VICARIOUS REINFORCEMENT PROCEDURES: AN ANALYSIS OF STIMULUS CONTROL AND POTENTIAL SIDE EFFECTS

BY

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Abstract

Vicarious reinforcement refers to a change in responding that is altered by observing another individual's behavior being reinforced (Kazdin, 1973a). Although vicarious reinforcement procedures appear to be an efficient teaching strategy because they involve learning from the behavior of others, previous research has shown varying degrees of vicarious responding. Additionally, previous research has suggested that vicarious responding may be associated with potential side effects (e.g., problem behavior). To date, the variables that influence vicarious responding and potential side effects have received little attention in the behavior analytic literature, which may be one factor that has contributed to the mixed findings. Therefore, the purposes of the current study were to (a) systematically replicate previous research to determine the extent to which stimulus control influenced positive and negative vicarious reinforcement effects (Studies 1 and 2) and (b) assess whether vicarious reinforcement contingencies were aversive for participants whose behavior did not contact direct reinforcement (Study 3). Results from Studies 1 and 2 showed the absence of a vicarious reinforcement effect for 11 of the 12 participants prior to a history of direct, differential reinforcement. Four participants showed vicarious responding following a history of direct, differential reinforcement. For these participants, stimulus control appeared to influence vicarious responding. Results from Study 3 showed idiosyncratic results across 3 participants. For one participant, vicarious positive reinforcement appeared to be aversive; for the second participant, vicarious positive reinforcement did not appear to be aversive. For the third participant, response patterns prevented definitive conclusions regarding whether vicarious positive reinforcement was aversive. Overall results are discussed with respect to the variables responsible for the emergence of vicarious responding and implications for clinical practice.

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Vicarious Reinforcement Procedures: An Analysis of Stimulus Control and Potential Side Effects

Vicarious reinforcement refers to a change in behavior in one individual as a result of observing another individual's behavior being reinforced (Bandura, 1971; Kazdin, 1973a). That is, the individual's behavior changes without directly contacting reinforcement. The term "vicarious reinforcement" is not conceptualized as its own behavioral principle; rather, vicarious reinforcement is a descriptive term that describes the interaction between behavior and environmental variables. The same operant mechanisms (discussed below) that are used to explain other behavioral phenomena are the basis upon which vicarious responding is conceptualized (Mazur, 2006). However, social-learning theorists present an alternative conceptualization that relies, in part, on cognitive processes (Deguchi, 1984; Masia & Chase, 1997). Because both behavior analysts and social psychologists study vicarious reinforcement effects, theoretical perspectives have differed substantially with respect to why vicarious responding occurs.

Social and Behavioral Perspectives

Social psychologists conceptualize vicarious reinforcement as a separate learning process, subject to its own underlying mechanisms (Catania, 2007). Alfred Bandura, who is known for his extensive research on vicarious reinforcement (or observational learning to which it has been referred), suggested that learning from the behavior of others could not be sufficiently explained by the principles of behavior (Bandura, Ross, & Ross, 1963). Thus, Bandura and his colleagues' research on vicarious reinforcement led to the development of social-learning theory, a theory based on environmental influences and cognitive processes to conceptualize why and how individuals learn from observing others' behavior (Bandura, 1977). Specifically, Bandura proposed that vicarious reinforcement is mediated through observation (i.e., acquiring the modeled behavior, then performing it), indirect-acting consequences (i.e., consequences arranged for the model's behavior), and cognitive mediation (Deguchi, 1984; Masia & Chase, 1997).

To illustrate, Bandura (1965) assessed the extent to which young children would imitate a model whose behavior resulted in either reinforcement, punishment, or no consequences using a group design. During Phase 1, children were either assigned to the reinforcement, punishment, or no consequences group. Children in each group viewed a 5-min video of a model engaging in aggressive responses to a BoBo doll. Depending on the condition, either praise and snacks, reprimands, or no consequences were provided to the model. Then, children were taken to a room that contained identical materials that were in the video, and they were told by the experimenter to play. Results showed that children in the reinforcement and no consequences groups emitted more aggressive responses than the children in the punishment group. Next, to show that all children in all groups were capable of emitting the aggressive responses regardless of the group to which they were assigned, Bandura directly reinforced imitative aggressive behavior (Phase 2). These results showed no differences in the level of imitation when the children's behavior was directly reinforced despite their initial differences in the level of responding.

According to Bandura, all children vicariously acquired the aggressive responses during the initial observation period despite their differential performance because they were all able to perform them once direct reinforcement was arranged, therefore, demonstrating the role of acquisition and performance. The indirect-acting consequences exerted control over the observers' behavior because the observers formed a cognitive representation of the consequences such that they were able to perform these aggressive behaviors once reinforcement was arranged.

Thus, the temporal delay between observers acquiring responses and later emitting them is explained by cognitive mediation (Bandura, 1971; Deguchi, 1984; Masia & Chase, 1997).

Perhaps the biggest difference between the social and behavioral perspectives is the role of cognitive mediation. Unlike the social-learning perspective, a behavior analytic conceptualization relies on processes that can be observed and measured such that inferences to cognitive processes are eliminated (Baer, Wolf, & Risley, 1968). Thus, vicarious reinforcement can be conceptualized according to one's "learning history and the relation of this history to current environmental variables…." (Masia & Chase, 1997, p. 44). Specifically, a behavior analytic account of vicarious responding can be conceptualized according to an individual's history of reinforcement for imitation, intermittent reinforcement, and the process of stimulus control.

An individual's learning history seems to play an important role in vicarious responding – specifically the role of generalized imitation (Fryling, Johnston, & Hayes, 2011; Masia & Chase, 1997; Pierce & Cheney, 2004). Generalized imitation is an operant response class in which novel or new imitative behavior is likely to occur as a result of a history of reinforcement for imitating others' behavior (Mazur, 2006). To claim that vicarious reinforcement occurred, observers must, by definition, be able to observe the model's behavior and the associated consequences to then be able to emit that same behavior (i.e., imitate). In other words, a generalized imitative repertoire seems to be a prerequisite response class that observers must possess in order to be sensitive to vicarious reinforcement arrangements. Recall Bandura's (1965) study in which participants were more likely to imitate the behavior of the model when the model's behavior was reinforced or followed by no reinforcement. From a behavior analytic perspective, these participants imitated the model's behavior not because of the cognitive mediation that bridged the temporal gap between observation and performance, but, in part, because they likely had extensive histories of reinforcement for imitation. Therefore, a more parsimonious account of vicarious reinforcement is one that includes the role of the individual's reinforcement history with respect to imitation.

The role of intermittent reinforcement is also pertinent in a behavior analytic conceptualization of vicarious reinforcement (Ollendick, Dailey, & Shapiro, 1983; Weisberg & Clements, 1977). Behavior maintained by intermittent reinforcement (i.e., reinforcement that does not follow every response) will occur in the absence of reinforcement and is resistant to extinction (Skinner, 1953). That is, behavior will continue to occur even if every response is not followed by a reinforcer, and even under extremely lean schedules of reinforcement (Ferster & Skinner, 1957). Therefore, within the context of vicarious reinforcement, if imitation of the model's reinforced behavior occurs in the absence of direct reinforcement, it is likely that the observer has a history of intermittent reinforcement for imitative behavior. For example, Weisberg and Clements (1977) found that following a history of direct intermittent reinforcement of compliance for a group of children, praising only one child's compliant behavior in the group was sufficient to sustain the group's compliance. A history of intermittent reinforcement alone, however, is insufficient to conceptualize all instances of vicarious responding because it is unlikely that the observer has a history of reinforcement for all modeled behavior (Masia & Chase, 1997). Although a generalized imitative repertoire and a history of intermittent reinforcement likely play an important role in vicarious responding, they do not sufficiently account for all the environmental variables that likely contribute to vicarious responding.

In addition to historical variables as factors influencing vicarious reinforcement effects, the process of stimulus control has been discussed extensively as a factor influencing vicarious responding (Camp & Iwata, 2009; Deguchi, Fujita, & Sato, 1988; Kazdin, 1973a, 1977, 1979). Behavior that has been reinforced in the presence of a stimulus but not reinforced in the absence of that stimulus is considered a discriminated operant (Catania, 2007). The stimulus then becomes discriminative for the availability of reinforcement. Within the context of vicarious reinforcement, a model's behavior being reinforced may function as a compound discriminative stimulus (i.e., the modeled behavior and reinforcer delivery) that signals the availability of reinforcement for the observer (Masia & Chase, 1997). That is, the availability of reinforcement for a model's behavior may signal the availability of reinforcement for the observer if the observer has an established history of receiving reinforcement when another individual's behavior is also reinforced.

Although few researchers have directly examined the role of stimulus control in vicarious reinforcement arrangements, there seems to be a general consensus in the literature that stimulus control influences vicarious responding to some extent. Yet, the empirical support for the effectiveness of vicarious reinforcement is mixed. Given the mixed findings, it seems prudent to clarify the role stimulus control plays in vicariously reinforced responding such that better conclusions can be made regarding the applied use of vicarious reinforcement procedures. The experimental methodology in previous research has prevented researchers from drawing definitive conclusions primarily because the studies were designed to answer questions about the applied aspects of vicarious reinforcement. Additionally, confounding variables (e.g., inadvertent reinforcement of the observer's behavior) have led to tentative conclusions regarding the influence of stimulus control per se. If the mechanisms are clarified, then researchers can provide better recommendations for the use of vicarious reinforcement procedures in applied settings.

Vicarious Reinforcement and Stimulus Control

One of the most common reinforcers used within the vicarious reinforcement literature is praise (Bol & Steinhauer, 1990; Broden, Bruce, Mitchel, Carter, & Hall, 1970; Kazdin, 1973a, 1973b, 1977; Kazdin, Silverman, & Sittler, 1975; Ollendick, Shapiro, & Barrett, 1982; Ollendick, et al., 1983; Ollendick & Shapiro, 1984; Strain, Shores, & Kerr, 1976; Strain & Timm, 1974; Weisberg & Clements, 1977; Witt & Adams, 1980). Several studies on the use of praise have been aimed at vicariously increasing attentive behavior. For example, Broden et al. (1970) evaluated the extent to which praise would increase the attentive behavior of two typically developing boys (Edwin and Greg) using a reversal design. The experiment took place in the boys' classroom in which the boys were seated next to each other. During baseline, no programmed consequences followed attentive or inattentive behavior for both boys. Following baseline, the teacher praised Edwin's attentive behavior; no consequences were arranged for Greg's behavior. During the next phase, the contingency was changed such that Greg's attentive behavior resulted in praise and no consequences were arranged for Edwin's behavior. During the final phase, both boys received praise contingent upon attentive behavior. Results showed that when the contingency was applied to only one of the boys, increases in attentive behavior were observed for the other boy. This effect was replicated across both boys. Additionally, results for both boys showed that increases in attentive behavior were the highest when attentive behavior was directly reinforced. Although the results demonstrated a vicarious reinforcement effect, some limitations should be noted. Given that the boys were seated next to each other, teacher proximity to the boy who did not receive direct reinforcement may have inadvertently reinforced his attentive behavior. Teacher proximity may have served as a discriminative stimulus for the availability of reinforcement (i.e., praise) such that teacher proximity might have been sufficient to increase appropriate behavior. Therefore, it is unclear what specific discriminative stimulus properties influenced attentive behavior. Additionally, the authors noted a procedural integrity failure; one of the boys received direct reinforcement during the phase in which he was not supposed to receive it. Therefore, increases in the vicarious reinforcement phase may have been a result of direct, rather than vicarious reinforcement.

To address the limitations noted above, Kazdin (1973a) systematically replicated the procedures of Broden et al. (1970) by controlling for teacher proximity and specifying the child for whom reinforcement was programmed. Four children with intellectual and developmental disabilities (IDD) were split into dyads (i.e., one child was the model and the other child was the observer). To control for teacher proximity, the experimenter sat immediately behind the pair of children to ensure that the he was equidistant from the children. To clarify whose behavior of the dyad was being reinforced, the experimenter specified the model's name when delivering praise. First, general praise for attentive behavior was delivered to only the model in each dyad. Then, praise was delivered for inattentive behavior to the model to assess if the observer's behavior would change in the same direction as that of the model. Results showed that the observer's attentive behavior increased over baseline levels when praise was contingent upon the model's attentive behavior. However, when praise was delivered for inattentive behavior to the models, attentive behavior by the observers remained high. Kazdin suggested that the delivery of praise for the model's behavior functioned as a discriminative stimulus (i.e., signal the availability of reinforcement) for the observer's behavior such that the mere delivery of reinforcement was influential in sustaining the observer's responding. That is, the reinforcement contingency, not the behavior per se, is of importance. However, one limitation worth noting is that order of conditions may have influenced observers' attentive behavior to remain high during the phase in which the model's inattentive behavior was reinforced. In other words, the observer's recent history with respect to observing praise being delivered for attentive behavior might have been a reason for the observer's sustained responding. Therefore, the extent to which the model's behavior functioned as a discriminative stimulus, in addition to the discriminative properties of praise, is unclear.

To clarify the role of the discriminative properties of praise and the model's behavior, Kazdin (1977) sought to identify if behavior change was attributed to imitation of the model's behavior or the discriminative properties of the reinforcement contingency. Kazdin extended his 1973 study by conducting the reinforcement for inattentive behavior phase prior to the reinforcement for attentive behavior phase. Two children with IDD participated; one child was designated as the model and the other child as the observer. During baseline, neither the model nor the observer's behavior was reinforced. Following baseline, the teacher reinforced the model's inattentive behavior. Then, following a return to baseline, the teacher reinforced the model's attentive behavior. No direct contingencies were arranged for the observer's behavior. Results showed that independent of the topography of the model's behavior (i.e., inattentive or attentive) being reinforced, the observer's attentive behavior increased and sustained over baseline levels. These data suggest that the discriminative properties of the delivery of praise, not the behavior per se, influenced responding.

Taken together, these studies demonstrated that vicarious reinforcement arrangements can increase and sustain observer's responding. Similar studies have replicated these findings (Kazdin, 1973b; Kazdin, et al., 1975). Of interest, is why observers' responding sustained in the absence of direct reinforcement. One commonality across these studies is that they all targeted a behavior (i.e., attentive behavior) that likely had been reinforced with praise outside of the experimental context. Further, these studies were all conducted in the participants' classrooms, which was also likely to have been correlated with reinforcement. Thus, histories of intermittent reinforcement combined with the discriminative stimuli correlated with praise in classroom settings may have exerted control over attentive behavior within the experimental context. In other words, response maintenance may have been a function of stimulus control per se rather than vicarious reinforcement.

Unlike the studies described above, other researchers evaluating the effects of vicarious reinforcement have shown only temporary increases in responding (Bol & Steinhauer, 1990; Camp & Iwata, 2009; Christy, 1975; Deguchi, et al., 1988; Ollendick, et al., 1982; Ollendick, et al., 1983; Ollendick & Shapiro, 1984). Christy (1975) evaluated the use of edibles paired with attention on vicariously increasing the in-seat behavior of two groups of preschool children in a classroom setting using a multiple baseline design. The child who was to receive the edible for in-seat behavior was announced to the group of children (i.e., a rule was stated). Results showed temporary increases in in-seat behavior for those children who observed the reinforcement contingency arranged for the target child; in-seat behavior decreased over time with the exception of one participant in which his responding remained high. Results from the second group were similar to that of the first group. Christy suggested the initial increase in vicarious responding was due to the discriminative properties of the rule, model's in-seat behavior and the reinforcer delivery; however, the relative contributions of each of these antecedent variables are unknown.

Ollendick, Shapiro, and Barrett (1982) evaluated the effects of praise on the number of puzzle placements with typically developing children (20 boys and 20 girls) using a between-groups design in a laboratory setting. Eight 3-min trials were conducted and during each trial, the participants were instructed to complete one puzzle. The dyads (i.e., model and observer) in the control group did not receive praise for puzzle completion. Within the experimental group, only the model received praise; the observer never received praise for puzzle completion. Results showed that the observers within the experimental group showed an initial increase in the mean number of puzzle placements; however, performance decreased over the course of trials. Mean performance of the control group was higher overall than the performance of the observers within the experimental group. Similar to Christy (1975), the authors suggested that the model's behavior and the discriminative properties of reinforcement were responsible for the initial increase in responding but the absence of direct reinforcement resulted in a decrease in responding.

Similarly, Bol and Steinhauer (1990) evaluated the effects of praise on the number of puzzle placements using a between-groups design. Forty eight children (4-5 years of age) participated, were formed randomly into same-sex pairs, and then randomly assigned to one of three conditions: no-reinforcement (neither child received praise for puzzle completion), direct reinforcement (both children received praise for puzzle completion), and vicarious reinforcement (only one child received praise for puzzle completion). Results showed that the highest mean percentage of puzzle completion was observed in the direct reinforcement group, followed by the children receiving direct reinforcement in the vicarious reinforcement condition (i.e., the models). The observers in the vicarious reinforcement condition and all of the children in the no-reinforcement condition showed lower mean percentages of puzzle completion. Half of the 12 observers in the vicarious-reinforcement showed a pattern of responding in which puzzle completion initially increased but decreased across trials.

Results from these studies are inconsistent with previous research that demonstrated sustained responding. This temporary effect actually might be a more lawful pattern of responding given that responding never contacted reinforcement. Potentially, weak reinforcement histories with respect to the target behaviors and experimental context may have resulted in this pattern. Given that direct histories of reinforcement largely influence the strength of responding, researchers have suggested that a history of direct reinforcement may also impact the extent to which a vicarious reinforcement effect is observed (Camp & Iwata, 2009; Deguchi, et al., 1988). Thus, a history of reinforcement seems to be an important variable in determining the strength of vicarious responding.

Weisberg and Clements (1977) assessed the role of direct reinforcement on levels of vicarious responding. The authors evaluated the effectiveness of praise to increase compliance for 12 preschool children. First, experimenters assessed compliance in the absence of direct reinforcement and found that compliance did not increase. Compliance only increased when experimenters arranged direct, intermittent reinforcement for each member of the group. When the direct reinforcement contingency was removed for all but one child, group compliance maintained at high levels. The authors suggested that the history of receiving direct intermittent reinforcement for compliance likely influenced the extent to which vicarious responding occurred. These results provide support for the role of direct reinforcement in the establishment of vicarious responding.

Although not the explicit purpose of the study, Deguchi et al., (1988) evaluated the effects of a direct history of reinforcement on the levels of vicarious responding. Two of the 6 participants were first exposed to the vicarious reinforcement condition, then provided a history of direct reinforcement, and then again exposed to the vicarious reinforcement condition. During the vicarious reinforcement condition, models received a token for engaging in the task; observer responding was never reinforced. During the direct reinforcement condition, both model and observer responding were reinforced for engaging in a button-pressing task. For both participants, the effects of the direct history of reinforcement did not affect the persistence of vicarious responding; in fact, the same pattern of responding (an initial increase then decrease) was observed prior to and following a history of direct reinforcement. Although it is likely that stimulus control was responsible for the initial increases in responding, these data suggest that extinction seemed to be a more potent controlling variable.

Camp and Iwata (2009) evaluated the influence of stimulus control on vicarious reinforcement effects with three adults with IDD by providing the participants 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 correlated with reinforcement. During baseline, task materials were present, but the model (a graduate student confederate) did not engage in the target response. No consequences were delivered to the model or to the participant (observer). Discrimination training consisted of two conditions: a discriminative stimulus (SD) condition and an S-Delta condition. During the SD condition, the reinforcer (i.e., an edible item and praise) was delivered both to the model and to the participant on a variable-ratio (VR) 3 schedule of reinforcement contingent upon engaging in the target response. During the S-Delta condition, no programmed consequences were arranged for the model or for the observer, although the model continued to engage in the target response. During the test for vicarious reinforcement, the reinforcer was delivered to the model on a VR-3 schedule of reinforcement; however, observer responses were not reinforced. During the discrimination test S-Delta condition, no consequences were delivered to the model or to the observer, although the model continued to engage in the target response. Results indicated a strong vicarious reinforcement effect for two of three participants. That is, during the test for vicarious reinforcement, two participants continued to engage in the target response only in the SD condition despite the fact that their behavior never contacted the reinforcement contingency during this condition. The third participant showed an immediate reduction in responding. These data suggest that stimulus control was likely responsible for sustained vicarious responding; however, they also provide direct evidence for the role of extinction when reinforcement is subsequently withheld.

To date, studies that have evaluated the role of direct reinforcement offer a more comprehensive conceptualization of the influence of stimulus control in vicarious reinforcement arrangements. An evaluation of direct reinforcement within an experimental arrangement will allow historical variables to be better controlled, thus allowing for a more thorough evaluation of stimulus control. Although stimulus control remains central to an understanding of vicarious reinforcement, one important implication of these procedures is the extent to which vicarious reinforcement produce unwanted side effects. These side effects may be one reason against recommending vicarious reinforcement as a group teaching strategy.

Side Effects of Vicarious Reinforcement

Several researchers have reported negative side effects of using vicarious reinforcement procedures. Although some researchers have anecdotally reported negative side effects (Ollendick, et al., 1983; Ollendick, et al., 1982), others have collected data on these side effects (Bol & Steinhauer, 1990; Christy, 1975; Ollendick & Shapiro, 1984). However, to date, empirical evidence regarding the conditions under which vicarious reinforcement produces negative side effects is lacking.

Ollendick, et al. (1983) reported that observers emitted negative statements such as, “It’s not fair,” and “I quit” when they observed the model’s behavior being reinforced. Similarly, Bol and Steinhauer (1990) collected data on observers’ negative statements and found that observers’ negative statements were higher when their behavior was not being reinforced while the model’s behavior was being reinforced. Christy (1975) collected data on complaints made by the observers. Results showed that observers complained more at the beginning of the phase in which the model received the edible reinforcer as compared to the end of the phase. It is likely that observers’ complaining behavior may have extinguish as their behavior did not contact reinforcement.

Potentially, negative statements may have resulted from the observer’s target responding not contacting reinforcement and thus decreasing. Bol and Steinhauer (1990) suggested that this pattern of responding may suggest a situation in which observers increase their rate of responding as a result of observing a model’s behavior result in reinforcement. If direct reinforcement is removed following a previously reinforced response, responding will likely undergo extinction, which has been shown to be aversive (Azrin, Hutchinson, & Hake, 1966; Sajwaj, Twardosz, & Burker, 1972; Lerman & Iwata, 1996; Todd, Morris, & Fenza, 1989). Bol and Steinhauer suggested that unequal distribution of reinforcers creates inequity, or unfairness, between the model and observer. Previous research on reinforcer inequity has shown that inequity is aversive for the individual who receives the smaller reinforcer or no reinforcers (Marwell & Schmitt, 1975; Shimoff & Matthews, 1975). If vicarious reinforcement contingencies are indeed aversive, observers may be more likely to respond to escape or avoid vicarious reinforcement conditions. Thus, further investigation of the specific conditions under which these types of negative side effects are more likely to occur seems warranted. This seems especially important because vicarious reinforcement procedures appear to be an attractive teaching strategy for use in classroom settings and seems to be one of the bases upon which the principle of inclusion is favored.

Limitations

Taken together, the vicarious reinforcement literature with respect to a stimulus control interpretation has illustrated four primary limitations. First, some studies showed increased and sustained observer responding in the absence of a programmed history of reinforcement. Extraneous variables rather than the contingencies arranged within the experiment might have contributed to these findings. For example, if the target response (e.g., attentive behavior) is being directly reinforced both outside and within the experiment, it may be that the discriminative stimuli correlated with attentive behavior are exerting control over responding within the experiment. Similarly, if the observers' have an established history of receiving reinforcement in the setting in which the experiment takes place (e.g., a classroom), the stimuli within the setting may also influence observer responding. Therefore, it is unclear whether the discriminative stimuli within or outside the experimental context contributed to sustained responding. To address these limitations, Studies 1-3 were conducted in controlled settings (i.e., session rooms) and conducted using an arbitrary response for which the child was unlikely to have an extensive reinforcement history.

Second, definitive conclusions about the role of direct reinforcement as a factor influencing vicarious responding are tentative because of the limitations within the few studies that have directly evaluated these variables (e.g., Camp & Iwata, 2009; Deguchi, et al. 1988;

Weisberg & Clements, 1977). For example, Camp and Iwata evaluated the influence of stimulus control on vicarious reinforcement effects by establishing a history of direct, differential reinforcement. Although their results support the conceptualization of the influence of stimulus control, the experimental design and participant characteristics limit conclusions regarding the vicarious reinforcement effect. Specifically, the test for vicarious reinforcement was immediately preceded by the discrimination training condition in which the observer's responding was directly reinforced. Therefore, it is possible that the vicarious reinforcement effect was more robust due to the observer's recent history of direct reinforcement. That is, response maintenance during the discrimination test may have been a function of stimulus control rather than vicarious reinforcement per se. Responding during the discrimination test condition may have also been the result of carry-over from the effects of the discrimination training condition. Additionally, it is unclear whether a vicarious reinforcement effect would have been observed prior to a history of direct reinforcement. Last, it is unclear whether the results of Camp and Iwata are limited to the IDD population for whom vicarious reinforcement effects were evaluated. It is possible that vicarious reinforcement effects may be more robust with nonclinical populations such as typically developing children with more refined behavioral repertories than individuals with IDD. These aforementioned limitations were addressed in Studies 1 and 2.

Third, it is interesting to note that we were unable to identify any studies that have investigated the use of negative reinforcement within vicarious reinforcement arrangements. If responding can be altered by watching others receive positive reinforcers, it seems reasonable that watching others receive negative reinforcers (i.e., escape) could influence an observer's responding. Given this lack of research, Study 2 was designed to evaluate whether stimulus control would influence responding under vicarious negative reinforcement arrangements.

Finally, there are a limited number of studies that have experimentally investigated the possibility that vicarious reinforcement procedures are aversive, and thus potentially disadvantageous for clinical application under certain conditions. Given the evidence (albeit limited and primarily descriptive) that negative statements may occur when individuals observed others' behavior being reinforced (Bol & Steinhauer, 1990; Christy, 1975; Ollendick, et al., 1983; Ollendick & Shapiro, 1984; Ollendick, et al., 1982), systematic investigations of the aversive qualities of vicarious responding should be addressed. Therefore, Study 3 was aimed at evaluating the extent to which vicarious reinforcement contingencies are aversive.

Purpose

There are several purposes to the current study. The purpose of Study 1 is to conduct a systematic replication of Camp and Iwata (2009) by assessing the extent to which stimulus control influences vicarious positive reinforcement. The purpose of Study 2 is to use the same experimental preparation in Study 1 to evaluate the influence of stimulus control on vicarious negative reinforcement. In Study 3, we evaluated the extent to which vicarious reinforcement contingencies are aversive. That is, are participants (i.e., observers) likely to emit a response that produces temporary escape from vicarious reinforcement contingencies?

General Method

Participants and Setting

Fifteen typically developing toddler- and preschool-aged children who were enrolled in a Midwestern-university early education program participated. Throughout the remainder of this manuscript, child participants will be referred to as either observers (i.e., participants for whom the effects of vicarious reinforcement were evaluated) or models. Six children (3 boys and 3 girls) participated as observers in Study 1, and their ages ranged from 2 years, 2 months to 4 years, 2 months (with a mean age of 3 years, 2 months). Two other preschool-aged children served as models and served as a model for more than one observer. Models' ages ranged from 3 years, 11 months to 5 years (with a mean age of 4 years, 5 months). Six children (2 boys and 4 girls) participated as observers in Study 2, and their ages ranged from 2 years, 9 months to 4 years, 7 months (with a mean age of 3 years, 8 months). Three other preschool-aged children served as models and their ages ranged from 4 years, 3 months to 5 years, 1 month (with a mean age of 4 years, 9 months). One observer (Ivy) was paired with an adult model (Study 2). Three children (1 boy and 2 girls) participated as observers in Study 3, and their ages ranged from 2 years, 10 months to 4 years, 9 months (with a mean age of 3 years, 11 months). Two other preschool-aged children served as models, and their ages ranged from 4 years, 4 months to 5 years, 4 months (with a mean age of 4 years, 10 months). Observers were able to imitate age-appropriate fine- and gross-motor tasks. Sessions in Studies 1-3 were conducted in two small research rooms equipped with a one-way observation window, and each room contained relevant task materials. An undergraduate (or graduate) research assistant served as an experimenter and was present in the room(s) with the children at all times.

Imitation Pretest (Observer)

Given that researchers have suggested that a generalized imitative repertoire is likely required for vicarious responding to occur, the current study included an imitation pretest conducted with the observers. That is, we wanted to decrease the likelihood that failure to demonstrate a vicarious reinforcement effect (a potential outcome) could not be attributed to an observer's inability to emit modeled behavior or the absence of a generalized imitative repertoire.

Therefore, prior to the start of Studies 1-3, an imitation pretest was conducted with the observer to ensure that he or she was capable of imitating the behavior of a model during the experimental conditions. The pretest consisted of 12 trials in which the observer was prompted to imitate a motor task. Each of six motor tasks (three fine motor and three gross motor) was assessed twice. At the start of each trial, the experimenter instructed the observer to “do this”, while the experimenter simultaneously performed one of the motor tasks. The experimenter delivered a neutral statement (e.g., “OK”) following the occurrence of any response (correct or incorrect) by the child. The trial was terminated if the observer did not respond within 5 s. Data collectors (trained undergraduate research assistants) recorded the occurrence of correct imitation using paper/pencil data collection. The inclusion criterion was 80% correct imitation of the tasks. All observers met this criterion (range 92-100%).

Compliance Training (Model)

Given that determination of the presence of a vicarious reinforcement effect (as compared to imitation per se) depends directly on patterns of observer responding as compared to patterns of model responding, the current study was designed to ensure that (a) child models were explicitly trained to emit the performances required by the various experimental conditions, and (b) objective information regarding the integrity of the model’s behavior during these experimental conditions was continuously assessed. Prior to the start of Studies 1-3, compliance training was conducted with the child models to (a) ensure that they were capable of complying with repeated instructions to respond and not respond, and (b) provide them a history of wearing, and receiving adult instructions via, a “bug-in-the-ear” device. Prior to the start of training, the instructions were given to the model (e.g., “I want to see how well you can follow directions. Sometimes I’m going to ask you to do a task. You get to wear this earpiece so that you can hear me when I’m not in the room.”). During compliance training, the adult delivering instructions to the child and a data collector were in the observation booth; an experimenter was in the session room with the child model. Compliance training was 5 min in duration and an instruction (e.g., “Stack” or “Touch the card”) was delivered approximately every 15 to 30 s. Praise was provided for correct responding. If incorrect responding occurred (i.e., the child did not correctly respond when prompted), the experimenter reminded the child to emit the correct response (e.g., “Remember, each time you’re asked to stack, you put the ring on the stacker.”). If the model demonstrated at least 90% compliance with the task, the model was allowed access to a preferred activity for 5 min or allowed selection of a preferred edible. Models participating in Study 2 were also trained to engage with a pre-specified task for the duration of the 5-min session. Instructions were provided at the beginning of each session to work on the task for the entire session. If the model stopped working on the task, the experimenter reminded the child to keep working on the task. The experimenter provided intermittent praise to the model for engaging in the task. Trained data collectors used hand-held devices to record the frequency of instructions and compliance and engagement with the task (Study 2 only). Compliance was defined as emitting the target response within 5 s of the instruction. Compliance was calculated by dividing the frequency of compliant behaviors by the frequency of instructions delivered and multiplying by 100%. Models were required to demonstrate 90% compliance across two consecutive sessions to be included in the study. Additionally, models in Study 2 were required to demonstrate at least 90% engagement with the pre-specified task to be included in the study.

Experimental Arrangement

Five-min sessions were conducted two to five times per day, three to five days per week. Sessions were terminated if emotional responding (see below) occurred for 10 consecutive s.

The session termination criterion was reset if emotional responding did not occur for 10 s. One to three experimenters (undergraduate and/or graduate research assistants) rotated within each condition and remained constant across conditions. To enhance discrimination, conditions were conducted in two different rooms and each condition was correlated with uniquely colored stimuli. For example, the discriminative stimulus (SD) condition was conducted in a green room, with therapist A or B or C (wearing a green shirt), using green task materials. The S-Delta condition was conducted in a yellow room, with therapist D or E or F (wearing a yellow tie-dye shirt), using yellow task materials. The target task that produced the reinforcer was present across all conditions and the model and observer had their own set of the target task. A control activity (described below) and the reinforcer (i.e., edibles) were present across conditions during Studies 1 and 3. Table 1 depicts the participant-specific materials across Studies 1-3. The "bug-in-ear" device was worn by the model across all sessions and was used to prompt the model to engage in the target response during relevant conditions (see below). Following each daily block of sessions, the observer and model were allowed 5 min access to a preferred item/activity or edible of his or her choice for participation in research sessions. A multielement and reversal experimental design were used across all three studies to evaluate the effects of the experimental conditions on levels of observer responding.

Study 1: Vicarious Positive Reinforcement and Stimulus Control

The purpose of Study 1 was to assess the extent to which stimulus control influences vicarious positive reinforcement effects. That is, we were interested in evaluating whether observers are more likely to imitate a model's behavior when his or her behavior is or is not followed by an edible reinforcer prior to and following a history of direct differential reinforcement.

Preference Assessments

Prior to the start of the study, two preference assessments were conducted with observers. First, a paired-choice preference assessment (Fisher, Piazza, Bowman, Hagopian, Owens, & Slevin, 1992) was conducted to identify highly preferred edible items for use as reinforcers during experimental conditions. During the paired-choice preference assessments, trained data collectors recorded selection responses using paper/pencil data collection. Selection was defined as the child reaching out and touching the item. A second, independent data collector collected data on 83% of trials. Interobserver agreement was calculated by comparing data collectors' records on a trial-by-trial basis. For a given trial, an agreement was scored if both data collectors recorded selection of the same item. An agreement coefficient was calculated by dividing the number of agreements by the total number of agreements plus disagreements and multiplying by 100%. IOA averaged 99%, with a range of 96%-100%.

Second, for all experimental conditions, it was possible that observers might engage in the target response (even in baseline) simply because there was no other activities available during session. Therefore, a moderately preferred activity was available throughout each session as a control procedure. A free-operant preference assessment (Roane, Vollmer, Ringdahl, & Marcus, 1998) was conducted to identify this "control activity", as well as to aid in selecting the target task for use as the target response. Target task activities were selected that were associated with a low, but not zero, level of responding (i.e., activity that the observer can do but is unlikely to do in the absence of reinforcement). During the free-operant preference assessments, trained data collectors recorded observer engagement using hand-held devices using a 5-s partial interval recording. Engagement was defined as the observer oriented to the activity while manipulating it in its intended way. A second, independent data collector collected data on 81% of sessions for the control task, and 67% of sessions for the target task. Interobserver agreement was calculated by dividing each 5-min session into 5-s intervals and comparing the records of two data collectors on an interval-by-interval basis. The number of agreement intervals was divided by the number of agreement and disagreement intervals and multiplied by 100% to obtain the agreement coefficient. IOA averaged 97%, with a range of 95%-99%, for the control task and 98%, with a range of 96%-100%, for the target task.

Response Measurement, Interobserver Agreement, and Procedural Integrity

Trained data collectors used hand-held devices to record the responses exhibited by both model and observer. The primary dependent variable was completion of the target task identified via the free operant preference assessment. For 3 participants (Ben, Molly, and Nell), the target task was placing laminated paper discs on a dowel rod. For 2 participants (Chase and Lynn), the target task was placing blocks in a plastic bin. For the last participant (Al), the target task was placing laminated paper cards in a box that had a small slit cut out on the top. Frequency of target task completion by both model and observer was recorded. Data were also collected on problem behavior and negative vocalizations. Data collectors used 10-s partial interval recording to measure problem behavior and negative vocalizations. Problem behavior was defined as throwing or swiping task materials, grabbing or attempting to grab reinforcer, stealing model's materials, kicking wall, blocking reinforcer delivery, blocking model from engaging in target task, stepping on task materials, mouthing task materials, and throwing materials at experimenter. Negative vocalizations were defined as comments or complaints about wanting or not getting the edible reinforcer, complaints about not wanting to engage in the target or aversive task (Study 2), name calling or insulting, whining/crying, and negative comments directed toward the model or therapist. Termination criterion was set at 10 consecutive s of crying or whining. Additionally, sessions were ended if participants stated they wanted to go back to class; however, this never happened. As a measure of procedural integrity, data collectors recorded the frequency of reinforcer delivery to both model and observer.

Interobserver agreement was assessed by having a second data collector record completion of the target task simultaneously, but independently on 33% of the sessions. Interobserver agreement was calculated using the proportional reliability method (Bailey & Burch, 2002) in which each 5-min session was divided into 10-s intervals and the records of both data collectors were compared on an interval-by-interval basis. An index of agreement was computed for each interval by dividing the smaller number of responses by the larger number. These fractions are then summed, and that number is divided by the total number of intervals. Interobserver agreement for problem behavior and negative vocalizations was calculated by dividing each 5-min session into 10-s intervals and comparing the records of two data collectors on an interval-by-interval basis. The number of agreement intervals was divided by the number of agreement and disagreement intervals and multiplied by 100% to obtain the agreement coefficient. IOA averaged 97% (range, 77%-100%) and 94% (range, 63%-100%) for completion of the target task by the observers and models, respectively. A second data collector recorded problem behavior and negative vocalizations on an average of 25% of sessions. IOA averaged 96% (range, 80%-100%) and 99% (range, 83%-100%) for problem behavior and negative vocalizations, respectively.

Finally, a procedural integrity coefficient was calculated to determine correct implementation of reinforcer delivery to the model and observer. Procedural integrity data were collected during 98% of total sessions and were calculated by dividing the number of opportunities to implement session contingencies by the total number of correct implementations.

For example, if an observer emitted the target response 10 times in the VSR+ SD condition, and the experimenter correctly implemented the session contingencies (i.e., did not deliver the reinforcer to the observer) 9 times, procedural integrity would be calculated as (9/10) X 100% = 90%. Similarly, if the model emitted the target response 20 times in the VSR+ SD condition and the experimenter delivered the reinforcer 18 times, procedural integrity would be calculated as (18/20) X 100% = 90%. Procedural integrity for correct implementation of observer contingencies averaged 99% (range 93% to 100%) and for model contingencies averaged 99% (range 92%-100%).

Experimental Conditions

Baseline (BL). Materials (i.e., target task, control activity, and edibles) were present during baseline sessions in both conditions (SD and S-Delta). The model was instructed to not emit the target response. No programmed consequences (i.e., highly preferred edibles) were delivered to the model or observer.

Vicarious Positive Reinforcement (VSR+). During both the SD and S-Delta conditions, the model was instructed to emit the target response (approximately once every 15 s). During the SD condition, only model responses were reinforced on a fixed-ratio (FR) 1 schedule of reinforcement; no consequences were delivered for observer responses. During the S-Delta condition, neither model nor observer responses were reinforced.

Discrimination Training (DT). Prior to the start of the SD and S-Delta sessions, the observer was exposed to the session contingencies. Prior to the SD condition, the experimenter prompted the observer to emit the target response and an edible was delivered. Prior to the S-Delta condition, the experimenter prompted the observer to emit the target response and following the target response the experimenter said, “When you stack the ring, nothing happens.”

The experimenter prompted the observer to do this two to three times before the session started. During both the SD and S-Delta conditions, the model was instructed to emit the target response (approximately once every 15 s). During the SD condition, both model and observer responses resulted in the edible on a FR-1 schedule of reinforcement. During the S-Delta condition, neither model nor observer responses were reinforced.

Results and Discussion

Results of Study 1 are depicted in Figures 1 to 6. Table 2 summarizes the results for all participants. Each figure displays the rate of responding for the observer (top panel) and model (bottom panel). During the first four phases in which vicarious positive reinforcement was tested, all 6 observers showed an absence of a vicarious reinforcement effect. That is, for some participants (Chase, Ben, Lynn, and Molly) rates of responding were initially variable across conditions but decreased to near zero or zero levels, and for other participants (Nell and Al) rates of responding were overall low and undifferentiated despite the fact that the model continued to engage in responding during the VSR+ phases. Data from this initial test for vicarious positive reinforcement suggest that the observers' responding was not sensitive to the model's behavior or the associated consequences.

During discrimination training, in which direct differential reinforcement was programmed, all 6 observers showed differentiated response patterns in which higher levels of responding occurred in the SD condition as compared to the S-Delta condition despite the fact that the model engaged in the target response across conditions. These data demonstrate that the participants' responding was sensitive to direct positive reinforcement.

Once stable and differentiated patterns of responding were observed, baseline was conducted to guard against carryover effects from DT to the VSR+ phase. Once low levels of responding were observed across the SD and S-Delta conditions in baseline, the VSR+ phase was reinstated (final phase) to test for a stimulus control effect. Patterns of responding differed across participants. Chase (Figure 1) showed differential responding initially in which higher levels of responding occurred in the SD condition relative to the S-Delta condition suggesting a stimulus control effect. That is, the model's responding and the delivery of the reinforcer to the model, although no longer correlated with direct reinforcement, likely signaled the availability of reinforcement due to a recent history of correlation. However, Chase's responding in the SD condition decreased over the course of sessions likely due to extinction. Nell's data (Figure 2) were similar. When the VSR+ phase was reinstated, Nell showed differential responding initially suggesting a stimulus control effect. Like Chase, Nell's responding in the SD condition appeared to extinguish over the course of sessions. However, interestingly, differential responding was again observed upon return from a break in the school semester as indicated by a break in the x-axis. These data, similar to Chase's data, suggest that a history of direct reinforcement was necessary to establish, at least initially, vicarious responding. By contrast, a vicarious positive reinforcement effect following direct reinforcement was not observed for Ben, Lynn, Al, and Molly (Figures 3-6, respectively). For these participants, stimulus control did not appear to exert control over vicarious responding. Although low rate responding was observed from these participants during the SD condition in the final VSR+ phase, participants' responding appeared to be most sensitive to extinction.

Figures 7 and 8 depict the mean percentage of problem behavior and negative vocalizations across phases and conditions, respectively. The top graphs in Figures 7 and 8 depict the mean percentage of problem behavior and negative vocalizations for all observers. The graphs below depict each observer's mean percentage of problem behavior and negative vocalizations, respectively. Error bars depict the range of problem behavior and negative vocalizations. Across all observers, a low percentage problem behavior was observed across phases. However, some notable differences were observed. For all observers, low to zero levels of problem behavior occurred in the condition in which responding was direct reinforced (DTSD phase) as compared to all other conditions in which observer responding did not result in the reinforcer. Additionally, similar levels of problem behavior were observed across baseline and VSR phases. This pattern is not too surprising given that observer responding never resulted in the reinforcer during these phases. Taken together, these data provide some support that under conditions of vicarious positive reinforcement or simply no reinforcer delivery (baseline), problem behavior is likely to occur.

Across all observers, negligible differences in negative vocalizations were observed. Negative vocalizations occurred on average 5% or less of the time across all phases; however, with the exception of Chase, no negative vocalizations were observed in the condition in which responding was directly reinforced (DT SD phase). Molly, Chase, Lynn, and Ben's data are interesting in that there was more variability (depicted by the error bars) in the VSR+ SD phases as compared to all other phases. Although negative vocalizations occurred at low percentages, their data may provide some support that vicarious reinforcement produces unwanted side effects that have been previously reported in the literature.

In summary, results from Study 1 provide further empirical support for the role of stimulus control in vicarious positive reinforcement effects. No participants showed a vicarious reinforcement effect prior to a history of direct reinforcement. That is, no participants showed higher levels of responding in the condition in which the model's behavior was reinforced (VSR+ SD) as compared to the condition in which the model's behavior was not reinforced

(VSR+ SDELTA). Two of 6 participants (Chase and Nell) showed a vicarious reinforcement effect following a history of direct, differential reinforcement, and their patterns of responding indicated the influence of stimulus control. That is, Chase and Nell continued to respond without direct reinforcement but only in the presence of the stimulus (reinforced model) that was correlated with reinforcement. However, target responding in the final VSR+ phase did not maintain for these participants further replicating previous research on the temporary effects of vicarious positive reinforcement. It is likely that extinction in the final VSR+ phase appeared to be the operant mechanism responsible for participants' decrease in responding. That is, because observer responding no longer contacted direct reinforcement, observer responding decreased. Additionally, results showed that problem behavior and negative vocalizations occur under conditions of no reinforcement, vicarious reinforcement and rarely occur under conditions of direct reinforcement. However, because negligible differences were seen across baseline and vicarious reinforcement conditions, definitive conclusions about the effects of vicarious reinforcement on problem behavior and negative vocalizations are tentative.

Study 2: Vicarious Negative Reinforcement and Stimulus Control

Because stimulus control influenced vicarious positive reinforcement effects to some extent, presumably stimulus control should also influence vicarious negative reinforcement effects. Therefore, the purpose of Study 2 was similar to that of Study 1. In Study 2 we used a similar experimental preparation and design as Study 1 to assess the extent to which stimulus control influences vicarious negative reinforcement effects. That is, we were interested in evaluating whether observers are more likely to emit an escape response to temporarily escape an aversive stimulus following observation of a model engaging in an identical response and receiving escape. These contingencies were evaluated prior to and following a history of direct differential reinforcement.

Preference Assessments

Prior to the start of the study, a free-operant preference assessment (Roane, et al., 1998) was conducted with observers to identify a low-preferred educational activity (i.e., an aversive task) to use during experimental conditions. During the free-operant preference assessment, trained data collectors recorded observer engagement using hand-held devices using a 5-s partial interval recording. Engagement was defined as the observer oriented to the activity while manipulating it. A task associated with near-zero levels of responding was selected. Interobserver agreement was calculated by dividing each 5-min session into 5-s intervals and comparing the records of two data collectors on an interval-by-interval basis. The number of agreement intervals was divided by the number of agreement and disagreement intervals and multiplied by 100% to obtain the agreement coefficient. A second, independent data collector collected data on 58% of sessions for the aversive task. Interobserver agreement was calculated by dividing each 5-min session into 5-s intervals and comparing the records of two data collectors on an interval-by-interval basis. The number of agreement intervals was divided by the number of agreement and disagreement intervals and multiplied by 100% to obtain the agreement coefficient. IOA averaged 97%, with a range of 93%-99% for the aversive task.

Response Measurement, Interobserver Agreement, and Procedural Integrity

Trained data collectors used hand-held devices to record the responses exhibited by both model and observer. The primary dependent variable was engaging in the escape response. For 5 participants (Luke, Erica, Mark, Sara, and Emma), the escape response was a card touch (i.e., placing hand on a laminated card taped to the table). For one participant (Ivy), the escape response was pressing a hand on a switch (button) press. Frequency of the escape response by both model and observer was recorded. Data collectors used 10-s partial interval recording to measure engagement with the aversive task. For 3 participants (Erica, Mark, and Emma), the aversive task was placing laminated paper discs on a dowel rod. For 2 participants (Luke and Ivy), the aversive task was placing laminated paper cards in a box that had a small slit cut out on the top. For one participant (Sara), the aversive task was lacing a board with yarn. Data also were collected on problem behavior and negative vocalizations as previously described in Study 1. As a measure of procedural integrity, data collectors recorded the frequency of reinforcer delivery (i.e., escape) to both model and observer.

Interobserver agreement and procedural integrity were assessed according to the same methods as Study 1. Interobserver agreement was assessed by having a second data collector record engagement with the aversive task and the escape response simultaneously, but independently on an average of 36% of the sessions. IOA averaged 93% (range, 70%-100%) and 91% (range, 60%-100%) for engagement with the aversive task for the observer and model, respectively. IOA averaged 98% (range, 75%-100%) and 98% (range, 83%-100%) for the escape response for the observer and model, respectively. A second data collector recorded problem behavior and negative vocalizations on an average of 33% of sessions. IOA averaged 97% (range, 63%-100%) and 99% (range, 83%-100%) for problem behavior and negative vocalizations, respectively. Procedural integrity data were collected during 88% of total sessions. Procedural integrity for correct implementation of observer contingencies averaged 99% (range, 89% to 100%) and for model contingencies averaged 99% (range, 93%-100%).

Experimental Conditions

Across all experimental conditions, both the aversive task and the escape task (i.e., card touch or button press) were available across all experimental conditions. The model was instructed to continuously complete the aversive task throughout all of the sessions. At the beginning of each session, the observer was instructed to complete the same aversive task. Subsequently, the model and observer were verbally prompted continuously throughout the phase to keep working on the task. For example, the experimenter said phrases such as “keep working hard,” “keep going,” and “stack the rings.” For two participants (Ivy and Sara), verbal prompts were initially provided every 15 s; however, a continuous schedule of prompting was used during discrimination training.

Baseline (BL). During both the SD and S-Delta conditions, the model was instructed to complete the aversive task but not emit the escape response. Emission of the escape response did not result in escape for either the observer or the model across the SD and S-Delta conditions.

Vicarious Negative Reinforcement (VSR-). During both the SD and S-Delta conditions, the model was instructed to complete the aversive task and emit the escape response approximately once every 30 s. During the SD condition, model escape responses resulted in 15 s of escape from the aversive task (i.e., the aversive task was removed for 15 s, and the experimenter said, “Okay, you don’t have to do it” or “Okay, you can have a break.”) on a FR-1 schedule of reinforcement. Emission of the escape response did not result in escape for the observer. During the S-Delta condition, neither model nor observer’s escape responses resulted in escape.

Contingency Reversal (CR). For one participant (Ivy), a contingency reversal was conducted to further evaluate the effects of vicarious responding prior to a history of direct reinforcement. That is, we wanted to evaluate whether Ivy’s escape responding in the VSR-phase was differentially sensitive to the escape contingency arranged for the model rather than some other stimulus features of the SD condition. Identical contingencies to that of the VSR-phase were conducted with the exception that the SD condition was conducted in the room previously correlated with no escape (S-Delta room), and the S-Delta condition was conducted in the room previously correlated with escape (SD room). Specifically, the model's escape responding was reinforced in the VSR- S-Delta condition and not reinforced in the VSR- SD condition. Observer escape responding was never reinforced.

Discrimination Training (DT). Prior to the start of the SD and S-Delta sessions, the observer was exposed to the session contingencies. Prior the SD condition, the experimenter prompted the observer to touch the card (for Ivy it was press a button) and a brief break (about 5 s) was provided in which the experimenter said, "When you hit the card, you get a break." Prior to the S-Delta condition, the experimenter prompted the observer to emit the same response and following the target response the experimenter said, "When you hit the card (press a button), nothing happens." The experimenter prompted the observer to do this two to three times before the session started. During both the SD and S-Delta conditions, the model was instructed to complete the aversive task and emit the escape response approximately once every 30 s. During the SD condition, emission of the escape response by both model and observer resulted in escape for 15 s on a FR-1 schedule of reinforcement. During the S-Delta condition, neither model nor observer's escape responses resulted in escape.

Discrimination Training (Model Not Engaging in Escape Response). For one participant (Mark), it was hypothesized that he was imitating the model's behavior specifically during DT. Thus, a phase was conducted in which the only change was that the model stopped engaging in the escape response across the SD and S-Delta conditions.

Results and Discussion

Results of Study 2 are depicted in Figures 9 to 16. Table 3 summarizes the results for all participants. Figures 9 to 14 display the rate of the escape response for the observer and model (top two panels) and the percentage of engagement with the aversive task for the observer and model (bottom two panels).

During the first four phases in which vicarious negative reinforcement was tested, five participants (Erica, Luke, Mark, Emma, and Sara) showed an absence of a vicarious negative reinforcement effect (Figures 9-13). That is, for these observers, the escape contingency arranged for the model did not seem to influence the observers' behavior. Patterns of responding during this initial evaluation, however, differed slightly across observers. Erica, Mark, and Emma showed overall low to zero levels of responding across SD and S-Delta conditions. Luke did not engage in the escape response during baseline, but engaged in high and variable responding across conditions during the VSR- test phase. Sara engaged in low to zero levels of responding during the baseline phases, but consistently engaged in the escape response across both the SD and S-Delta conditions in the VSR- test phases, a pattern of responding almost identical to that of her model (Carrie). This pattern of responding suggested that Sara was imitating the behavior of Carrie regardless of the negative reinforcement contingency arranged for the model.

During discrimination training (DT), in which direct differential reinforcement was programmed, four of these five participants (Erica, Luke, Sara, and Mark) showed higher levels of escape responding in the SD condition as compared to the S-Delta condition, demonstrating a direct negative reinforcement effect. Mark's pattern of responding during the first and third DT phases (Figure 11) suggested that Mark was imitating the model's behavior, as he was engaging in the escape response across conditions; however, a direct reinforcement effect was only observed once the model stopped engaging in the escape response. Emma (Figure 12) did not show a direct reinforcement effect; in fact, she never emitted the escape response in the phase in which direct reinforcement was arranged (DT SD), and she rarely engaged in the escape response in the DT S-Delta condition. Emma's data make an analysis of the influence of stimulus control on vicarious negative reinforcement difficult as we were unable to demonstrate a vicarious or direct reinforcement effect. Because Emma did not show a direct negative reinforcement effect, her evaluation was ended.

For Erica, Luke, Mark, and Sara (who all showed a direct negative reinforcement effect), baseline was conducted following the discrimination training phase. Erica, Luke, and Sara showed immediate decreases in responding across conditions. Mark (Figure 11) engaged in a high rate of escape responding in the first baseline SD session likely indicative of an extinction burst; however; his rate of responding decreased across conditions over the course of the phase. Subsequently, the VSR- test phase was reinstated for these four participants who showed similar, although slightly different, patterns of responding. Erica's data (Figure 9) showed a differentiated pattern of responding in which she engaged in higher levels of the escape response in the SD condition as compared to the S-Delta condition demonstrating a stimulus control effect. That is, although Erica's escape responding no longer resulted in negative reinforcement, she continued to respond as if her behavior was, in fact, being directly reinforced due to the discriminative properties of the SD condition exerting stimulus control over her responding. Interestingly, Erica's escape responding did not extinguish in the SD condition. Luke's pattern of responding also indicated a stimulus control effect (Figure 10). However, like Chase and Nell in Study 1, Luke's escape responding in the SD condition decreased quickly over the course of the phase. Mark's data (Figure 11) were similar to that of Erica's data (Figure 9), except that Mark engaged in sustained responding in both the S-Delta condition and SD condition. Thus, Mark's data do not clearly depict a vicarious reinforcement effect influenced by stimulus control by a reinforced model; his responding continued to occur without direct reinforcement in the presence and absence of a reinforced model. However, his responding was more likely to occur when the model was responding than when the model was not responding (baseline phase preceding the final VSR- phase). Mark's escape responding may suggest that his behavior was largely influenced by the model's behavior per se, which may be indicative of imitation. Because Mark engaged in responding across conditions, it is unclear the extent to which the reinforcement contingency arranged for the model in the VSR- SD condition influenced his responding. Similar to her responding in the initial VSR- phases, Sara (Figure 13) continued to engage in escape responding across conditions in the final VSR- test phase again showing an imitative pattern of responding. Sara's data suggest that although the task was aversive as demonstrated in the discrimination training phase, a history of direct differential reinforcement was not sufficient to establish a vicarious negative reinforcement effect.

Ivy (Figure 14) is the only participant who showed a vicarious negative reinforcement effect without a history of direct reinforcement. During baseline, Ivy engaged in overall low levels of responding across conditions. Upon introduction of the VSR- phase, Ivy began to engage in escape responding only during the SD condition; however, her responding decreased over the course of the phase. Following baseline in which zero levels of responding occurred, the VSR- phase was reinstated and escape responding began to emerge in the SD condition. Overall, low levels of responding occurred in the S-Delta condition. This pattern of responding suggested that the discriminative properties of reinforcer delivery (i.e., escape) to the model influenced Ivy's escape responding despite the fact that escape was never provided. To ensure that Ivy's responding was a function of observing differential negative reinforcement delivered to the model (rather than some other stimulus feature of the SD condition), a contingency reversal was conducted in which the contingencies of the SD condition were arranged in the S-Delta condition and vise versa. Ivy continued to show higher levels of escape responding in the SD condition relative to the S-Delta condition further suggesting that Ivy's behavior was sensitive to the escape contingency arranged for the model. Although we observed a vicarious reinforcement effect prior to a history of direct reinforcement, we were interested in evaluating whether a direct reinforcement effect would be observed. Following baseline, discrimination training was conducted, and Ivy showed variable and undifferentiated responding across the SD and S-Delta conditions, demonstrating the absence of a direct negative reinforcement effect. Like Emma, because undifferentiated responding was observed, we ended the evaluation.

Figures 15 and 16 depict the mean percentages of problem behavior and negative vocalizations, respectively. Graphing conventions are the same as Study 1. Similar to that of Study 1, low levels of problem behavior were observed across phases and observers (with the exception of Luke). However, individual patterns differed across some observers. Luke engaged in more problem behavior in the VSR- phases and in the S-Delta condition in the discrimination training phase (DT SDELTA). Although occurring at a very low percentage, Erica engaged in problem behavior only in the VSR- phase. Upon further analysis of Erica's data, she only engaged in problem behavior in the final VSR- phase (following a history of reinforcement). Thus, the emergence of problem behavior may have been due to extinction. Mark engaged in more problem behavior during baseline and discrimination training. Interestingly, Mark's problem behavior began to emerge during the discrimination training phase. Anecdotally, it appeared that once he contacted the consequence that no differential consequences occurred following problem behavior, an increase was observed. However, low levels of problem behavior were observed at the end of baseline and during the final VSR- phase.

Negligible differences in negative vocalizations during Study 2 were observed, with the exception of Erica. Similar to her problem behavior, a higher level of negative vocalizations occurred in the VSR- SD condition following a history of direct reinforcement. Furthermore, the second SD session in the final VSR- phase was terminated early due to her meeting the session termination criterion (i.e., 10 consecutive s of emotional responding). Thus, her data suggest that vicarious reinforcement procedures, especially following a history of direct reinforcement, may have been aversive. Luke, Ivy, Emma, and Sara engaged in low to zero levels of negative vocalizations. Mark engaged in negative vocalizations across all conditions, albeit at low levels. As such, his data do not permit a clear understanding of the variables likely influencing his negative vocalizations.

In summary, results from Study 2 replicate findings from Study 1 regarding the role of stimulus control in vicarious negative reinforcement effects. That is, all but one observer showed the absence of a vicarious negative reinforcement effect prior to a history of direct reinforcement. During discrimination training, in which observers were provided a history of direct reinforcement in the presence of one stimulus (reinforced model) but not another stimulus (nonreinforced model), 4 of 6 observers showed a direct negative reinforcement effect, and 2 observers (Emma and Ivy) showed undifferentiated responding in discrimination training such that their evaluation ended. Following discrimination training, 2 (Erica and Luke) of these 4 observers showed a vicarious reinforcement effect influenced by stimulus control. That is, Erica and Luke continued to respond without direct reinforcement but only in the presence of the stimulus (reinforced model) that was correlated with reinforcement. Mark's responding in the final VSR- phase appeared to be largely influenced by the model's escape responding (unlike Mark's initial responding in the VSR- phase) and Sara showed an imitative pattern of responding during all VSR- phases regardless of the contingencies arranged for the model. Ivy's pattern of responding is interesting as she showed a vicarious reinforcement effect in the initial evaluation (i.e., prior to a history of direct negative reinforcement), however, we were unable to demonstrate a direct negative reinforcement effect. A few possibilities may account for this pattern of responding. As stated above, the only time that pre-session rules were provided was during discrimination training. Potentially, these rules influenced her responding within session; however, it is unclear what specific features of the rules would influence such variable and undifferentiated response patterns. Or, Ivy may have been responding to self-derived rules such that she was responding to the rules, rather than the arranged contingencies. Another interpretation based on her pattern of responding during discrimination training is that the button press became automatically reinforcing. That is, hitting the button produced the reinforcer. This interpretation, however, is limited in that her responding in the first four phases does not indicate that the button press functioned as an automatic reinforcer. Thus, the variables influencing Ivy's responding are unclear such that conclusions remain tentative. Finally, similar to Study 1, results showed that problem behavior and negative vocalizations occurred at low levels across all conditions. However, data from some participants (Erica and Luke) lend further support to the hypothesis that vicarious reinforcement arrangements may be aversive. Therefore, Study 3 was aimed at addressing this question.

Study 3: Aversive Properties of Vicarious Positive Reinforcement

The purpose of Study 3 was to assess whether vicarious reinforcement contingencies are aversive. Although relatively similar levels of problem behavior and negative vocalizations occurred during Study 1 (positive reinforcement) and Study 2 (negative reinforcement), we used a vicarious positive reinforcement arrangement during Study 3 because (a) previous research that has reported problem behavior and negative vocalizations all evaluated vicarious *positive* reinforcement, and (b) we were unable to demonstrate a direct negative reinforcement effect for 2 of 6 participants in Study 2, whereas a direct positive reinforcement effect was demonstrate for all 6 participants in Study 1. Specifically, we were interested in identifying the conditions under which the observer is more likely to terminate the positive reinforcement contingency for the model.

Preference Assessments

Prior to the start of the study, preference assessments were conducted with observers using the same procedures and IOA methods described in Study 1 to identify highly preferred edibles and a target and control task. First, a paired-choice preference assessment (Fisher et al., 1992) was conducted to identify highly preferred edible items for use as reinforcers during experimental conditions. A second, independent data collector collected data on 100% of trials. IOA averaged 100%.

Second, for all experimental conditions, it was possible that observers might engage in the target response (even in baseline) simply because there was no other activities available during session. Therefore, a moderately preferred activity was available throughout each session as a control procedure. A free-operant preference assessment (Roane, Vollmer, Ringdahl, & Marcus, 1998) was conducted to identify this "control activity", as well as to aid in selecting the target task for use as the target response. Target task activities were selected that were associated with a low, but not zero, levels of responding (i.e., activity that the observer can do but is unlikely to do in the absence of reinforcement). A second, independent data collector collected data on 44% of sessions for the control task, and 67% of sessions for the target task. Interobserver agreement was calculated by dividing each 5-min session into 5-s intervals and comparing the records of two data collectors on an interval-by-interval basis. The number of agreement intervals was divided by the number of agreement and disagreement intervals and multiplied by 100% to obtain the agreement coefficient. IOA averaged 93%, with a range of 87%-98%, for the control task and averaged 96%, with a range of 93%-98%, for the target task.

Response Measurement, Interobserver Agreement, and Procedural Integrity

The dependent variable was completion of the target task identified via the free operant preference assessment. For all 3 participants (Luke, Catie, and Erica), the target task was placing laminated paper discs on a dowel rod. Frequency of target task completion by both model and observer was recorded. Data also were collected on the termination (escape) response (i.e., placing hand on “STOP” card that terminated the model’s reinforcement contingency). The frequency of the termination response was recorded for the observer. Finally, data were collected on problem behavior and negative vocalizations as previously described in Study 1. As a measure of procedural integrity, data collectors recorded the frequency of reinforcer delivery and removal of the reinforcer (i.e., removal of the model’s reinforcer contingent upon the observer hitting the STOP card).

Interobserver agreement and procedural integrity were assessed according to the same methods as Study 1. Interobserver agreement was assessed by having a second data collector record engagement with the above-described responses simultaneously, but independently on an average of 34% of the sessions. IOA averaged 94% (range, 82%-100%) and 96% (range, 79%-

100%) for engagement with the target task for the model and observer, respectively. IOA averaged 99% (range, 93%-100%) for the termination (escape) response for the observer. Finally, IOA averaged 98% (range, 77%-100%) and 97% (range, 70%-100%) for problem behavior and negative vocalizations, respectively. Procedural integrity data were collected during 70% of total sessions. Procedural integrity for correct implementation of observer contingencies averaged 99% (range, 89% to 100%) and for model contingencies averaged 99% (range, 92%-100%).

Experimental Conditions

Each experimental condition was paired with uniquely colored stimuli to enhance discrimination across conditions. Specifically, each condition was conducted in a different colored session room with matching colored target task materials. The target task (i.e., task the produced the edible), control activity (i.e., moderately preferred toy), and the “STOP” card (i.e., stimulus that terminated the reinforcement contingency for the model) were present across all experimental conditions; however, only the observer had access to the “STOP” card (i.e., it was taped to the table in front of the observer). The observer and model each had their own, but identical edible that was placed across from them. Besides Baseline 1, the model was instructed to engage in the target task via the bug-in-the-ear device approximately once every 15 s.

Baseline 1. The model was instructed to not engage in the target task. No programmed consequences were delivered to the model or observer for engaging with the target task. If the observer touched the “STOP” card, the experimenter briefly said, “Not now.” This was done such that we were not ignoring the children’s responding. This condition was conducted to assess whether the observer would engage in the target response without any programmed consequences.

Baseline 2 (imitation test). Baseline 2 was identical to baseline 1 except that the model was prompted every 15 s to engage with the target task. This condition was conducted to assess whether the observer would imitate the model's behavior (i.e., engage in the target response) in the absence of direct or vicarious reinforcement contingencies.

Vicarious Reinforcement (VSR+). Model responses for engagement with the target task resulted in the reinforcer on a FR-1 schedule of reinforcement; no consequences were delivered for observer target responses. If the observer touched the "STOP" card, the experimenter said, "Not now." This phase was conducted to provide the observer with a history of observing the model's behavior being reinforced and observe whether problem behavior and negative vocalizations would occur.

Escape (Model Reinforcer Removal). This phase directly evaluated the extent to which the observer would terminate the reinforcement contingency for the model under conditions of vicarious and direct reinforcement.

Vicarious Reinforcement + Escape (VSR + Escape). Prior to the start of session, the observer was exposed to the session contingencies. That is, the experimenter prompted the observer to emit the target response and touch the "STOP" card. When the observer emitted the target response the experimenter stated, "When you stack, nothing happens" and when the observer hit the "STOP" card the experimenter removed the model's edibles from the table and said, "When you hit the "STOP" card, (model's name) doesn't get any treats." The experimenter prompted the observer to do this three times before the session started. Model responses for engagement with the target task resulted in the reinforcer on a FR-1 schedule of reinforcement; no consequences were delivered for observer target responses. However, if the observer touched the “STOP” card, the model’s reinforcer was temporarily terminated for 15 s in which the experimenter said, “Okay, (model’s name) doesn’t get any right now.”

Direct Reinforcement + Escape (SR+ Escape). Prior to the start of the session, the observer was exposed to the session contingencies in an identical manner as the vicarious reinforcement + escape condition. However, when the observer was prompted to stack, an edible was delivered and the experimenter said, “When you stack, you get a treat.” This condition was identical to the vicarious reinforcement + escape condition with one exception. Observer responses for engagement with the target task resulted in the reinforcer on a FR-1 schedule of reinforcement.

Results and Discussion

Figures 17 to 19 depict the results for Luke, Catie, and Erica. The top panel in each graph depicts the rate of escape (i.e., observer hitting the STOP card to terminate the model’s reinforcement contingency). The second and third panels depict the percentages of problem behavior and negative vocalizations, respectively. The bottom two panels depict the rate of engagement with the target task (i.e., task that produces the reinforcer) for the observer (4^{th} panel) and model (bottom panel). Asterisks above sessions represent sessions in which observers met session termination criterion (10 consecutive s of emotional responding). Table 4 summarizes the results for all participants.

During baseline, Luke (Figure 17) did not engage in the escape response, engaged in zero to low levels of problem behavior and negative vocalizations, and engaged in zero levels of responding with the target task. During the imitation test, Luke engaged in zero to low levels of responding despite the fact that the model continued to engage with the target task suggesting that Luke did not do the target task simply because he observed the model doing it. During the

VSR+ phase in which the reinforcer was only delivered to the model for engaging with the target task, Luke continued to not engage in the escape response. Luke showed low levels of problem behavior that slightly increased at the end of the phase, and he showed increase in negative vocalizations that decreased over the phase. Luke initially engaged in the target task but his responding decreased to zero for the duration of the phase. During the Escape phase in which hitting the "STOP" card produced removal of the model's reinforcer for 15 s, Luke showed differentiated escape responding across the VSR + Escape and SR + Escape conditions in which he terminated the model's reinforcer more often in the VSR + Escape condition in which his responding to the target task resulted in no reinforcer as compared to the SR + Escape condition in which his responding to the target task resulted in the reinforcer. Additionally, Luke showed low levels of problem behavior in the VSR + Escape condition and no problem behavior in the SR + Escape condition. Luke did not engage in any negative vocalizations across these conditions. Luke showed a differentiated pattern of responding with respect to the target task in which higher levels of responding occurred in the SR + Escape condition compared to the VSR + Escape condition suggesting that his behavior was sensitive to direct reinforcement. For further experimental control over the independent variable, we returned to the VSR+ phase and Escape phase and replicated the findings. Taken together, Luke's data suggest that the vicarious reinforcement contingency arranged for the model was likely aversive such that he was more willing to terminate the model's contingency in the condition in which his behavior resulted in extinction (VSR+ + Escape condition).

Catie (Figure 18) showed a slightly different pattern of responding. During baseline Catie engaged in zero to low levels of responding for each dependent variable. Upon introduction of the VSR+ phase, the first three sessions were terminated due to Catie meeting the session termination criterion due to 10 consecutive s of whining and crying. During the last three sessions in this phase, Catie did not meet the session termination criterion; however, she continued to engage in negative vocalizations. Rate of responding to the target task decreased over the phase and she never engaged in the escape response. When the Escape phase was introduced, Catie engaged in escape responding across conditions. That is, Catie terminated the model's reinforcement contingency when Catie did (SR+ + Escape) and did not (VSR+ + Escape) receive the edible reinforcer for engaging in the target task. Low levels of problem behavior and negative vocalizations were observed, and she engaged in the target task at much higher levels when her behavior was reinforced. Upon returning to the VSR+ phase, Catie continued to hit the STOP card, albeit at low levels, with the exception of one session in which high levels of responding occurred. Anecdotally, while Catie was hitting the card in this session, she was stating that she was "playing the drums" on the table. An initial increase of problem behavior and negative vocalizations was observed; however, Catie's responding decreased over the course of the phase. This pattern of responding is consistent with previous research showing initial increases in problem behavior that decrease over time (Christy, 1975). Because Catie terminated the model's reinforcer across conditions in the Escape phase, conclusions regarding whether vicarious positive reinforcement was aversive for her remain tentative.

Erica's (Figure 19) pattern of responding suggested that vicarious reinforcement procedures may not necessarily be aversive. Although Erica engaged in a high level of negative vocalizations upon initiating the VSR+ phase such that she met session termination criterion, negative vocalizations decreased to low levels, and she engaged in low levels of problem behavior throughout the phase. With the exception of the first VSR + Escape session in the

Escape phase, Catie did not terminate the model's reinforcer across conditions. Additionally, she did not engage in any problem behavior or negative vocalizations.

In summary, results from Study 3 were idiosyncratic across participants. Luke showed that vicarious reinforcement contingencies are likely aversive whereas Erica showed that they might not be aversive despite high levels of negative vocalizations in the first session of the VSR+ phase. Potentially, not receiving the preferred edible was initially aversive for Erica regardless of whether or not the model received it. Erica's data are interesting because her problem behavior and negative vocalizations suggested that vicarious negative reinforcement was aversive; however, it may be the case that Erica's behavior is less sensitive to vicarious positive reinforcement. Alternatively, the contingencies may, in fact, be aversive but the experimental preparation used in the current study does not capture this effect. Catie's data are more difficult to interpret as she terminated the model's reinforcement regardless if she was receiving the reinforcer or not. However, Catie's emotional responding, may provide further support that that vicarious reinforcement is aversive due to the initially high levels of negative vocalizations in both VSR+ phases. Additionally, because the Escape phase was conducted using a multielement design, the rapid alternation of reinforcement (SR+ + Escape) with no reinforcement (VSR+ + Escape) may have reduced the overall aversiveness of the VSR + ESCAPE condition. However, like Erica, not receiving the edible regardless of whether the model received it may have influenced Catie's levels of problem behavior and negative vocalizations in the VSR+ phases.

General Discussion

The purposes of the current series of studies were to (a) assess vicarious positive and negative reinforcement effects prior to and following a history of direct differential reinforcement, (b) evaluate the role of stimulus control in vicarious positive and negative reinforcement arrangements, and (c) assess the extent to which vicarious reinforcement arrangements are aversive. The results of Studies 1 and 2 support previous research showing that vicarious reinforcement produces temporary effects at best and that a history of direct reinforcement influences vicarious responding (Bol & Steinhauer, 1990; Camp & Iwata, 2009; Christy, 1975; Deguchi, et al., 1988; Ollendick, et al., 1982; Ollendick, et al., 1983; Ollendick & Shapiro, 1984; Weisberg & Clements, 1977). Of 12 participants across Studies 1 and 2, only one participant (Ivy) showed vicarious responding prior to a history of direct reinforcement. These results are not particularly surprising as participants did not have an established history of direct reinforcement for emitting the target response. Furthermore, although initial responding was observed for the majority of participants in the initial VSR+/- phase across conditions in Study 1, and to a lesser extent in Study 2, the extent to which participants were imitating the model's behavior or responding to the discriminative properties of reinforcement delivery is unclear. As such, no definitive conclusions can be made about vicarious reinforcement effects during the initial VSR+/- phases.

Discrimination training was necessary to demonstrate differential response patterns during the final VSR+/- test phase. Following a history of direct reinforcement, vicarious responding was only observed for 4 (Chase, Nell, Erica, and Luke) of 10 participants, and 3 of those 4 participants showed only temporary effects. These data are somewhat inconsistent with Camp and Iwata's (2009) findings from Experiment 1 in that they showed response maintenance following a history of direct reinforcement for 2 of 3 participants. The observation length in the final VSR+/- phase in the current study was almost two to three times longer than Camp and Iwata's such that extended exposure to vicarious reinforcement arrangements may have accounted for the decrease in responding in the current study. Erica (Study 2) is the only participant who showed sustained responding, even with repeated exposure to vicarious reinforcement. Because we conducted the discrimination training phase to stability, the length of Erica's discrimination training phase was almost three times as long as Chase, Nell, and Luke's discrimination training phase. Potentially, Erica's longer history of direct reinforcement increased the strength of escape responding in the final VSR- phase making her responding more resistant to extinction.

Additionally, results from Studies 1 and 2 support and extend previous research with respect to the influence of stimulus control (Bol & Steinhauer, 1990; Broden, et al., 1970; Camp & Iwata, 2009; Christy, 1975; Deguchi, et al., 1988; Kazdin, 1973a, 1973b, 1977). Specifically, Studies 1 and 2 extended Camp and Iwata by (a) assessing vicarious responding prior to a history of reinforcement (b) including typically developing children, (c) assessing negative reinforcement, and (d) changing the experimental design. With respect to the experimental design, we inserted a baseline phase between discrimination training and the test for vicarious reinforcement. Including baseline allowed for a better evaluation of discriminative control of the model's responding and the reinforcer delivery in the final VSR+/- phase because baseline involved the model not engaging in the target response and no reinforcer delivery. Thus, baseline helped ruled out carryover from discrimination training and mere stimulus control, which allowed for a more thorough evaluation of the discriminative properties of the model's behavior and reinforcer delivery. With respect to vicarious negative reinforcement, Study 2 extends the existing literature by showing that observers' responding was sensitive to negative reinforcement arranged for the model, and stimulus control influenced vicarious negative reinforcement effects in the same manner as vicarious positive reinforcement effects. However, some methodological implications of vicarious negative reinforcement are worth noting.

In general, the study of negative reinforcement with young children is difficult in that it implicitly requires the presence of an aversive stimulus event. Thus, our criterion for identifying an aversive stimulus was a low percentage of engagement with an arbitrary task based on results of a free-operant preference assessment. Because we were interested in evaluating vicarious negative reinforcement *prior* to a history of direct reinforcement, an evaluation of vicarious negative reinforcement was particularly difficult in that it was unclear whether the task was actually aversive until escape was directly assessed (discrimination training phase). Thus, one limitation of the Study 2 was the inability to identify aversive tasks for all participants (e.g., Emma and Ivy). Potentially, the free-operant preference assessment was not a sufficient method to use in identifying the aversive stimulus. Results from this assessment showed the *relative* preference of stimuli such that engagement with a particular stimulus was influenced by the other stimuli in the array. Thus, a more appropriate preference assessment method may have been a single-stimulus preference assessment in which each stimulus is assessed in isolation. The results of this preference assessment would yield the absolute, rather than relative, preference, which may be a more sensitive measure to identify an aversive stimulus.

An additional methodological implication of Study 2 is the inclusion of verbal prompts. From the perspective of the observer, verbal prompts were included to further create a "small group" instructional context. For those participants who showed a negative reinforcement effect, it is interesting that they engaged with the aversive stimulus at all. Potentially, one explanation is the influence of instructional control. It is very likely that participants in the current study had a history of complying with adult/teacher instructions, especially because compliance with demands is a skill that is continuously taught in the preschool in which they were enrolled. Given this possibility, the engagement data are somewhat difficult to interpret. However, Erica's engagement data are noteworthy in that large differences in engagement were observed in the initial VSR- phases as compared final VSR- phase. Likely, a history of reinforcement for escape followed by escape (extinction) influenced her levels engagement. That is, because engaging in the escape response no longer produced escape, Erica "escaped" by simply not doing the task.

Study 3 is particularly noteworthy in that, to date, no studies have experimentally evaluated side effects of vicarious positive reinforcement. Thus, Study 3 extends previous literature by establishing an experimental preparation to study side effects commonly reported in the vicarious reinforcement literature. Results of Study 3 demonstrated at least initial empirical support for the hypothesis that vicarious positive reinforcement arrangements are aversive. However, one limitation to Study 3 is that response patterns across participants were idiosyncratic such that general conclusions about the aversiveness of vicarious reinforcement remain tentative. Given that the literature on side effects of vicarious reinforcement is sparse, there are many areas for future research. One area of future research is using the experimental preparation in the current study to evaluate side effects within a vicarious negative reinforcement arrangement. Because problem behavior and negative vocalizations were observed in Study 2, it seems logical to assess side effects in negative reinforcement. Additionally, with respect to Catie's data, the rapid alternation of the SR+ Escape and the VSR + Escape, may have resulted in carryover such that response patterns were influenced by the preceding condition. Thus, future researchers may consider using a reversal design to limit this possibility. Taken together, results from Studies 1-3 provide a more thorough understanding of the influence of stimulus control on vicarious positive and negative vicarious reinforcement effects, and provide initial evidence that vicarious reinforcement can be aversive. However, some additional limitations and suggestions for future research should be noted.

One limitation is the amount of exposure to direct reinforcement (Studies 1 and 2). As mentioned previously, the length of reinforcement history may be particularly influential in establishing or sustaining vicarious responding. Although the length of the phase was determined by response stability, Erica had much more exposure to direct reinforcement, which may have accounted for her sustained responding. Thus, future research should be aimed at evaluating the extent to which different lengths of reinforcement histories influence initial or sustained vicarious responding.

An additional limitation is the schedule of reinforcement used during discrimination training (Studies 1 and 2). In the current study, we used an FR-1 schedule of reinforcement. Given that behavior is more resistant to extinction using intermittent as compared to continuous schedules, initial or sustained vicarious responding may have been observed for those participants who did not show an effect had we used a VR schedule. Camp and Iwata (2009) used a VR-3 schedule and showed sustained responding, and Weisberg and Clements (1977) showed sustained responding using an intermittent schedule (the exact schedule was not described). Thus, it seems prudent to further evaluate the schedules of reinforcement that would produce initial or sustained vicarious responding.

A third limitation is that no assessments of generalization were conducted. Studies 1-3 were conducted in a controlled setting using very specific discriminative stimuli. Although this allowed a thorough evaluation of stimulus control and side effects (and one of the purposes of the study), the extent to which similar patterns of responding would occur in a different setting, with a different response, or with different people are unknown. Because vicarious reinforcement is a procedure that may be useful as a teaching strategy, it is important to demonstrate its effects in the setting in which it's likely to be used. Thus, future research should assess vicarious responding within a controlled context to establish its effects, then program or assess whether those stimuli or responses generalize to a less-controlled environment. Although generalization was not conducted, results of the current study have implications for clinical practice.

Consistent with previous research, results from Studies 1-3 demonstrated the temporary effects of vicarious reinforcement and the importance of a history of reinforcement to establish vicarious responding. As such, it does not seem appropriate to solely recommend using vicarious reinforcement procedures as a teaching strategy. However, as Camp and Iwata (2009) and Deguchi et al., (1988) noted, vicarious reinforcement procedures may be useful in evoking initial responding but responding must be followed by reinforcement such that further responding will continue. Results of Study 3 showed lower levels of problem behavior and negative vocalizations when responding was directly reinforced. Therefore, to reduce the potential side effects of vicarious reinforcement, direct reinforcement should be arranged for observers' responding. Finally, before arranging vicarious reinforcement strategies, a generalized imitative repertoire should be assessed to ensure that the observer is capable of producing behavior similar to that of the model.

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Table 1

Participants' materials and target responses across Studies 1-3

Study	Subject	Target Response	Control Task	Aversive Task	SR+/-
Positive	Chase	Block in bin	Color sorting	N/A	Gummies, Skittles, Cap'n Crunch
	Nell	Stacking	Shape match	N/A	Chips, Cheez-its, Fruit Loops,
	Ben	Stacking	Color sorting	N/A	Pretzel, Cheez-its, Gummies
	Al	Card in box	Shape stack	N/A	Gummies, Smarties, Skittles
	Molly	Stacking	Color sorting	N/A	Cap'n Crunch, Fruit loops, Cinnamon Toast Crunch
	Lynn	Block in bin	Shape match	N/A	Cheez-its, M & Ms, Cinnamon Toast Crunch
Negative	Sara	Card touch	N/A	Lacing	Escape
	Erica	Card touch	N/A	Stacking	Escape
	Mark	Card touch	N/A	Stacking	Escape
	Emma	Card touch	N/A	Stacking	Escape
	Luke	Card touch	N/A	Card in box	Escape
	Ivy	Button press	N/A	Card in box	Escape
Side Effects	Catie	Stacking	Horse	N/A	Raisins, Smarties, Cheese Puffs
	Erica	Stacking	Horse	N/A	Gummies, Mike & Ikes, M & Ms
	Luke	Stacking	Animals	N/A	Kit-Kat, Mike & Ikes, Cheetos

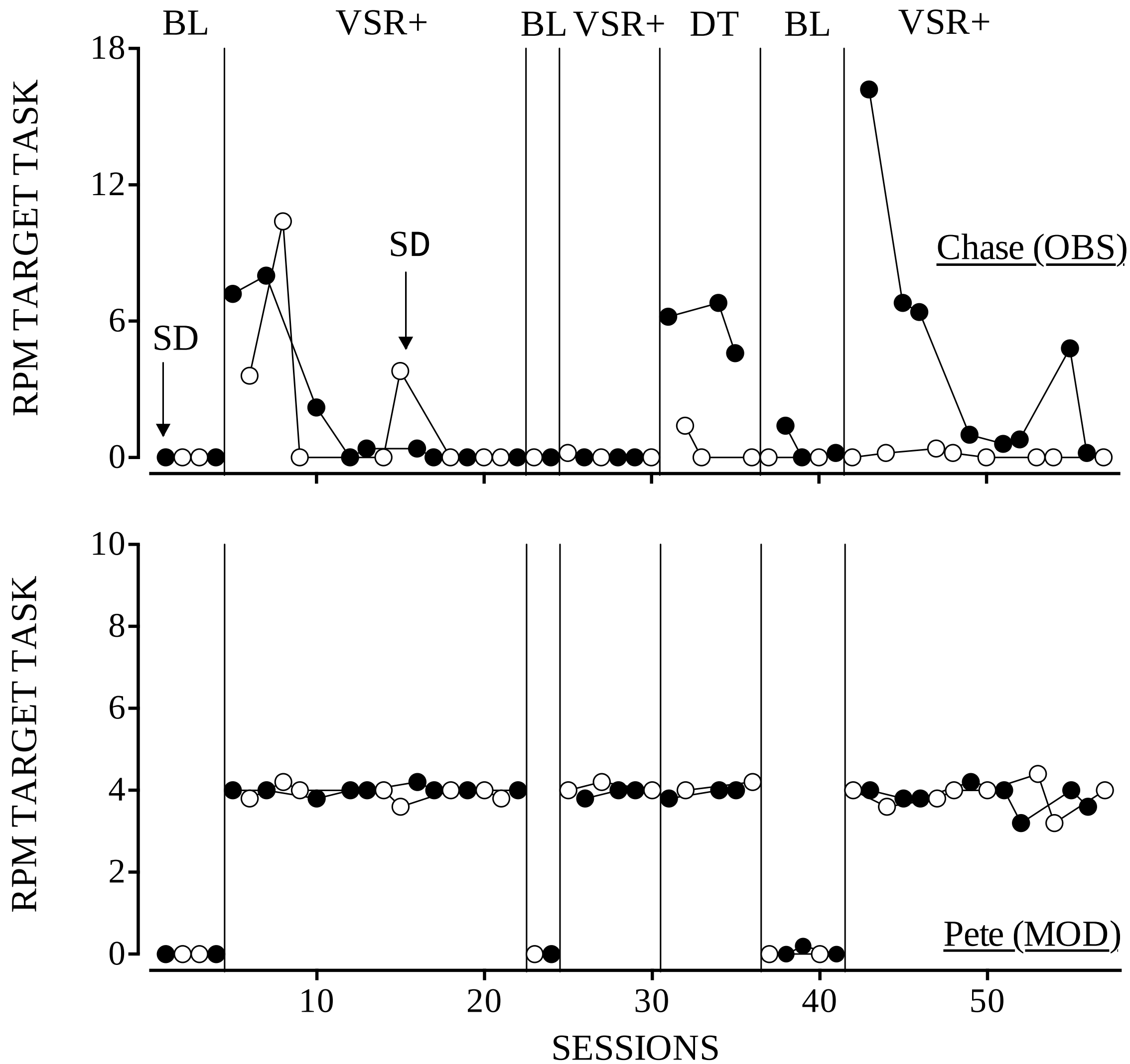

Figure 1. Rate of engagement with the target task across phases and conditions for Chase (observer) and Pete (model).

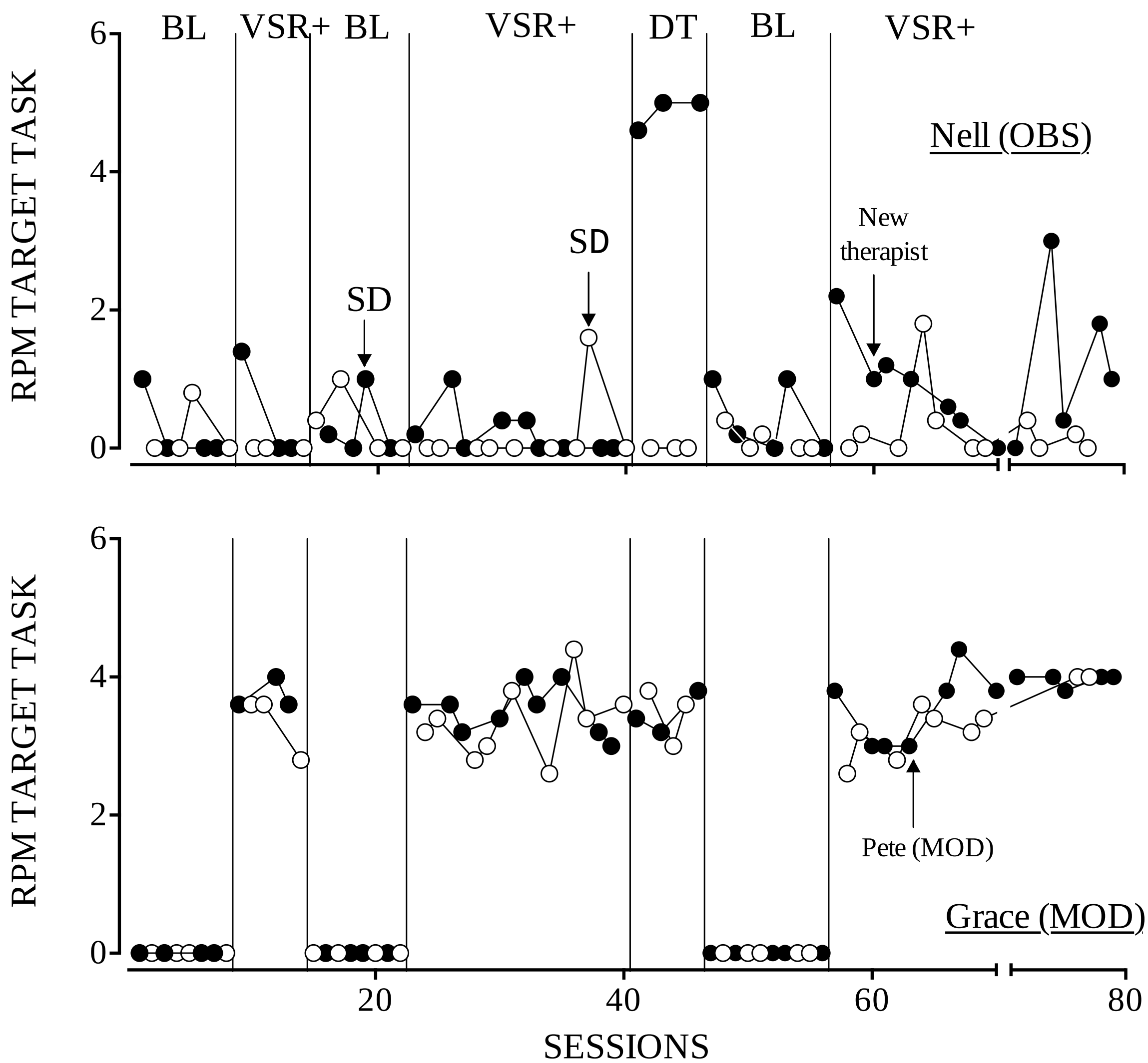

Figure 2. Rate of engagement with the target task across phases and conditions for Nell (observer) and Grace and Pete (models).

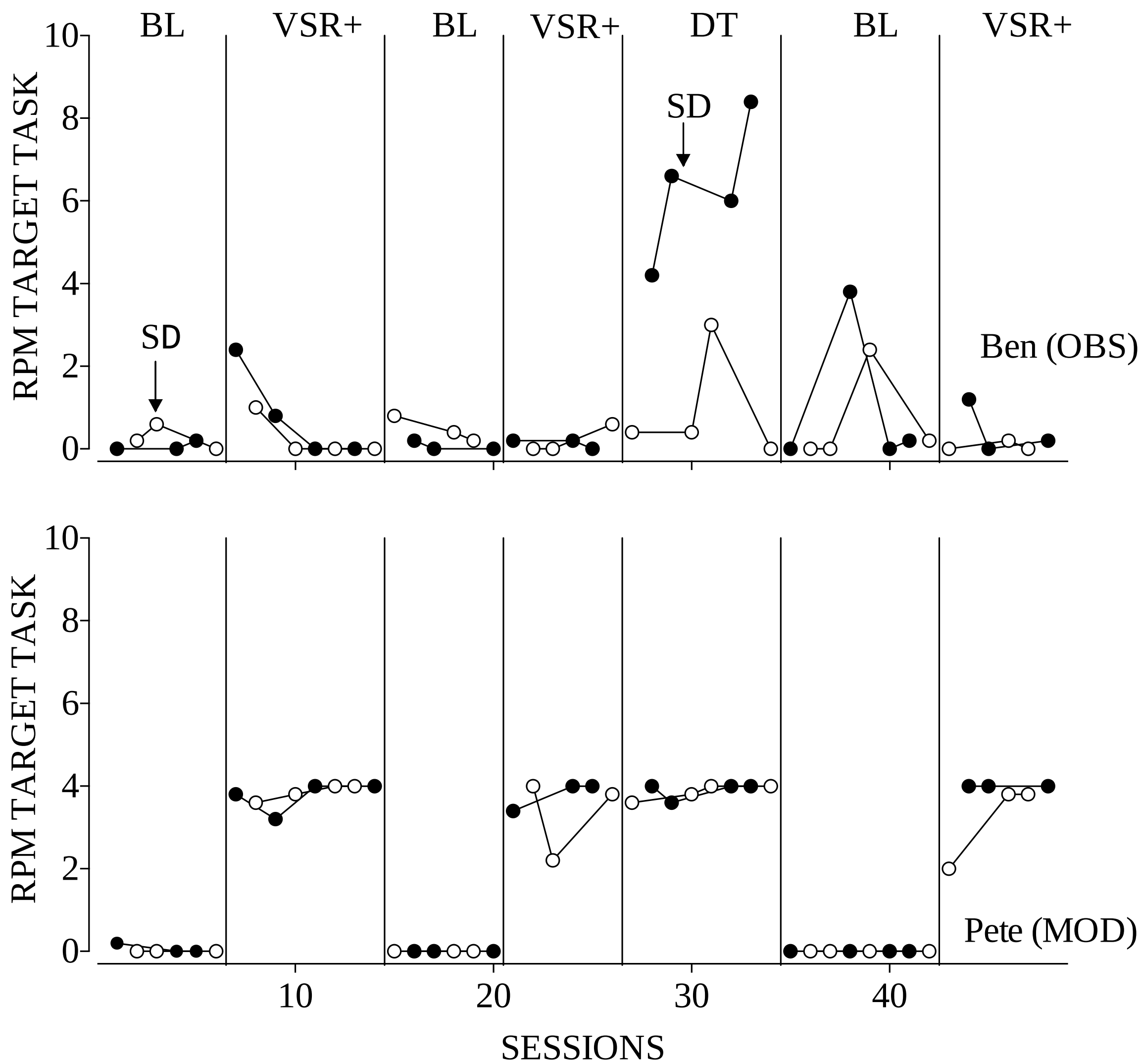

Figure 3. Rate of engagement with the target task across phases and conditions for Ben (observer) and Pete (model).

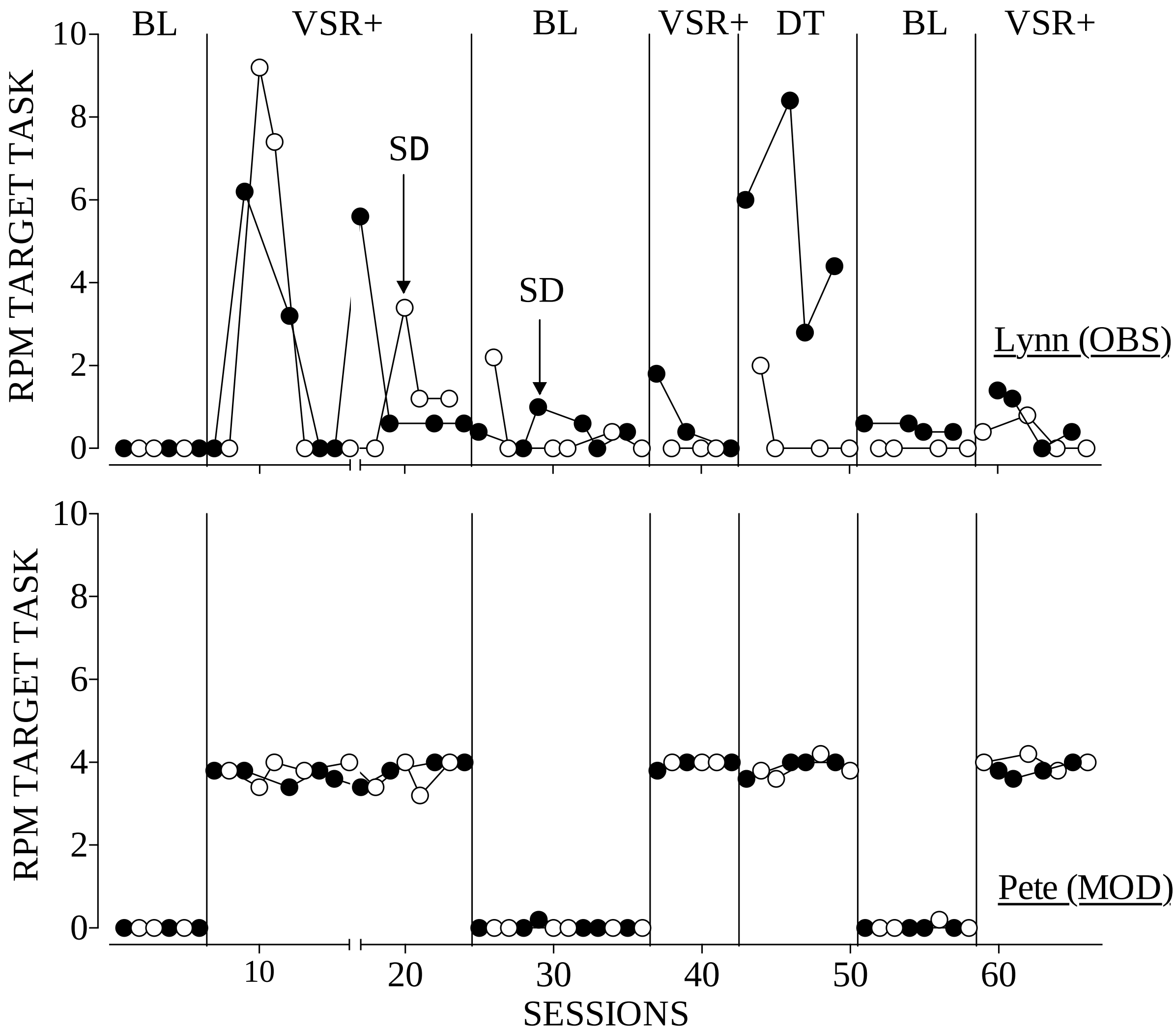

Figure 4. Rate of engagement with the target task across phases and conditions for Lynn (observer) and Pete (model).

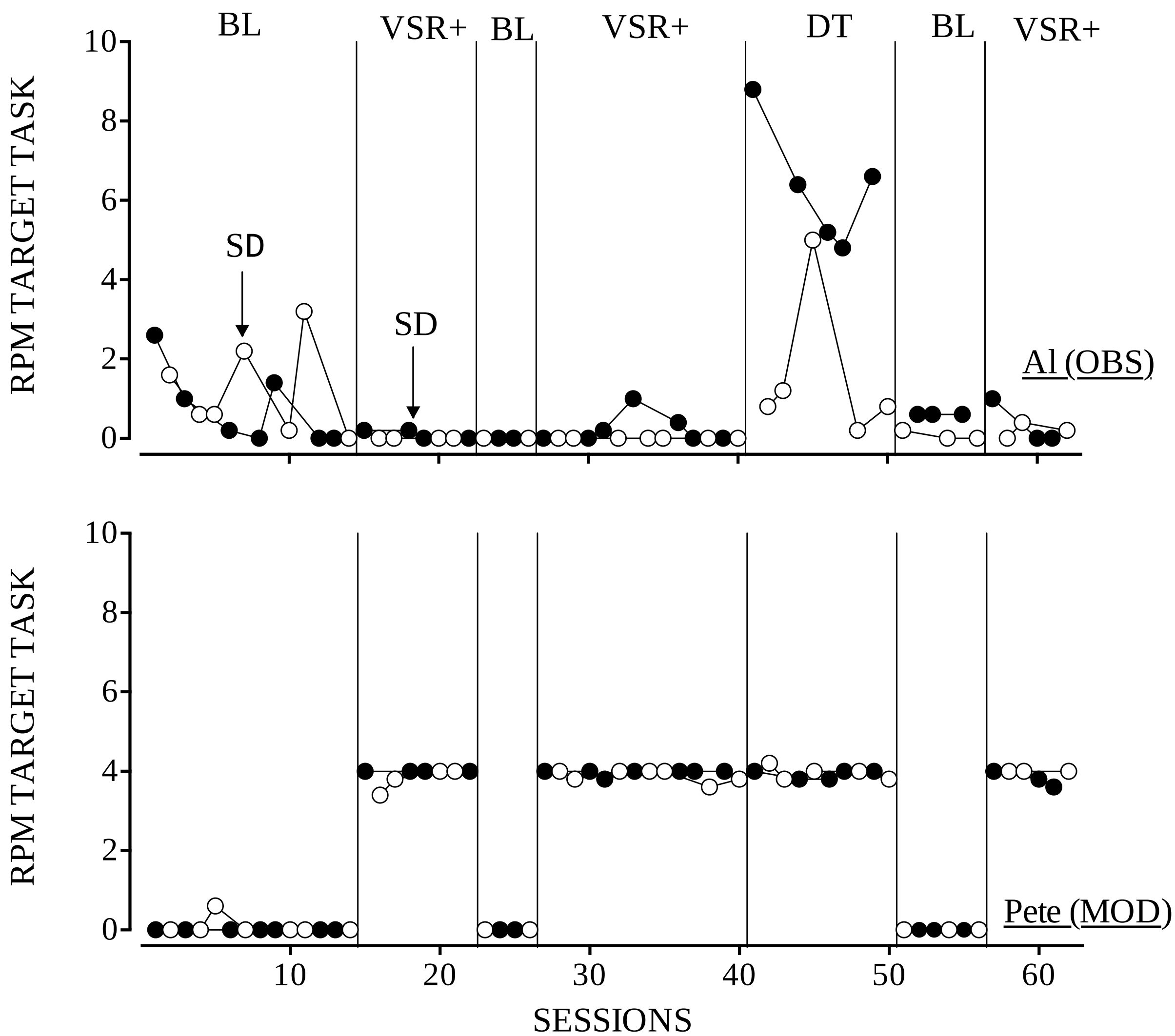

Figure 5. Rate of engagement with the target task across phases and conditions for Al (observer) and Pete (model).

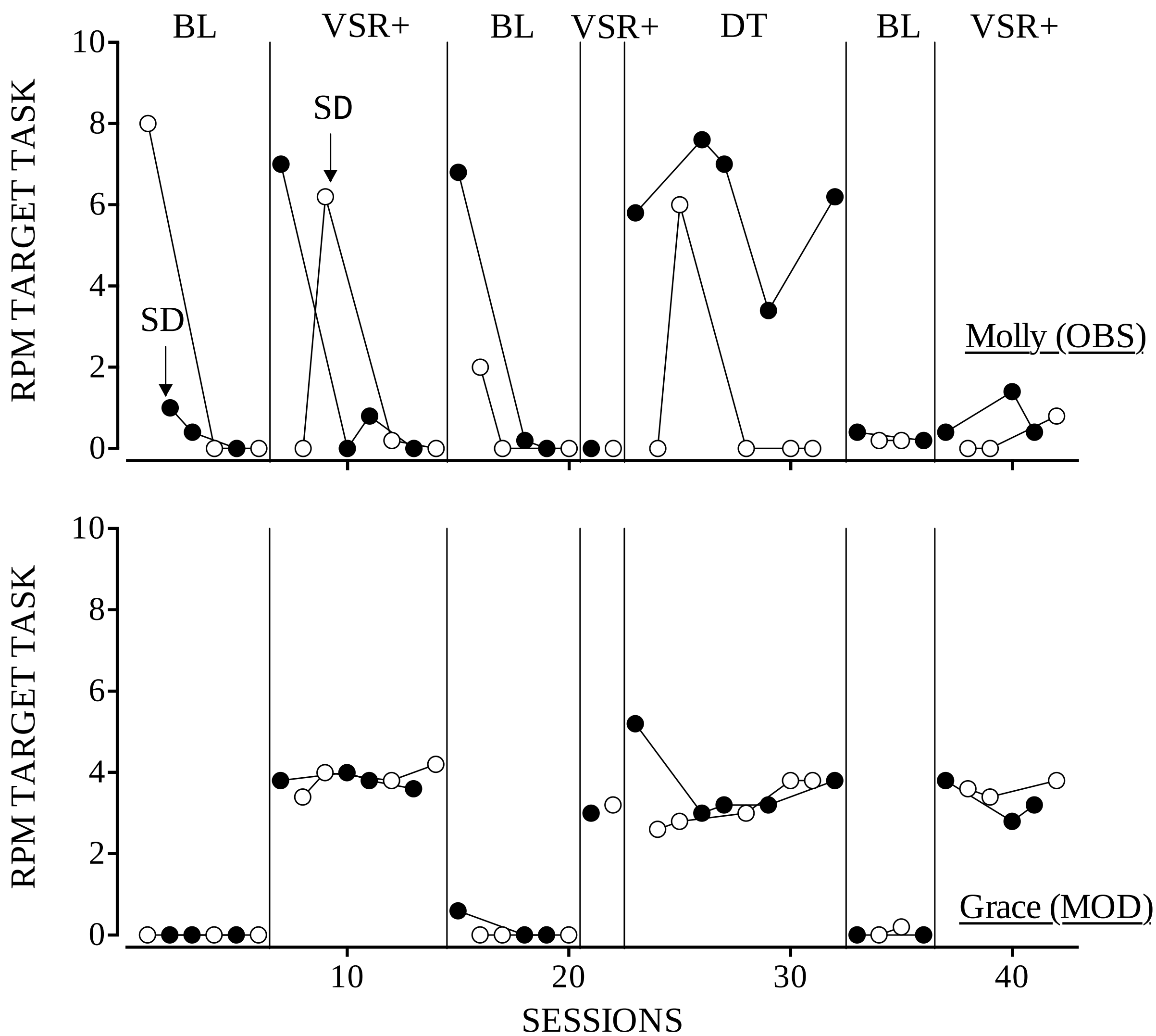

Figure 6. Rate of engagement with the target task across phases and conditions for Molly (observer) and Grace (model).

Table 2

Summary of positive vicarious reinforcement effects prior to and following direct reinforcement

Subject	VSR effect prior to SR?	SR effect?	VSR effect after SR?
Chase	No	Yes	Yes
Nell	No	Yes	Yes
Ben	No	Yes	No
Lynn	No	Yes	No
Al	No	Yes	No
Molly	No	Yes	No
Total	0/6	6/6	2/6

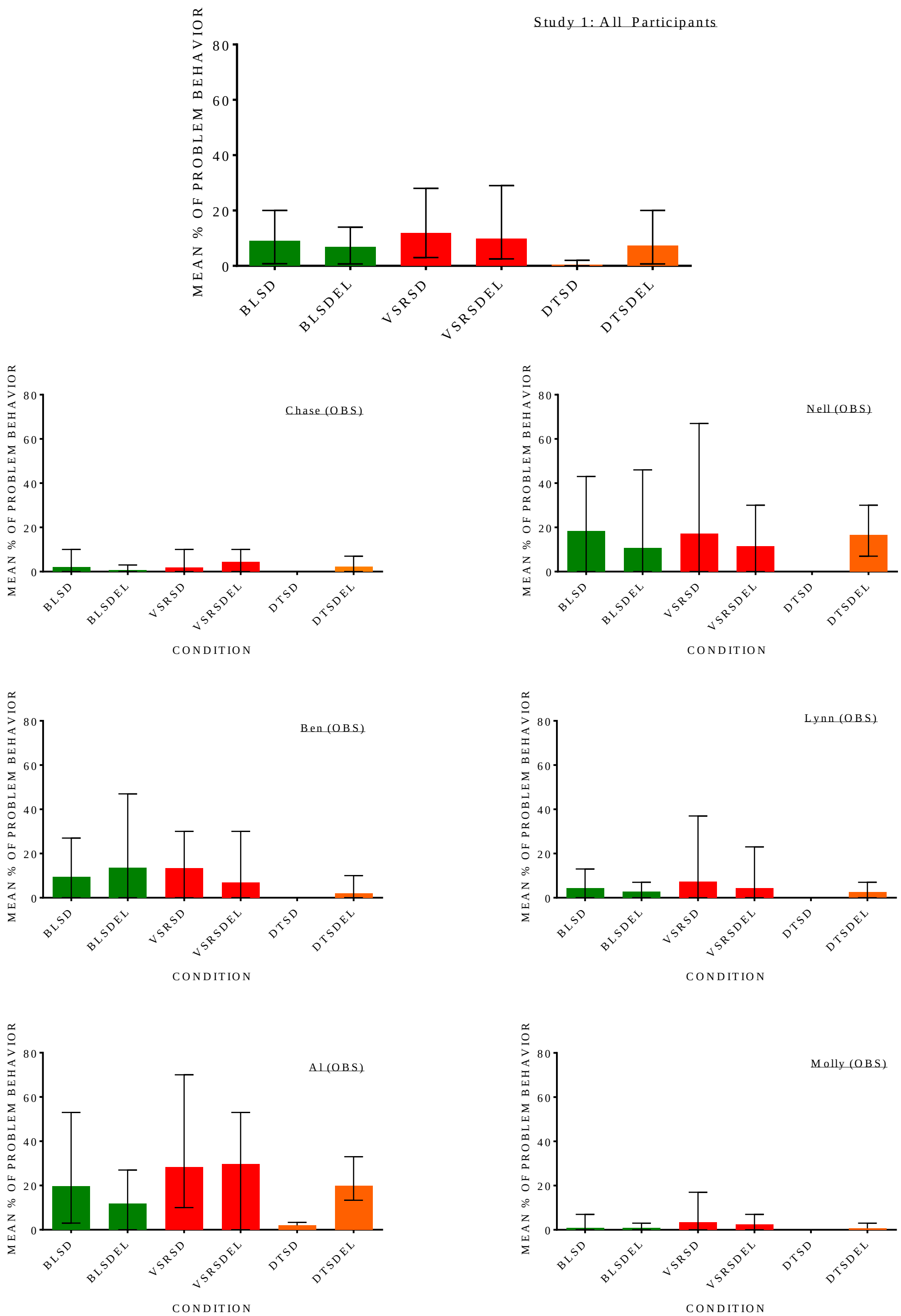

Figure 7. Mean percentage of problem behavior for all participants (top graph) and each individual participant (bottom graphs). Error bars depict the range for each condition.

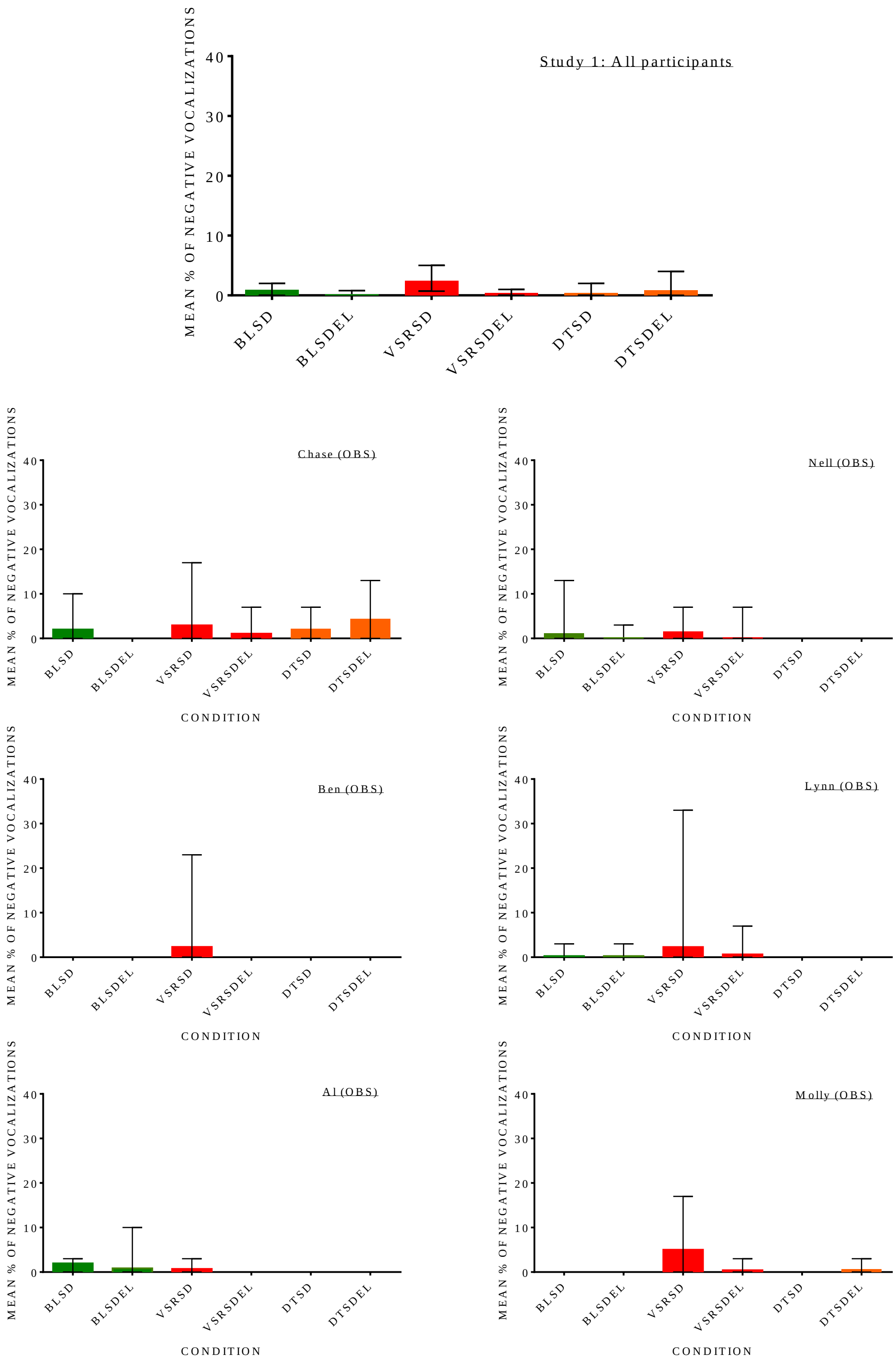

Figure 8. Mean percentage of negative vocalizations for all participants (top graph) and each individual participant (bottom graphs). Error bars depict the range for each condition.

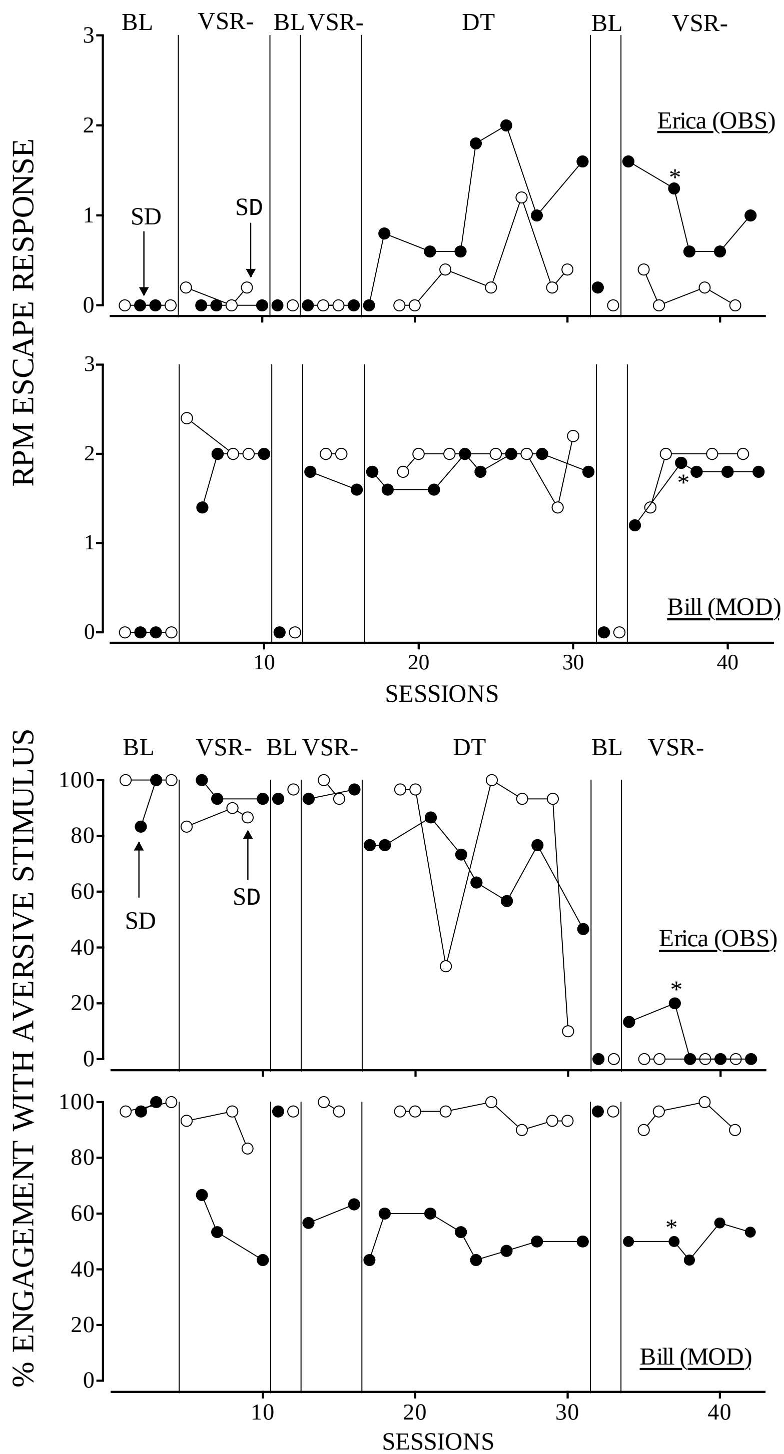

Figure 9. Rate of escape responding (top two graphs) and percentage of engagement with the aversive stimulus (bottom two graphs) across phases and conditions for Erica (observer) and Bill (model). Asterisk denotes session termination.

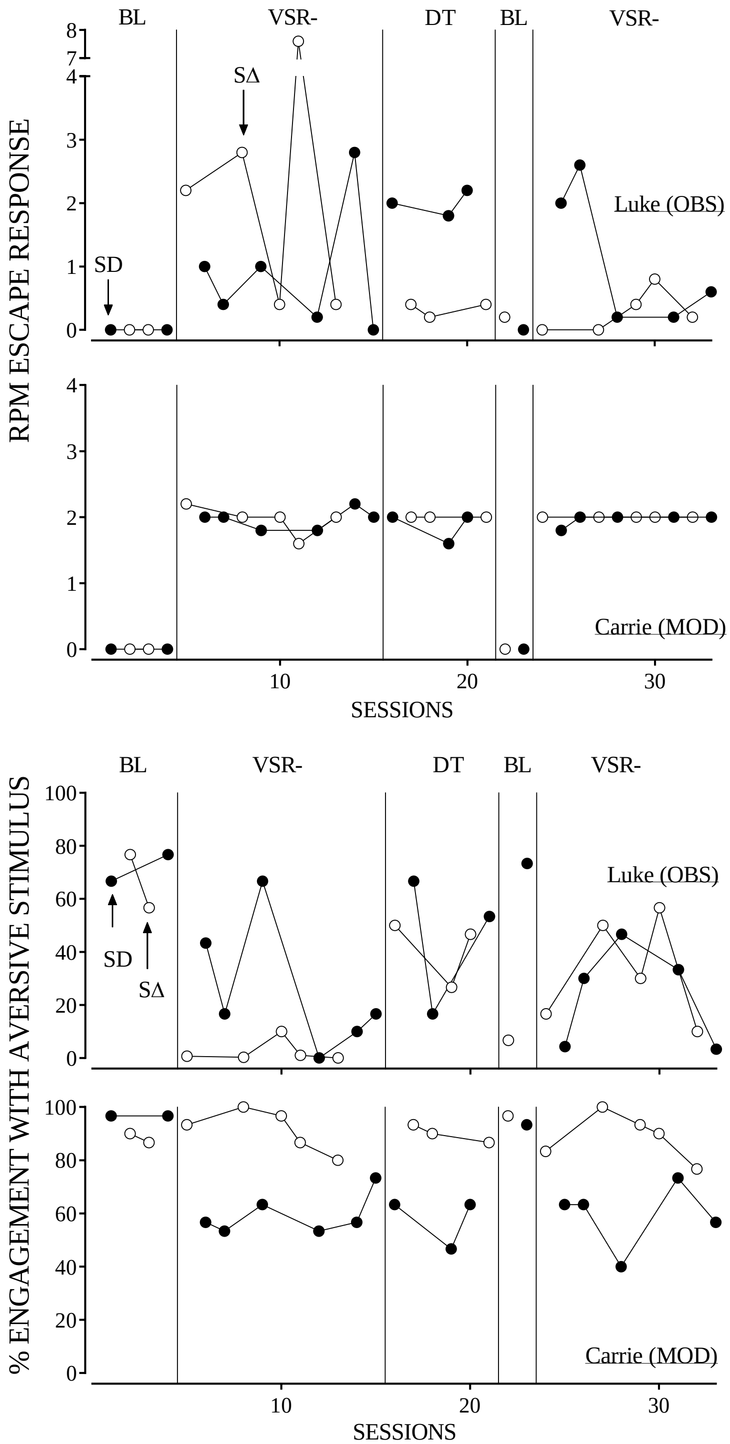

Figure 10. Rate of escape responding (top two graphs) and percentage of engagement with the aversive stimulus (bottom two graphs) across phases and conditions for Luke (observer) and Carrie (model).

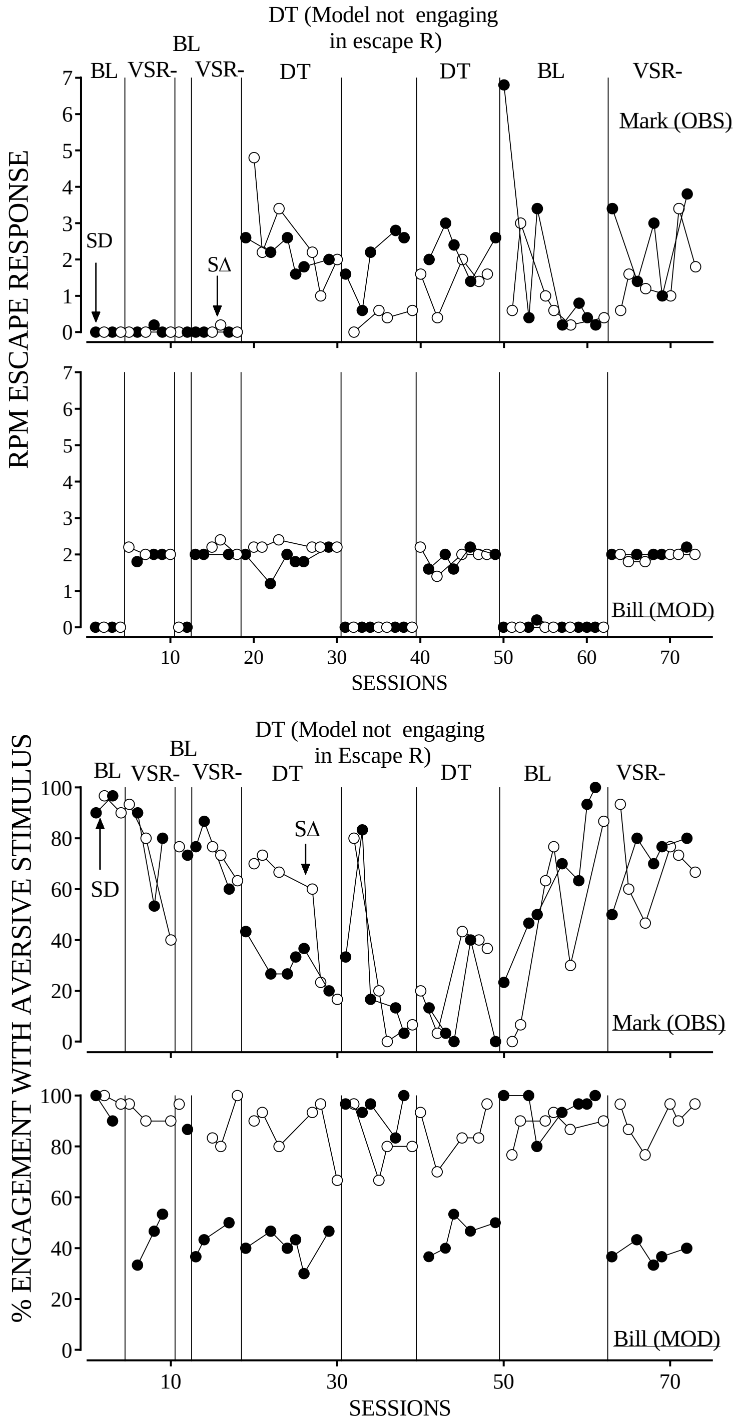

Figure 11. Rate of escape responding (top two graphs) and percentage of engagement with the aversive stimulus (bottom two graphs) across phases and conditions for Mark (observer) and Bill (model).

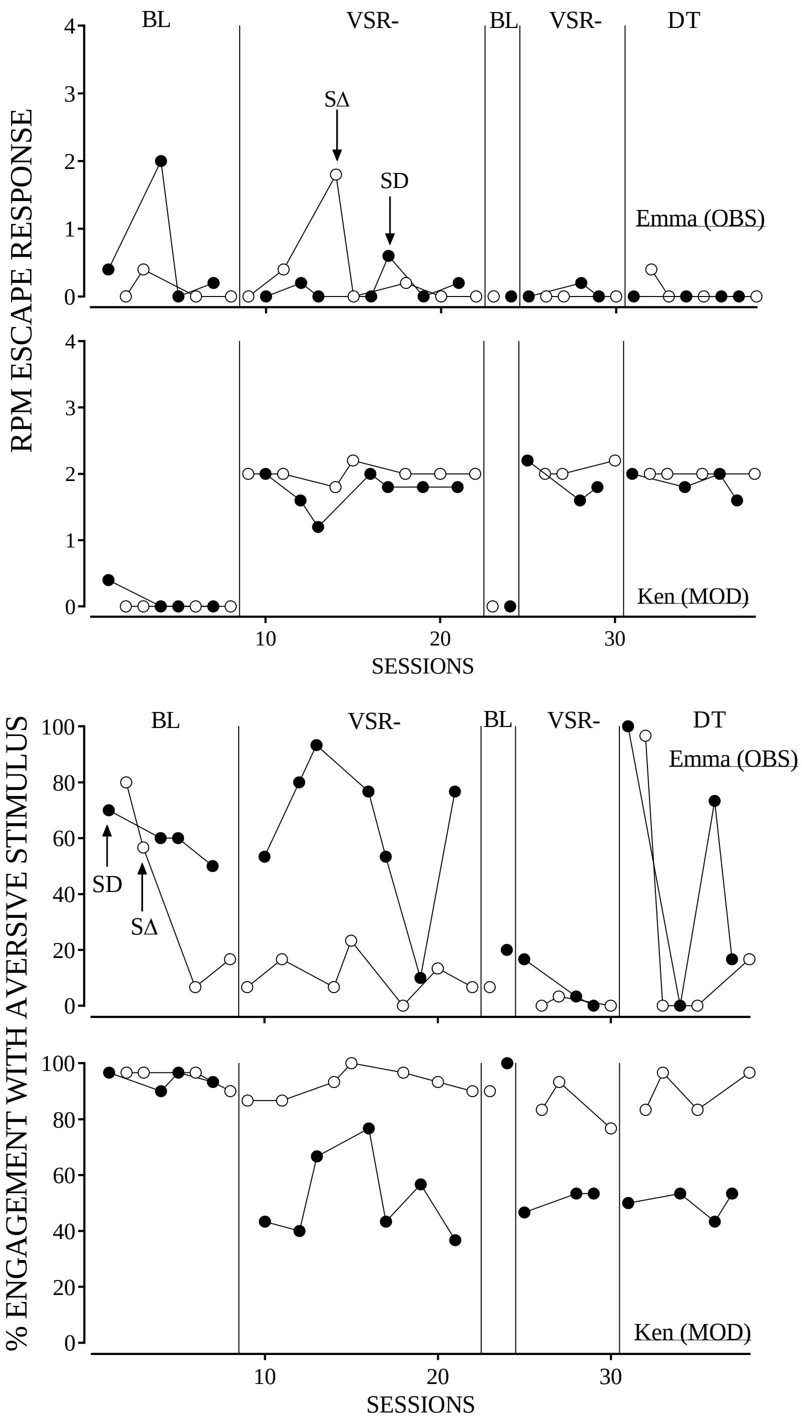

Figure 12. Rate of escape responding (top two graphs) and percentage of engagement with the aversive stimulus (bottom two graphs) across phases and conditions for Emma (observer) and Ken (model).

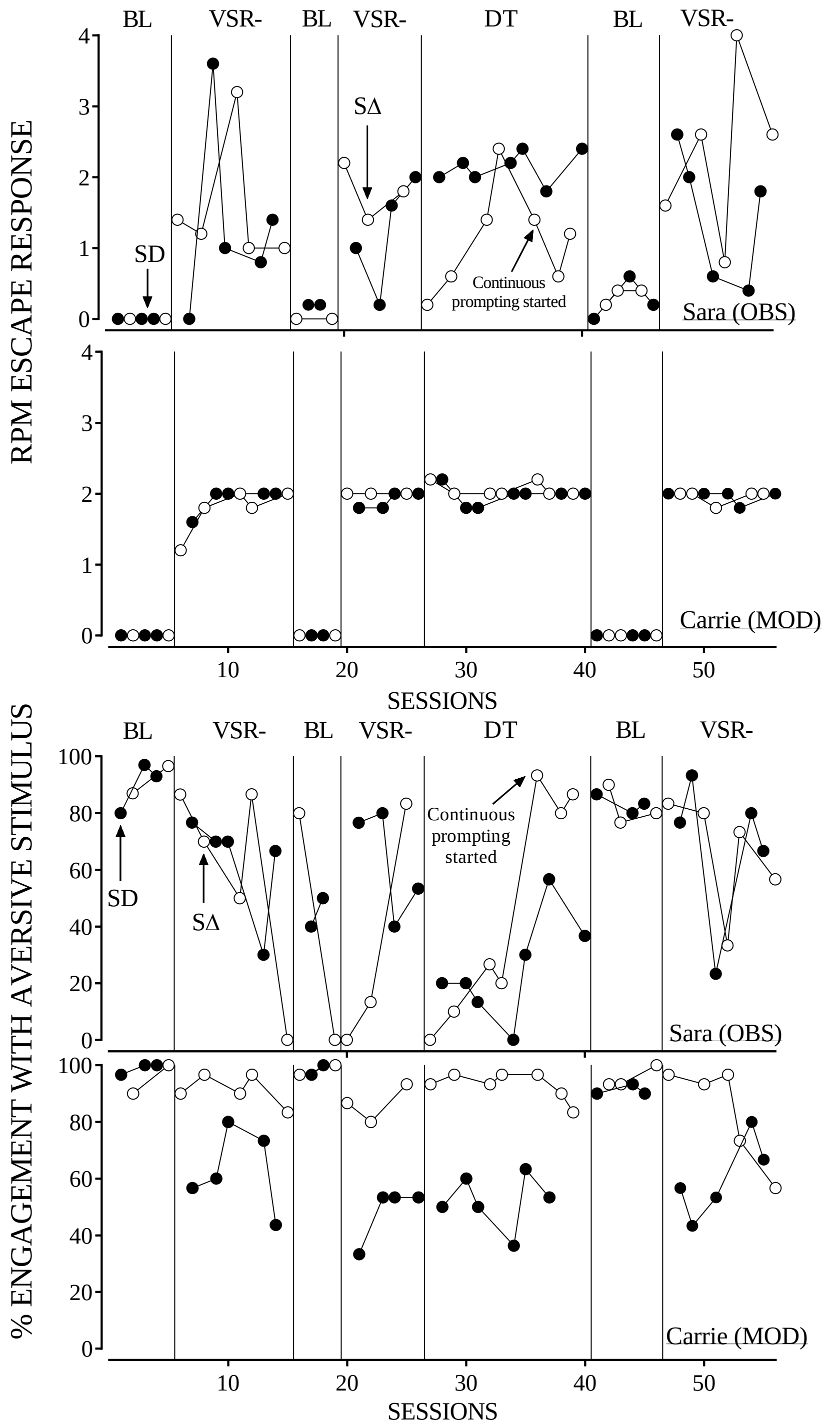

Figure 13. Rate of escape responding (top two graphs) and percentage of engagement with the aversive stimulus (bottom two graphs) across phases and conditions for Sara (observer) and Carrie (model).

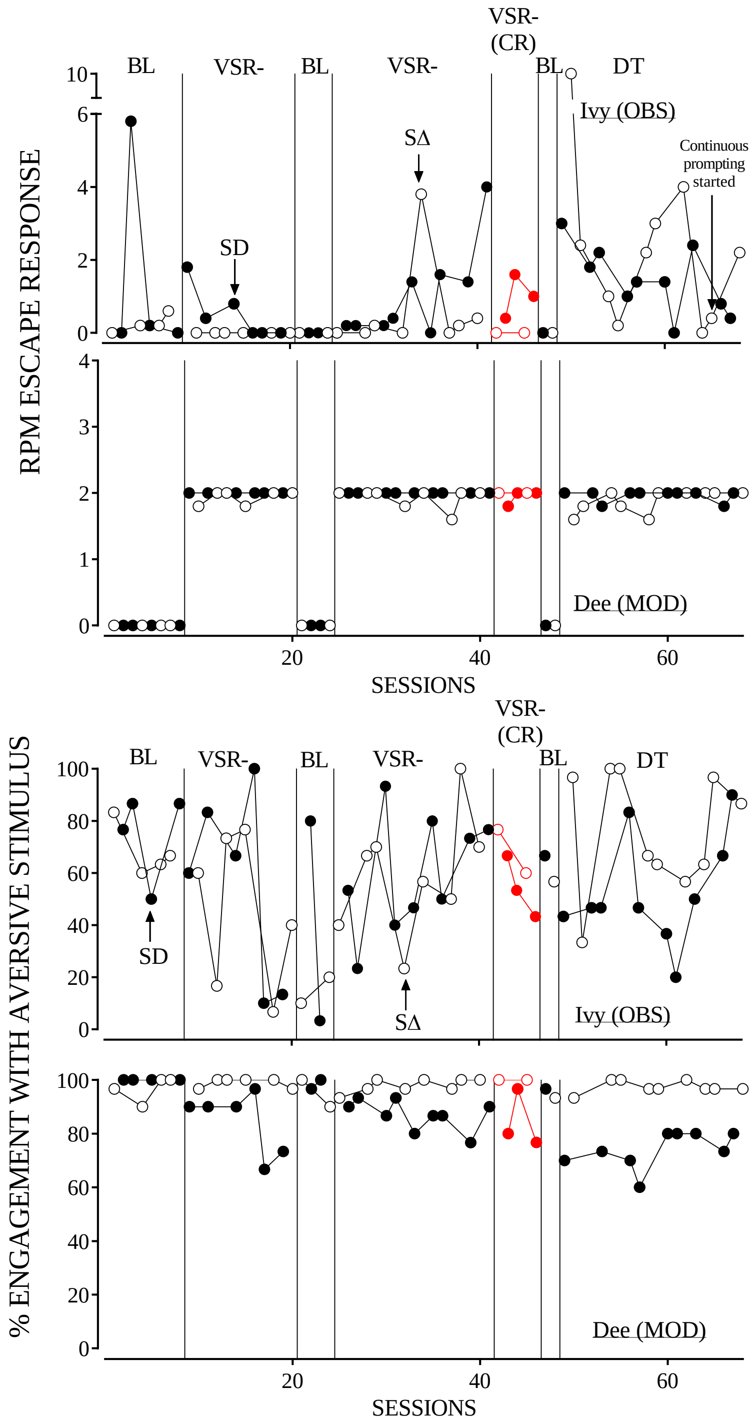

Figure 14. Rate of escape responding (top two graphs) and percentage of engagement with the aversive stimulus (bottom two graphs) across phases and conditions for Ivy (observer) and Dee (model).

Table 3
Summary of vicarious negative reinforcement effects prior to and following direct reinforcement

Subject	VSR effect prior to SR?	SR effect?	VSR effect after SR?
Erica	No	Yes	Yes
Luke	No	Yes	Yes
Mark	No	Yes	No
Emma	No	No	N/A
Sara	No	Yes	No
Ivy	Yes	No	N/A
Total	1/6	4/6	2/4

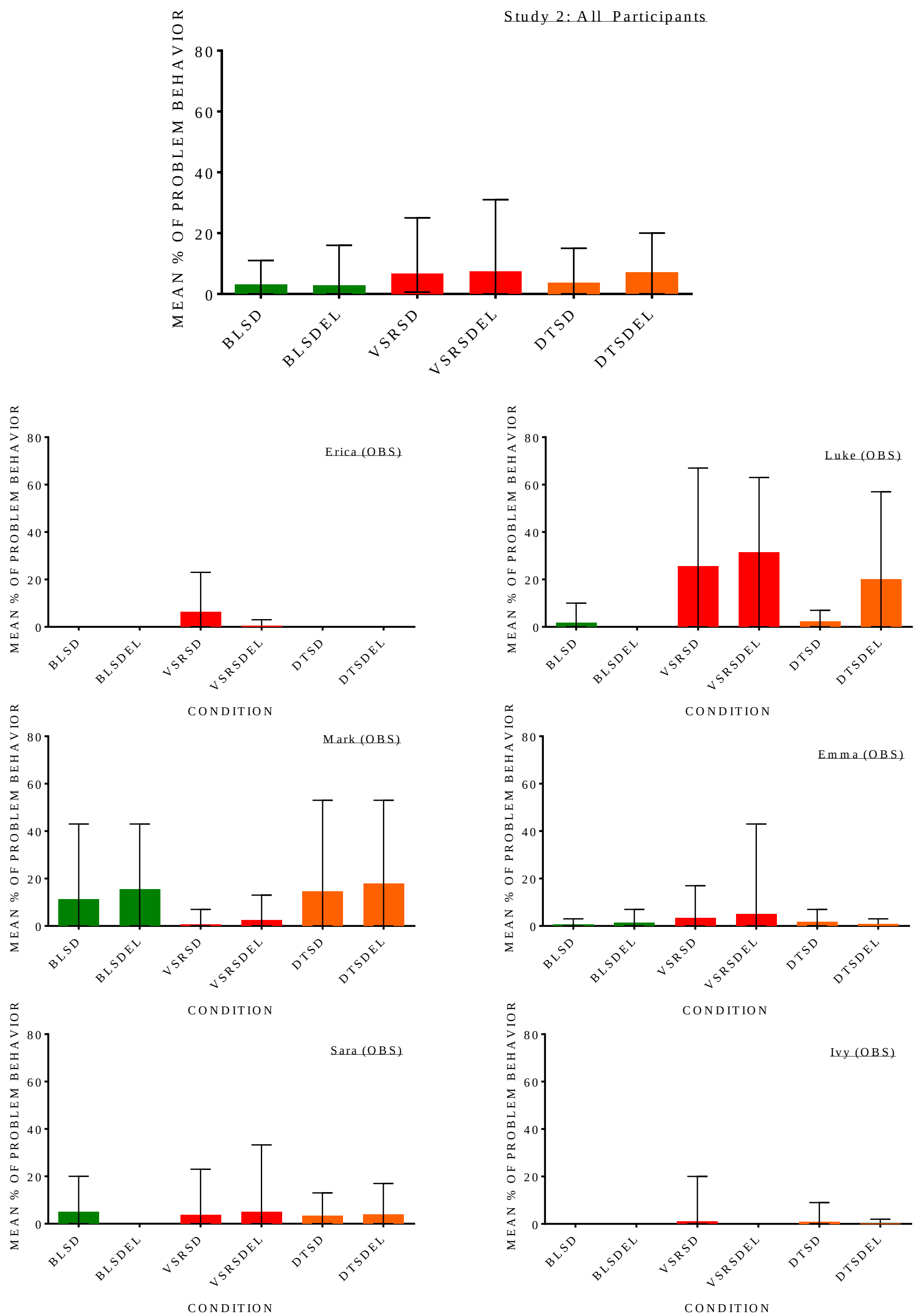

Figure 15. Mean percentage of problem behavior for all participants (top graph) and each individual participant (bottom graphs). Error bars depict the range for each condition.

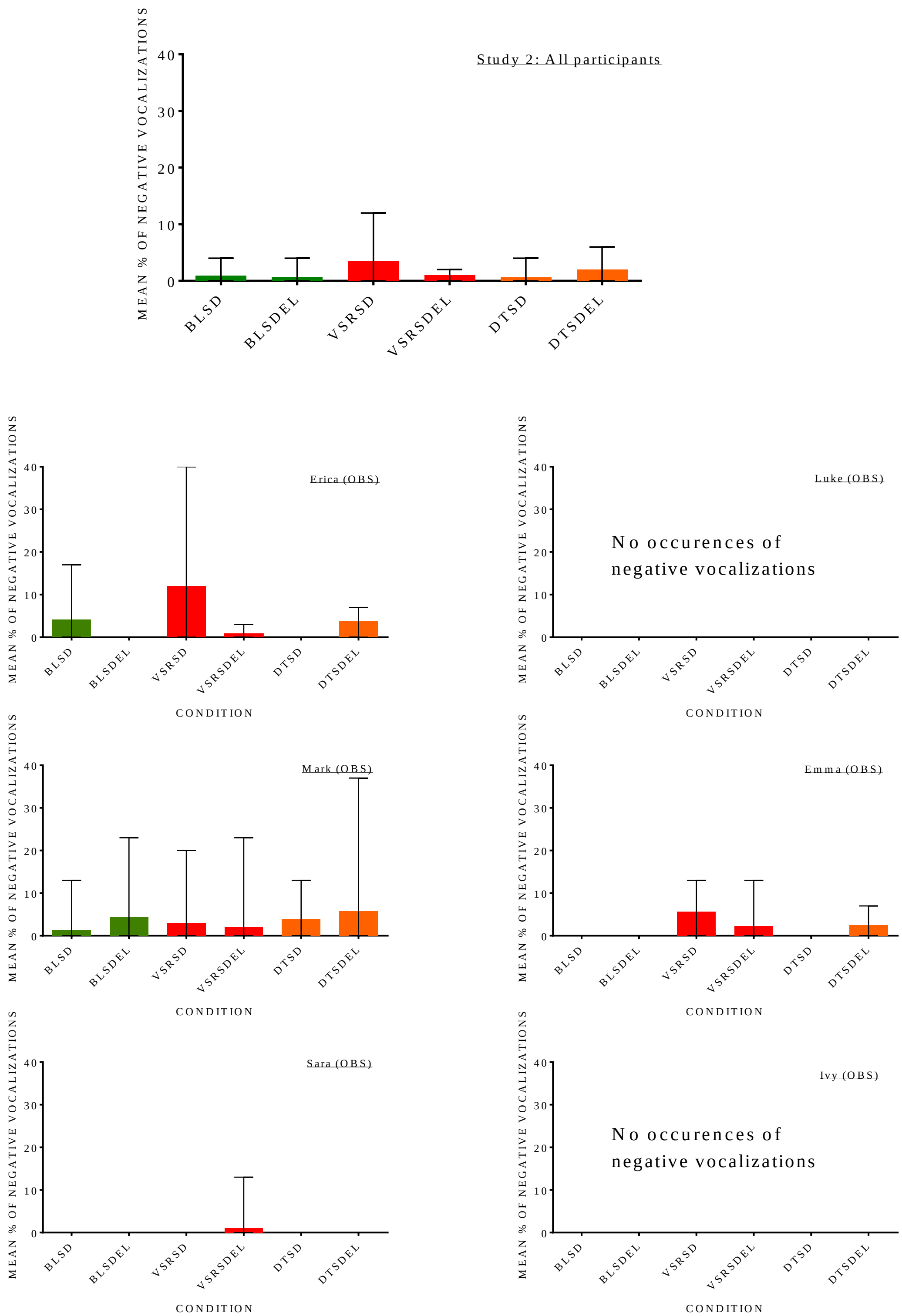

Figure 16. Mean percentage of negative vocalizations for all participants (top graph) and each individual participant (bottom graphs). Error bars depict the range for each condition.

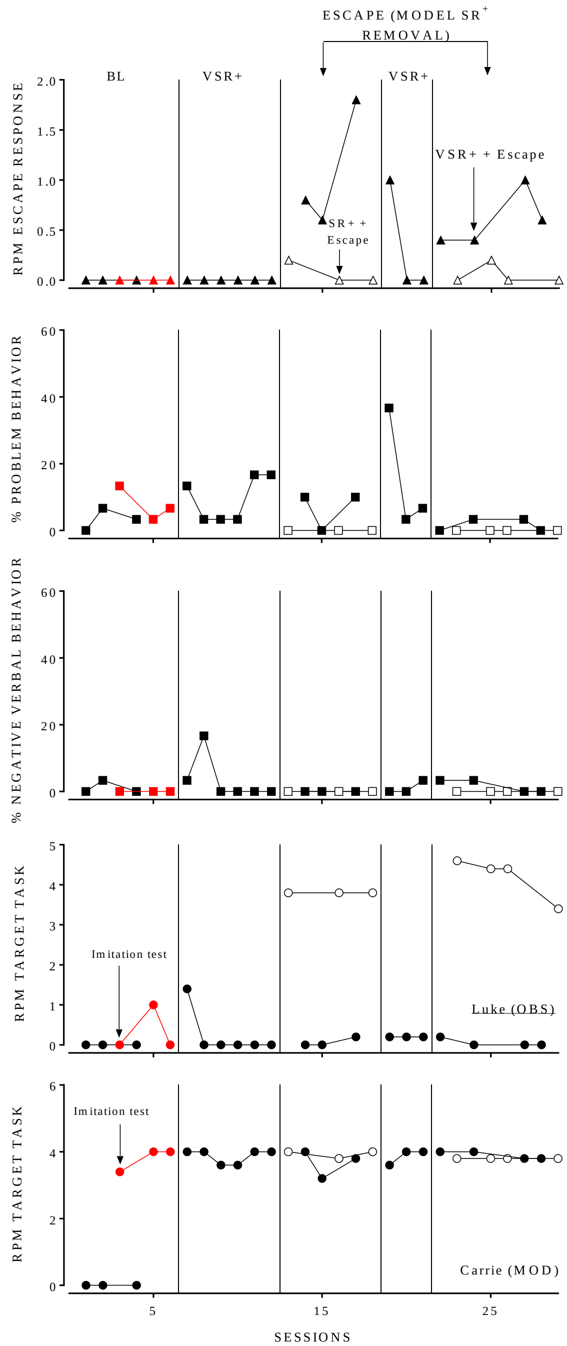

Figure 17. Rate of escape response (top panel), percentage of problem behavior and negative vocalizations (second and third panels), and rate of the target response (forth panel) across phases and conditions for Luke (observer). Rate of the target response (bottom panel) across phases and conditions for Carrie (model).

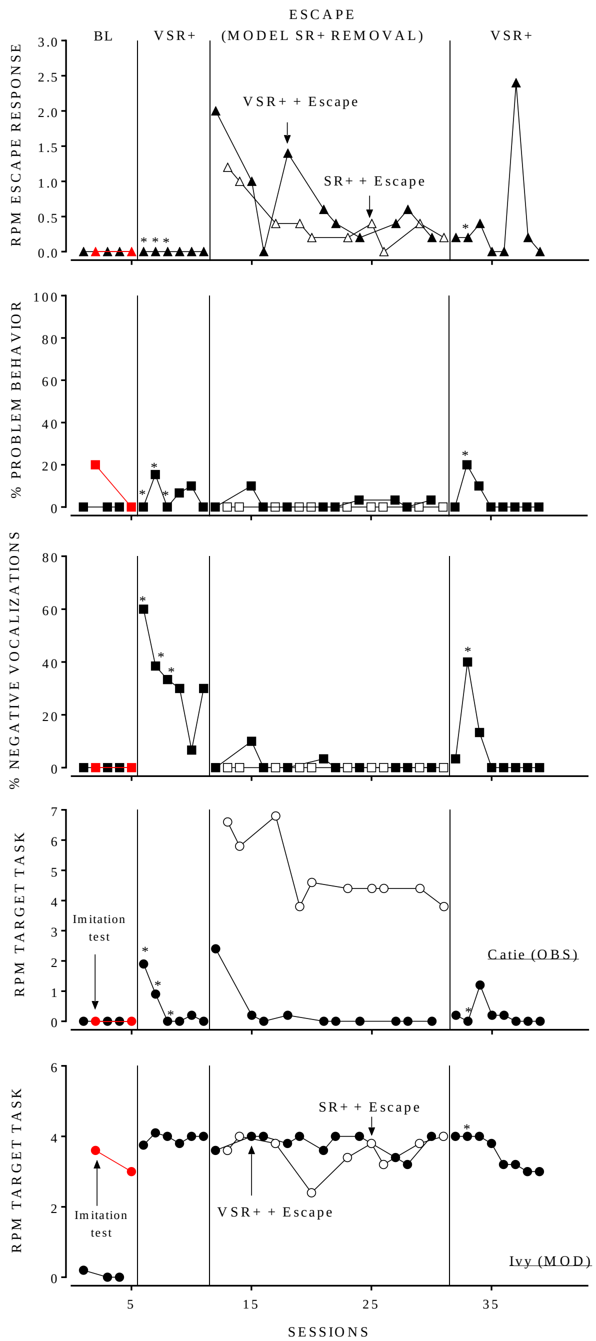

Figure 18. Rate of escape response (top panel), percentage of problem behavior and negative vocalizations (second and third panels), and rate of the target response (forth panel) across phases and conditions for Catie (observer). Rate of the target response (bottom panel) across phases and conditions for Ivy (model). Asterisks denote session termination.

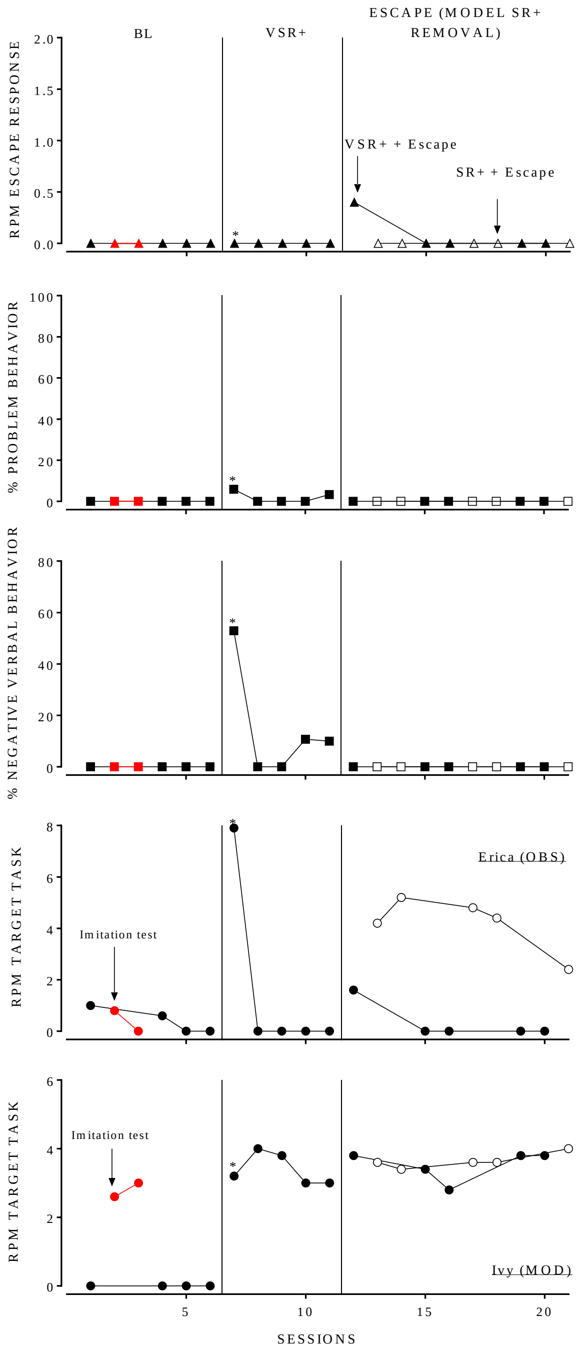

Figure 19. Rate of escape response (top panel), percentage of problem behavior and negative vocalizations (second and third panels), and rate of the target response (forth panel) across phases and conditions for Erica (observer). Rate of the target response (bottom panel) across phases and conditions for Ivy (model). Asterisks denote session termination.

Table 4

Summary of aversive properties of vicarious positive reinforcement

Subject	Imitation?	Temporary VSR+ effect?	Problem behavior?	Negative vocalizations?	VSR+ aversive?
Luke	No	Yes	Yes	Yes	Yes
Catie	No	Yes	Yes	Yes	Unclear
Erica	No	Yes	Yes	Yes	No
Total	0/3	3/3	3/3	3/3	1/3