SOME DETERMINANTS OF VICARIOUS REINFORCEMENT EFFECTS

By

ERIN M. CAMP

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
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Erin M. Camp

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Although vicarious reinforcement effects (increases in one's behavior as a result of observing another's behavior being reinforced) have been demonstrated under a variety of experimental arrangements, little research has examined the determinants of those effects from the standpoint of basic learning principles or the conditions under which they are more or less likely to be observed. This study examined some antecedent and consequent influences of vicarious reinforcement effects, as well as the maintenance and generalization of those effects. The results of Experiment 1 identified the influence of both stimulus control and establishing operations on vicariously reinforced responding. Experiment 2 examined the influence of differential consequences delivered to a model in a vicarious reinforcement arrangement. Experiment 3 showed the maintenance, over time, of a response acquired via vicarious reinforcement as well as the generalization of responses to new environments and the generalization of imitative behavior. The general results from all three experiments highlight a variety of determinants of vicarious reinforcement effects.

CHAPTER 1
INTRODUCTION

Vicarious reinforcement refers to one type of learning that occurs in the absence of direct contingencies. In general, vicarious reinforcement describes a change in responding as a result of observing the effectiveness of a model's response; more specifically, the reinforcement of a model's response. Many fields of psychology have described the influence of vicarious reinforcement, although the terminology associated with, and mechanisms of action attributed to vicarious reinforcement by these different fields vary widely. Especially significant differences can be seen between social psychology and a behavior analytic perspective.

Social and Behavioral Perspectives

The fields of social and cognitive psychology frequently examine a wide range of topics based on informal learning from other people including, but not limited to: prejudice and discrimination, gender roles, group dynamics and leadership, conflict and violence, and personal and familial relationships. These topics are certainly diverse, as are the theoretical interpretations and empirical evidence that explain them. However, the commonality across these topics has to do with behavior that is acquired and/or mediated by the influence of other people. Vicarious reinforcement is one way that other people may influence the behavior of an individual.

Research on vicarious reinforcement in the area of social psychology is typically subsumed under the more general category of observational learning, or social learning theory (Bandura, 1977; Miller & Dollard, 1941), which attempts to combine behavioral and cognitive perspectives. Social learning theory is a multi-process conceptualization that accounts for learning based on the observation of other individuals. Four components (attention, retention, reproduction, and motivation) comprise this system and, according to social leaning theory, each

component is necessary for observational learning to occur. The four components include both cognitive processes and behavioral outputs.

The social learning approach is most classically illustrated in a series of studies by Bandura on aggression (Bandura, 1965, 1973; Bandura, Ross, & Ross, 1961, 1963a, 1963b). For example, Bandura et al. (1963a) evaluated whether aggression was more likely to occur following the observation of a successful model, an unsuccessful model, or a neutral model. Results indicated that the group that viewed the successful model was mostly likely to engage in aggression, a vicarious reinforcement effect, whereas the group that viewed the unsuccessful model was least likely to engage in aggression, a vicarious punishment effect. Other studies by Bandura have examined various qualities of the model (e.g., a live model vs. video model or cartoon, adult model vs. peer model) as well as different subject characteristics (e.g., gender, age).

Social learning theorists also have examined the effects of vicarious reinforcement on performances other than aggression. For example, Marston (Kanfer & Marston, 1963; Marston, 1966) examined vicarious reinforcement in the context of verbal interactions between individuals, and Liebert and Fernandez (1970) studied selections of commodities that were influenced by the performance of a model. In these examples, some of the variables examined (e.g., reinforcement of the model's behavior) were similar to those of interest to operant learning theorists. However, several procedural differences exist (e.g., group designs vs. single-subject designs, pre-post sampling vs. repeated measures, the use of inferential statistics, etc.), as well as differences in pre-experimental assumptions and post-experimental interpretations. For example, a social learning interpretation of vicarious reinforcement effects might emphasize the subject's ability to attend to the model based on characteristics of the model (e.g., what the model looks

like, whether the model is an "authority figure," or the personality or affect of the model) as well as the subject's level of arousal or perceptual set. Or, a social learning theorist might discuss the subject's retention of the information observed, which could be the result of processes such as cognitive mapping, symbolic coding, storage and retrieval, or mental rehearsal. By contrast, a behavior analytic theorist emphasizes those features of the experimental context that are observable and directly tied to basic principles of learning.

Behavior analysts have examined intensely the effects of direct contingencies on behavior. For example, well-established empirical and theoretical analyses can be found on the influence of behavioral processes like reinforcement and punishment (Cooper, Heron, & Heward, 2007; Pierce & Cheney, 2003). Most often, behavior analytic research has focused on the subject's direct experience with environmental contingencies. Indirect effects, such as vicarious reinforcement, have been studied less extensively.

A few studies have examined vicarious reinforcement from a behavioral perspective (Broden, Bruce, Mitchell, Carter, & Hall, 1970; Greer, Dorow, Williams, McCorkle, & Asnses, 1991; Kazdin, 1973, 1977, 1979; Kazdin, Silverman, & Sittler, 1975; Ollendick, Dailey & Shapiro, 1983; Van Houten, Nau, MacKenzie-Keating, Sameoto, & Colavecchia, 1982). Some early examples of vicarious reinforcement research in applied behavior analysis focused on the classroom behavior of young students. Broden et al. and Kazdin (1973) both examined changes in the attending behavior of one student when a teacher delivered consequences for the attending behavior of a classmate. Similarly, Christy (1975) evaluated the effects of reinforcing the in-seat behavior of one student on the behavior of other non-reinforced students. Other types of social behavior also have been studied with respect to vicarious reinforcement. For example, Ihrig and Wolchik (1988) used vicarious reinforcement to teach social responses to questions, and Van

Houten et al. (1982) used vicarious punishment to decrease the disruptive behavior of pairs of children.

Video modeling is a procedure that utilizes filmed models to enhance skill acquisition and may be based, in part, on vicarious reinforcement. That is, video-modeling examples that depict the consequences of a response can be considered vicarious reinforcement (e.g., Charlop, Shreibman, & Tryon, 1983; Charlop-Christy, Le, & Freeman, 2001; Conyers, et al., 2004; Ihrig & Wolchik, 1988; LeBlanc et al., 2003; O'Connor, 1969). For example, O'Connor (1969) used video taped interactions of peers whose social behavior resulted in praise, acceptance to the group activity, access to toys, etc. to increase children's interactions with peers. The influence of vicarious reinforcement in video modeling arrangements is unknown, especially when the subject receives direct reinforcement for imitating the performance demonstrated by the model.

Antecedent Determinants of Vicarious Reinforcement Effects

Given a number of demonstrations of vicarious reinforcement, a fundamental question still remains about why responding occurs under conditions in which the subject never receives reinforcement. The social learning approach typically attributes behavior change to cognitive processes. For example, observation of the outcome of a model's behavior leads to the development of some expectation (Rotter, 1954) about the outcome of the subject's behavior. Expectation as an explanatory concept describes a person's belief or prediction that an event will occur in the future. For example, most people expect to receive a beverage from a vending machine after having made several previous purchases from vending machines; that is, through direct contact with consequences. Through observational learning, a person could develop the same expectation after observing another person purchase a beverage. Expectancy-value theory (Fishbein & Azjen, 1975) might suggest that the observation of a model could provide novel

information that affects one's belief about the observed action. Thus, expectancy is a function of beliefs (information about an action) and values (the benefit attributed to the belief).

In either of the above examples, expectation is a construct that requires identification of its operational features as well as its determinants. Operationally, expectation is inferred when a subject has been exposed to a particular event and then behaves as if that event were to happen. In the case of vicarious reinforcement, the subject is exposed indirectly to reinforced responding (exhibited by the model) and then behaves as if the subject's behavior were to be reinforced even though it is not. In other words, some feature of a model's reinforced responding generates unreinforced responding on the part of the subject and, as such, implicates the influence of antecedent variables.

This operationalization is consistent with a basic experimental preparation used to examine a common antecedent influence – the process of stimulus control. It is a well-known fact that a history of reinforced responding in the presence of certain stimuli produces a situation in which those stimuli acquire "discriminative" properties, and that the subsequent presentation of such discriminative stimuli occasions responding (Dinsmoor, 1995a, 1995b; Eckerman, 1969; Halle & Holt, 1991; Maglieri, DeLeon, Rodiriguez-Catter, & Sevin, 2000; Morse, & Skinner, 1958; Terrace, 1966; For example, Tiger and Hanley (2004) trained young students to request attention from a teacher only in the presence of a particular stimulus (a lei) by providing reinforcement for responses made in the presence of the stimulus and by withholding reinforcement for responses made in the absence of the stimulus. After this history of reinforcement and extinction, requests for attention were much more likely to occur in the presence of the stimulus associated with reinforcement.

In the case of vicarious reinforcement, the subject may likely have an established history of receiving reinforcement when others are also reinforced. Given this history, the presence of a model's reinforced responding could act as a discriminative stimulus. Thus, the observation of preferred consequences presented to a model in a vicarious reinforcement arrangement might occasion similar responses by the subject. That is, the availability of reinforcement for a model's behavior may be predictive of the availability of reinforcement for the subject, if the subject has a history of receiving reinforcers when reinforcement is provided to someone else.

Another antecedent determinant of learned behavior is the extent to which a stimulus actually serves as a reinforcer, which, for a given stimulus, often is a function of degree of exposure. Deprivation and satiation, two ends of the continuum describing amount of exposure to a reinforcer, are examples of the more general influence of establishing operations (Michael, 1982, 1993; Skinner, 1953). Establishing operations (EOs) are antecedent events that alter the value of a reinforcer and increase the occurrence of behavior that historically produced that reinforcer. Deprivation (lack of exposure) is a classic example of an EO because it increases the value of a reinforcer and occasions behavior that has been maintained by it. By contrast, satiation (excessive exposure) decreases the value of a reinforcer and its relevant behavior. Vollmer and Iwata (1991) examined the effects of EOs for several different types of reinforcers (food, music, and social interaction) on the performance of individuals with developmental disabilities and observed reliable increases and decreases in behavior under conditions of deprivation and satiation, respectively.

Responding that occurs under vicarious reinforcement contingencies may be influenced at least in part by the presence or absence of an EO. That is, because reinforcement is not available

to the subject in vicarious reinforcement conditions, the subject is necessarily deprived to some extent, which may occasion responding.

In summary, at least two antecedent influences—stimulus control and establishing operations—that are common determinants of learned behavior may contribute to the occurrence of vicariously reinforced responding. The purpose of Experiment 1 was to evaluate the separate effects of these variables in the context of vicarious reinforcement arrangements. Stimulus control was examined by correlating unique stimuli with the availability or unavailability of reinforcement for responding under direct reinforcement contingencies, and then testing for vicarious reinforcement in the presence of those stimuli. The role of establishing operations was examined by comparing vicarious reinforcement conditions presented during periods of deprivation vs. satiation.

Characteristics of Consequences

Although vicarious reinforcement is likely to be influenced in part by antecedent events, the role of consequences should not be overlooked. Even though the subject does not receive reinforcement under vicarious reinforcement conditions, the subject observes consequences delivered to a model. If vicarious reinforcement does have a discriminative stimulus function, then the effect may not be the result of just any consequence delivered to the model but instead is likely to be the result of a particular characteristic of the consequence. Previous research has demonstrated that different effects may be observed when different vicarious contingencies (i.e., reinforcement vs. punishment) are arranged (e.g., Bandura, Ross, & Ross, 1963a), but this effect may extend to characteristics of consequences within the same behavioral contingency.

A large body of literature, both basic and applied, has identified key determinants of direct reinforcement effects (Fisher & Mazur, 1997; Herrnstein, 1961; Holland & Davison, 1971; Neef, Shade, & Miller, 1994, Neuringer, 1967; Todorov, 1973). Specifically, the quality, magnitude,

duration, immediacy, and/or schedule of reinforcement, as well as the effort of the response, can alter response strength. For example, Neef et al. examined different values of reinforcer rate, quality, and delay, as well as response effort, on completion of basic math problems and found that subjects allocated their responses according to the parameters of reinforcement that were available (e.g., allocating more responses towards reinforcers that were higher quality, or more immediate). Although there have been many demonstrations of vicarious reinforcement effects, the parameters of reinforcement are typically static and not manipulated within the experiment. Some vicarious reinforcement studies have manipulated reinforcer dimensions in combination with other manipulations (e.g., magnitude, Bruning et al, 1965; quality, Kelly, 1966; and schedule, Rosekrans & Hartup, 1972; Rosenbaum & Bruning, 1966), but the isolated effects of specific reinforcer dimensions are unclear.

Given that differential responding has been observed when parametric manipulations are made in the context of direct reinforcement, it seems likely that responding also would be influenced under changing conditions of vicarious reinforcement. Reinforcer quality has been identified as a highly influential determinant of reinforcement effects in applied studies when examined alone (DeLeon & Iwata, 1996; Fisher et al., 1992; Pace, Ivancic, Edwards, Iwata, & Page, 1985; Roane, Vollmer, Ringdahl, & Marcus, 1998) and when compared to other dimensions of reinforcement such as magnitude, schedule, and immediacy (Fisher, Thompson, Piazza, Crosland, & Gotjen, 1997; Mace, Neef, Shade, & Mauro, 1994; Neef, Mace, & Shade, 1992; Neef, Mace, Shea, & Shade, 1992; Neef, Shade, & Miller, 1994). Experiment 2 examined the effects of reinforcer quality (as determined by preference ranking) on responding in the context of vicarious reinforcement by evaluating the effects of presenting different qualities of reinforcers to a model.

Durability of Effects

Once a vicarious reinforcement effect has been observed, it is unclear whether the effect will maintain over time or will extend, or generalize, to other circumstances. When direct consequences are delivered to a subject, maintenance and generalization of an acquired response often are observed or can be carefully programmed to ensure that they will be observed (Stokes & Baer, 1977). Given that the subject never directly contacts reinforcement for responding in vicarious reinforcement arrangements, subsequent maintenance or generalization may or may not be observed. A few studies that have utilized vicarious reinforcement procedures have presented some data on maintenance or generalization (Charlop, Shreibman, & Tryon, 1983; Ihrig & Wolchik 1988; Ollendick et al, 1983) but the results of these studies were mixed. For example, Charlop et al. compared the effects of trial-and-error learning versus peer modeling on the acquisition of receptive labeling and reported similar response acquisition across conditions but better maintenance and generalization for the modeling condition. Ihrig and Wolchik (1988) reported maintenance and generalization data following a study designed to evaluate differences between adult and peer modeling on a language task. However, in some conditions of this study, both the model and the subject received reinforcers for responding, so the maintenance and generalization reported may have been a result of direct reinforcement contingencies as well as vicarious reinforcement. By contrast, Ollendick et al. (1983) observed initial acquisition of puzzle completion via vicarious reinforcement alone but found that performance did not maintain. Only the subsequent addition of direct reinforcement was effective at recapturing high rates of puzzle completion.

The purpose of Experiment 3 was to assess maintenance and generalization of responses acquired through vicarious reinforcement. Maintenance was assessed by first establishing a response via vicarious reinforcement, and then continuing to conduct sessions in which the

subject never received direct reinforcement, to determine how quickly the response would extinguish. Two types of generalization were also assessed. The first test of generalization involved assessing the occurrence of the response initially acquired under vicarious reinforcement conditions by conducting a test conditions in a new setting without a model present. This was a test for generalization of the specific response. The second generalization test involved substituting a new model who engaged in a new task in the absence of reinforcement contingencies to assess generalization of imitative behavior.

CHAPTER 2
GENERAL METHOD

Subjects and Setting

Thirteen individuals diagnosed with developmental disabilities participated in Experiments 1, 2, and/or 3. Table 2-1 lists specific information about the subjects' ages and diagnoses. Each subject's teacher or supervisor was interviewed to confirm that the subject was observed to attend to the behavior of others as well as to imitate the performance of gross motor tasks.

Sessions were conducted in therapy rooms at either a day program for adults with developmental disabilities or a special education school. All sessions were 5 min in length and were conducted 3 to 6 times per day, 4 to 5 days per week, based on subject and experimenter availability. Trained confederates served as the models in all three experiments to ensure that model performance would be consistent across sessions and that they would respond even when the consequence involved delivery of non-preferred items. In each session, the model and subject were seated together on the same side of a table across from a therapist. Two identical sets of task materials (one for the model and one for the subject) were available on the table.

Stimulus Selection

Prior to the beginning of each experiment, several assessments were conducted to identify specific types of stimuli to be included in each condition. For all experiments, it was possible that subjects might engage in the target response simply because no other activity was available during the sessions. As an activity control, a moderately preferred leisure activity was available throughout each session. Leisure activities were identified via multiple stimulus without replacement (MSWO) preference assessments (DeLeon & Iwata, 1996). An array of leisure items was presented to the subject, who was instructed to select one item from the array. The subject was allowed to interact with the selected item for 30 s, after which that item was

removed from the array, and the subject was again instructed to pick an item from the remaining array. This continued until each item in the array was selected. Following all selections, preference for each item was determined by dividing the number of times each item was selected by the number of times that item was available in the array. A moderately preferred item was defined as an item that was ranked between the 4th and 6th selection of a 9-item array.

For all three experiments, high quality (HQ) edible items were identified by conducting a paired stimulus preference assessment (Fisher et al., 1992). Pairs of edible items were presented to the subject, who was instructed to select one of the two items. The subject was allowed to consume the selected item while the non-selected item was removed. Each edible item was paired with every other item until all possible pairs of items had been presented. After items had been presented, preference rankings were based on the percentage of trials on which each item was selected. HQ edible items were defined as those selected on at least 80% of trials. Preference assessments were conducted until 2-3 HQ edible items were identified; these are listed for each subject in Table 2-2.

Experiment 2 also required low quality (LQ) edible items, which were identified by conducting single stimulus preference assessments (Pace et al., 1985). Edible items were presented to the subject singly at least 3 times. Subjects had the opportunity to consume or not consume each item. Edible items were determined to be low quality if they were never approached or consumed by the subject (selected on 0% of presentations). The LQ edible items identified for each subject are presented in Table 2-3.

Response Measurement and Interobserver Agreement

During the preference assessments, data were collected on subjects' selections of items. Trained observers recorded each subject's response during each stimulus presentation. A second independent observer recorded subject selections on at least 30% (range, 33.3% to 100%) of the

trials presented. Interobserver agreement was calculated by comparing the records of the two observers on a trial-by-trial basis. An agreement was scored for each trial on which both observers reported the same item selected. The number of trials with agreement was divided by the total number of trials (agreements plus disagreements) and multiplied by 100%. The mean agreement across subjects was 97.1% (range, 87.5% to 100%) for leisure activity assessments, 97.9% (range, 91.6% to 100%) for HQ edible item assessments, and 100% for LQ edible item assessments.

For Experiments 1, 2, and 3, target responses consisted of vocational tasks that were chosen for subjects on an individual basis. The subjects' teachers or supervisors were interviewed to determine that the subjects had no known history of working with the specific task materials yet had the physical ability (motility and coordination) to complete the tasks. Target responses included: folding paper (Ben, Jenna, Jeff, Justin, Evan, Max, Jimmy), placing index cards in envelopes (Cal, Brad, Dave, Ted, Evan, Lisa, Jimmy), placing erasers on pencils (Evan, Cal, Ben, Jenna), or placing index cards in a basket (Jimmy, Ellen, Ben).

Trained observers collected data on the frequency of subject responses and model responses as well as on the frequency of reinforcer delivery to the subject and the model when applicable. A second independent observer collected the same data on an average of 49.2% of the sessions (range, 34.8% to 78.6%) for each subject. Interobserver agreement was calculated by dividing each 5-min session into 10-s intervals and comparing the records of two observers on an interval-by-interval basis. The smaller number of recorded responses for each interval was divided by the larger number of recorded responses. The proportion calculated for each interval was summed across all intervals in the session and was divided by the total number of intervals in the session to obtain a percentage of agreement between the two observers. The mean

percentage agreement across subjects was 97.2% (range, 91.1% to 100%) for subject responses, 93.0% (range, 88.5% to 99.5%) for model responses, 95.4% (range, 90.0% to 97.8%) for reinforcers delivered to the subject and 92.7% (range, 86.3% to 96.8%) for reinforcers delivered to the model.

Table 2-1. Subject characteristics.

Subject	Age	Diagnosis	Experiment
Max	40	Moderate mental retardation	1
Justin	19	Partial agenesis of the corpus callosum, Tourette's syndrome, ADHD, speech/language impaired	1
Jeff	21	Educable mental handicap, speech/language impaired	1
Ted	47	Mental retardation	1
Lisa	24	Autism	1
Ellen	14	Down's syndrome, educable mental handicap	1
Jenna	4	Developmental delay, speech/language impaired	2
Dave	14	Autism	2
Brad	10	Dandy Walker syndrome, other health impaired, ADHD, language impaired	2
Cal	19	Trainable mental handicap, speech/language impaired	2
Evan	5	Developmental delay, speech/language impaired	2, 3
Ben	5	Autism, speech/language impaired	2, 3
Jimmy	49	Congenital cerebellar agenesis, moderate mental retardation	2, 3

Table 2-2. Results of HQ edible item preference assessments

Subject	HQ edible items
Max	Pretzels, Hot Tamale candies
Justin	Reese's Pieces, M&Ms
Jeff	Reese's Pieces, M&Ms
Ted	M&Ms, pretzels, wasabi peas
Lisa	M&Ms, Smarties candies
Ellen	Cheetos, ranch rice cakes
Jenna	Goldfish crackers, Reese's Pieces
Dave	M&Ms, Reese's Pieces, pretzels
Brad	Reese's Pieces, M&Ms
Cal	Smarties candies, Twizzlers
Evan	Study 2: Reese's Pieces, M&Ms
	Study 3: Pretzels, Smarties candies
Ben	Study 2: Fruit snacks, Smarties candies
	Study 3: Fritos, applesauce
Jimmy	Study 2: Hot Tamale candies, almonds
	Study 3: M&Ms, Reese's pieces, Cheetos

Table 2-3. Results of LQ edible item preference assessments

Subject	LQ edible items
Jimmy	Green olives, mushrooms
Ben	Cauliflower, zucchini
Jenna	Broccoli, green olives
Dave	Feta cheese, green olives, cottage cheese
Brad	Bell pepper, feta cheese
Cal	Cauliflower, green olives
Evan	Broccoli, raisins

CHAPTER 3
EXPERIMENT 1: ANTECEDENT EFFECTS OF VICARIOUS REINFORCMENT

Six subjects participated in Experiment 1. The purpose of Experiment 1 was to determine the extent to which vicarious reinforcement effects are influenced by specific antecedent influences. The effects of stimulus control were assessed by conducting discrimination training and then testing for vicarious reinforcement effects. Establishing operations were assessed by presenting vicarious reinforcement conditions during periods of deprivation and satiation.

Stimulus Control

The test for stimulus control involved training a subject with a history of reinforcement for responding in the presence of one stimulus but not in the presence of another, and then testing whether responding would continue to occur without direct reinforcement but in the presence of the stimulus that was correlated with reinforcement. Sessions were conducted in two different rooms, by two different therapists, and each room was paired with unique stimuli: colored response materials, tablecloths, therapist shirts, and plates on which edible items were placed. One set of stimuli was designated as the discriminative stimuli (S^D) and the other, the stimuli delta (S^Δ). Specifically, S^D sessions were conducted by therapist A (wearing a green shirt) in room A, which contained a green table, green task materials, and green plates. S^Δ sessions were conducted by therapist B (wearing a red shirt) in room B, which contained a red table, red task materials, and red plates. The same model was present in both types of sessions. During sessions in which the model engaged in the target response, the rate of responding was similar across sessions, approximately 6 responses per min (i.e., about 1 response every 10 s). Sessions were alternated between the two rooms.

Baseline (BL): Task materials were present during baseline sessions in both rooms (S^D and S^Δ). The model did not engage in the target response, and no programmed consequences were delivered to the model or to the subject.

Discrimination training: During discrimination training sessions, the model engaged in the target response. In the S^D condition, both subject and model responses resulted in HQ edible items and brief praise delivered by the therapist on a variable ratio (VR) 3 schedule. In the S^Δ condition, neither subject nor model responses resulted in edible items or praise. That is, responses were reinforced in the presence of S^D but not in the presence of the $S^{\Delta.}$

Discrimination test: During discrimination test sessions, the model again engaged in the target response. In the S^D condition, model responses resulted in HQ edible items and brief praise delivered on a VR3 schedule; however, subject responses resulted in no consequences (vicarious reinforcement only). In the S^Δ condition, neither subject nor model responses resulted in edible items.

Establishing Operations

The effects of establishing operations were examined by conducting vicarious reinforcement under two conditions. In each vicarious reinforcement session, a model engaged the target response. A therapist delivered contingent HQ edible items and brief praise to the model on a VR-3 schedule. No consequences were delivered for subject responses. In each contingent reinforcement session, both model and subject responses resulted in HQ edible items and brief praise on a VR-3 schedule. The effects of deprivation and satiation were assessed using and ABAB reversal design.

Contingent reinforcement (C-Sr): During this condition, the model engaged in the target response, and a therapist provided HQ edible items and brief praise. In addition, responses made by the subject also resulted in the delivery of HQ items and praise.

Vicarious reinforcement, Deprivation (V-Sr DEP): During this condition, the model engaged in the target response and a therapist provided HQ edible items and brief praise to the model. Subject responses resulted in no programmed consequences. These sessions were conducted after at least 60 min had elapsed since the subject had consumed a meal or snack.

Vicarious reinforcement, Satiation (V-Sr SAT): Prior to each satiation session, the subject was allowed 10 min of free access to the HQ edible items. Satiation sessions were identical to the deprivation sessions; however, HQ edible items were available to the subject continuously (not contingent on any response) for the duration of the session.

Results and Discussion

Figure 3-1 shows the rate of responding for the 3 subjects (Max, Justin, and Jeff) who participated in the stimulus control assessment. None of the subjects engaged in any responses during baseline in either the S^D or the S^Δ condition. When discrimination training began, high rates of responding were observed for Max, Justin, and Jeff in the S^D condition. In the S^Δ condition, Max and Justin responded initially, but their rates of responding quickly decreased to zero, whereas Jeff engaged in zero responses. After stable and differential rates of responding during discrimination training were observed for all 3 subjects, the discrimination test was conducted. Max and Justin's data show sustained responding during the S^D condition of the discrimination test, thereby demonstrating a stimulus control effect. That is, the green stimuli, although no longer correlated with reinforcement, occasioned responding due to a history of correlation. Jeff responded initially in the S^D test condition, but his responding quickly

extinguished. This pattern was replicated in subsequent discrimination training and test conditions. Jeff's data indicated that stimulus control may have been observed, but that extinction in the test condition seemed to have a greater influence on his response rate.

Figure 3-2 shows the rate of responding for the 3 subjects (Ted, Lisa, and Ellen) who participated in the establishing operations assessment. All 3 subjects engaged in similar patterns of responding. In the baseline condition, none of the subjects engaged in the target response. Ted engaged in high and increasing rates of responding in the first contingent reinforcement conditions. Lisa and Ellen's rates were higher than Ted's in contingent reinforcement, although the data were slightly more variable. In the first vicarious reinforcement condition, the deprivation condition, Ted's initial rate of responding was much lower than it was in contingent reinforcement, and his responding was extinguished by the fourth session. Both Lisa and Ellen showed sharp decreases in responding in the first vicarious reinforcement condition. Lisa stopped responding in the second session. Ellen's continued to respond throughout the condition, although her rate of responding was much lower than in the previous condition. A second contingent reinforcement condition demonstrated high, stable rates of responding for all three subjects. In the satiation vicarious reinforcement condition, Ted, Lisa, and Ellen engaged in zero responses across the entire condition.

The effects of deprivation and satiation on vicarious reinforcement were replicated for all 3 subjects, and a nearly identical pattern of responding was replicated for each subject when each condition was presented a second time. Ted and Lisa responded in only the first session of the deprivation condition, and ceased responding for the following sessions. Ellen engaged in the target response in the first 2 deprivation sessions, although her rate of responding was much

lower than the rate observed in the first presentation of the deprivation condition. Again, zero responses were observed for all 3 subjects in the second satiation condition.

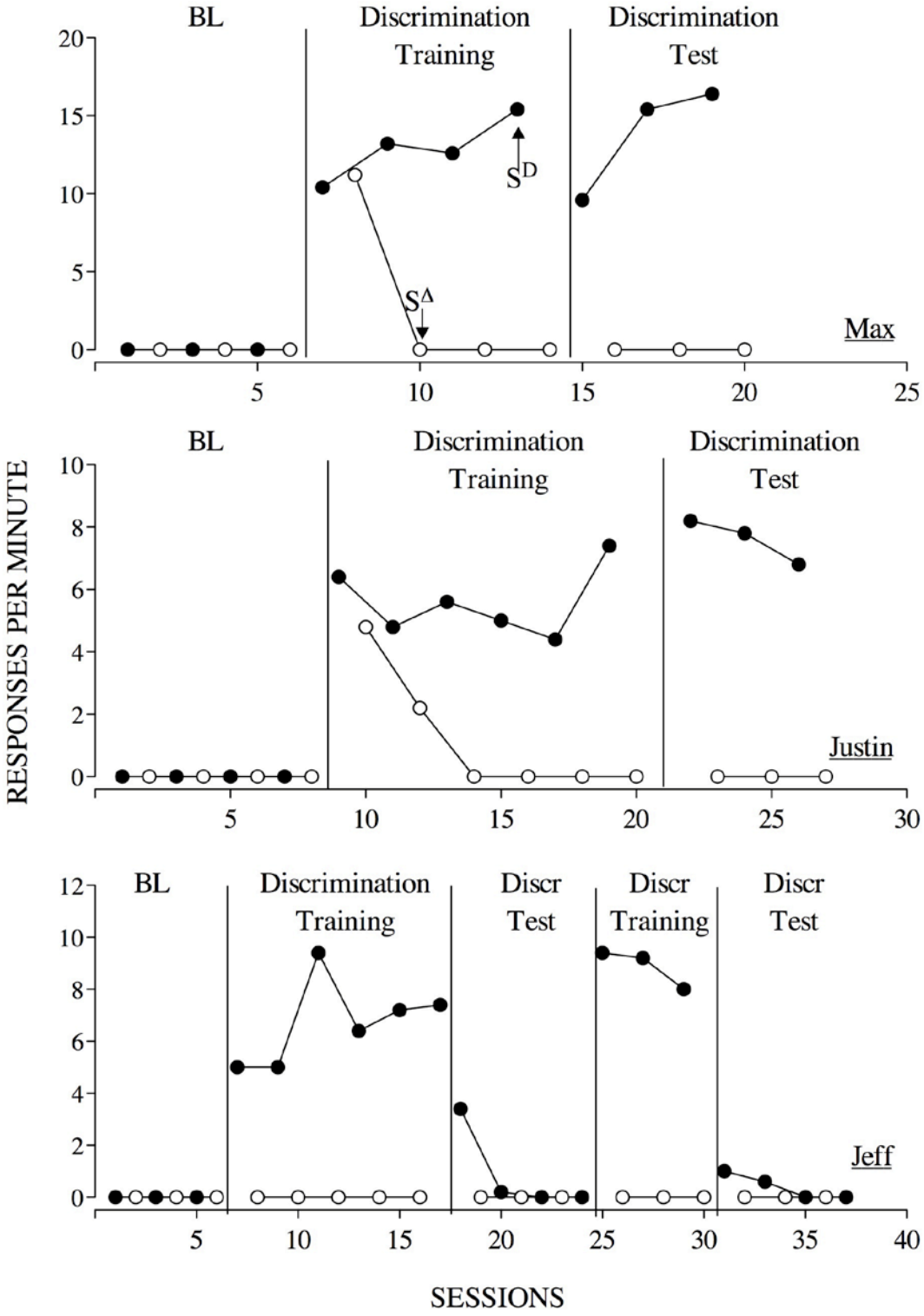

Figure 3-1. Responses per minute of target responses across conditions during the assessment of stimulus control (Experiment 1).

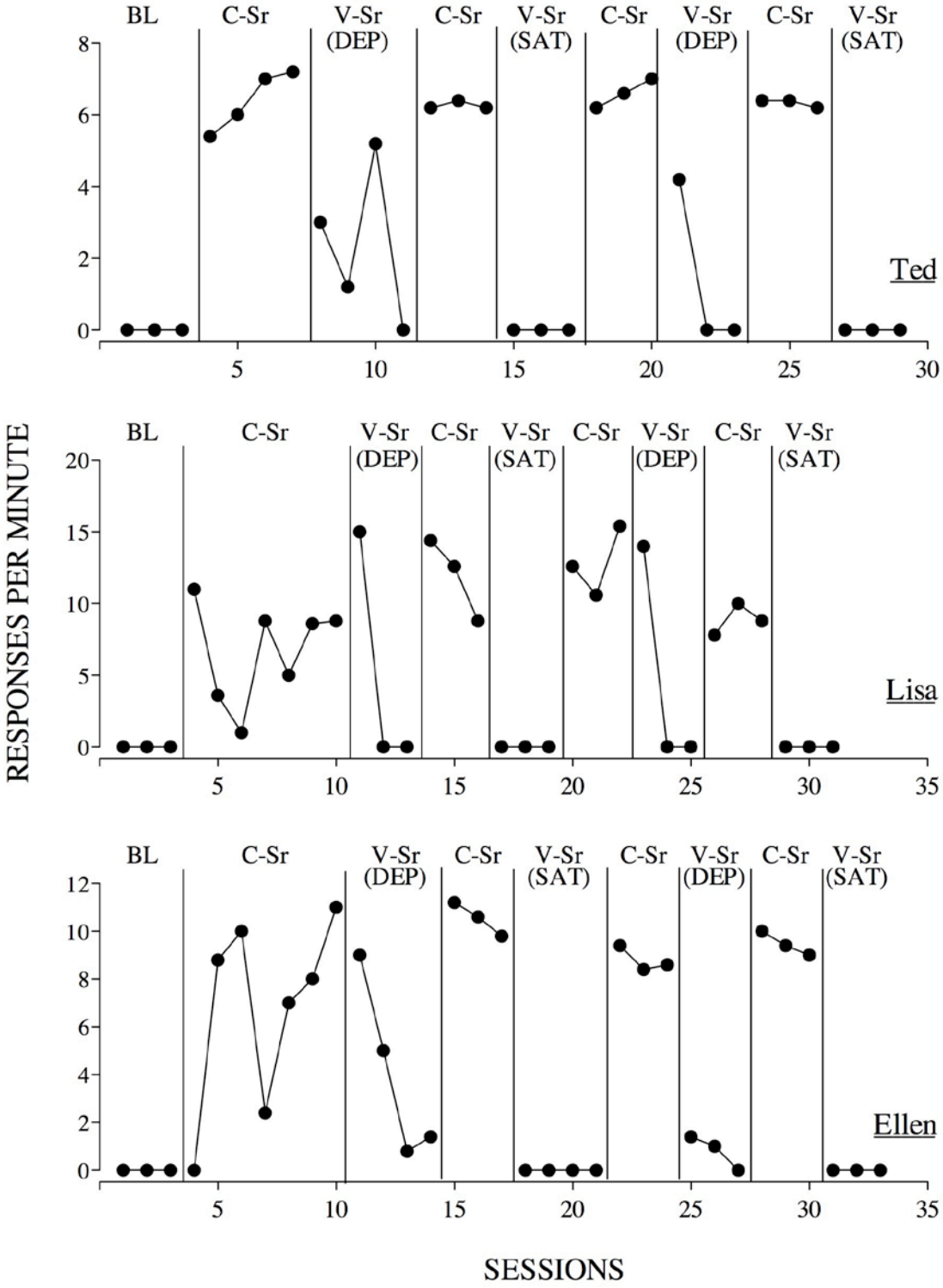

Figure 3-2. Responses per minute of target responses across conditions during the establishing operations evaluation (Experiment 1)

CHAPTER 4
EXPERIMENT 2: QUALITY OF REINFORCEMENT DELIVERED TO MODEL

Participants, Design, and Procedure

Seven subjects participated in Experiment 2, which involved presenting differential consequences to the model during vicarious reinforcement. HQ and LQ edible items were identified for each subject as described previously. A baseline condition was conducted in which the model did not engage in the target response, and no consequences were provided to the model or the subject. Following baseline, low quality vicarious reinforcement was assessed first, followed by an assessment of high quality vicarious reinforcement. During vicarious reinforcement conditions, the model engaged in the target response, and edible items identified as either HQ or LQ for the subject were delivered to the model along with brief praise on a fixed ratio (FR) 1 schedule. Prior to the first vicarious reinforcement session of each day, a therapist provided the subject with the edible items that would be delivered to the model such that the subject could sample each item. If little or no responding was observed across either LQ or HQ vicarious reinforcement conditions, the subject was exposed to a contingent reinforcement phase, during which HQ edible items and brief praise were delivered to both the subject and the model on an FR-1 schedule. Prior to the first contingent reinforcement session of each day, a therapist prompted the subject to engage in the response and delivered the edible items to experience the contingency in effect. A subsequent HQ vicarious reinforcement condition was examined following the contingent reinforcement condition for any subject who experienced the contingent reinforcement condition. The effects of the quality of reinforcement for the model were evaluated in a multiple baseline across subjects design.

Baseline (BL): During this condition, the model did not engage in the target response. No consequences were delivered for any responses made by the model or the subject.

Vicarious reinforcement (V-Sr) LQ: In this condition, the model engaged in the target response. A therapist delivered the LQ edible items (identified as low-quality for the subject) and brief praise for the model's responses on an FR 1 schedule. No consequences were delivered for any responses made by the subject.

Vicarious reinforcement (V-Sr) HQ: This condition was identical to the previous condition, except that HQ edible items (those highly preferred by the subject) were delivered to the model instead of LQ items.

Contingent reinforcement (C-Sr): During this condition, the model continued to engage the target response, and a therapist provided HQ edible items and brief praise. In addition, any responses made by the subject also resulted in the HQ items and praise.

Results and Discussion

Figure 4-1 shows the results for Jimmy, Ben, Jenna, Dave, Brad, Cal, and Evan. During baseline, 6 out of 7 subjects engaged in zero rates of responding. One subject, Evan, engaged in a low rate of responding in one baseline session, and zero rates of responding for the remaining baseline sessions. In the low-quality vicarious reinforcement condition, 4 subjects (Jimmy, Ben, Dave, and Cal) engaged in zero responses, and 2 subjects (Brad and Evan) initially engaged in a low rate of responding that subsequently decreased to zero. The remaining subject (Jenna) initially engaged low rates of responding, but her responding gradually increased as the condition continued.

In the first exposure to the high-quality vicarious reinforcement condition, Jimmy and Dave again engaged in zero target responses. Ben, Brad, and Evan responded initially but stopped responding after several sessions. Cal began to engage in target responses during this condition, and Jenna's responding increased somewhat from the previous (LQ) condition and occurred at more stable rates.

Five subjects whose responding did not increase during the high-quality vicarious reinforcement condition (Jimmy, Ben, Dave, Brad, and Evan) were exposed to the contingent reinforcement condition. When reinforcers were delivered to the subject contingent on responding, all five subjects engaged in high, stable rates of responding. Following a history of contingent reinforcement and a subsequent return to baseline, the high-quality vicarious reinforcement condition was re-introduced. Jimmy's responding increased during his second exposure to high-quality vicarious reinforcement. By contrast, Ben, Dave, Brandon, and Evan responded in a manner similar to that observed during their first exposure to high-quality vicarious reinforcement: These subjects engaged in some responses initially but eventually stopped responding.

The results of Experiment 2 are somewhat difficult to interpret due to variability in responding across subjects. However, the observed between-subject variability did not seem to be correlated with the subjects' ages, diagnoses, or other characteristics. Five of the 7 subjects (Ben, Jenna, Brad, Cal, and Evan) engaged in some responding during their initial exposure to either the LQ or HQ vicarious reinforcement condition. Of these, Ben and Cal showed higher rates of responding under the HQ condition (although Ben's responding eventually ceased). Jenna showed an increase in responding during the LQ condition, which maintained under the HQ condition. Finally, Brad and Evan initially engaged in some responding but eventually stopped in both conditions. Thus, the role of reinforcer quality in determining a vicarious reinforcement effects seems tenuous based on the present data.

Although not the initial focus of this study, a history of direct reinforcement seemed to be a much more influential variable. Five subjects were exposed to this condition because they either never responded under LQ or HQ vicarious reinforcement (Jimmy and Dave) or their responding

ceased under HQ vicarious reinforcement (Ben, Brad, and Evan). All five showed immediate increases in behavior under direct (contingent) reinforcement, although only one subject's (Jimmy's) maintained when HQ vicarious reinforcement was reinstated. These data raise the question of whether a vicarious reinforcement effect will maintain for any given period of time.

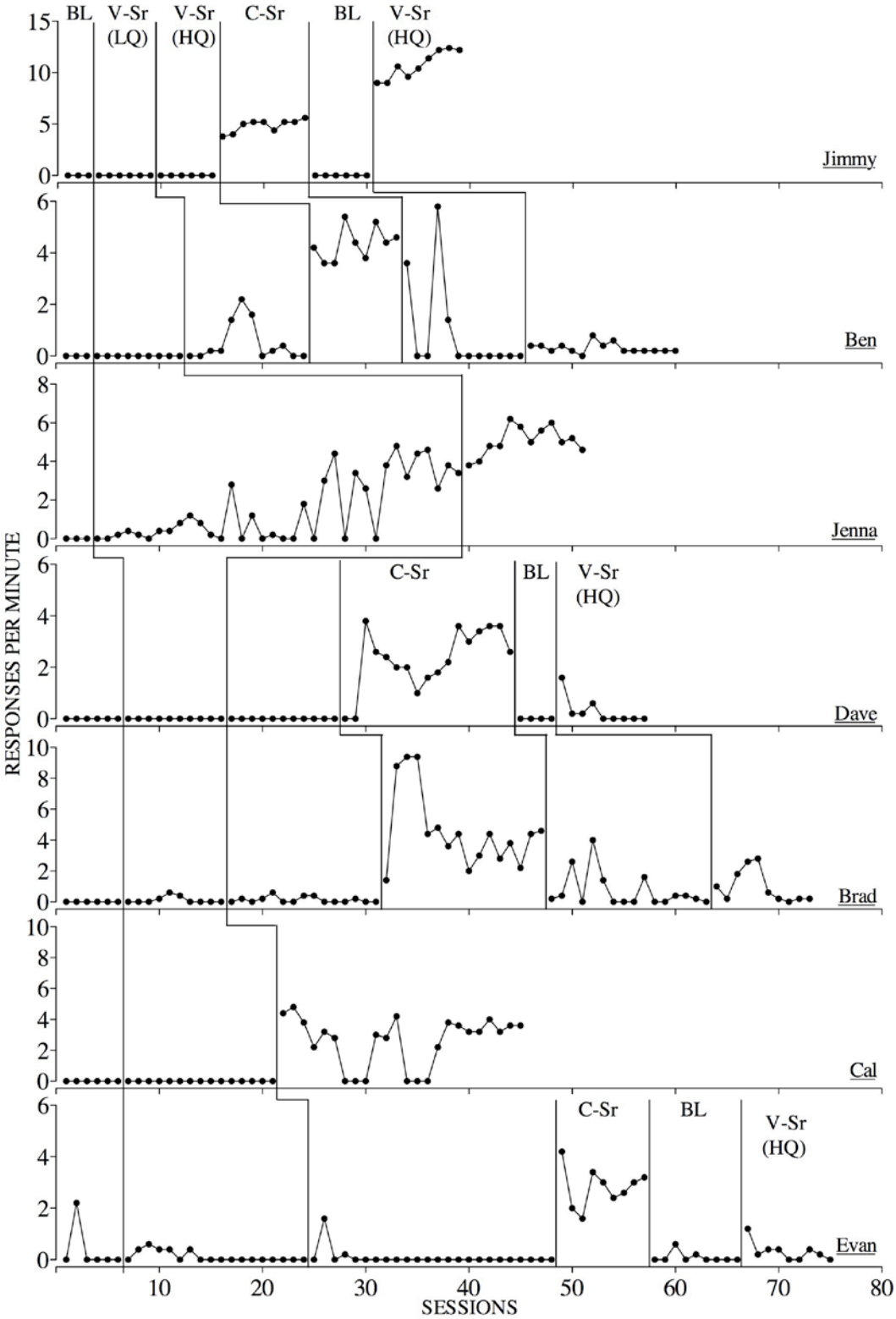

Figure 4-1. Responses per minute of target responses across conditions of the quality of reinforcement assessment (Experiment 2).

CHAPTER 5
EXPERIMENT 3: MAINTENANCE AND GENERALIZATION OF VICARIOUS REINFORCEMENT EFFECTS

Participants, Design, and Procedure

Three subjects, Evan, Ben, and Jimmy, who showed various patterns of responding in the vicarious reinforcement condition of Experiment 2, participated in Experiment 3. The purpose of Experiment 3 was to assess maintenance and generalization of vicarious reinforcement effects. The vicarious reinforcement conditions were similar to those of the previous two experiments. Maintenance of vicarious reinforcement effects was assessed by repeatedly presenting vicarious reinforcement conditions until either extinction or long-term persistence of responding was observed. Two types of generalization were assessed. The first generalization test was conducted to determine whether a response acquired under vicarious reinforcement conditions would occur under novel conditions and in the absence of a model (a test for generalization of the response under new stimulus conditions). The second generalization test was conducted to determine whether a novel response would be acquired in a novel condition with a model but in the absence of vicarious reinforcement (a test for generalization of imitative behavior).

Baseline (BL): During the baseline condition, task materials were available to the model and the subject. The model did not engage in the target response, and no programmed consequences were delivered to the model or the subject.

Baseline probe 1 (alone): During this probe, task materials were available to the subject. No model was present, and no programmed consequences were delivered for subject responses.

Baseline probe 2 (imitation): In this baseline probe, a set of task materials for a second response was available to the model and the subject. The model did not engage in the target response, and no programmed consequences were delivered to the model or the subject.

Vicarious reinforcement (V-Sr): During vicarious reinforcement conditions, the model engaged in the target response. A therapist presented HQ edible items and brief praise to the model on an FR 1 schedule. No programmed consequences were arranged for subject responses.

Generalization probe 1 (alone): In this condition, the subject was seated in front of task materials for the target response in the vicarious reinforcement condition. No model was present, and no programmed consequences were delivered for subject responses.

Generalization probe 2 (imitation): During this probe, the subject and model had access to materials for the second target response. The model engaged in the target response. No programmed consequences were delivered for model or subject responses.

Results and Discussion

Figure 5-1 shows rates of responding for Evan, Ben, and Jimmy for Experiment 3. During the baseline condition, none of the subjects engaged in any responses in the baseline sessions or the baseline probes. Evan responded at low rates in the first few vicarious reinforcement sessions. However, maintenance was not observed over time in this condition. In fact, Evan usually responded once time at the beginning of each block of 3 vicarious reinforcement sessions and then did not engage in any additional responses for the duration of that session and the subsequent sessions. In addition, zero or near-zero rates of responding were observed in both types of probe sessions, demonstrating the absence of generalization.

Ben's responding in the vicarious reinforcement condition was slightly more variable, but overall a low rate was observed and responding quickly extinguished. Ben engaged in one response at the beginning of the second generalization-imitation probe but then ceased responding for the rest of that session. Zero responses were observed in the generalization-alone probes in which no model was present.

Jimmy did not engage in the target response during the first two vicarious reinforcement sessions. Following these first 2 sessions, a moderate rate of responding was observed for 6 subsequent vicarious reinforcement sessions. However, ultimately, Jimmy's responding extinguished. In addition, responding was initially observed in the generalization-alone probes but this performance also quickly extinguished. Zero responses were observed in the generalization-imitation probes.

The results of Experiment 3 showed that maintenance of a response acquired through vicarious reinforcement was quick to extinguish. As in Experiments 1 and 2, it is likely the case that initial responding was a result of stimulus control exerted by some property of the experimental arrangement. However, these data again indicate that the extinction component of vicarious reinforcement conditions is highly influential on the responding of most subjects. That is, sustained responding was not observed because environmental conditions were not arranged to support continued responding. Generalization to novel conditions was not observed. Given that zero responses were observed, little can be said about the effect of vicarious reinforcement per se, but the data do suggest that the absence of reinforcement for responding again had a suppressive effect.

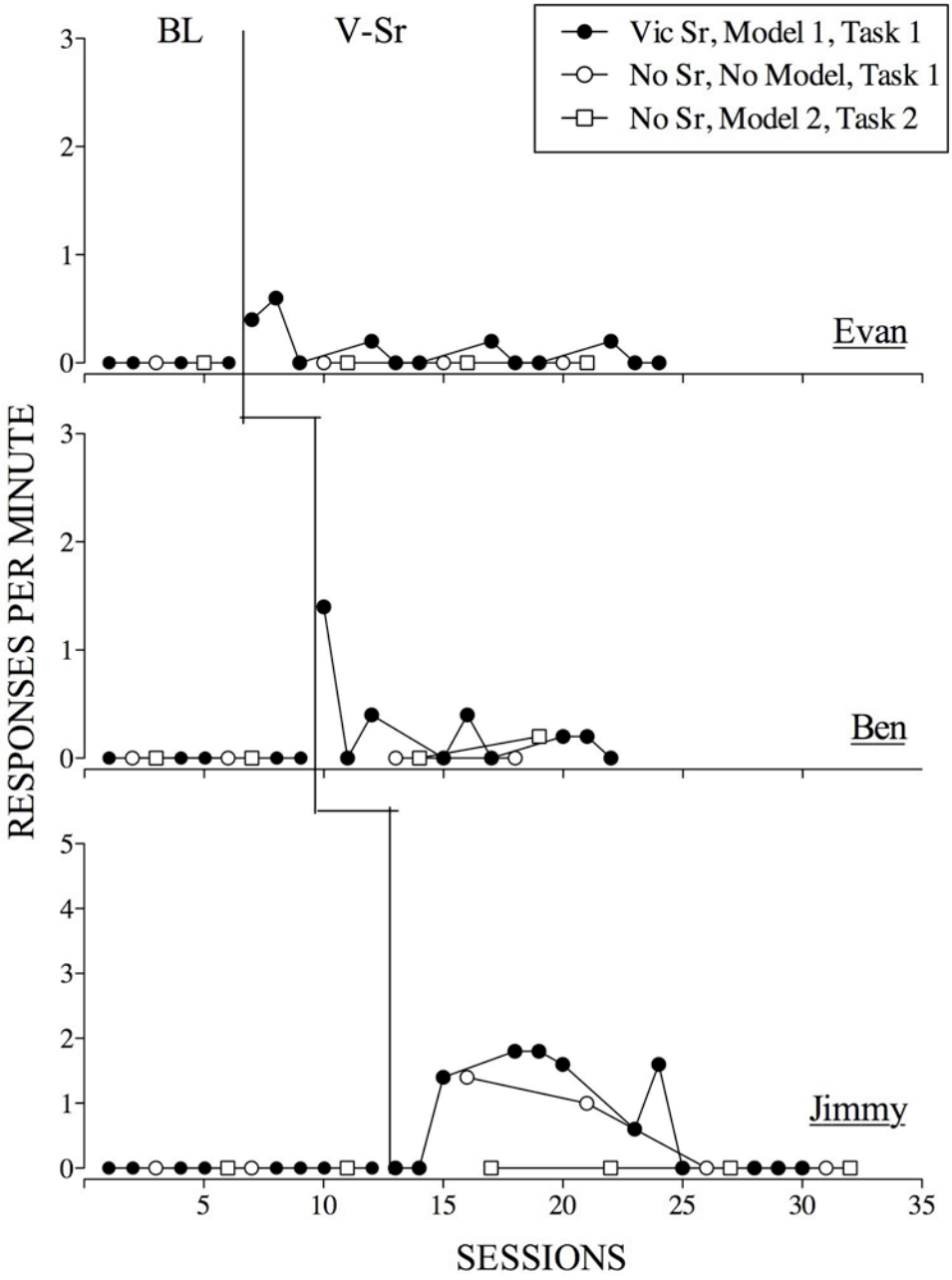

Figure 5-1. Responses per minute of target responses across conditions in the assessment of maintenance and generalization (Experiment 3).

CHAPTER 6
GENERAL DISCUSSION

Vicarious reinforcement seems to capitalize on the influence of a number of variables, some of which were investigated in this study. The general purpose of this study was to examine some potential determinants of vicarious reinforcement effects, specifically, the antecedent functions of vicarious reinforcement, the influence of varied consequences provided to models, and the durability and generalization of vicarious reinforcement effects. The combination of these three experiments attempted to identify a range of behavioral processes involved in the occurrence of vicarious reinforcement. The results of Experiment 1 demonstrated the antecedent influences on responding during vicarious reinforcement. Results of Experiment 2 demonstrated that the quality of reinforcement delivered to a model during vicarious reinforcement was not influential for 4 of 7 subjects but it may have been influential in some way for the remaining 3 subjects. Finally, the results of Experiment 3 indicated that maintenance and generalization of vicarious reinforcement effects are not likely to be observed.

Two types of antecedent influences were specifically evaluated in Experiment 1. Max, Jeff, and Justin's data showed that stimulus control produced vicarious reinforcement effects, at least initially. Max and Justin's data showed strong stimulus control effects, whereas Jeff's data highlighted the more potent control by direct contingencies. That is, stimulus control is likely to be responsible for initial vicarious responding, but the direct consequences for responding (extinction) seemed to be a more potent controlling variable. Although stimulus control was explicitly examined in Experiment 1, the results of Experiments 2 and 3 lend support to the conclusion that discriminative stimuli may initially occasion responding that is subsequently extinguished in the absence of direct reinforcement contingencies. For example, in Experiment 2, Evan engaged in a few responses at the onset of each vicarious reinforcement condition (the LQ

condition, and the first and second HQ conditions). A similar pattern also was observed in at least one condition for Ted, Lisa, and Ellen in Experiment 1; for Ben, Dave, and Brad in Experiment 2; and again for Evan, Ben, and Jimmy in Experiment 3.

Ted's, Lisa's, and Ellen's data from Experiment 1 revealed the antecedent influence of establishing operations on vicarious reinforcement effects. Their data indicated that at least initial vicarious reinforcement effects would be observed during conditions of deprivation. By contrast, responding under vicarious reinforcement conditions was never observed during periods of satiation. In other words, some motivation to respond must be present if any vicarious reinforcement effect will be observed, even if that effect is temporary. Again, although tested explicitly in Experiment 1, other data also demonstrate the importance of motivational variables. In each subsequent experiment, any vicarious reinforcement condition that was presented was similar to the deprivation condition of Experiment 1. Thus, any effects of vicarious reinforcement that were observed were likely influenced, at least in part, by the presence of establishing operations.

The results of Experiment 2 were somewhat surprising given the large amount of data indicating that reinforcer quality is an important determinant of learned behavior. That is, few subjects demonstrated a sensitivity to the quality of reinforcement provided to the model. However, the results were not completely unexpected in light of the absence of direct reinforcement contingencies. Even the conditions of HQ reinforcement delivered to the model had limited effects when the subjects did not receive those HQ items. This is demonstrated by the absence of any responding for some subjects (Jimmy, Dave) and the rapid extinction of responding observed for the remaining subjects (Ben, Brad, and Evan). In other words, it is not surprising that the consequences delivered to a model had little effect when no consequences

were delivered to a subject. In fact, several subjects showed a great deal of sensitivity to the absence of reinforcement for responding. These data suggest that the subjects quickly contacted the extinction contingencies arranged for responding. When responding was not observed, it seemed logical to create a history of contingent reinforcement for the response to determine whether responding would later occur under repeated conditions of vicarious reinforcement. However, this effect was observed for only one subject (Jimmy). These data add evidence to the notion that some amount of intermittent, contingent reinforcement may be necessary to observe persistent responding during vicarious reinforcement conditions.

The results of Experiment 3 reiterate that the effects of vicarious reinforcement are often transitory at best. Sustained maintenance was not observed for any of the subjects. This conclusion is also evidenced by Jeff's, Ted's, Lisa's, and Ellen's data in Experiment 1 and Ben's, Dave's, Brad's, and Evan's data from Experiment 2. In addition, the results of Experiment 3 demonstrate that the effects of vicarious reinforcement are not likely to generalize to other contexts, at least in the absence of arranged contingencies of reinforcement for generalized responding.

One variable that appeared to be highly influential for producing vicarious reinforcement effects seemed to be a previous history of direct reinforcement. This potentially influential variable was not specifically evaluated in this study, but a combination of data sets obtained seems to indicate a required history of reinforcement. A specific learning history was required for the stimulus control assessment in Experiment 1. As such, those data do not depict what responding may have been observed prior to any history of reinforcement for responding. Experiment 2 purposefully examined the effects of LQ and HQ vicarious consequences in the absence of any programmed learning history, and some subjects failed to engage in any

responses or engaged in very low rates of responding. As a remedial strategy, a contingent reinforcement condition was implemented to determine whether subsequent vicarious reinforcement conditions would be more or less effective. However, only one subject (Jimmy) showed a different pattern of responding in a vicarious reinforcement condition subsequent to a contingent reinforcement condition.

It is important to note that interpretation of the results from these studies may be limited to application for subjects with developmental disabilities. A number of studies have reported positive results of vicarious reinforcement with nonclinical populations, and it may be that nonclinical subjects already have sufficiently extensive and diverse histories with both contingent reinforcement and vicarious reinforcement, such that they are more likely to show vicarious reinforcement effects. If so, additional research on vicarious reinforcement for subjects with developmental disabilities may be especially helpful given the more limited historical influences within this population. For example, early research in the area of language acquisition was determined to be best suited to the area of developmental disabilities given the more limited historical influences of this population. In experiments on language acquisition in nonclinical populations, subjects tended to quickly acquire the target responses (Cuvo & Riva, 1980), and the effects of treatment may have been masked by other variables such as ongoing training in other contexts or maturation.

Although the results of this study identified some determinants of vicarious reinforcement effects, more research is needed to examine a range of related behavioral processes involved in vicarious reinforcement. For example, in combination, the results of all 3 experiments indicate that vicarious reinforcement alone may not be sufficient to establish or maintain behavior. It is probably the case that previous demonstrations of vicarious reinforcement effects have involved

responses that continue to produce some schedule of intermittent reinforcement. For example, Charlop et al (1983) reported consistent maintenance of a receptive labeling task acquired via vicarious reinforcement procedures; however, it may be that the nature of their task made it likely that similar responses would produce direct social reinforcement for the subject (i.e., teachers are likely to respond with praise if a subject subsequently labels correctly). By contrast, Ollendick et al. (1983) used a relatively arbitrary task (puzzle completion) that may have been similar to the arbitrary tasks selected for the current study, and they observed a lack of maintenance. It seems less likely that completion of these arbitrary tasks will be met with contingencies of reinforcement outside the experimental arrangement. Future research might attempt to further evaluate the history or availability of lean schedules of contingent reinforcement to enhance the effectiveness of vicarious reinforcement.

In typical application, the isolated use of a pure vicarious reinforcement arrangements does not seem to have much utility. That is, if a teacher or therapist is able to deliver reinforcers to a model, it seems that he or she should be equally able to deliver reinforcers to the subject. However, in combination with direct reinforcement contingencies, vicarious reinforcement procedures could certainly be used to enhance behavioral programs. It may be the case that vicarious reinforcement is most useful as a tool to address the problem of first occurrence. That is, if an individual does not demonstrate a particular skill independently, vicarious reinforcement as an antecedent event may be sufficient to occasion an initial response. However, it is probably necessary for an individual's initial responses to contact direct reinforcement contingencies in order to ensure that additional responses will occur. Finally, if vicarious reinforcement is used a strategy for producing initial responses, it is important to note that the intended observers must probably have at least some generalized imitative repertoire (Baer, Peterson, & Sherman, 1967;

Garcia, Baer, & Firestone, 1971). In other words, without a history of receiving reinforcers for imitating the behavior of others, the observer may be unlikely to reproduce the behavior of a model, regardless of the consequences provided to that model.

Observational learning and imitation are certainly frequently reported behavioral occurrences. However, it is becoming increasingly clear that additional research is needed to provide a technological account of how these processes operate. In fact, although vicarious reinforcement is a widely accepted behavioral phenomenon, to date, no thorough operational account of vicarious reinforcement effects has been reported. It might be the case that the effects of direct reinforcement are too easily, and mistakenly, translated to account for the occurrence of vicarious reinforcement.

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BIOGRAPHICAL SKETCH

Erin Camp initially studied behavior analysis at the University of North Carolina – Wilmington (UNCW) under the supervision of Dr. Carol Pilgrim. She received a B.A. in psychology from UNCW in 2000 and subsequently entered the behavior analysis graduate program at the (UF) under the supervision of Dr. Brian Iwata. While at UF, Erin participated in a variety of research and clinical activities. She was involved in a number of different research projects that covered a wide range of topics including the assessment and treatment of problem behavior and skill acquisition. While at UF, Erin also provided clinical behavior services to individuals who lived at a residential treatment facility for developmental disabilities (e.g., autism, mental retardation, and Prader-Willi syndrome). In addition, she engaged in several teaching activities including instructing an introductory behavior analysis course and serving as a teaching assistant for a behavior analysis laboratory course. Erin completed her M.S. at UF in 2007. Following completion of the Ph.D. degree, Erin hopes to begin a research/clinical career specializing in behavioral applications in the field of developmental disabilities.