the same frequency as the verbal prompts condition. If a subject attained his work rate criterion, he was given social reinforcement plus tangible reinforcement in the form of three nickels. The subject was allowed to keep the money earned during a session, or he could purchase edibles in a "store" created for the study. Consumables on sale in the store included an assortment of snacks such as corn chips, potato chips, popcorn, raisins, nuts; different brands of small candy bars; and a variety of soft drinks sold in 3 ounce servings. The prices of the items were set so that the amount earned during a session was sufficient to buy almost any two items available (because of the special prices in the "store", $.15 had an actual purchasing power of approximately $.50). Subjects were allowed to consume items which they had purchased during their 5 minute break.

Maintenance

In this final phase, baseline sessions were no longer alternated

with those from an experimental condition, and instead, the most effective reinforcement condition was instituted for a number of consecutive sessions. If it was difficult to ascertain which was the more potent reinforcer, social reinforcement (the least expensive and most practical procedure for an actual training program) was applied in the maintenance phase.

CHAPTER III

RESULTS

Individual data for the four subjects are plotted in Figures 1-4. Data points indicate the mean number of knives assembled for three consecutive sessions of the same experimental condition. When the number of sessions in a phase is not divisible by three, the last data point within the phase represents the mean of either two or four sessions. Results were interpreted through visual analysis of the graphic display and descriptive statistics, the recommended method for analyzing single-subject data (Michael, 1974; Parsonson & Baer, 1978).

Baseline vs. Verbal Prompts

Comparisons between these two conditions yielded different results across individual subjects. Mel is somewhat representative of the inconsistent effect of verbal prompts on work rate. In the first phase that prompts were introduced with this subject, they enhanced productivity ($\bar{X}$ of Bln = 48.7; $\bar{X}$ of VP = 50.1); however, by the second half of the second phase in which verbal prompts were employed, they generated a lower work rate than that obtained in adjacent baseline sessions. James and Carl were exposed to the verbal prompts condition only once, and for a shorter period of time than Mel. Both of these subjects emitted higher work rates during prompted sessions than during contiguous baseline sessions, with the largest difference obtained in James ($\bar{X}$ of Bln = 39.4;

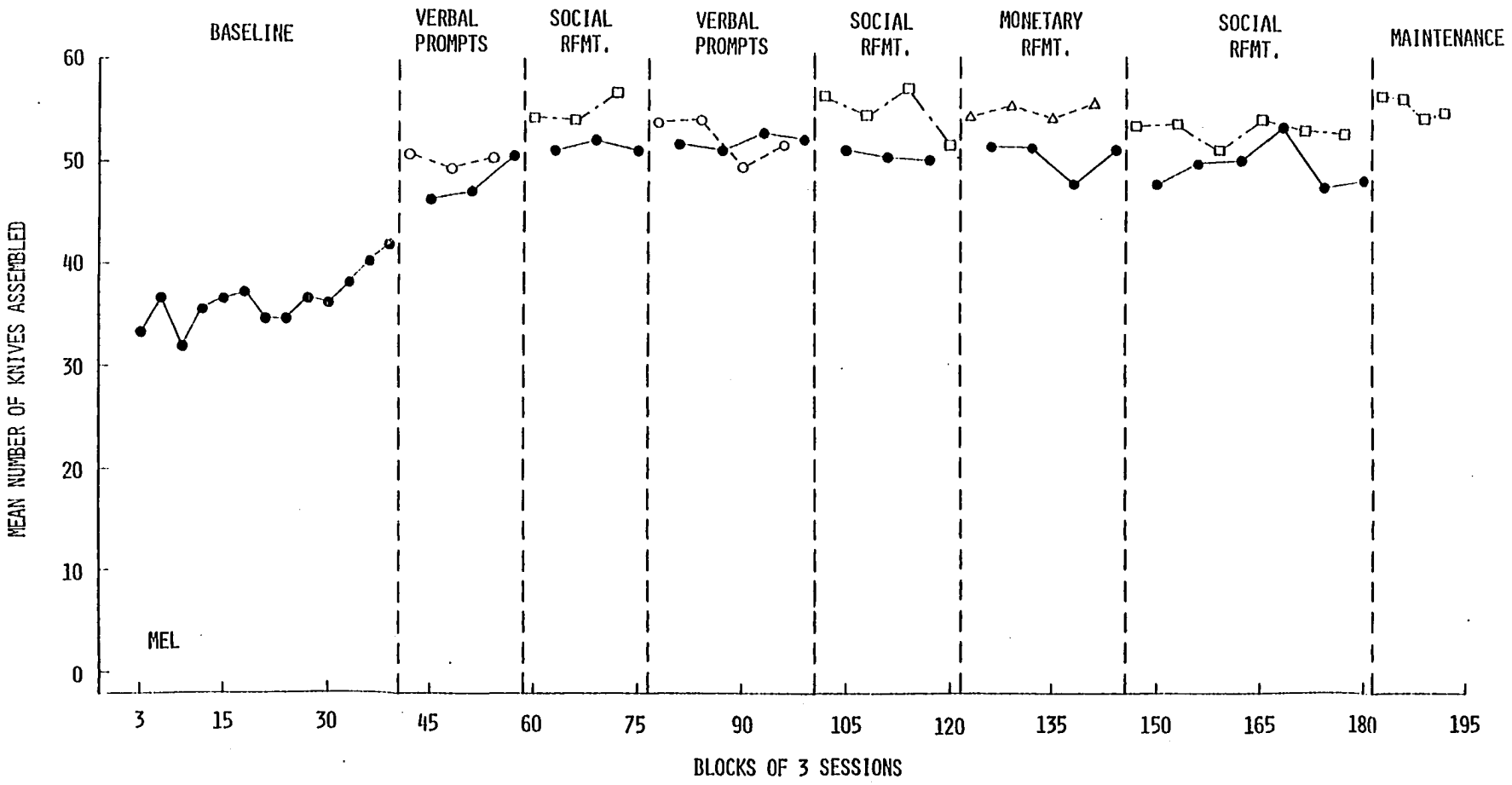

Figure 1. Line graph of data for Mel. "Social Rfmt." signifies verbal prompts and social reinforcement; "Monetary Rfmt." signifies verbal prompts, social reinforcement, and monetary reinforcement. Filled circles denote baseline sessions; unfilled symbols denote experimental sessions.

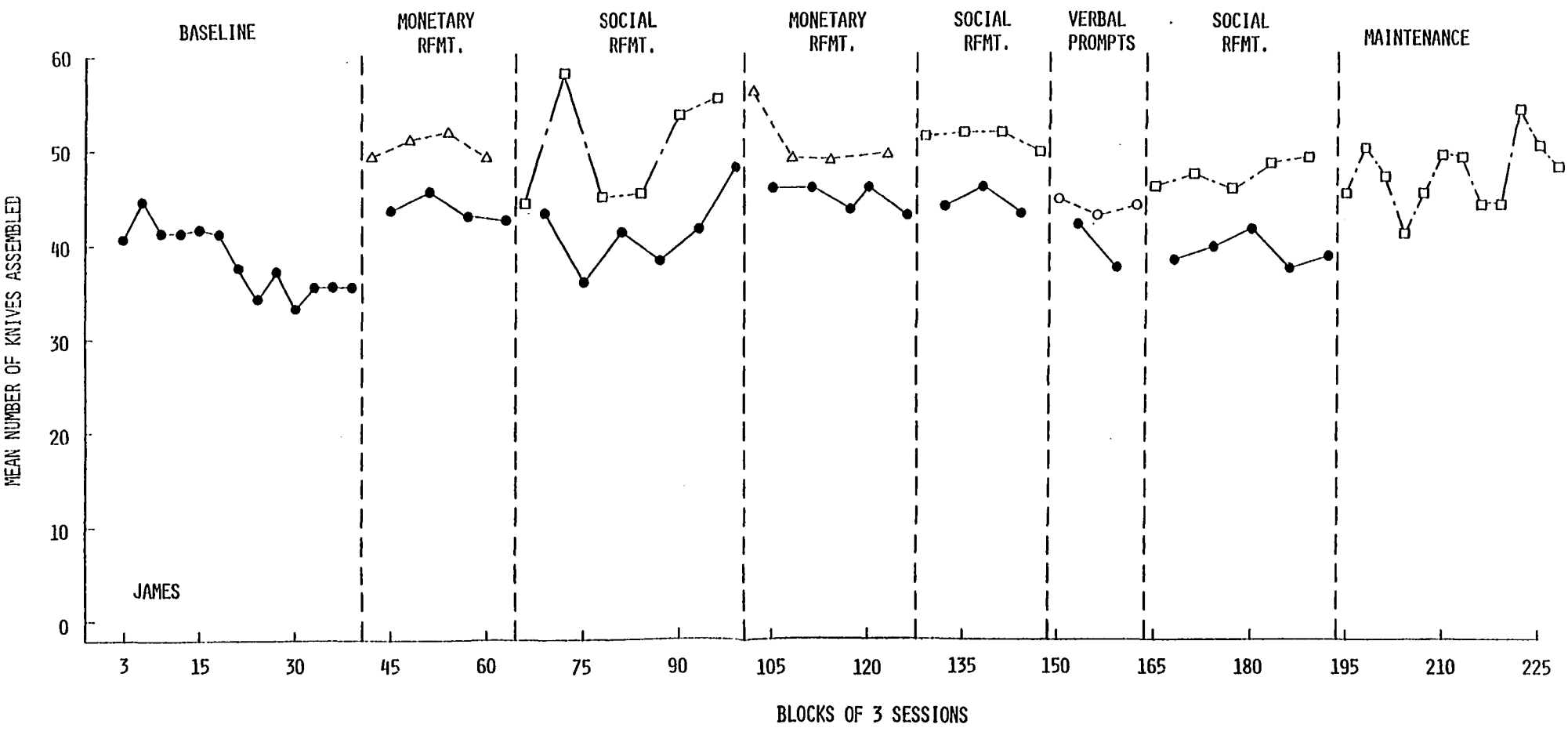

Figure 2. Line graph of data for James. "Social Rfmt." signifies verbal prompts and social reinforcement; "Monetary Rfmt." signifies verbal prompts, social reinforcement, and monetary reinforcement. Filled circles denote baseline sessions; unfilled symbols denote experimental sessions.

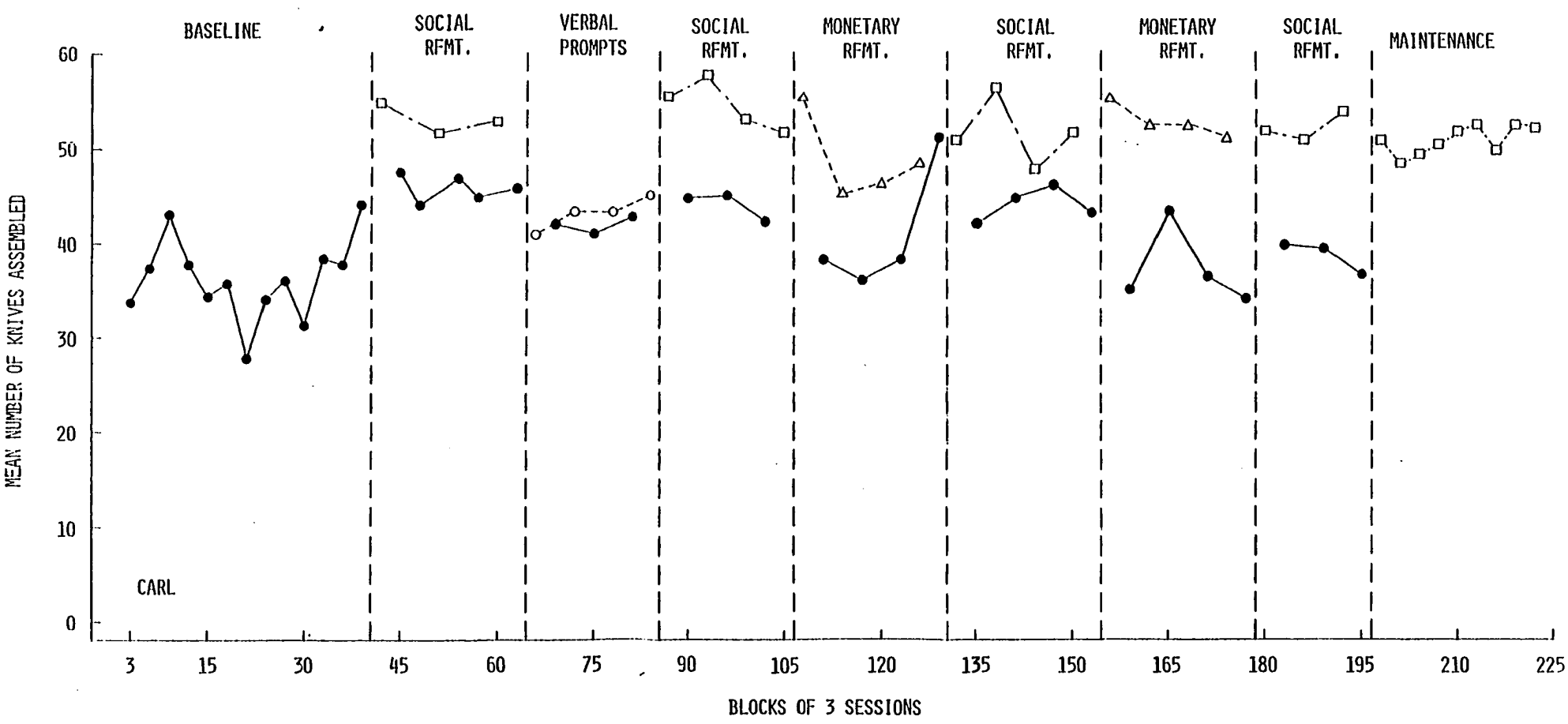

Figure 3. Line graph of data for Carl. "Social Rfmt." signifies verbal prompts and social reinforcement; "Monetary Rfmt." signifies verbal prompts, social reinforcement, and monetary reinforcement. Filled circles denote baseline sessions; unfilled symbols denote experimental sessions.

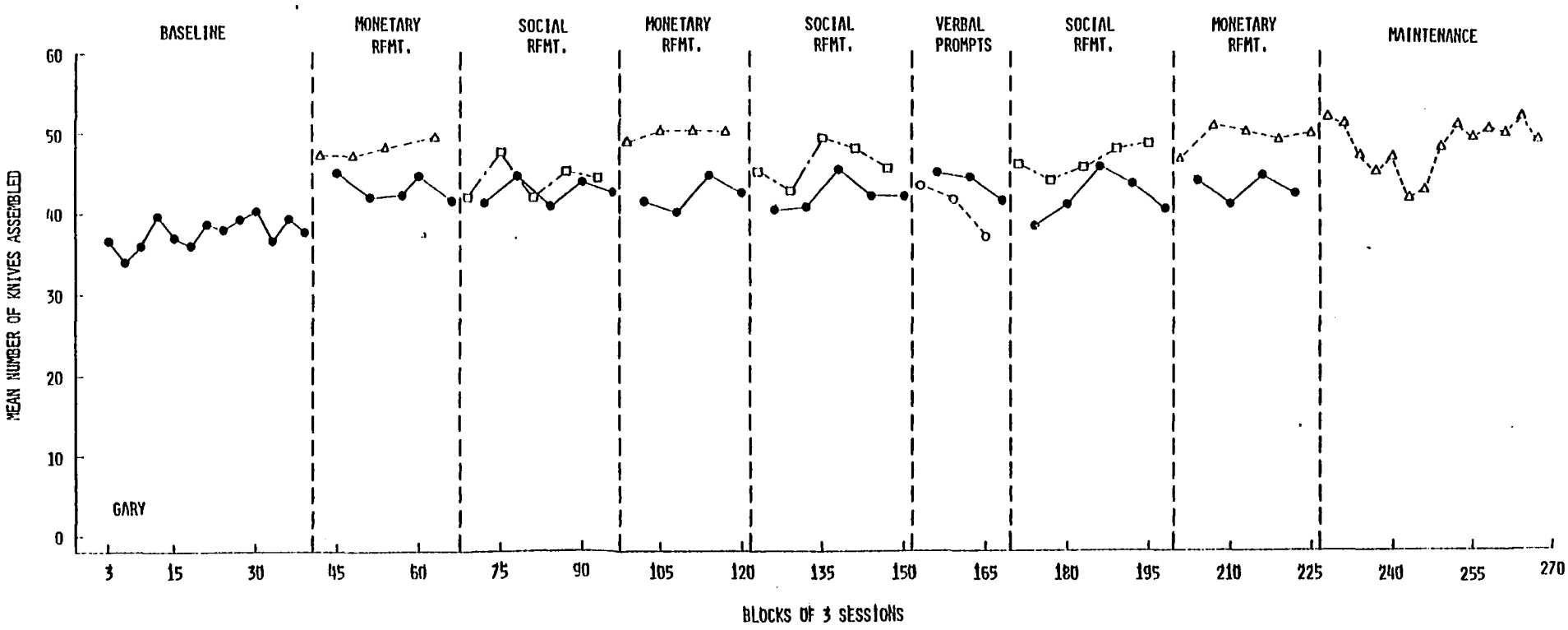

Figure 4. Line graph of data for Gary. "Social Rfmt." signifies verbal prompts and social reinforcement; "Monetary Rfmt." signifies verbal prompts, social reinforcement, and monetary reinforcement. Filled circles denote baseline sessions; unfilled symbols denote experimental sessions.

$\bar{X}$ of VP = 43.9). Although performance in the verbal prompts condition for these two subjects was superior to that in adjoining baseline sessions, the rate recorded in the experimental sessions was nearly identical to the overall work rate for all baseline sessions. In other words, verbal prompts did not seem to increase work rate for sessions in which they were used so much as to decrease rate in adjacent baseline sessions. With Gary, the fourth subject, a clear decelerative effect of prompts was found. Verbal prompts to work fast accompanied by instructions that nothing could be earned for working fast produced a slight suppression of work rate ($\bar{X}$ of Bln = 43.7: $\bar{X}$ of VP = 41.3).

Verbal Prompts vs. Verbal Prompts and Social Reinforcement

Verbal prompts plus social reinforcement maintained a higher work rate than verbal prompts alone in all four subjects. The effect of reinforcement exhibited in condition means of proximal phases was the smallest for Mel experiencing a BCBC sequence ($\bar{X}$ of VP = 51.3; $\bar{X}$ of VP and SR = 52.6) and the largest for Carl undertaking a CBC sequence ($\bar{X}$ of VP = 42.9; $\bar{X}$ of VP and SR = 51.5). Inspection of baseline response levels helps to further reveal the influence of social reinforcement. While none of the four subjects showed a distinct improvement in the verbal prompts condition as compared to their overall work rate in baseline sessions, all subjects maintained higher work rate in social reinforcement over that in baseline.

Verbal Prompts and Social Reinforcement vs. Verbal Prompts, Social Reinforcement, and Monetary Reinforcement

The addition of a second type of reinforcement contingent on achiev-

ing a criterion work rate produced similar results for three out of four subjects. For Mel, James, and Carl, there were no noticeable gains when two rather than one reinforcer was applied. In fact, changes in reinforcement conditions appeared to have little effect on trends in work rate occurring prior to phase changes. Levels and trends observed in one condition seemed to continue in the subsequent phase despite changes in the reinforcers used. A possible exception to this finding were the data derived from Gary. For this subject, work rate under social and monetary reinforcement was superior to that under social reinforcement. The effect was more pronounced during the first four phases in which the two conditions were alternated ($\overline{X}$ of VP and SR = 45.2; $\overline{X}$ of VP, SR, and MR = 48.9) than in the last two phases in which these conditions were presented ($\overline{X}$ of VP and SR = 46.5; $\overline{X}$ of VP, SR, and MR = 49.2)

Another way of looking at the relative effectiveness of the two reinforcement procedures is by considering the proportion of reinforcements obtained within each condition. Table 2 presents the percentage of scheduled reinforcements earned as a function of experimental condition, broken down by successive training phases. These data further demonstrate the similarity of rate performances in the two conditions for all subjects except Gary. He obtained more reinforcements with repeated exposure to the social reinforcement condition, but never matched his performance under social and monetary reinforcement.

Maintenance

Evaluation of the effect of regular availability of reinforcement for high work rate was limited to three subjects, because Mel was with-

Table 2

Percent of Scheduled Reinforcements Earned as a Function of Experimental Condition and Number of Training Phases

	Social Reinforcement				Monetary Reinforcement		
Subject	Training Phase				Training Phase		
	1	2	3	4	1	2	3
Mel	60	55	32		55		
James	50	92	37		54	62	
Carl	70	73	46	56	25	75	
Gary	7	29	47		55	73	73

Note. "Social Reinforcement" = verbal prompts and social reinforcement; and "Monetary Reinforcement" = verbal prompts, social reinforcement, and monetary reinforcement.

drawn from the study early due to his parents' wishes. The number of sessions conducted under maintenance conditions ranged from 26 to 42. Work rate in sessions where reinforcement was repeatedly scheduled was somewhat lower than when reinforcement was alternated with baseline for Carl and Gary, and somewhat more variable for James and Gary. The ability for social reinforcement to maintain elevated work rate did not appear to differ from that of social plus monetary reinforcement.

Assembly Errors

Errors in assembly occurred at a very low frequency throughout the study. The average number of errors per session were .16 for Mel, .16 for James, .10 for Carl, and .09 for Gary. No systematic difference in the distribution of errors among experimental conditions or change in the frequency of errors across time was detected.

CHAPTER IV

DISCUSSION

Results indicate that verbal prompts administered without reinforcement were a relatively ineffective method of controlling work rate. Although rate in prompted sessions was higher than that in adjacent baseline sessions for two subjects, productivity of these individuals was no better than their overall baseline average. Furthermore, effects of verbal prompts were inconsistent or detrimental for the remaining two subjects. The weak, variable impact of prompts in the present research contrasts with results of earlier studies (Bellamy et al., 1975; Hunt & Zimmerman, 1969), and this may have been due to the introduction given at the start of each session. Subjects were told to work as fast as they could during sessions, but these directives were preceded by instructions that accurately predicted no reinforcement for high-rate work. The data suggest that moderately retarded subjects do not respond simply to the immediate verbal prompt, but rather react to the entire context in which prompts are given including the prevailing reinforcement contingency and the presence of other stimuli correlated with that contingency.

It should be noted that in this investigation prompts were administered during the session independent of the subject's ongoing work rate. Different results might have been obtained by applying verbal stimuli contingently, such as in directing a client to return to work whenever he is off-task (as done by Bellamy et al., 1975). This latter procedure,

however, may involve a form of aversive control (clients working fast to avoid frequent commands) a contingency not examined here.

Social reinforcement proved to be a reliably effective procedure for maintaining elevated work rate, improving productivity above that under verbal prompts alone for all of the subjects. While gains engendered by social reinforcement were consistent across individuals, they were not very large. Subject gains resulting from the addition of social reinforcement, averaged across proximal phases, ranged from 3% to 20%. The addition of monetary reinforcement produced further advancements in only one of the subjects. For Gary, the inclusion of tangible reinforcement was associated with an average increase in productivity of 7% over the social reinforcement condition. Again, while improvements were fairly consistent with repeated alterations between the two conditions, they were comparatively small.

Social reinforcement may have been particularly potent in this study because of the way it was delivered. Experimenters displayed approval through verbal comment, facial expression, and physical contact, all elements which could have enhanced the interaction's reinforcing effect. Previous investigations (Brown et al., 1971; Zimmerman et al., 1969) comparing social consequences to social plus tangible consequences have employed only verbal social reinforcement, and this may partly account for the divergent results occurring here.

The virtual equivalence between work rates maintained by social reinforcement and those maintained by social plus monetary reinforcement in three out of four subjects is relevant to behavioral programs currently being implemented in vocational rehabilitation facilities.

The appearance of complex treatment packages (Martin et al., 1980) may reflect a belief that interventions composed of multiple treatments are more effective and have greater generality. The present results offer little support for this assumption. In fact, the current findings contradict the idea that "more is better" in behavioral programs to increase client work rate, especially with respect to the inclusion of prompts uncorrelated with reinforcement or tangible reinforcement when social reinforcement is already present. A minor improvement in the performance of one subject was the only return for the greater time and expense required to institute the monetary reinforcement condition. Such small and unreliable gains would not seem to justify the additional expenditure, even in agencies whose primary objective is training and not economic profit.

It is possible that superior performance might have been attained in the reinforcement conditions if stronger reinforcers had been employed or if reinforcement had been delivered more frequently. Future research might investigate the effect of individualized incentives and optimal reinforcement schedules for maintaining high rate work. But, of course, factors such as cost and staff availability will limit the interventions that are applicable in sheltered workshops. These same pragmatic considerations helped to determine the specific reinforcers and parameters of reinforcement used in this study.

An interesting feature of the present data is the high and stable work rate recorded in baseline, behavior likely reflecting the extensive training subjects had undergone prior to participating in the experiment. Despite repeated announcements that no reinforcement was forthcoming in

in baseline sessions and the continued exposure to extinction, subjects assembled knives at approximately 90% of the rate achieved in reinforced sessions. Performances observed in baseline showed that either subjects were under strong instructional control, or they were reinforced by stimulus changes inherent in the assembly task, or both. The power of instructions was demonstrated by the fact that, with very few exceptions, subjects began work only after being told to do so and worked continuously until being told to stop. On the other hand, subject's behavior at the end of the sessions indicated that there were reinforcing aspects to completing steps in the assembly task. When terminating a session, experimenters allowed subjects to finish any knives they were working on at the time. On many occasions, subjects asked permission to complete the knife they were working on rather than immediately put down the partially assembled parts and take a break. Thus both verbal report and motoric behavior suggest that engaging in terminal responses of the assembly chain was reinforcing.

Possible reinforcing aspects of the work task have largely been ignored by behavioral researchers in vocational rehabilitation. This study, however, examined a well-established work behavior and discovered a very substantial baserate probably maintained by conditioned reinforcement associated with the activity. A worthwhile branch of future research might investigate the development and variation of such baserate patterns, as they could constitute a major portion of normal work behavior.

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