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An Investigation of Vicarious Reinforcement in a Basic Research Setting

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by

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THE PROBLEM AND ITS BACKGROUND

With the development of the operant paradigm, and the subsequent employment of this model in the modification of human behavior, the functioning of each component of the originally proposed process has been more and more finely articulated. Thorough analyses have been carried out on the relationship between behavior and the temporal aspect of reinforcement delivery, the relative effectiveness of different types and amounts of reinforcement, as well as the relationship between other aspects of reinforcement and behavior. Most all of these types of analyses have dealt with the effect that variables connected with reinforcement (or reinforcement itself) have on the behavior of the person who is receiving the reinforcement. This approach is appropriate to basic investigations where reinforcement effects are studied in situations where only one person, the subject, is present. As behavior modification has attempted to become more and more widely used, techniques have been developed for working with one or a group of subjects within the context of situations where a number of persons are present. To assume that the effects of "consequences" delivered in presence of a number of people are confined to the target subject, as in the basic research situation, may be a naive and potentially unfortunate fallacy. It seems quite likely that reinforcement directed at a single member of a group would have some effect on the behavior of one or more of the other group members.

Bandura, for instance, (1962, 1965) has shown that children witnessing an aggressive model are more likely to imitate that model if they also witness the model receiving reinforcement for his aggression than if they witness the model receiving no consequences or being punished for his behavior. Research such as Bandura's points out some potentially undesireable effects that a model's behavior (whether a parent, television character or whatever) can have on children's behavior. It likewise seems plausible that these effects, which Bandura calls vicarious or implicit reinforcement (Bandura, 1971) would have some potentially useful aplication.

Some researchers in the area of applied behavior analysis have hinted at this possibility in discussions of research dealing with classroom situations. Surratt, Ulrich, and Hawkins (1969) noted an increase in working time which occurred in the behavior of two students who witnessed two other students receiving reinforcement (via a small light panel mounted on their desks) for working behavior. This increase, which occurred in a multiple baseline design before any contingencies had been put into effect for this behavior, was discussed as possibly attributable to the lights serving as discriminative stimuli or to the fact that the behavior of the other (reinforced) children provided fewer distractions while the reinforcement contingencies were in effect. In another study by Bolstad and Johnson (1972), a lowered rate of disruptive behavior was reported for control subjects in a classroom where ex-

perimental subjects received reinforcement in a self regulation procedure for non disruptive behavior. Again the authors note the possibility that this was partially due to the occurrence of fewer distractions by the experimental subjects. Evidence for this conclusion is found in the fact that fewer disruptive interactions between the experimental and control subjects were recorded during treatment phases than during baseline. An alternative explanation offerred by the authors is that the control subjects "may have discovered" that the experimental subjects were being reinforced for non disruptive behavior. Reinforcement of the experimental subjects might thus have served to set the occasion for imitation of the lowered rates of disruptive behavior.

Some investigations have addressed themselves specifically to examinations of the effects of reinforcement of a model's behavior on the behavior of those observing the occurrence of this reinforcement.

Presbie and Coitereux,(1971) conducted a study of the effects of vicarious reinforcement on the sharing behavior of first grade children. Half of the subjects in a group design heard the experimenter praise a model for being "generous" while the other half heard the model praised for being " stingy". The "stingy" model favored himself in a marble distribution task and the "generous" model favored another person in the distribution. After having observed one of the two models, each subject was given the opportunity to perform the marble distribution task. Those subjects who ob-

served the generous model initially shared more than those who observed the stingy model. A repeated measures analysis of variance attributed the significance of the effect to the generosity of the model (as imitated by the subjects) rather than to the effect of reinforcement on the observer's behavior. These investigators attempted to separate the effects of modeling from the effects of viewing reinforcement delivery and claim that vicarious reinforcement was not effective in controlling the behavior of the subjects.

Dubner, (1973) compared three groups in terms of the occurrence of a class of imitative behavior. One group saw a video tape of a model performing a drawing task and being reinforced upon completion of the task. A second group saw the same model perform the same task but without reinforcement. A third group (a control) did not see the model. The experimenter measured the occurrence of drawing behavior in an " activity preference" procedure following exposure (or non exposure) to the model. The results showed a difference between the two experimental groups in terms of imitation of the drawing behavior of the model. These results question the role of vicarious reinforcement in accounting for the increase in imitation by the two experimental groups (since merely viewing the model had an equal effect). The results of this particular experiment, however, are somewhat clouded by the limited exposure the children had to the "model reinforced" situation. The subjects only saw one instance of reinforcement by the " teacher" of the model. This occurred at the end of a 90 second film and the total

duration of reinforcement viewed was only 10 seconds.

A study by Thelen, McGuire, Simmonds, and Akamatsu (1974), attempted to measure the effects of vicarious reinforcement on the recall of the model's behavior. The subjects in the two groups compared watched a model pressing three numbered buttons on a panel in a pre-determined order. Half of the subjects saw the models reinforced for their efforts and half of the subjects saw the models not reinforced. The two groups were then sub divided for the retention test with half first completing a non related task before attempting the button press task. The results showed that for those subjects performing the intervening task, viewing the reinforced model facilitated correct responding on the button press task. Those subjects who did not perform the intervening task, and those subjects viewing the non-reinforced model, did not show improved responding on the button press task.

A number of studies have been published which have investigated vicarious reinforcement in verbal learning situations. Many of the studies done in this area, (Marston and Kanfer, 1963, Marston, 1964, and Smith and Marston, 1965) have confounded the effects of modeling and reinforcement with those of reinforcement alone. Phillips (1968) attempted to remedy this situation with a replication of one of Marston and Kanfer's procedures with the addition of an extra control condition. The procedure involved having a subject listen to a tape in which a model emits an increasingly large number of words in a certain response class. In

Marston and Kanfer's procedure the subject heard the model reinforced for his " correct" responses. Phillips added a condition in which the model made the response but was not reinforced for it. Phillips' results indicate that the increase in the subjects' responses from the designated response class cannot be attributed to the effects of vicarious reinforcement since the increase occurs following the condition in which the subjects heard just the model.

The preceding studies in which the effects of vicarious reinforcement have been specifically pursued, have relied upon group designs for making comparisons of the behavior of subjects viewing reinforced versus non reinforced models. Problems inherent in designe of this nature have been pointed out by numerous advocates of individual organism designs. The use of statistical analyses, necessary in analyzing differences between groups, tends to obscure the behavior patterns of individuals within the groups. As evidenced by preceding examples, a great deal of controversy exists over the relative effects of modeling versus reinforcement " spillover" in accounting for facilitative effects noted in situations where subjects view models being reinforced for responding on a variety of tasks. Individual organism designs common to applied behavior analysis seem to provide a framework within which these questions could be answered. These designs have been utilized in at least two studies which conserned themselves with the possible effects of vicarious reinforcement on the behavior of

observers.

Broden, Bruce, Mitchell, Carter, and Hall (1970), investigated the effects of teacher attention on the attending behavior of two boys at adjacent desks. During one phase of the experiment, teacher attention was given to one of the boys contingent on non-disruptive behavior. In addition to the expected increase in " on task" behavior of the target, a lesser but still significant increase in the " on task" behavior of the seatmate was noted. The investigators state that increased attending in the non target child may be attributable to the discriminative function of teacher proximity, which acted as a cue for appropriate responding. An alternate explanation proposed is that the behavior may be attributable to " spillover" of reinforcement from the teacher.

The first explanation indicates a basic flaw in the research design. A basic premise in investigations of vicarious reinforcement demands that the reinforcement not be gained directly. In this case there is a possibility that teacher proximity itself, which is not controlled served as a direct reinforcer. The second arguement which the authors propose is also subject to some question. An interpretation specifically in terms of "spillover" of reinforcement ignores the fact that this reinforcement could just as easily have reinforced inappropriate behavior. Some cue function, whether from the teacher's behavior or the behavior of the peers, must be assumed in order to account for the occurrence of on task as opposed to disruptive behavior.

A similiar study by Kazdin (1973), controlled for the variable of teacher proximity more successfully and thus circumvented arguements concerning the possible effects of direct reinforcement. Kazdin's study investigated the effects of reinforcement of one member of each of two pairs of subjects for attentive behavior on the behavior of the non reinforced member of the pair. Teacher proximity was controlled as was the content of the verbal praise (reinforcement did not specify the behavior being praised). This study found that when the target was reinforced for appropriate behavior, the level of appropriate behavior in the adjacent peer also increased. Of interest is the fact that during a phase in which the target was reinforced for inappropriate behavior, the behavior of the adjacent peer remained at, or slightly above, the same appropriate level it had been at while the reinforcement contingencies were in effect for the target subject. The target's behavior, in the meantime, became steadily more inappropriate. This finding suggests that, at least in this case, the behavior of the non-target child was not simply the result of imitation of the target child's behavior.

At present, the literature concerned with the analysis and application of vicarious reinforcement is both sparse and widely variant. As was noted previously, much disagreement presently exists over the relative importance of the model's behavior and the contingencies observed. Although individual organism designs seem to possess the power required to separate these effects, the re-

search with these tecniques to date has simply not addressed this type of analysis directly.

At present, the research in this area is sufficient to allow the conclusion that when reinforcement is delivered in a group situation, some effect on the other group members is possible. Effects of this nature have been demonstrated both by group and individual analysis designs. The separation of modeling from reinforcement effects does seem to be a crucial step towards increasing the reliability of using vicarious reinforcement in applied settings. If, for example, the function is simply one of reinforcement, there would be a danger inherent in dorecting positive reinforcement toward a subject for appropriate behavior in a room where other subjects were being inappropriate (since the inappropriate beahvior could be strengthened by the "spillover"). If, on the other hand, the effect is simply one of modeling (imitation), quite the opposite effect would be expected.

Purpose

Effects such as those outlined in the experimental procedures mentioned previously, have been variously attributed to 1) the discriminative stimulus properties of praise etc. delivered toward the target, 2) the effects of modeling alone, 3) the effects of a "spillover" of reinforcement from the target to the behavior of the observers, and 4) combinations of two or more of these effects. In most cases, variables connected with the social

histories of the observers or the social situation observed have contributed toward making an analysis of the variables to which the noted effects are attributable quite difficult.

The present experiment attempts to accomplish three main purposes in a more basic research setting:

1) To investigate whether an effect such as those mentioned previously can be produced in a setting where no adult modeling or verbal reinforcement from an adult is present.

2) To attempt to separate the effects of reinforcement "spillover" from those of simple modeling.

3) To investigate the course of the strength of the effect over time in order to make some estimation of possibilities for use in applied situations.

METHOD

Subjects

The subjects were pre-school children between the ages of 4 and 5 years who attended the Kalamazoo Learning Village, a day care, pre-school program in Kalamazoo, Michigan. Altogether, eight children participated in the study. Only four of the children were subjects of experimental manipulations; the other four children served as "models". The children, five boys and three girls, were paired randomly at the beginning of the experiment and the pairs remained constant throughout the experiment.

Apparatus

The apparatus consisted of a 3' x 3' x 6' sound attenuating chamber into which a response panel was mounted. Lighting in the chamber was provided by a 100 watt incandescent bulb mounted behind a translucent panel in the ceiling of the chamber. The response panel consisted of a 10" x 3' board behind which had been mounted two human response levers. The levers were mounted 10" from each side of the panel. Approximately 16" separated the two levers. The levers were electrically retractable and protruded through the board approximately 1" when fully extended. When retracted, the levers did not protrude through the board and were not reachable. Also mounted on the response panel, on the chamber wall closest to each lever, were two beepers (Mallory Sonalert) which acted as auditory stimuli, sounding whenever a reinforcer was delivered. Below each lever was a cup into which reinforcers (small chocolate candy pieces) were delivered by two

universal feeders, one on each side, mounted on the outside of the chamber. The lever. beepers, and feeders were connected to electromechanical programming equipment which was located in an adjoining room. Responses were counted by electromechanical counters and the schedule changes occurred automatically.

Experimental Procedure

The experiment was divided into four phases; baseline, control for the addition of a second child, vicarious reinforcement, and baseline (reversal). Daily experimental sessions were conducted, each of which lasted for approximately fifteen minutes.

Baseline

From each pair of subjects, one was chosen randomly as the target. The other member of the pair became the model. Both the target and the model retained their status throughout the experiment. On day 1 of baseline, the target was asked to "play a game" with the experimenter. The subject was seated in a chair facing the response panel and the experimenter told the subject that he would show him how the "game" worked. The experimenter pressed the lever until a reinforcer was produced at which time the lever was withdrawn. The experimenter then told the subject that when the lever reappeared, the subject could respond on the lever. After the first day of baseline, the experimenter merely went to the child's classroom, asked the child to come and play the game with him, walked the child to the experimen-

tal chamber, and seated the child at the response panel. The experimenter gave no instructions after the first day and said only "okay, you may start as soon as the lever somes out". The lever was always withdrawn at the beginning of the session to control the starting time and to make sure that the experimenter was not present when the first response was made.

The subject responsed on the lever and was reinforced on an FR 15 schedule until eight reinforcements had been received; at that time reinforcement no longer occurred. Responses to a daily criterion were counted. For purposes of this study the daily extinction criterion was defined as a period of three minutes during which the child made no responses on the lever.

Control for the addition of a second child

In some instances, the addition of a second child to a situation where only one child had formerly been responding, may have an effect on the behavior of the first child. For this reason, a control condition in which this effect could be evaluated was added. Before this phase began, the " model" of each pair was given one session of training on the bar press response without the target present. Following this training, both children were seated at the control panel, side by side. The experimenter explained to the children that they were to respond only on their own levers and then said "okay, you may start when the levers come out " and left the chamber. The subjects then were allowed to respond at the same time on their separate levers. The experimental contingencies in this phase were controlled by the

target subject's responding. The schedule was the same as during baseline, i.e., when the target received eight reinforcers on the FR15 schedule, reinforcement to both subjects was terminated. Responses to the extinction criterion were counted for both the target and the model.

Vicarious reinforcement

During this phase, the pairs were placed on different reinforcement schedules. After receiving eight reinforcers on the FR15 schedule, reinforcement was terminated for the target child. The model, however, continued to receive positive reinforcement on the FR15 schedule throughout the session. Responses to extinction were counted for the target child.

Baseline (reversal)

Baseline conditions were again programmed. The model was no longer present in the chamber and the target responded on an FR15 schedule until he received eight reinforcers. At that time reinforcement was terminated and responses to extinction were counted.

RESULTS

Figures 1 through 5 show the results of the four experimental phases, session by session. Figure 1 presents the mean number of responses across subjects for each day. Figures 2 through 5 present the data obtained from individual subjects.

The mean number of responses to extinction (across subjects) during the baseline phase was approximately 64. Data from individual subjects shows a high degree of variability during the early sessions, but is somewhat more consistent across subjects by the later sessions. Again, with the exception of one subject, the targets made 28 to 37 responses to extinction on the final day of baseline. The remaining subject made 63 responses on the final day of baseline.

In the control phase, where the second child was added to the chamber and received reinforcement in a "yoked" contingencies situation, responses by the target initially increased slightly but remained at about, or slightly below, the level of the responding during baseline.

The models' responding, across sessions, was initially relatively high (range 87 - 160) but decreased quickly over sessions (this pattern greatly resembled responding by the target subjects in baseline). The level of the model's behavior was, in most sessions, considerably above that of the target subject.

In the vicarious reinforcement phase, (responding by the target in the presence of continued reinforcement received by the models)

patterns of responding typically consisted of greatly increased rates during the early phases (ranging from 144 to 192) followed by rapid declines in responding in latter sessions. During the later sessions of the third phase, the level of responding was close to or below the original baseline level. In the reversal (return to baseline) phase, responding by three of the subjects occurred at a level which was actually an increase over the final few sessions of the preceding, vicarious reinforcement, phase.

FIGURE ONE

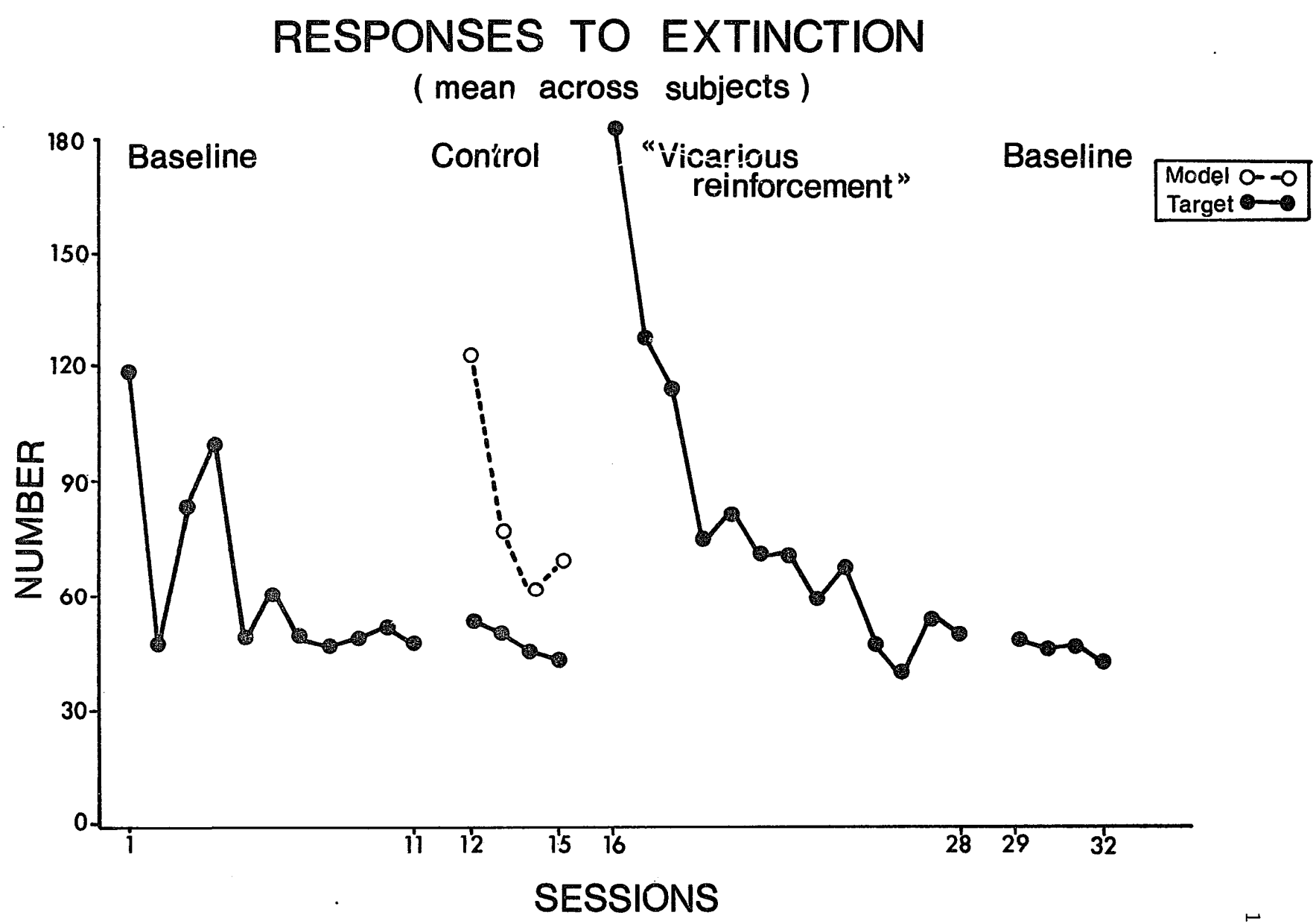


FIGURE TWO

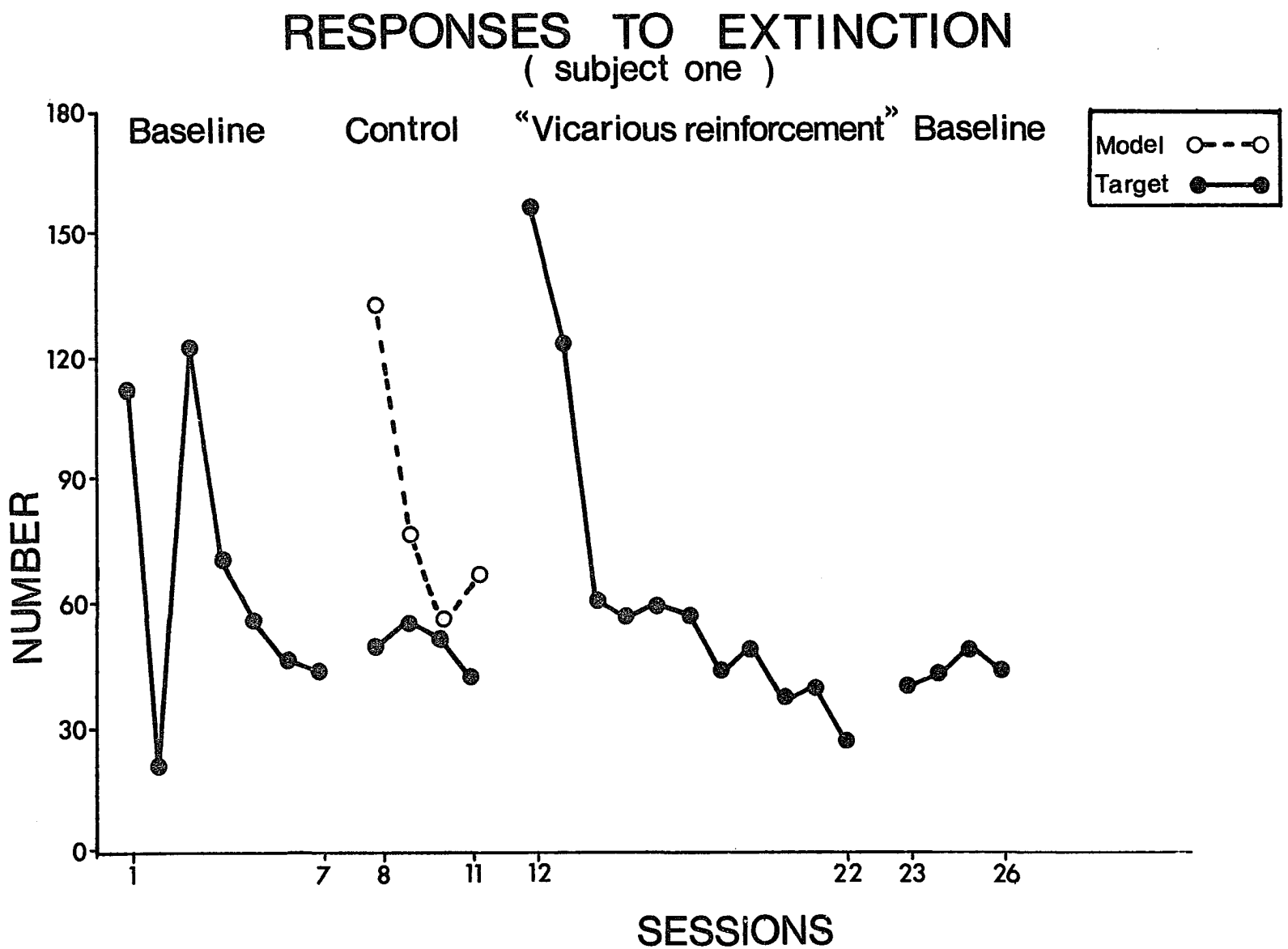


FIGURE THREE

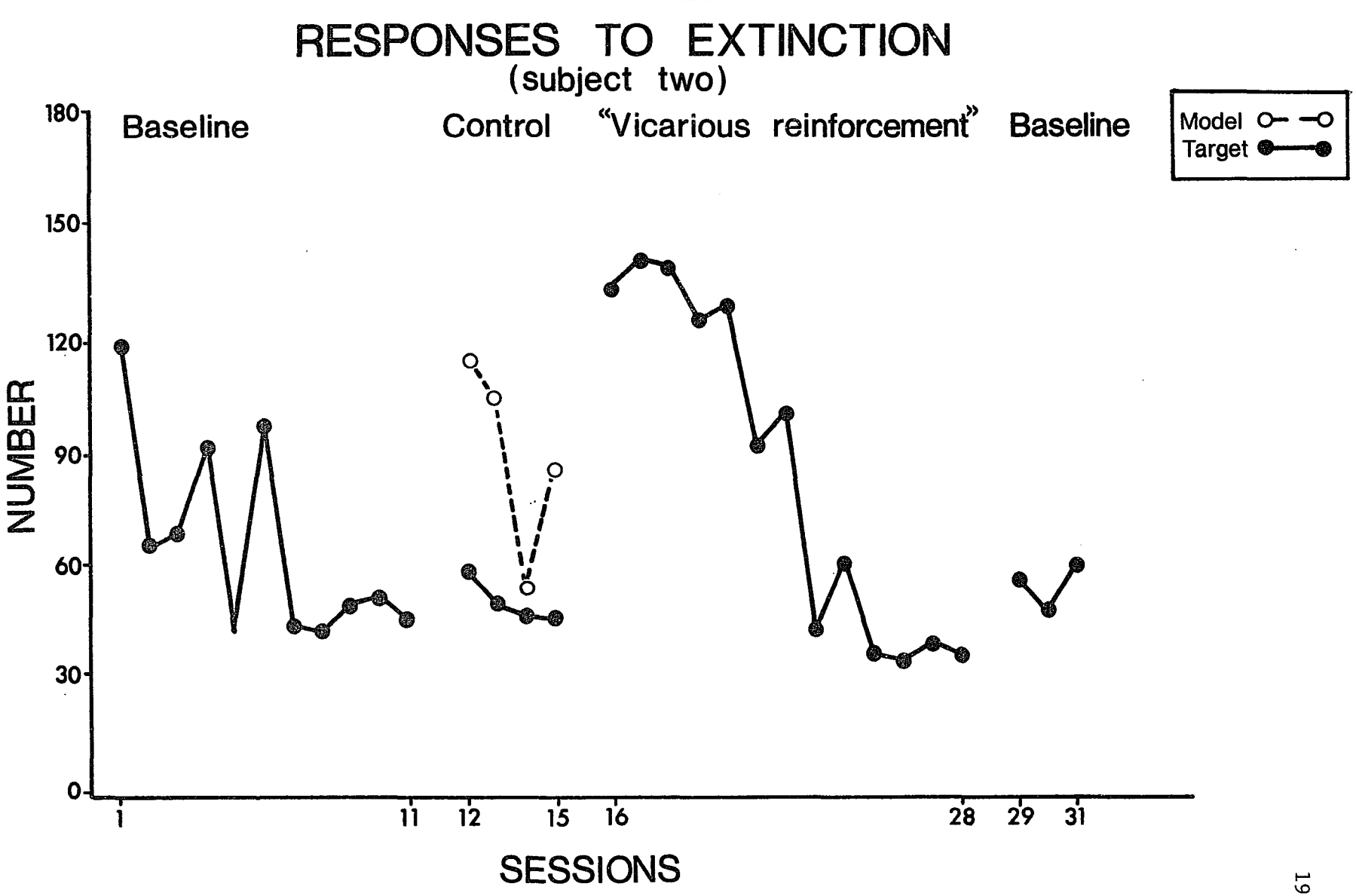


FIGURE FOUR

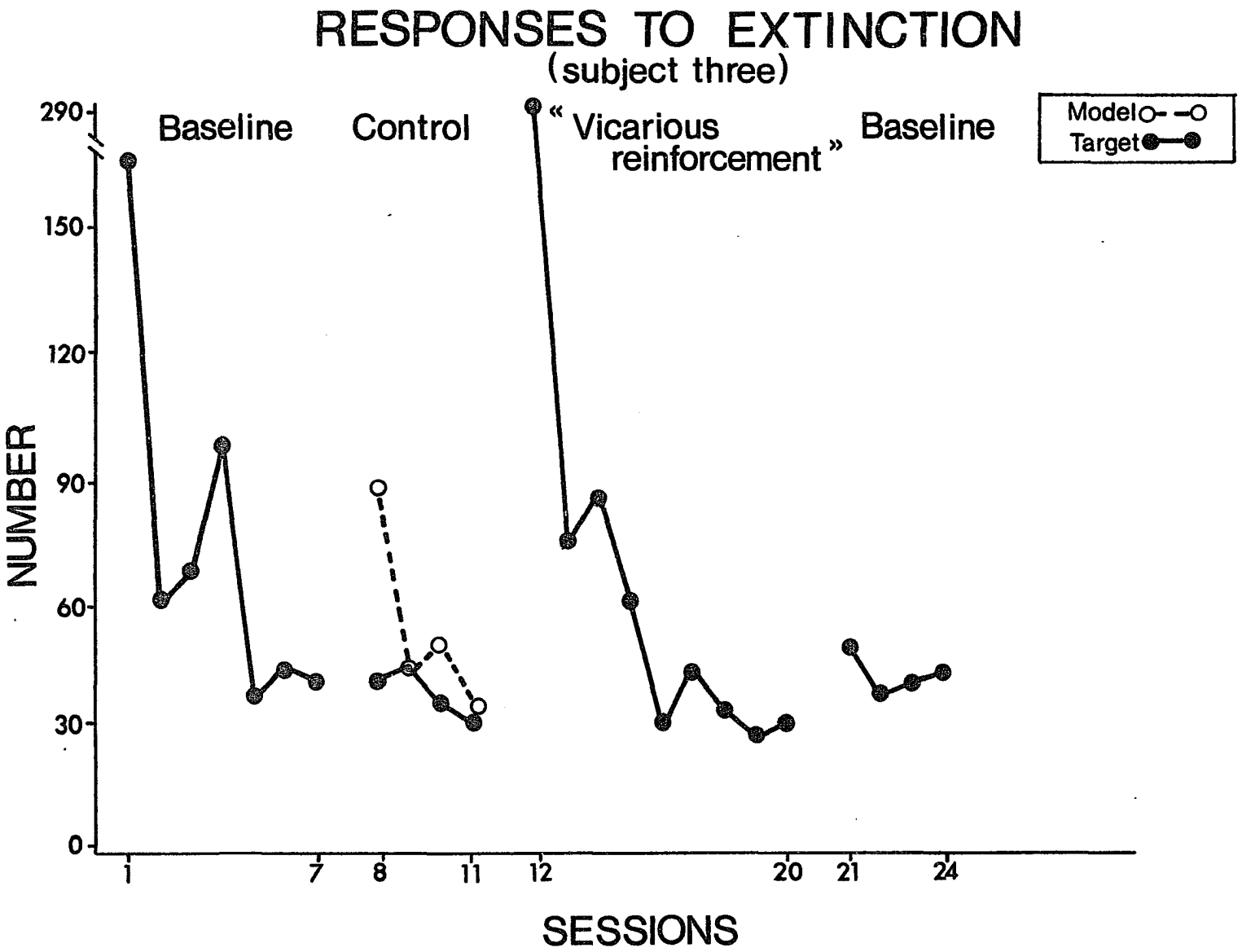
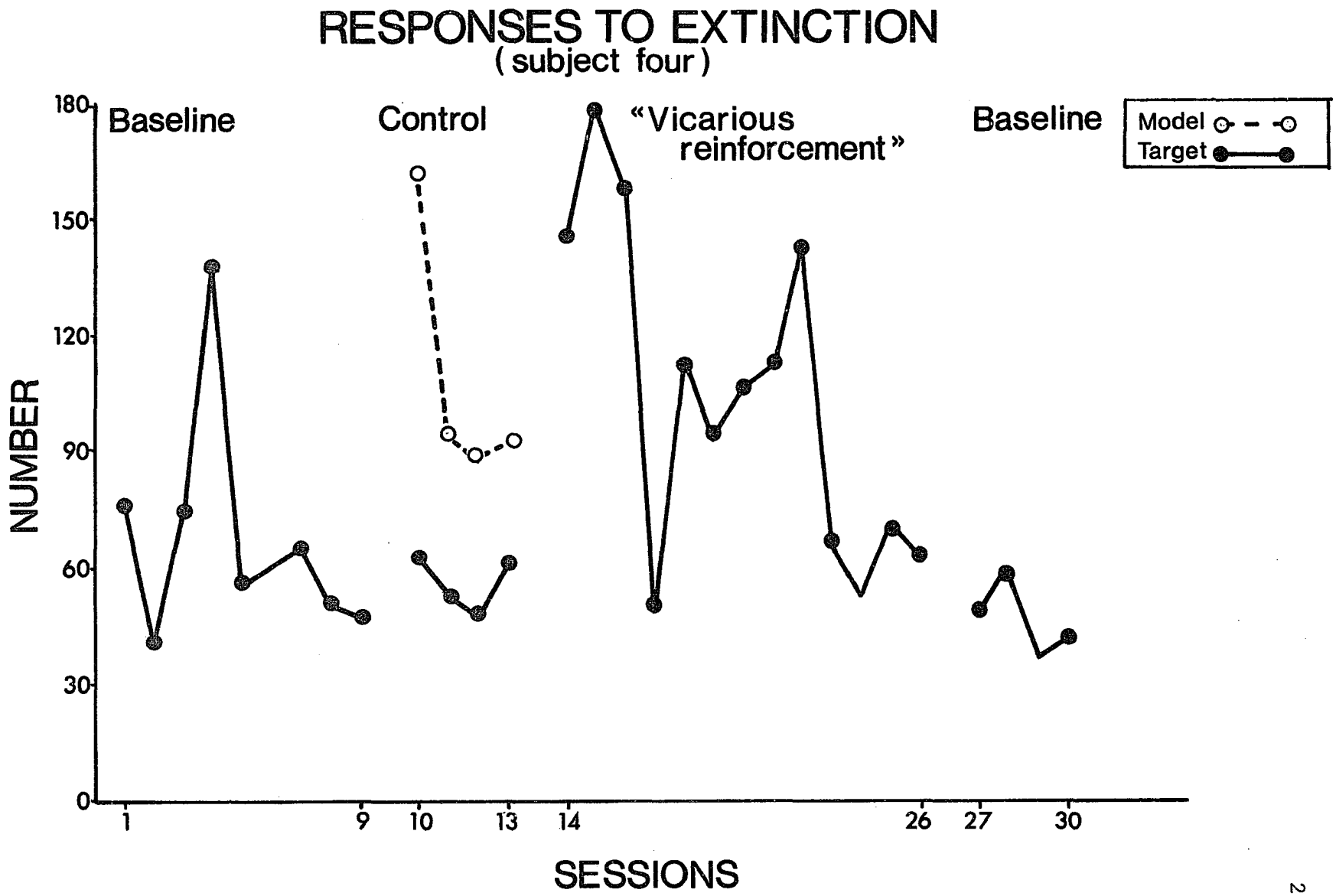


FIGURE FIVE



DISCUSSION

In the present experiment the second or " control" phase was designed to insure that any effect measured in the vicarious reinforcement phase could not be attributed to the presence of the second child in the experimental setting. Since the level of responding by the target children remained fairly stable during this phase (except for slight initial increases) it seems safe to say that the effects measured in later phases are not due to variables associated with the second child's presence. The behavior of the target in relation to that of the model is, nevertheless, of interest.

In the initial (baseline) phase, the number of responses declines across sessions from a mean of about 120 responses to extinction in the early phases to a mean of about 50 responses to extinction by the later sessions. This decline, it is assumed, occurs as the target subjects begin to make the discrimination associated with the FR 15 schedule. Thus, by the beginning of the control phase, the number of responses to extinction by the target subjects are fairly stable across sessions. When the models are introduced into the experimental situation during the control phase, they apparantly do not immediately make the same discrimination and their " responses to extinction" scores are initially much higher than those of the targets. An arguement in defense of attributing the effects obtained in later phases to modeling alone would predict that the targets' behavior would increase with that of the model during the initial sessions of the control phase. As can be seen in the data from all four subjects, the changes in the

target's behavior over the baseline levels is very slight and transitory - probably not of the magnitude or duration that would argue strongly for a modeling effect. Thus it seems safe to assume that later effects, in this instance, cannot be attributed to modeling.

These results seem to be contrary to those obtained earlier by other researchers in this area (Presbie and Coiteraux, 1971 and Phillips, 1968). It should be noted, however, that the above studies employed adult models, a fact which may or may not be an important variable.

With the institution of the vicarious reinforcement phase, a substantial increase in responses to extinction is seen across all four subjects. This effect, which will be referred to here (for lack of a more specific term) as vicarious reinforcement, is relatively transitory. Responding begins to drop almost immediately towards the baseline level and reaches this level within 15 sessions. The transitory nature of this effect would be an important factor in considerations of the use of related procedures in an applied setting. A possible effect not shown reliably here but suggested in three subjects, is that these procedures might, if extended over a long enough period of time, produce a suppression of the response level below baseline levels. Intuitively, at least, this seems to be a reasonable assumption. In situations where a child repeatedly sees a classmate reinforced while his equivalent behavior goes unnoticed, it does not seem unreasonable that the child would simply " give up" and stop responding.

In earlier studies where verbal praise was used, it is not unlikely that praise, especially descriptive praise, acted as a discriminative stimulus which presented the occasion for responding. In the present study, no verbal praise was used; thus the possibility of a verbal discriminative stimulus was eliminated. A distinct possibility, however, is that the occurrence of reinforcement might have served as an equally potent discriminative stimulus.

An additional observation which occurred in the present study concerned the rate at which responses occurred. During baseline measures, the targets, alone in the chamber, exhibited response patterns characterized by alternating high rate responding and pausing (an initial burst of responding ended in reinforcement followed by a paues before responding began again). With the addition of the second subject, these pauses disappeared. Both subjects seemed to respond as fast as they were able - not pausing to consume each reinforcer as it was delivered (as happened with the targets during baseline) but accumulating their reinforcers until the session ended. The target subjects, who received only 8 reinforcements, continued to respond at this high rate without pause usually until the time they stopped responding altogether. With the removal of the second child during the reversal phase, the targets' responding again occurred in the form of response " bursts" alternating with pauses.

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