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SOME EXPERIMENTS ON THE ORGANIZATION OF A CLASS OF IMITATIVE BEHAVIORS[1,2,3]

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A retarded child was taught to imitate diverse demonstrations made by an experimenter, until new demonstrations were imitated correctly upon first presentation without direct training. These imitations could be maintained without reinforcement, when they were distributed among other reinforced imitations. Factors responsible for the continued performance of these unreinforced imitations were examined. When subjected to massed extinction trials, unreinforced imitations eventually disappeared; they reappeared when again interspersed among reinforced imitations. In addition, the stimulus function of "similarity of response between subject and experimenter" was examined. The subject was taught a set of non-imitative responses, through discriminative stimuli controlled by the experimenter, and a comparable imitative set. Unreinforced non-imitations, like reinforced imitations, were maintained only when interspersed among reinforced imitations. When all reinforcement was discontinued, all responses extinguished similarly, indicating that reinforcement was necessary to maintain the response-class organization, but not confirming an essential role for "similarity" as such.

Much of human behavior is characterized by a great deal of flexibility. An apparently small or subtle cue may have considerable influence over a wide range of behaviors, causing some to be strengthened and others to be weakened. What is interesting from a behavioral viewpoint are the conditions involved in making these effects so far-reaching. What is indeed curious is the fact that although only a few responses may enter into a contingent relationship with a stimulus, a large number of responses which do not have such a relationship are influenced by the same stimulus. This type of interaction among behaviors is evidence of what has been described as response induction (Millenson, 1967) or as illustrating the operation of a generalized response system or a functional response class (Peterson, 1965, 1967).

The concept of a response class is a descriptive one. The class may be viewed as composed of a number of single responses (Skinner, 1935). The class may be relatively narrow, and therefore include only those responses which resemble one another topographically, such as the behaviors involved in saying "bow-wow", or may be relatively large and include behaviors which are topographically different such as crying, hitting, and pulling. Central to the definition of a response class is the observation that a number of topographically different responses have the same relationship to common controlling stimuli. These controlling stimuli may have an eliciting, discriminative, or reinforcing function, and can influence a set of behaviors in such a way that they become interrelated: variables which operate directly on some responses indirectly affect other responses. An example of the operation of a functional response class has been provided in a recent study on the development of imitative behaviors in retarded children by

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[2]Portions of this paper were presented in a symposium on Achieving Generality of Behavior Change at the seventy-fifth annual meeting of the American Psychological Association, Washington, D.C., 1967.

[3]This research was supported by grants to Dr. D. M. Baer and Dr. Sidney Bijou from the United States Public Health Service, National Institute of Mental Health (MH 02208 and MH 12067). Reprints may be obtained from the author, Dept. of Psychology, Psychological Clinic, University of Illinois, Champaign, Illinois 61820.

the author and his associates (Baer, Peterson, and Sherman, 1967). In this study the investigators attempted to build a repertoire of generalized imitative behaviors in three severely retarded children. These children were observed at length and judged to possess little, if any imitative behavior. Subsequently, the experimenter began to teach them imitative responses. He looked at a child and said, "Do this" and performed a response such as raising his arm. The child did not imitate his behavior, so he took the child's arm, raised it, said "Good", and gave the child a bit of food. This procedure was repeated a number of times. After a while the experimenter began to reduce his assistance in helping the child perform the response until the only stimulus for the child's response was the initial raising of the experimenter's arm. In this manner the subjects were taught a variety of simple behaviors such as tapping a table, opening a drawer, and putting on a hat.

After the subjects had learned a number of such responses they showed an increasing tendency to imitate new behaviors on which they received no training. By the time two of the subjects had learned some 130 responses, they were able to imitate almost any simple motor behavior the first time it was presented.

In addition, the subjects continued to perform a number of responses which were never reinforced. Although these responses varied in topography, it seemed likely that they were members of the more general class of imitative behaviors and were indirectly under reinforcement control. To test this assumption, a 30-sec delay of reinforcement (DRO 30-sec) was introduced. As a result, both reinforced and non-reinforced imitative responses declined in strength. When reinforcement was again immediately contingent upon an imitative response, both types of responses returned to their former levels. Thus, it appeared that non-reinforced imitative behaviors were under the control of reinforcement and were therefore members of the same response class.

METHOD

Subject and Apparatus

A 12-yr-old retarded girl was chosen to participate because she had (before training) evidenced no examples of imitative behavior despite repeated testing. She was without language but would respond to a few simple commands such as "come here" or "sit down". The child could move about fairly readily and had some simple manipulatory skills. Her most frequent activity was to sit on the floor, kick her legs, and spin a ball.

All experiments were performed in a room near the child's ward. The room contained a desk, two tables, a coat rack, several chairs, and other common office materials. Response times were recorded by a stop watch. Toys and some of the room fixtures were often used as imitative stimulus materials.

General Procedure

The subject was seen at mealtimes, once or twice a day, three to five times a week. Sessions lasted 15 to 40 min. Food was used as a reinforcer and delivered a spoonful at a time by the experimenter, who always said "Good" just before putting the spoon into the subject's mouth. Subject and experimenter faced each other across the corner of a small table on which were placed a food tray and the experimenter's records.

A response was scored as imitative if it either duplicated the topography of the experimenter's response, *e.g.*, putting his hand on his head or if the child used an object in the same way as the experimenter, *e.g.*, rattled the window shade. In addition, the response had to occur within 30 sec of the imitative stimulus. On seven different occasions one of three independent observers also scored the subject's behavior during a session. Since each presentation of an imitative stimulus constituted a separate trial, reliability was computed by dividing the number of trials, where experimenter and observer agreed that imitation had or had not occurred, by the total number of trials (agreements plus disagreements); average agreement exceeded 98%.

The present experiments were concerned with variables influencing the organization of an imitative response class. Assuming that the development and operation of a complex imitative repertoire is important to the acquisition of other behavioral skills (Peterson, 1968), it would appear valuable to know how a response might be added to or removed from such a class. Such knowledge could be useful to the educator, who is interested in building new response systems, and to the clinician,

who may want to break up certain kinds of behavioral organization.

Experiment I attempted to demonstrate a technique for removing a response from the class organization. This technique involved successive presentations of an imitative stimulus without reinforcement. Experiments II and III attempted to assess whether the dimension "similarity of behavior between subject and model" was essential for the continued performance of non-reinforced responses. In these experiments the subject was taught a series of non-imitative responses. These behaviors then underwent two different extinction procedures: one involved successive presentations of a stimulus and the other involved an intermittent presentation of the stimulus. The final study, Exp. IV, involved the demonstration of a functional response class which included imitative as well as other behaviors. In this study, reinforcement was withheld from imitative responses to see if other behaviors would also be affected.

EXPERIMENT I

Just before this experiment, the subject had participated in the aforementioned study by Baer *et al.* (1967) and had developed a large repertoire of imitative behaviors. In addition, the subject continued to perform a variety of non-reinforced imitations which were interspersed among reinforced imitations. These behaviors showed no tendency toward extinction and appeared to be members of the general class of imitative behavior.

The goal of Exp. I was to demonstrate a technique for freeing a response from such a class organization. The effects of two types of stimulus presentation were contrasted. The first, termed massed evocation, involved the continuously repeated presentation of an imitative stimulus; the second, labeled interspersed evocation, involved presentation of a single stimulus interposed among other imitative stimuli. In addition, the effect of massed evocation on non-reinforced imitations was determined.

Procedure

Six imitative behaviors, three of which had never been reinforced, were examined. All are listed in the second column of Table 1. First, the experimenter took one response from those listed in Table 1. He then looked at the subject, said "Do this" and modeled that response. Each demonstration constituted a trial.

Table 1

Responses Employed in Exp. I

Reinforced Responses	*Test Responses*
1. Sit in chair	1. Put on hat
2. Stand up	2. Tap wall
3. Tap left knee with left hand	3. Tap desk
4. Tap wall	4. Clap sides*
5. Tap head with left hand	5. Clap hands*
6. Say "ee"	6. Remove lid from box*
7. Stand in corner	
8. Say "ah"	
9. Move Kleenex box	
10. Tap right knee with right hand	
11. Tap desk	
12. Put on hat	

*Never reinforced.

To be scored, the subject's response had to occur within 30 sec of the demonstration. The subject's behavior was not reinforced. If the subject imitated the response within 30 sec the stimulus was repeated; if the response was not imitated, the experimenter waited a full 30 sec before repeating the demonstration. Extinction was defined as 10 consecutive failures to respond.

Next, using the same verbal command, the experimenter demonstrated two or three of a series of 11 behaviors which, if performed, were reinforced. (The response pool from which these 11 behaviors were selected may also be found in Table 1). The order of these 11 behaviors was randomized with each new session. After presenting stimuli for two or three of these (reinforced) responses, the experimenter modeled one of the previously extinguished responses. If this behavior was imitated, it was not reinforced. In all, stimuli for this response were interspersed five times each time the series of 11 behaviors was demonstrated.

In order to minimize possible chaining effects, a 20- to 30-sec pause always followed the subject's imitation or (if no response occurred) the experimenter's demonstration. After one of the six responses had been repeatedly tested, using both massed and interspersed stimulus presentations, other behaviors on the list were similarly examined.

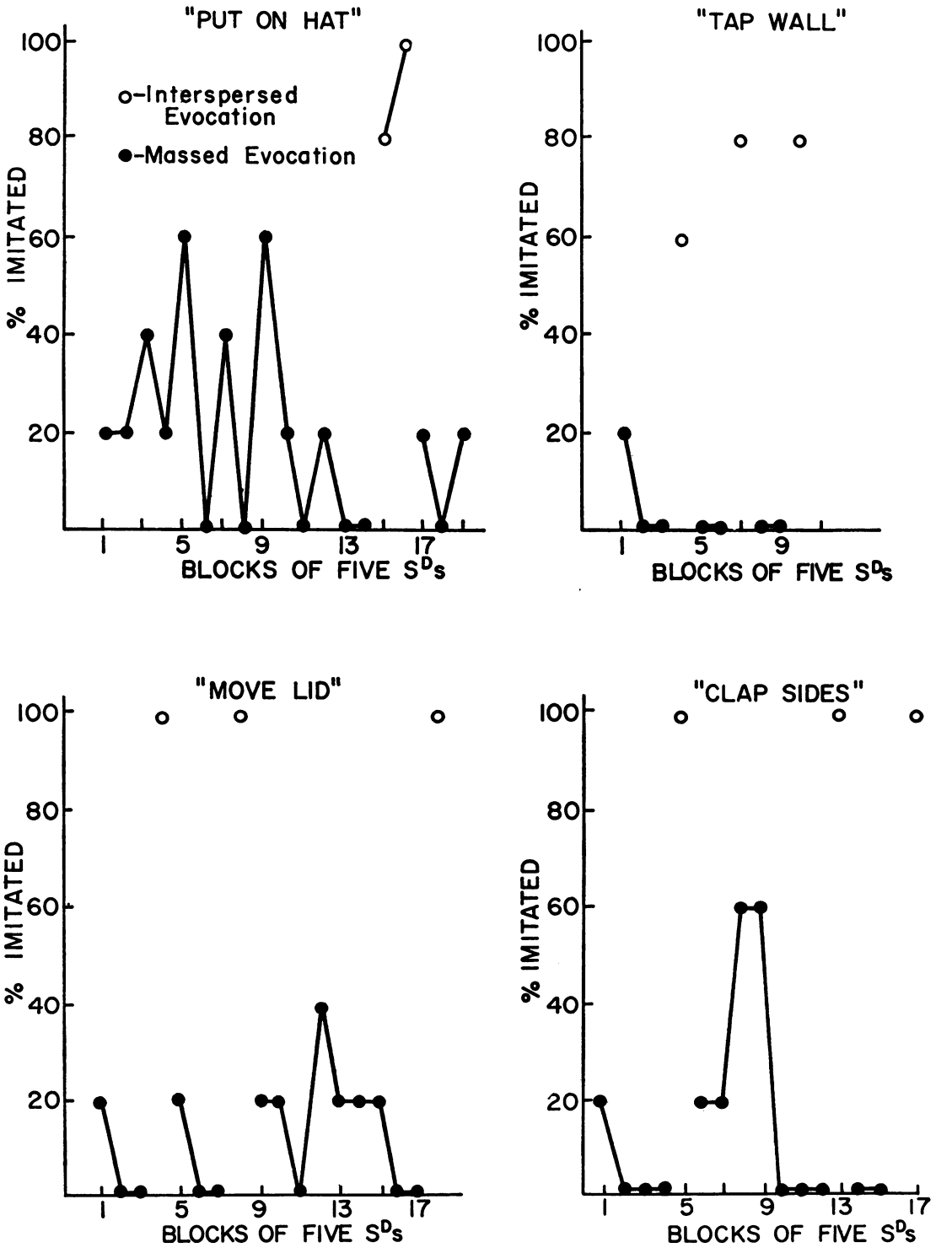

Fig. 1. The effects of massed *versus* interspersed stimulus presentation on two previously reinforced responses ("Put on hat" and "Tap wall") and two never-reinforced responses ("Move lid" and "Clap sides").

Results

Figure 1 shows, for four responses, the percent of $S^{D}s$ (trials) imitated under the two stimulus conditions. In each condition the response was not reinforced. The responses "Put on hat" and "Tap wall", however, had histories of reinforcement before this experiment, while the responses "Move lid" and "Clap sides" had never been reinforced. In all cases responses tended to be performed when interspersed among reinforced imitations and were displayed less frequently under massed stimulus presentation.

Similar results may be seen in Fig. 2, which shows extended tests of two responses under these same conditions. The response "Tap desk" was reinforced during the first two blocks (10 trials) and then mass-evoked. After extinction was achieved, the stimulus for this behavior was interspersed a total of 60 times. Although the response was no longer reinforced, the subject always responded.

The lower part of Fig. 2 shows a response that had no history of reinforcement ("clap hands") and which underwent periods of both massed and interspersed stimulus presentation. Since the subject's behavior tended to extinguish more quickly in this example, the contrast between the two stimulus operations is even more striking.

Discussion

This experiment demonstrated that under massed stimulus presentation, single responses could be extinguished but were performed when their evoking stimulus was interspersed among other imitative stimuli. One possible explanation for this result may lie in the reinforcement dispensed for other members of the imitative class. Baer *et al.* (1967) demonstrated that under certain conditions, non-contingent reinforcement can cause both reinforced and non-reinforced behaviors to decline to operant level. Reinstatement of the contingency reestablished both sets of behavior. Thus, it may be concluded that some reinforcement is necessary for the performance of all imitative responses.

One interpretation of this phenomenon suggests an additional factor which may be involved in the performance of non-reinforced imitative responses. This factor involves a stimulus dimension which might be labeled "similarity of behavior between child and model". Despite the fact that the imitative behaviors displayed by the child differ in topography, they all have the general property of being similar to the behavior of the experimenter. A test of the importance of similarity *per se* for the maintenance of non-reinforced responses was performed in the following experiment.

EXPERIMENT II

This experiment attempted to assess whether the quality of being imitative was necessary for the performance of non-reinforced responses. If the dimension "similarity of behavior between subject and experimenter" is essential for the performance of non-reinforced responses, then non-imitative behaviors should extinguish under both massed and interspersed presentation. If, on the other hand, this dimension is not important, then any unreinforced response, regardless of its dissimilarity to the experimenter's behavior should extinguish under massed evocation but continue to be displayed when its stimulus is interspersed among reinforced imitative behaviors.

Procedure

First the subject was taught five non-imitative behaviors using food, social reinforcement, and fading techniques. In each case, the topography of the discriminative stimulus for each response was quite different from topography of the response itself. All stimuli and responses are listed in Table 2. The usual verbal command "Do this", was not used with these five behaviors.

After a response was nearly always displayed when its stimulus was presented, the response was extinguished through the massed evocation procedure described in Exp. I. Extinction was again defined as 10 consecutive trials where no response occurred within 30 sec of a demonstration. Next, the stimulus for the response was interspersed among stimuli for 10 reinforced behaviors. To avoid adventitious contingencies, the interspersed response was always followed by a (minimal) pause of 15 sec. The behavior was not reinforced. As before, the sequence of the 10 reinforced behaviors was randomized with each new session. The two stimulus operations, massed and

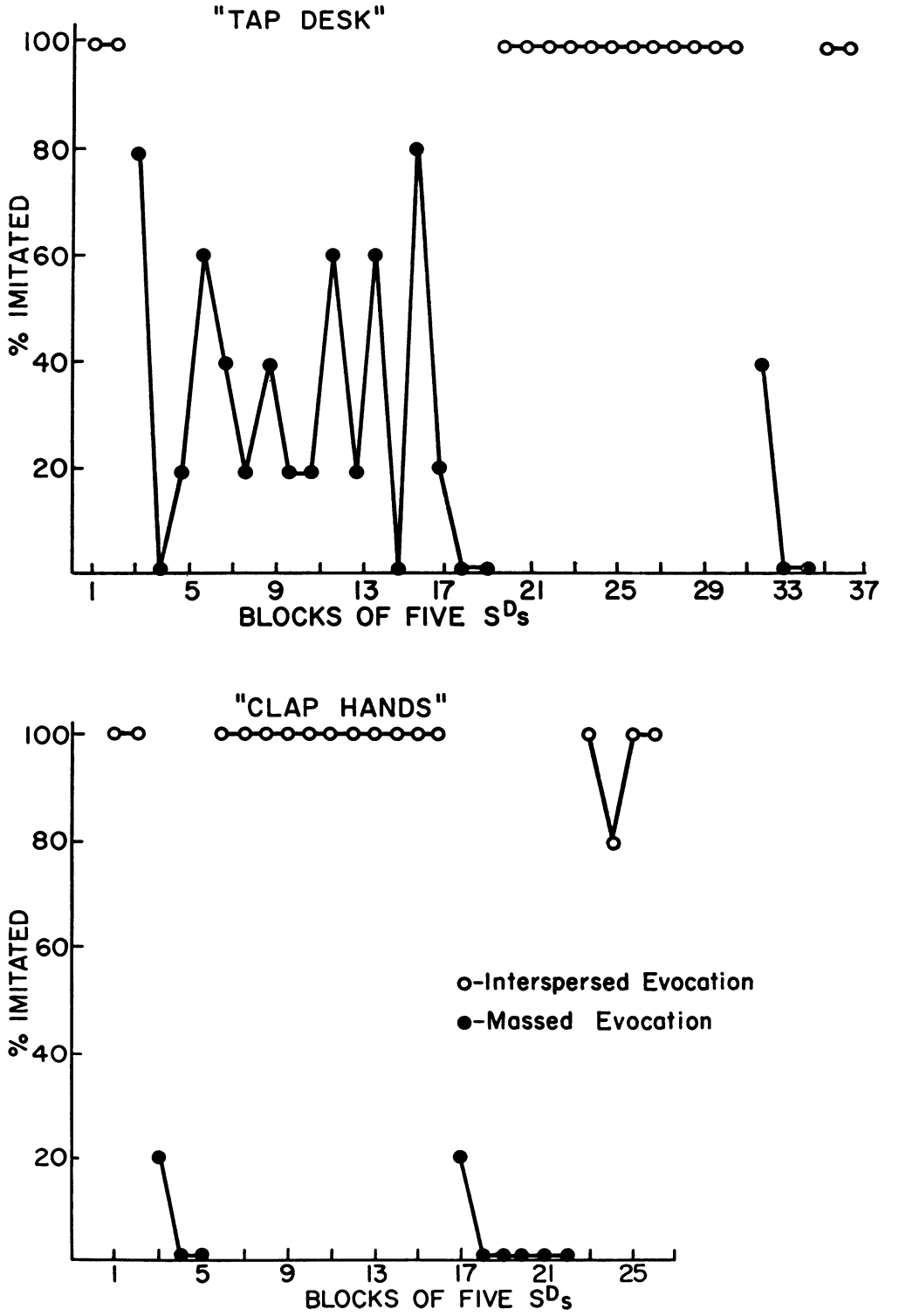

Fig. 2. The effects of massed *versus* interspersed stimulus presentation on the previously reinforced response "Tap desk" and the never-reinforced response "Clap hands".

Table 2

Stimuli and Responses Employed in Exp. II

Non-imitative Behaviors	
Stimulus	*Response*
1. Verbal command, "Move the lever."	1. Move lever on toy
2. Place hands behind neck	2. Twist knob (on toy)
3. Clasp knees	3. Shake coffee can
4. Twirl hands	4. Stamp foot
5. Cover mouth with hand	5. Stretch rubber band
Imitative Behaviors	
Test Responses	*Reinforced Responses*
1. Clap hands*	1. Stand up
2. Move carriage return (on typewriter)	2. Tap head with left hand
3. Remove lid from box*	3. Tap desk
	4. Say "ah"
	5. Stand in corner
	6. Tap right knee with right hnd
	7. Say "ee"
	8. Sit in chair
	9. Tap left knee with left hand
	10. Tap wall

*Never reinforced

interspersed, were alternated several times. Five non-imitative responses underwent these procedures. Subsequently, three imitative behaviors were similarly tested. Two of these three responses, "Remove lid from box" and "Clap hands", were imitations which had no history of reinforcement.

Results

Four of the five non-imitative behaviors extinguished under both massed and interspersed stimulus operations. The exception was the first response tested, "Move lever", which continued to be performed when interposed among reinforced imitations. The three imitative behaviors which followed the five non-imitative responses, however, also extinguished under both stimulus conditions. The first response in this latter group, "Clap hands", showed some strength when initially interspersed, but like the others, its rate soon fell to zero.

Discussion

The aim of the present experiment was to investigate whether the factor of behavioral similarity was necessary to maintain non-reinforced responses. The results, however, are inconclusive because the subject failed to perform nearly all non-reinforced responses, both imitative and non-imitative alike. It is not clear why these behaviors extinguished. Since, in previous work, it was demonstrated that reinforcement did indirectly control non-reinforced behaviors, one might ask if there was any change in the effectiveness of the reinforcers in the present study. The answer appears to be no, inasmuch as all reinforced responses were performed at their usual high levels.

The subject's failure to respond might have been due to the introduction of non-imitative behaviors. It could be argued that as long as all responses were imitative, it was difficult for her to discriminate those which were reinforced from those which were not. Perhaps the use of non-imitative responses promoted such a discrimination. On the other hand, since the subject had no trouble differentiating one imitative response from another, it is not immediately apparent why she could not also distinguish a reinforced response from one that was consistently unreinforced.

EXPERIMENT III

The purpose of this study, as in the previous one, was to investigate whether the dimension "similarity of behavior between subject and experimenter" was essential to the performance of non-reinforced responses. The plan of the experiment was first to reestablish the performance of unreinforced imitations, and then again test non-imitative behaviors using both massed and interspersed stimulus presentations.

Procedure

The experimenter looked at the subject, said, "Do this", and demonstrated two or three of a series of 9 to 10 behaviors, which if imitated, were reinforced. Then the experimenter modeled the stimulus for a non-reinforced imitation. This was followed by other demonstrations of reinforced imitations. Stimuli for a variety of non-reinforced imitations were interspersed three to five times during each series of reinforced demonstrations. If the subject did not readily respond to the stimulus for a non-reinforced response, she was

prompted by the experimenter. This prompt consisted of a gentle tug on the child's arm. A minimal pause of 15 sec followed each of the subject's responses. After four sessions of these procedures (271 presentations), stimuli for two non-imitative responses were also interspersed among stimuli for reinforced imitations. No verbal instruction was employed with these behaviors. The non-imitative behaviors received prompts when necessary but were not reinforced. After six sessions (332 demonstrations) using these procedures, three non-imitative behaviors were subjected to successive periods of massed and interspersed stimulus demonstrations. The general procedure was identical to that employed in Exp. I. All stimuli and responses employed in this experiment are listed in Table 3.

Table 3

Stimuli and Responses Employed in Exp. III

Non-imitative Responses	
Stimuli	*Responses*
1. Place hands behind neck	1. Twist knob (on toy)
2. Cover mouth with hand	2. Stretch rubber band
3. Clasp knees	3. Shake coffee can
Imitative Responses	
Non-Reinforced	*Reinforced*
1. Sit on floor	1. Stand up
2. Ring bell	2. Tap wall
3. Walk with arms above head	3. Sit in chair
4. Remove lid from box	4. Tap left knee with left hand
5. Clap hands	5. Tap desk
	6. Tap right knee with right hand
	7. Say "ah"
	8. Say "ee"
	9. Hit stapler
	10. Stand in corner

Results

Non-reinforced imitations were frequently displayed by the end of the second training session. The subject was prompted eight times in the first session and once in the second. A final prompt was given when non-imitative behaviors were introduced in session five. Figure 3 shows the effects of massed and interspersed stimulus presentations on three non-reinforced, non-imitative, responses. Without exception, these behaviors extinguished under massed evocation but were readily performed when interspersed among reinforced imitations.

Discussion

The results of this study indicate that non-imitative responses are displayed in much the same manner as imitative responses under conditions of massed and interspersed stimulus presentation. Therefore, it would appear that

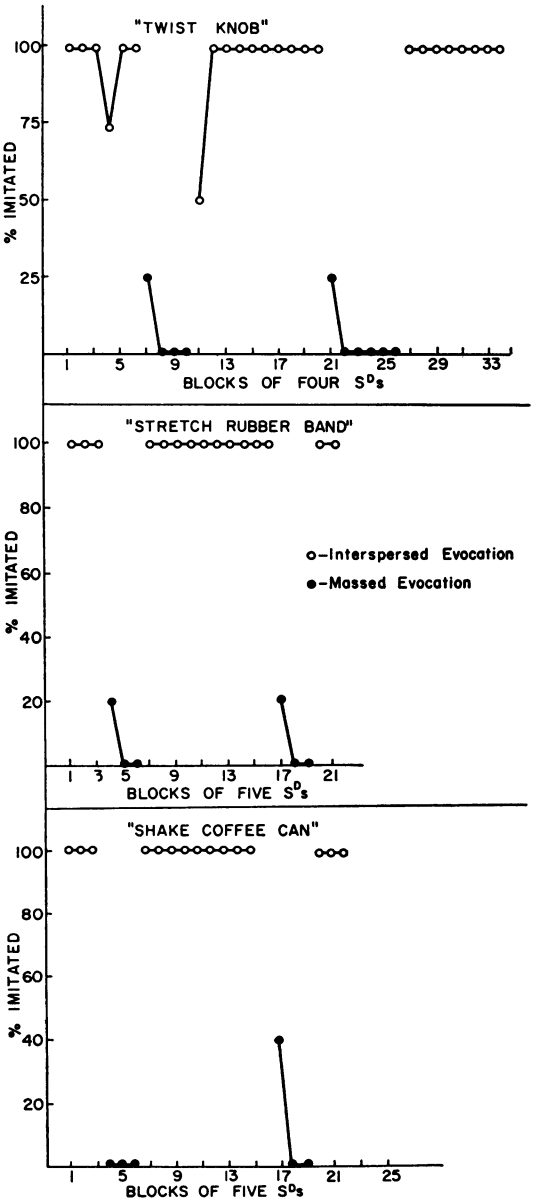

Fig. 3. The effects of massed *versus* interspersed stimulus presentation on three non-imitative responses.

non-reinforced imitative behaviors were not being performed because of their similarity (in terms of being imitative) to reinforced imitations. It is possible, however, that unreinforced responses (imitative and non-imitative) were being maintained because of other similarities to reinforced behaviors. For example, all responses were performed under the same general conditions in the same experimental room. Furthermore, they each have in common the fact that they were cued by the experimenter, *i.e.*, in every case the experimenter "instructed" the subject how to behave. It is possible that these conditions could create a large response class which includes both imitative and non-imitative behaviors. A demonstration of such a class might elaborate the findings of this experiment.

EXPERIMENT IV

The results of Exp. III suggest that both imitative and non-imitative behaviors may be members of the same response class. This possibility was investigated in the present study by attempting to demonstrate certain functional relationships between the two types of behavior. Thus, this study endeavored to show that variables which operate on one kind of response, indirectly affect other types of responses.

Procedure

The general procedure differed little from that employed in previous experiments. The subject was instructed to "Do this", and the experimenter then modeled two or three of a series of 10 behaviors which, if imitated, were reinforced. Next, the stimulus for a non-imitative response was presented. Non-imitative responses were not reinforced. Stimuli for four non-imitative responses were interspersed in each series of 10 imitative responses. The sequence of imitative responses was randomized with each new session. A minimal 15-sec pause followed each of the subject's responses. If the subject did not respond within 30 sec of a stimulus, the experimenter modeled the next behavior in the series. After a baseline level of responding had been established, reinforcement for imitative behaviors was discontinued. After a short period, reinforcement was again dispensed contingent upon an imitative performance. All stimuli and responses displayed in this experiment are listed in Table 4.

Table 4

Stimuli and Responses Employed in Exp. IV

Non-imitative Responses	
Stimuli	*Responses*
1. Place hands behind neck	1. Twist knob (on toy)
2. Cover mouth with hand	2. Stretch rubber band
3. Clasp knees	3. Shake coffee can
4. Twirl hands	4. Stamp foot

Imitative Responses
1. Put on hat
2. Tap head with left hand
3. Stand in corner
4. Sit in chair
5. Stand up
6. Hit stapler
7. Pull drawer
8. Pet coat
9. Tap desk
10. Tap wall

Results

The effects of the above procedures are shown in Fig. 4. Imitations are plotted in blocks of 10 stimulus presentations while non-imitative behaviors are plotted in blocks of four. This graph shows that the subject ceased to perform non-imitative responses as soon as reinforcement for imitative behaviors was discontinued. Forty stimulus presentations later, the rate of imitative responses also declined. When imitative responses were again reinforced, the rates of both types of behavior returned to baseline levels.

GENERAL DISCUSSION

The present experiments suggest that imitative responses appear to satisfy the criteria for a functional response class. These responses, however, should not be conceived of as a rigidly organized behavioral unit in that the results indicate that imitative behaviors may also be members of an even larger response class which includes non-imitative behaviors as well.

Several arguments have been put forth to explain the performance of non-reinforced imitative responses. In earlier studies, Baer and his associates (1964, 1967) suggested that

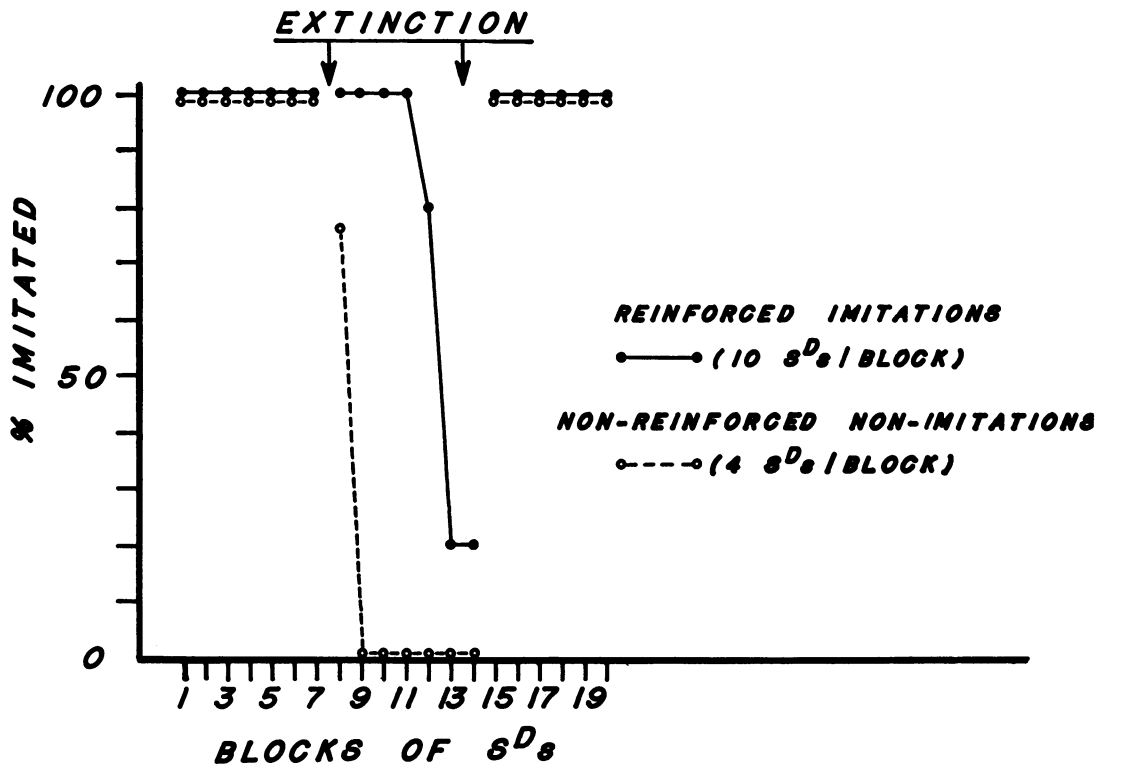

Fig. 4. The effects of reinforcement withdrawal on imitative and non-imitative behaviors.

non-reinforced imitations might be displayed because matching the behavior of the experimenter had been discriminative for reinforcement. Thus, "matching" in and of itself could serve to maintain behavior in the absence of reinforcement.

In contrast, the present results suggest that although the dimension of behavioral similarity may be crucial to the development of a class of imitative behaviors, this dimension probably does not function to maintain non-reinforced imitative behaviors. It is even more unlikely that "similarity" *per se* could be important in the performance of non-reinforced non-imitative behaviors. However, the possibility that other stimulus dimensions may play a role has not been ruled out.

Bandura (1968) has argued that discriminative difficulties may explain the performance of non-reinforced imitative behaviors. He believes that it may be difficult for the subject to discriminate reinforced from non-reinforced behavior since only a small percentage of the behaviors are reinforced. Thus, if a model were to portray a series of reinforced responses followed by a series of non-reinforced responses, the latter would cease to be performed.

Although the ratio of reinforced to non-reinforced responses should undoubtedly be considered in the performance of non-reinforced behaviors, the present results do indicate that under a relatively high ratio of one non-reinforced to two or three reinforced responses, non-reinforced responses were still performed. Since the subject ceased to perform responses which were mass-evoked, but performed those which were interspersed, an explanation in terms of a possible chaining effect might also be examined. In other words, it could be argued that the subject performed the non-reinforced response in order to get to the next reinforced response as quickly as possible. However, the pauses programmed before each demonstration, coupled with the time it took for the subject to imitate the behavior (at least 20 sec, since nearly all of the responses involved going to another part of the room and returning) guaranteed that it would take just as long if not longer to perform the response as it would to wait 30 sec for the next S^D.

In considering any tentative explanation of these results, the reader should keep in mind the possibility that the behavior of the child studied may be unique; caution should be used in attempting to generalize these findings to other subjects and situations. It is notable, however, that other investigators (Lovaas, 1967; Metz, 1965; Lovaas, Freitas, Nelson, and Wahlen, 1967) have reported a number of similarities between the imitative behavior displayed by their subjects and the present one.

Perhaps the simplest explanation for the performance of non-reinforced behaviors lies with the reinforcement dispensed for other responses. In all of the experiments, reinforcement contingent on some behavior was necessary for the performance of non-reinforced responses. This was true when the experiment involved both imitative and non-imitative behaviors and massed *versus* interspersed stimulus presentations. The importance of reinforcement in a functional response class and its implications for imitation and identification have been discussed in an interesting article by Gewirtz and Stingle (in press).

The individual responses studied in the present experiments were quite varied topographically. The class they formed could be considered a fairly broad one. When viewed as a unit, the class could also be considered as under the influence of an intermittent schedule of reinforcement. This conceptualization raises questions concerning the boundaries of the class (*i.e.*, its generalization gradient) and those stimulus aspects which in addition to reinforcement may create a functional response class. No doubt the isolation of those dimensions which cause behaviors to interlock and be strengthened or weakened as a unit would prove valuable. Such knowledge would not only further theoretical formulations of multi-operant repertories but would also increase the psychologist's effectiveness in dealing with social, educational, and clinical problems.

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