DIFFERENTIAL INTERFERING EFFECTS OF OBSERVATIONAL LEARNING IN BOYS AND GIRLS

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Abstract

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This experiment compared the relative interfering effects of prior observational learning and direct learning upon the subsequent acquisition of a different response. In the observational learning condition children learned discriminated response B for penny rewards after watching an adult model receive pennies for performing response A on the same apparatus. In the direct learning condition children acquired response A by trial and error to a criterion. Then without their knowledge the reward contingency was altered, requiring them to learn a new response, B, in order to gain further reward. Children in the control condition simply learned response B for penny rewards. It was found that control children acquired B in fewer trials than children in the observational and direct learning conditions. Boys in these two conditions did not differ in number of trials required to learn B. Also boys and girls in the direct learning group required comparable numbers of trials to learn B. However, girls in the observational learning condition required more trials to acquire B than boys in that group and more than girls in the direct learning condition. The sex difference obtained was discussed in terms of sex-role training.

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Introduction

Observational, or imitative learning has been under extensive investigation for the past thirty years. Miller and Dollard's classic work (1941) emphasizing the role of learning in the development of imitation is one of the important early treatments of the subject. Imitation occurs when observation of a model's behavior leads the observer to match his responses to those of the model. In imitation experiments increased similarity between the observer's and model's behavior has been measured by frequency of response, magnitude of response or sometimes overall resemblance between the two behaviors. The majority of experiments employ a pretest-posttest design, in which all subjects are measured on a specific behavior prior to being divided into experimental and control groups. The experimental group is exposed to a model performing the critical behavior, whereas the control group is exposed to the stimulus situation without the model. There are three major classes of modeling experiments: vicarious extinction of fearful behavior, changing the frequency or intensity of habitual responses, and the teaching of novel responses which did not previously exist in the subject's repertoire. Various simple types of behavior which have been transmitted through modeling include styles of aggressive behavior (Bandura, Ross and Ross, 1963), play patterns (Marshall and Hahn, 1967) and linguistic structures (Lovaas, 1966). More complex patterns of behavior such as conceptual strategies (Flanders and Thistlethwaite, 1969), self-reinforcement standards (Bandura and Kupers, 1964) and delay-of-gratification (Bandura and Mischel, 1965) have also been taught through exposure to modeling stimuli.

Some current theorists (e.g. Bandura, 1971) consider observational learning to have its own governing principles whereas Gewirtz (1971) maintains that it may be adequately understood in terms of the laws of operant conditioning. Regardless of theoretical differences it is generally accepted that modeling is one of the most efficient means of transmitting behavior and that many of our social behaviors are acquired in this manner. Bandura (1969) has commented that "It is doubtful if many classes of responses would ever be acquired if social training proceeded solely by the method of successive approximations through differential reinforcement of emitted responses".

The role of reinforcement has been a matter of controversy in observational learning. Miller and Dollard (1941) demonstrated that imitative responses increased over trials as a function of reinforcement. They maintained that acquisition training without reinforcement had little effect. Bandura (1969) disagrees with this view. Experimental evidence supports his contention that nonreinforced training conditions are sufficient for imparting at least some tendencies to imitate the model (Berger, 1966; Manfer and Marston, 1963). Fundamental to Bandura's theory is his distinction between acquisition and performance of modeled responses illustrated in the following experiment (Bandura, 1965). Subjects were divided into three groups, each of which observed a model who was either rewarded, punished, or received no consequences for displaying aggressive behavior. Subsequent tests of imitative behavior revealed wide performance differences between the three groups, with the rewarded model condition generating the most imitation. In the second phase of the experiment a strong positive incentive was offered to subjects in all conditions contingent upon performance of the modeled behavior. Under these circumstances the three groups performed approximately the same number of imitative responses. According to Bandura acquisition corresponds to the first half of the experiment and refers to what was learned simply through exposure to the model. His theory states that during acquisition the observer does not have to respond overtly (i.e., no-trial learning) but incorporates the modeled behavior in cognitive terms. Performance, on the other hand, is a reflection of the subject's desire to display what he has learned, which is determined by incentive conditions. Several recent studies (Baer, 1968; Mischel and Grusec, 1966) support the principle that rewards offered to the observer contingent upon imitation of a model's behavior increases the frequency of that behavior.

The previous experiment also illustrated that reinforcement of the model's behavior has an effect upon the probability of obtaining imitative behavior in an observer. This effect upon the observer has been called vicarious reinforcement. Vicarious reinforcement operates by providing the observer with information concerning the probability that he will be rewarded for performing the model's behavior (Bandura and Walters, 1963). According to Bandura "vicarious reinforcement processes are governed by variables such as the percentage (Bisese, 1966), intermittance (Rosenbaum and Bruning, 1966), and magnitude (Bruning, 1965) of reinforcement in essentially the same manner as when they are applied directly to a performing subject". Most of these studies have concentrated on the effects of different schedules of direct and vicarious reinforcement on extinction and find that they produce comparable performances (Braun, 1972; Rosenbaum and Bruning, 1966).

The subject's attention, which is in part controlled by incentive conditions, obviously plays a key role in observational learning. Model attributes and observer characteristics are two other attention-determining variables which influence imitation. It has been demonstrated that models who display high competence (Mausner, 1954) or possess high prestige (Lefkowitz, Blake and Mouton, 1955) will be more influential than those who do not. Other model characteristics such as age (Bandura and Kupers, 1964) and sex (Bandura, Ross, and Ross, 1963) may also influence the degree of imitation. Some experiments show that observers will imitate same-sex models more than cross-sex models (Grusec and Brinker, 1972; Maccoby and Wilson, 1957). Flanders (1968) has reviewed the literature on the influence of the model's sex and sums up the evidence as inconclusive.

Numerous studies have shown that sex of observer interacts with the nature of the task in observational learning. In studies of aggressive behavior boys will imitate more than girls (Bandura, 1965; Hicks, 1965), but in experiments not involving aggressive acts there are generally no sex differences (Bandura and Kupers, 1964; Mischel and Liebert, 1966; Thelen, 1972). A few nonaggression studies have been reported in which males imitated more than females (Bandura et al., 1966; Kanereff and Lanzetta, 1961) or in which females imitated more than males (Hertherington, 1965; Patel and Gordon, 1960). Other observer characteristics which have been related to the performance of imitative responses are dependency (Ross, 1966), level of competence (Kanareff and Lanzetta, 1960) and socioeconomic status (Beyer and May, 1968).

In addition to incentive conditions, model attributes and observer characteristics, the development of imitative responses depends on the observer's attention to the relevant environmental cues. Miller and Dollard (Expt. 7, 1941) demonstrated that one of the advantages of observational learning was that it directed the subject (via a model) to respond to the relevant cue more quickly than he otherwise might. Bandura suggests that reinforcement given to a model may serve an informational function by identifying those discriminative stimuli to which responding is rewarded.

In the majority of modeling studies the observer is required to imitate the model to gain a reward. Miller and Dollard (Expt. 5, 1941), however, conducted an experiment in which the conditions were reversed, i.e., imitation of a model led to nonreward whereas reinforcement was contingent upon performance of alternative behavior. They obtained 100% nonimitation in subjects who were reinforced for performing the response which was the opposite of the model's. They employed a two-choice place-learning task which provided a clear-cut alternative to the model's response. Subjects were able to learn the rewarded response quite rapidly.

One important aspect of learning by observation is rather neglected in the literature. Few studies have examined the circumstances in which observation of a model hinders rather than facilitates acquisition of the correct or most effective response. Two experiments related to this issue were concerned with the learning of information-processing strategies (Lamal, 1971; Laughlin, 1969). These studies conclude that subjects utilize effective or ineffective strategies for gaining information depending upon which technique had previously been modeled.

McDavid (1964) studied the interfering effects of model observation on children in a visual discrimination task. The experiment involved the learning of a motor response to a particular color cue which was reinforced on a continuous basis. The subject was exposed to a model performing the task on each trial, prior to the subject's response, but the consistency of the model's behavior varied. For one group the model responded to the correct color cue on every trial. The second group witnessed a model responding two-thirds of the time to the appropriate cue, with one-third of the responses equally divided between the other two colors. For the third group the model responded randomly to each of the three color cues. The results revealed that the learning of the color discrimination took place most readily when the correct color cue and the model's response were either consistently or randomly associated, but with greater difficulty when they were partially associated. McDavid suggested that "partial association between social and nonsocial cues may lead to the development of tendencies to imitate the model blindly rather than to actual observational learning."

The experiment to be reported dealt with the effects of prior observation of a model upon the acquisition of a discriminated passive response which was different from the one performed by the model. The effects of prior observational learning were compared with those of direct learning. Under investigation was the question of whether exposure to a model produces a greater interference effect for subsequent learning than first-hand experience. The study involved three conditions with three groups of children serving as subjects. In the first condition (Misleading Model) boys and girls were required to learn discriminated response B for penny rewards after watching an adult model receive pennies for performing response A. In the second condition (Direct Learning) boys and girls learned response A by trial and error to a criterion. Then, without the subject's knowledge, the reward contingency was altered, obliging them to learn response B in order to gain further rewards. The third group of children who served as controls simply learned response B for penny rewards.

The design of this experiment made it possible to compare the effects of prior observational learning with direct prior learning and no prior learning upon the acquisition of a response.

Method

Subjects

Sixty children, thirty boys and thirty girls, ranging in age from seven to nine years, participated in the study. They were obtained from a school in which the majority of fathers' occupations were managerial or professional.

Apparatus

The experiment was conducted in a mobile laboratory situated outside the school. The experimental room, measuring seven feet long by six feet wide, was separated from an adjacent room by a one-way mirror. The investigator stood behind the mirror which afforded a side view of the apparatus and subject. The apparatus consisted of a blue wooden box, 18" on each side, equipped with a response key which could be illuminated. The key, which was activated by pressing it, represented the nose of a clown's face painted on the front of the box. A Gerbrands penny dispenser, located inside the box and connected to the response key, delivered pennies into a plastic dish below the clown's face. All experimental events were controlled by Grason-Stadler programming equipment which was situated in the adjacent room. Pressing responses made by the subject were automatically recorded on a three-channel event recorder.

Procedure

Subjects were randomly assigned to one of three conditions, Misleading Model, Direct Learning, or Control, with the limitation that each group was arranged to include an equal number of males and females at each of three age levels. There were 24 children in each of the experimental conditions, and 12 children in the control condition.

The apparatus was programmed to generate one of two different reinforcement contingencies. For both contingencies the onset of a trial was marked by the illumination of the response key. In the Press-Reward contingency the first press coincident with the light terminated it, initiated the intertrial interval (ITI), and delivered a penny. If no response occurred the light went off after three seconds and no reward was delivered. The second contingency, designated the No Press-Reward arrangement, required the subject not to press during the light in order to obtain a reward. If a subject did not press while the key light was on, the light terminated after three seconds and a penny was delivered. Pressing during the light turned it off without a reward. For both contingencies presses during the ITI were recorded but had no consequences. The ITI ranged from 10 to 45 seconds with a mean of 22 seconds.

Misleading Model Condition (MM)

In this condition the apparatus was set to the Press-Reward contingency before a subject arrived. The experimenter demonstrated to each subject for ten consecutive trials the response (press during light) required for the penny reward. At the end of ten trials the experimenter left the room and switched the apparatus to the No Press-Reward contingency. Thus the response previously modeled for the subject no longer resulted in reinforcement. The data of interest were the number of trials required by the subject to learn the altered reinforcement contingency.

Direct Learning Condition (DL)

For subjects in this group the apparatus was again set initially to the Press-Reward contingency. No demonstrations were given by the experimenter prior to leaving the subject with the apparatus. After the child (presumably by trial and error) reached a criterion of ten consecutive rewards, the experimenter switched the apparatus to the No Press-Reward arrangement without the knowledge of the subject. The child was required at this point to shift from pressing to not pressing during the light in order to earn further rewards. The experimental data in this condition as in the previous one were the number of trials required to learn the new reward contingency.

Control Condition

Each subject in this group was exposed to the No Press-Reward contingency throughout the entire session. There were no prior demonstrations. This condition provided information on the number of trials required to attain criterion on the No Press-Reward contingency without the interference of previous learning, whether observational (MM) or direct (DL).

A summary of the experimental design is presented in Table I.

Subjects were taken individually into the experimental room by the investigator, a female graduate student in psychology. On the way to the trailer the experimenter conversed with the subject using a standardized list of questions (See Appendix A). Each child was carefully questioned to determine whether he was naive as to details

Table 1

Summary of Experimental Design

MM	DL	Control
Model Performs A	Child Performs A	
Child Performs B	Child Performs B	Child Performs B

of the study. Three children were rejected because they had been informed about the reward contingencies.

Upon entering the experimental room all subjects were told: "I have a game for you to play. This game gives pennies. You can keep any pennies that fall into this dish." Subjects in the Direct Learning and Control groups were then left alone by the experimenter who said, "I'm going next door to do some work so please don't disturb me. I'll be back in a short while and we'll see how many pennies you have."

For subjects in the Misleading Model group, the experimenter remained in the room and said: "I'm going to play the game for a few minutes. You can watch me if you want." In view of the subject the experimenter pressed the response key when illuminated and was rewarded on ten consecutive trials. The experimenter collected her pennies and told the subject it was his turn to play. She then left the room offering the same explanation as used with the other two groups.

All subjects were observed by the investigator through the one-way mirror. Criterion behavior for all groups (on the No Press-Reward contingency) was set at ten consecutive rewards, at which point the investigator returned to the experimental room. If a subject did not reach criterion in 100 trials (approximately one hour), the session was terminated. Any child who did not earn at least 25 pennies was given the difference as a token amount for participating in the study. Subjects could not be brought back for another session because of possible communication between sessions with other subjects who had learned the contingencies. Before the subject left the mobile laboratory he was instructed not to describe the details of the game to others since there was a competition to see who would get the most pennies. It was suggested to the child that he might say that he received pennies in the trailer.

At the conclusion of the experiment the Otis-Lennon group intelligence test (Smith, 1970) was administered to all subjects.

Results

A set of independent comparisons were carried out using the Mann-Whitney U test (two-tailed). The dependent variable used in the analysis was the number of trials to criterion on the No Press-Reward contingency.

The median number of trials to criterion for each group was as follows: Misleading Model, 62; Direct Learning, 50; Control, 18. Four female subjects in the MM condition did not succeed in reaching criterion within 100 trials; all subjects in the other two groups learned the No Press-Reward contingency in less than 100 trials. (See Table 2)

The data of the two experimental groups (MM and DL) were combined and compared with control scores and a significant difference was obtained ($U = 227$, $z = 2.78$, $p < .005$). The controls learned the No Press-Reward contingency in fewer trials than experimental subjects. There was no significant difference between the MM and DL conditions ($U = 382.5$, $z = 1.95$, $p > .05$) in attainment of the criterion.

Table 2

Median Scores to Criterion on the
No Press-Reward Contingency

	Group	Boys	Girls
Misleading Model	62	46	70
Direct Learning	50	51.5	48
Control	18	16	20.5

Table 2 also presents the acquisition scores in each condition separately for boys and girls. In the MM condition the median number of trials to criterion was 46 for males and 70 for females; in the DL condition, 51.5 for males and 48 for females; in the control condition 16 for males and 20.5 for females. These data were evaluated first by comparing the differences in performance by sex across conditions, followed by a comparison of the differences in performance by sex within each condition.

<u>Between Conditions Comparisons</u>

When acquisition scores for males in the MM and DL conditions were compared no significant difference was found ($U = 53$, $p > .05$). However, a significant difference in acquisition scores was obtained between girls in the MM and DL conditions ($U = 16$, $p < .01$). Inspection of the data indicates that girls in the MM group required a greater number of trials to reach criterion.

<u>Within Conditions Comparisons</u>

When trials to criterion for males and females within each treatment group were compared, no significant differences were found between them in the DL ($U = 53$, $p > .05$) and the control ($U = 11$, $p > .05$) conditions. However, in the MM condition there was a significant male-female difference in trials to criterion ($U = 19$, $p < .005$). Females took longer than males to learn the contingency.

The above analyses are summarized in Table 3.

In the Direct Learning group the median number of trials to criterion on the initial Press-Reward contingency was 25.5 (28 for

Table 3

Independent Comparisons of Differences
in Trials to Criterion on the
No Press-Reward Contingency
(Mann-Whitney U Test)

Between Conditions	U	z
Group Comparison		
MM vs. DL	382.5	1.95
MM and DL vs. C	227.0	2.78*
Males		
MM vs. DL	53.0	-
Females		
MM vs. DL	16.0*	-
Within Conditions Males vs. Females		
Control	11.0	-
DL	53.0	-
MM	19.0**	-

* $p < .01$

** $p < .005$

males, 24 for females). There was no significant difference between males and females in the acquisition of this contingency ($U = 54.5$, $p > .05$).

The mean I.Q. scores for the MM, DL and control groups were 110, 109, 107, respectively. When tested by a one-way analysis of variance these scores did not differ significantly from one another ($F = 1.87$, $df = 2,57$, $p > .05$). I.Q. scores by sex are presented in Table 4. There were no significant differences between male and female I.Q. scores in the MM ($t = 1.33$, $df = 22$, $p > .05$), DL ($t = .82$, $df = 22$, $p > .05$), or control ($t = 1.62$, $df = 10$, $p > .05$) groups.

Discussion

The MM and DL groups required more trials to learn the new response than did naive control subjects. This occurred because of the prior exposure of experimental subjects to a different contingency. There were no overall differences in trials to criterion between the two treatment groups. Although the MM and DL groups did not differ, a finer analysis of the data by sex yielded a different picture. The number of trials to criterion for males in both conditions were comparable but females in the MM condition took longer to learn the new contingency than did females in the DL group. Furthermore, prior observation of the misleading model produced greater interference for girls than it did for boys in the subsequent acquisition of the new response. No male-female differences occurred in the DL condition.

Girls, as readily as boys, abandoned a response which ceased to be rewarded and learned the new contingency provided that the first

Table 4

Mean I. Q. Scores

(Otis-Lennon Intelligence Test)

	Total	Female	Male
Misleading Model	110	112	108
Direct Learning	109	109	109
Control	107	110.5	103.5

response was self-acquired. However, girls were much slower than boys to give up a no longer rewarded response which had been previously modeled by an adult. The most remarkable feature of the girls' performance was the absence of experimentation. Whereas boys tried various solutions in search of rewards, girls responded as though hopeful that blind repetition of the model's response would eventually produce a payoff. It has been generally assumed that it is adaptive to be a receptive observer, but the present results imply that this is not always the case. For females, prior observational learning proved more of a hindrance than trial and error learning.

Various lines of evidence lend support to the male-female performance differences found in this experiment. Several studies of child-rearing practices suggest that from an early age girls are rewarded for dependent behavior while boys are rewarded for independent behavior in problem situations (Goldberg and Lewis, 1969; Sears, Rau and Alpert, 1965). Furthermore it has been demonstrated that high dependency tends to be associated with greater imitation (Bandura and Huston, 1961; Ross, 1966). Children learn sex-appropriate behavior at a very young age and in our culture, boys are expected to be object-oriented whereas girls are expected to be person-oriented (Kagan, 1964).

The results of this experiment are noteworthy particularly at this time when there is great interest in psychological differences between the sexes and concern about the manner in which female children are being socialized. Due to the fact that only a female model was used in this investigation, a desirable first step with regard to the present findings would be to repeat the experiment using a male as well as a female model. Since there is little evidence to show that sex of model differentially affects imitation on the kind of task employed in this experiment, the present results should prove reliable. Subsequent studies should be done to determine whether the present findings are applicable to situations in the female child's normal learning environment.

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Appendix A

1. How old are you?
2. What grade are you in?
3. What games do you like to play?
4. Do you know what I have in the trailer?
5. Do you know anyone who has been in the trailer? What did they tell you about it?
6. Do you like pennies?