THE EFFECTS OF COMBINING POSITIVE AND NEGATIVE

REINFORCEMENT DURING TRAINING

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Thesis Prepared for the Degree of

MASTER OF SCIENCE

UNIVERSITY OF NORTH TEXAS

May 2007

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Murrey, Nicole A., <u>The effects of combining positive and negative reinforcement during training</u>. Master of Science (Behavior Analysis), May 2007, 95 pp., 14 figures, references, 25 titles.

The purpose of this experiment was to compare the effects of combining negative reinforcement and positive reinforcement during teaching with the effects of using positive reinforcement alone. A behavior was trained under two stimulus conditions and procedures. One method involved presenting the cue ven and reinforcing successive approximations to the target behavior. The other method involved presenting the cue punir, physically prompting the target behavior by pulling the leash, and delivering a reinforcer. Three other behaviors were trained using the two cues contingent on their occurrence. The results suggest that stimuli associated with both a positive reinforcer and an aversive stimulus produce a different dynamic than a situation that uses positive reinforcement or punishment alone.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

Chapter

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

It is well established in the behavior analytic literature that a stimulus event that precedes a reinforcing event (Skinner, 1938/1991; Kelleher & Gollub, 1962) or the removal of an aversive event (Dinsmoor & Clayton, 1963) becomes a conditioned positive reinforcer. These stimuli can be effectively used in a chain of behavior as conditioned reinforcers as well as set the occasion for the next response (Ferster & Skinner, 1957). On the other hand, stimuli associated with the onset of an aversive event become conditioned aversive stimuli or conditioned punishers (Hake & Azrin, 1965). These have a suppressive effect on behavior when presented as consequences and often generate emotional responding (Estes & Skinner 1941; Hoffman, 1966; Hoffman & Fleshler, 1962; Solomon & Wynne, 1953). In addition to the stimuli associated with unconditioned aversive stimuli (called pre-aversive or warning stimulus), stimuli preceding the withdrawal of a reinforcing event contingent on behavior (S-) and stimuli preceding extinction (S^Δ) also become conditioned aversive stimuli and they, too, generate emotional responding (Skinner, 1953). However, in the case of extinction the side effects are considered a function of the termination of reinforcer vs. the termination of the reinforcement contingency (Catania, 1998).

Although a great deal is known about stimuli either correlated with reinforcers or aversive stimuli, little is known, experimentally, about stimuli followed by both a reinforcing as well as an aversive event. Hearst and Sidman (1961) examined whether escape to a neutral situation in which neither reinforcers nor punishers were received would be preferred to a situation with reinforcers and punishers concurrently scheduled.

1

Ten rats underwent preliminary training in which lever pressing (lever A) in the presence of one stimulus (S^D) was reinforced on a variable-interval schedule (VI) while responding in the presence of another stimulus (S^Δ) was not reinforced. Four rats were exposed to a tone as the S^D and a period of silence as the S^Δ. A VI-2 min schedule was in effect during S^D, which lasted 5 min and alternated with 15 min S^Δ periods. Experimental sessions lasted 6 hours. The remaining subjects were exposed to silent periods as S^D, which lasted 2 min and alternated with S^Δ, a 6 min clicker period. A VI-1 min schedule was in effect during the S^D period. For these subjects experimental sessions lasted 4 hours. Following preliminary training lever pressing had two consequences: milk was delivered on a variable interval of reinforcement and shock was delivered every nth response. Along with the concurrent food and shock schedule, a second lever (B) was available. Reponses on this lever replaced the S^D with the S^Δ where responses produced neither food nor shock. The results showed that the FR punishment contingency had a suppressive effect on VI responding in all subjects. At least 3 of 8 subjects escaped regularly from the concurrently reinforcing and aversive consequence. For these subjects removal of either the food or shock from the contingency produced many fewer responses to lever B than when both components were present. This led Hearst and Sidman to suggest that the physical characteristics of S^Δ or "stimulus change" were not in themselves reinforcing and that "Neither reward nor punishment alone, therefore, can account for S^D escape behavior in these animals. Rather, some sort of interaction between the positive and negative aspects of the S^D situation seems the important factor." (p. 252)

Hearst and Sidman (1961) offered their results as preliminary and in need of further research. Indeed, their research points to several relevant directions. Unfortunately, the effects of the concurrent programming of reinforcing and aversive consequences have not attracted much research. This is surprising not only at the level of basic processes as indicated by Hearst and Sidman but also at the level of application. A large number of teaching and training procedures unintentionally or intentionally incorporate both reinforcing and aversive consequences. For instance, during instruction a trainer may use hand over hand prompting to facilitate a correct response, such as touching an object. Following the prompted response, verbal praise or some other positive reinforcer might be delivered. However, if the hand-over-hand prompt functions as an aversive event that occurs following an incorrect response, it becomes unclear as to whether the target response (touching an object) increased as a function of negative reinforcement (touch the object and avoid being touched), as a function of positive reinforcement (touch the object and receive praise), or of some combination of the two.

Procedures incorporating both reinforcing and aversive consequences can be found in studies using both corrective feedback and positive reinforcement (e.g., Wilson, Boni, & Hogg, 1997). The combination of reinforcing and aversive consequences is also recommended by the Behavior Analyst Certification Board Guidelines for Responsible Conduct for Behavior Analysts: "If punishment procedures are necessary, the behavior analyst always includes reinforcement procedures for alternative behavior in the program" (Section 4.02). Therefore, a procedure that involves punishment but also

includes reinforcement is considered acceptable. Furthermore, Axelrod (1990) states "combining reinforcement and punishment is superior to reinforcement alone."

Further examples of combining positive and negative reinforcement can be found in the field of dog training. Traditionally, dog training has involved the use of both rewards and corrections delivered contingently upon behavior (Frawley, 2005). Lindsay (2001) also recommends prompting and reinforcing an alternative behavior immediately after the termination of punishment as one of his general guidelines for the use of punishment. Furthermore, such combinations are commonly found in training materials. For example, a dog-training manual provided by the Vancouver Animal Shelter recommends providing praise and food when the dog responds correctly to a known command. If the correct response does not occur, trainers are advised to correct (through physical prompting) the behavior until the dog is in the desired position and deliver praise once the animal is in that position (Clark, 2006).

Pryor (2002) pointed out that performances established with reward and correction methods do not resemble those established and maintained by positive reinforcement only. She noted that, in contrast to the eagerness seen in dogs trained with positive reinforcement procedures dogs trained with correction and positive reinforcement were reluctant participants. She called the discriminative stimulus or cue associated with both reinforcing and aversive consequences a "poisoned cue." She distinguished the poisoned cue from a regular cue and a command. A cue is an S^D established through positive differential reinforcement, and a command is an S^D established through negative reinforcement. Whereas the outcome is certain with cues and commands, the outcome of a poisoned cue is ambiguous. Pryor also noted that the

4

use of a poisoned cue as part of a behavior chain is likely to produce breaks in behavior before as well as following the cue.

Hearst and Sidman's (1961) data and Pryor's (2002) observations indicate that behavior under differential positive reinforcement contingencies is different from behavior under differential reinforcing and aversive consequences. However, in Hearst and Sidman's study the shocks were delivered on a fixed programmed schedule; they were not reduced as the behavior was acquired, as would occur in a training situation. Perhaps, in a typical training situation behavior established and maintained by positive and negative reinforcement would resemble performances generated and maintained by differential positive reinforcement. In addition, Hearst and Sidman and Pryor agree that cues or S^D s associated with both reinforcing and aversive consequences seem to function as conditioned aversive stimuli. The present research seeks to further compare the effects of training with differential positive reinforcement only and training with differential positive and negative reinforcement. Four studies were conducted. The first study compared the acquisition and maintenance of behavior under the two training procedures. The second and third study tested the effectiveness of the cues associated with each training procedure in selecting new behavior, and the fourth tested for the control exerted by various aspects of the environment.

CHAPTER 2

METHOD

Experiment 1

Participant

One male toy poodle, *Canis familiaris*, named Zephyr served as the participant. The dog was 6 years old at the onset of the experiment and 9 years old upon completion. Zephyr was in good health and all vaccinations were current. Throughout the experiment, he weighed approximately 10 lbs and was taken for annual veterinary health exams and vaccinations. He has been with the experimenter as a family pet since the age of 1 year.

The participant was selected for practical reasons including accessibility, the ability to observe and control everyday environmental conditions and behavior, as well as the existence of a prior history. Zephyr's prior history included conditioning of the sound of a clicker as reinforcement as well as a limited, if any, history with a leash or harness as a conditioned aversive stimulus.

Setting and Materials

Initially, sessions were conducted in an enclosed yard measuring approximately 8 m by 8.23 m where Zephyr resided. Subsequent sessions were conducted in a 3.22 m by 3.86 m room that also served as an office in the experimenter's home. Doors to adjoining rooms were closed or made otherwise inaccessible to the participant. This room contained computers, printers, computer desks, chairs, a bookshelf, several side tables, filing cabinets, a dresser, other miscellaneous personal materials (e.g., hair dryer, plants, books, papers, file folders, binders, pictures), and a grid on the floor. The

2.13 m by 2.13 m grid was constructed of masking tape applied to the hard wood floor. The grid contained 49 squares each measuring 30.48 cm by 30.48 cm (Figure 1).

The experimenter served as the trainer and was present during each session. The trainer and the dog were located in various positions on the grid. Another individual was present to operate a video camera. This individual was located near the entrance of the room and remained behind the video camera until the completion of the session. The dog was familiar with both the trainer and the camera operator. All sessions were videotaped. When the cameraperson was not available, the video camera was set up in the corner of the room on a tripod.

Lean hot dogs were cut into small pieces and used as reinforcers and leash tugs were used as corrections. Depending on the condition in effect, additional materials included a clicker attached to the trainer's apron, data sheets, a leash, a harness, a digital timer, a clipboard, and a laptop computer.

Behavioral Measures and Recording Procedures

Participant data were collected from videotaped sessions either electronically or by hand. Data collected electronically utilized a laptop computer equipped with a program that recorded session duration as well as the frequency and duration of each response.

Thirteen behaviors were recorded and five measures were calculated. Behaviors and measures were categorized as behavior emitted by the dog, behavior emitted by the trainer, and session measures. Behavior emitted by the dog included walking to the trainer and approximations, high and low tail wags, snorting, whining, sitting, lying down, and freezing. Behavior emitted by the trainer included *clicks* delivered, *cues* delivered

and *leash tugs* delivered. Session measures included rate of reinforcement and session duration.

Walking to the trainer, the target response, was recorded as either Criterion 1 or Criterion 2. *Criterion 1* was recorded when the dog walked in a forward motion across one or more complete squares, excluding the square he was standing in, and had any part of either front paw in the same square as the trainer within approximately 3 s of cue presentation. *Criterion 2* was recorded when the dog walked in a forward motion across one or more complete squares and had any part of either front paw in or on the border of the square located directly in front of the square the trainer was standing in within approximately 3 s of the cue. An *approximation* was recorded when the dog made an approximation to the target response such as taking a step towards the trainer or orienting the face towards the trainer within approximately 3 s of cue presentation, or when the dog could not make a criterion-level response due to the trainer's position. The frequency of occurrence of each measure was calculated for each session.

A *high tail wag* was defined as the base of the dog's tail pointing upward or parallel to the floor and moving right and then left or vice versa at least one time while all four paws were on the ground.

A *low tail wag* was defined as the base of the dog's tail pointing downward and below the parallel line of the body in relation to the floor and moving both right and left or vice versa at least one time while all four paws were on the ground.

Whining was defined as the dog producing a high-pitched sound from the throat and expelling air through the nose.

Snorting was defined as the dog expelling enough air from the nostrils, mouth, or both, and producing an "mmmph" sound*.*

The occurrence of *high and low tails wags*, *whining, and snorting* within a trial was recorded. The number of trials in which each behavior did or did not occur was calculated and reported for each session. *Freezing, sitting, and lying down* were recorded as durations and described below.

Freezing was defined as the dog standing in one position with all four legs extended and all four paws on the ground for three or more seconds with no leg or paw movements forwards, backwards or upwards. Other movements such as tail wagging, head turns, and arching of the back could occur simultaneously. The duration of freezing was recorded from the moment the dog was standing in one position for longer than 3 s until the moment in which the dog moved out of that position.

Sitting was defined as the dog's hindquarters touching the ground with his two front legs in an upright extended position and his front feet touching the ground. The duration of sitting was recorded from the moment the dog's hindquarters touched the ground to the moment the dog's hindquarters were lifted off the ground.

Lying down was defined as the stomach being flush on the floor and the front and back legs are touching the ground. The duration of lying down was recorded from the moment the dog's stomach touched the ground to the moment the dog's stomach was lifted off the ground.

A *click* was recorded when the trainer pressed the clicker and a "click" noise was produced. A *leash tug* was recorded when the trainer pulled on the leash with enough force to move the dog to a determined position in respect to the trainer. A *cue* was

scored each time the trainer said either "ven" or "punir." The number of occurrences of clicks, leash tugs, and cues were calculated for each session.

The rate of reinforcement was defined as the number of reinforcers delivered per min and was calculated by dividing the number of reinforcers delivered per session by the session duration.

Session duration was defined as the length of time each session lasted and was recorded from the moment the trainer stood still in a particular square to the moment the last click occurred.

Interobserver Agreement

Interobserver agreement (IOA) scores were obtained by having a second observer independently collect data during 25% of the sessions for Criterion 1, Criterion 2, and approximations; during 30% of the sessions for tail wags, snorting, and whining; and during 35% of the sessions for clicks, cues, and leash tugs. The investigator trained three graduate students in the data collection procedures and provided instructions in written form in which each behavior was defined and procedures for data collection were outlined. Data collectors collected data on different days. The same three graduate students were data collectors for Experiments 1 - 4.

For Criterion 1, the mean agreement was 100%. For Criterion 2, the mean agreement was 99.7% (range, 99.0% to 100%). For approximations, the mean agreement was 99.7% (range, 99.0% to 100%). For high tail wags delivered, the mean agreement was 90.8% (range, 50.0% to 100%). For low tail wags, the mean agreement was 85.8% (range, 60.0% to 100%). For whining, the mean agreement was 100%. For snorting, the mean agreement was 98.3% (range, 90.0% to 100%). The formula used

was agreements on the occurrence and non-occurrence of behavior during a trial divided by agreements plus disagreements multiplied by 100.

For leash tugs delivered, the mean agreement was 97.4% (range, 86.7% to 100%). For cues delivered, the mean agreement was 92.9% (range, 81.7% to100%). For clicks delivered, the mean agreement was 93.3% (range, 80.8% to 100%). For lying down, and sitting, the mean agreement was 100%. For freezing, the mean agreement was 99.9% (range, 98.3 to 100%). Agreement scores for the frequency of leash tugs, cues delivered, clicks delivered and the duration of emotional behaviors (lying down, freezing, and sitting), were calculated electronically by dividing sessions into 10-s intervals. The total number of seconds and response occurrences recorded by each observer were summed for each interval. The smaller number was then divided by the larger number. Results were summed across intervals, and the sum was divided by the total number of intervals and multiplied by 100.

Procedures

General. Typically, 10 trials were conducted per session. Sessions were conducted in pairs in which the verbal cue ven was presented in one session while the verbal cue punir was presented in the other session. There were 29 pairs of sessions during Experiment 1. The dog participated in both afternoon and evening training sessions. Each session lasted approximately 2-5 min and was separated by an interval of approximately 3 hours, with conditions counterbalanced to control for sequence effects. Sessions were typically conducted between the hours of 3:00 p.m. and 6:00 p.m. However, there were times when each session for the day began approximately an hour earlier or later; on these days, there was approximately 3 hours between sessions.

11

Occasionally, only one session was conducted on a given day. In these instances, the afternoon session was conducted on one day and the evening session was conducted on the following day. Session pairs were conducted two to three times per week.

Cue testing. During this phase, the control of the cues (ven and punir) over the target response (walking to the trainer*)* was tested. A trial began when the trainer positioned herself approximately 3-5 ft. (.91to1.52 mm) away from the participant, activated a timer preset for 2 s, and said "ven." If the dog emitted the target response within 2 s, no programmed consequence was delivered, the trainer repositioned and the next trial began. If the target response did not begin within 2 s, the trial ended, the trainer repositioned and the next trial began. Sessions testing the ven cue were conducted outdoors. Sessions testing the punir cue were identical except sessions were conducted indoors; a leash was present on a table, and the trainer said "punir" instead of "ven." A session began when the trainer was standing still in a square and ended after the 10th trial.

Cue training. During cue training, procedures were similar to the cue testing baseline with several exceptions. First, the indoor setting was used for both ven and punir conditions. Next, a grid was drawn on the floor for measurement purposes. With the addition of the grid, the definition for walking to the trainer was modified to include distance in relation to the number of squares crossed.

During ven sessions, a trial consisted of the trainer positioning herself one or more squares away from the dog and saying "ven." Approximations to the target response, walking to the trainer, resulted in a click, which was followed by delivery of a reinforcer (a piece of lean hotdog) within 1-2 s. If the dog began walking toward the

trainer before the cue, the trainer repositioned and the trial reset. If the dog did not emit the target response within 2 s the trainer waited for an approximation or the target behavior to occur. After reinforcer delivery, the trainer repositioned to another square on the grid and the next trial began. A session began when the trainer was standing still in a square and was completed after the 10th trial.

During punir sessions, the trainer attached a leash to the dog's collar before the session began. The procedures were the same as the ven condition; however, the trainer said "punir" instead of "ven" and failure to emit the complete target response resulted in a leash tug that pulled the dog to the correct location. Once in the correct position, a click occurred and a reinforcer immediately followed. During session 11, a harness replaced the collar as the point of attachment for the leash in an effort to minimize the potential for injury resulting from the leash tugs.

Cue training was completed when Criterion 2 occurred at least 8 times per session for 7 consecutive sessions in each condition.

Experimental Design

A multi-element design was used to compare the effects of training cues with two training procedures: negative reinforcement combined with positive reinforcement which was associated with the cue punir and positive reinforcement only which was associated with the cue ven.

CHAPTER 3

RESULTS

Experiment 1

Figure 2 displays the number of trials in which criteria 1, 2, and approximations to the target behavior occurred per session during the ven condition (top) and the punir condition (bottom). Sessions are displayed along the horizontal axis (x-axis) in chronological order and frequency is displayed along the vertical axis (y-axis).

During the Criterion 1 phase of the ven condition, approximations ranged from 7-10 responses per session during the first three sessions. As approximations decreased, Criterion 2 responding increased to 6 –10 responses by the end of the phase. Criterion 1 responding remained low throughout and reached a maximum of 5 responses during the last session. Once Criterion 2 became the target response, accuracy significantly increased to 9 responses during the first 2 sessions and stabilized at 10 responses/session for the remainder of the phase. During the ven condition, criteria for the termination of this phase were accomplished by session 46. However, training sessions continued until criteria were met during the punir condition.

During the Criterion 1 phase of the punir condition, approximations were initially high and ranged from 8-10 responses per session. Criterion 2 responding increased from 4 to 8 responses during the final 3 sessions and Criterion 1 responding occurred only once during this phase. When the criterion changed to Criterion 2 responding, approximations decreased and accuracy immediately increased to 10 correct responses during the first few sessions but began to vary between 6-10 correct responses/session. It is important to note that the camera malfunctioned during session 37 and only 5 trials

14

were completed. Therefore, 5 Criterion 2 responses represent correct responding throughout the session. During the punir condition, criteria for the termination of cue training were accomplished by the last session.

Figure 3 displays the number of trials in which high and low tail wags, whining, snorting, and leash tugs (punir condition only) occurred during the ven condition (top) and the punir condition (bottom). The number of trials in which each behavior occurred is shown along the vertical y-axis while sessions are shown along the horizontal x-axis.

During the Criterion 1 phase of the ven condition, high tail wags occurred during each trial except for one session in which high tail wags occurred during 8 out of 10 trials. Low tail wags occurred during 3 out of 6 sessions and ranged from 2 to 7 occurrences per session. Snorting and whining did not occur during this phase. During the Criterion 2 phase, high tail wags occurred during most sessions except for 2 sessions in which high tail wags occurred during 6 and 2 trials. Low tail wags continued to vary and occurred in 8 out of 14 sessions. In 4 of these sessions occurrence was higher than 6 low tail wags, and in the other 4 occurrence was less than 2 low tail wags session. Snorting occurred during three sessions and never occurred in more than one trial during each of these sessions.

During the Criterion 1 phase of the punir condition, leash tugs occurred during each trial with the exception of 1 trial during session 26 and 1 trial during session 30. High tail wags occurred during each trial of the first session but disappeared during subsequent sessions with the exception of 3 trials during session 27. As high tail wags decreased, low tail wags increased over time from occurring during 1 trial to occurring during 7 trials. Whining and snorting did not occur during any of the sessions. During

15

the Criterion 2 phase, leash tugs were not delivered until session 42. Tugs continued in session 43 and then in sessions 48, 52, and 59. Leash tugs ranged from 1-4 tugs in a given session. Both high and low tail wags were variable throughout the Criterion 2 phase. On average, high tail wags occurred during 2.79 trials per session and occurred in 8 of the 14 sessions. Low tail wags occurred during 5.36 trials per session and occurred in every session of this phase.

Figure 4 displays session duration (top) and rate of reinforcement (bottom) during the ven and punir conditions. On the top graph, the number of minutes is shown along the vertical y-axis while sessions are shown along the horizontal x-axis. Throughout the experiment, session lengths were similar for both punir and ven conditions. However, on average, punir sessions tended to last slightly longer than ven sessions. On average, ven sessions lasted 2.15 min while punir sessions lasted 2.41 min during the Criterion 1 phase. During the Criterion 2 phase, ven sessions lasted on average 1.88 min, while punir sessions lasted 2.08 min.

On the bottom graph, the number of reinforcers delivered minute is shown along the vertical y-axis, and sessions are shown along the horizontal x-axis. Throughout the experiment, average rate of reinforcement is typically higher during the ven condition. On average, 4.98 reinforcers were delivered per minute during ven sessions and 4.23 reinforcers were delivered per minute during punir sessions, in the Criterion 1 phase. During the Criterion 2 phase, an average of 5.60 reinforcers were delivered per minute during ven sessions and an average of 4.84 reinforcers were delivered minute during punir sessions.

CHAPTER 4

DISCUSSION

Experiment 1

The results of Experiment 1 demonstrated that walking to the trainer was successfully acquired in the presence of both the ven and punir cues. However, there were important differences in the outcomes of the two training procedures. Most notable among these differences were the additional emotional responses generated by the punir condition.

Acquisition of the target response (Criterion 1) was difficult during both conditions. The target response occurred five times during the ven condition and two times during the punir condition. Because Criterion 1 required that the dog step into the square where the trainer was located (a subtle and precise motor requirement), it became apparent that training a fine discrimination consisting of a step or two would be more difficult during the punir condition and unnecessarily extend the punishment history. Therefore, the criterion was relaxed and the target response became Criterion 2, a response that was already occurring during the Criterion 1 phase. After the criterion was relaxed, the target response occurred reliably in both conditions. However, accuracy during the Criterion 2 phase was, overall, higher, and less variable during the ven condition than during the punir condition. After 2 sessions in the ven condition, no errors occurred. In contrast, errors persisted throughout the punir condition until the completion of experiment 1. This is contrary to Fowler and Wischner (1969) suggestion that the addition of punishment can facilitate discrimination.

In addition to accuracy, emotional behavior differed between the two conditions. High and low tail wags occurred during both ven and punir conditions; however, high tail wags occurred during most trials in the ven condition while low tail wags occurred more often during the punir condition. These outcomes are consistent with previous research indicating that successful avoidance was accompanied by emotionality (e.g., Hoffman & Fleshler, 1962; Schilder & Van der Borg, 2004; Solomon & Wynne, 1953) and also supports Pryor's observations that the use of aversive procedures during training produces behavior that is significantly different than behavior trained using positive reinforcement only.

Interestingly, during the punir condition, high and low tail wags were extremely variable during the Criterion 2 phase and leash tugs occurred less frequently. By contrast, the Criterion 1 phase generated less variability, and responding during these initial sessions typically resulted in a leash tug, a click, and treat. The increased variability during the Criterion 2 phase coincides with increased accuracy and decreased corrections. Of interest is the change in the outcome. For instance, trials in the Criterion 1 phase frequently resulted in a leash tug as well as treat because the behavior was not yet learned. However, as learning occurred during the Criterion 2 phase, the outcome became less predictable and hence, ambiguous. Errors resulted in both a leash tug and a click and treat while accuracy resulted in only a click and treat. This is supported by changes in emotional behavior between Criteria 1 and 2. There were very few high tail wags during the Criterion 1 phase where leash tugs were avoided during 2 trials only. In contrast, during Criterion 2 phase, there is a combination of both high and low tail wags once the number of trials without leash tugs increased

Overall, the present results are consistent with other literature comparing positive reinforcement and punishment. The present results show that the combination of positive and negative reinforcement although, successfully increased a target response, it produced similar results to punishment procedures. That is, the accuracy was compromised and more emotional behavior was produced. Thus, the suggestion that a combination of reinforcement and punishment is superior to reinforcement alone or the recommendation "that when punishment procedures *are* used, they be used *in conjunction* with positive reinforcement procedures (Axelrod, 1990, p. 62)." requires further examination. Perhaps this recommendation was made because intuitively it would seem that once the behavior was acquired, positive reinforcement would facilitate extinction of the emotional responding. However, this did not occur during Experiment 1.

CHAPTER 5

INTRODUCTION

Experiment 2

During Experiment 1, two cues were established. In the presence of the cue ven, the occurrence of the target response resulted in the delivery of a positive reinforcer while other responses were extinguished. On the other hand, in the presence of the cue punir, the occurrence of the target response resulted in the delivery of a positive reinforcer, whereas, other responses resulted in the delivery of an aversive stimulus (i.e., a leash tug). Establishment of these cues permitted an examination of the conditioned reinforcing or aversive properties of the cues.

Experiment 2 examined the reinforcing function of the ven and punir cues. A stimulus that repeatedly precedes a reinforcing stimulus acquires reinforcing properties and is considered a conditioned reinforcer (Skinner, 1938/1991; Kelleher & Gollub 1962). Likewise, a stimulus that repeatedly precedes an aversive stimulus acquires punishing properties and is considered a conditioned punisher (Hake & Azrin, 1965). In the current experiment, it was unclear whether the cue punir would function as an aversive stimulus or as a conditioned reinforcer given its correlation with both aversive and reinforcing events. In addition, will the emotional behavior decrease and disappear over time as the frequency of corrections decrease and responding that results in positive reinforcement alone increases?

CHAPTER 6

METHOD

Experiment 2

Participant, Setting and Materials

The participant, setting, and materials were the same as during Experiment 1.

Behavioral Measures and Recording Procedures

Six measures were calculated and 15 behaviors were recorded throughout

Experiment 2. As in Experiment 1, the behaviors and measures were divided into

behavior emitted by the dog, behavior emitted by the trainer, and session measures.

Behavior emitted by the dog included high and low tail wags, snorting, whining, sitting,

lying down, and freezing. These were defined and recorded in the same manner as in

Experiment 1. Additional behaviors emitted by the dog included back stepping and

walking to squares F7, A5, G4, or to the corner squares. A diagram corresponding to

the taped grid on the floor was used to define walking to squares F7, A5, G4, or to the

corner squares. A designated letter and number based on xy coordinates identified

each cell of the diagram and grid (Figure 1). Therefore, a total of seven numbers and

seven letters were used to identify the positions of the grid (e.g., E3, C7). Trainer

behavior included clicks delivered, cues delivered, and leash tugs delivered. These

were defined and recorded in the same way as described in Experiment 1. Session

measures included rate of reinforcement and session duration, which were defined and

recorded as in Experiment 1. In addition, post-reinforcement pause (PRP) data were

calculated.

Walking to squares F7, A5, or G4 were defined as the dog walking into or contacting the border of a given square with any part of either front paw within 3 s of the presentation of the cue.

Walking to the corner was defined as the dog walking into or contacting the border of particular squares with any part of either front paw. The corner squares consisted of cells A1, B1, A2, B2; F1, G1, F2, G2; A6, B6, A7, B7; and F6, G6, G7. Walking to the corner square was not scored when the dog touched corner squares while performing back stepping, or when walking to target square F7 (which required crossing squares F6, G6 or G7). However, walking to the corner was scored if the dog paused for at least 3 s before entering square F7 (Figure 5).

Back stepping was defined as the dog's front right or left leg as well as either the right or left back leg moving backward for one or more steps, thus moving the dog backward. Occasionally back stepping occurred when the trainer was adjusting the leash or harness or giving a treat. These occurrences were not included in this definition.

Response frequency was recorded for walking to particular squares and back stepping. These data were converted into response rates by dividing the number of occurrences per session by the session duration.

PRP was defined as the length of time between a click and delivery of the next cue. PRP was calculated trial by trial by subtracting the time between the click of the previous trial and the delivery of the cue on the next trial. Then, times were averaged across each session.

Interobserver Agreement

IOA scores were obtained by having a second observer independently collect data during 30% of the sessions for tail wags, snorting, and whining; during 30% of the sessions for clicks, cues, and leash tugs; and during 35% of the sessions for back stepping and walking to squares.

For high tail wags delivered, the mean agreement was 96.0% (range, 80.0% to 100%). For low tail wags, the mean agreement was 90.0% (range, 70.0% to 100%). For whining, the mean agreement was 99% (range, 80.0% to 100%). For snorting, the mean agreement was 89% (range, 50.0% to 100%). The formula used was agreements on the occurrence and non-occurrence of behavior during a trial divided by agreements plus disagreements multiplied by 100.

For leash tugs delivered, the mean agreement was 100%. For cues delivered, the mean agreement was 95.8% (range, 75.0% to 100%). For clicks delivered, the mean agreement was 97.1% (range, 73.3% to 100%). For lying down and sitting, the mean agreement was 100%. For freezing the mean agreement was 97.0% (range, 80.9% to 100%). For back stepping, the mean agreement was 97.0% (range, 90.0% to 100%). For walking to square F7, the mean agreement was 96.8% (range, 76.7% to 100%). For walking to square A5, the mean agreement was 98.2% (range, 93.3% to 100%). For walking to square G4, the mean agreement was 95.9% (range, 80.0% to 100%). For walking to the corner squares, the mean agreement was 94.0% (range, 87.0% to 100%). Agreement scores were calculated electronically by dividing sessions into 10-s intervals. The total number of seconds and response occurrences recorded by each observer were summed for each interval. The smaller number was then divided by

the larger number. Results were summed across intervals, and the sum was divided by the total number of intervals and multiplied by 100.

Procedures

General. Procedures during this experiment were the same as Experiment 1 with a few exceptions. Sessions varied in length from 1.05 – 13.32 min. Typically each session consisted of 10 trials; however, sessions 41 and 56 of the punir condition consisted of 9 trials and session 31 of the punir condition consisted of 11 trials due to experimenter error. Finally, session 45 of the ven condition was conducted however, the session was erased. A session began when the trainer stepped into the trainer's square and was completed after the 10th trial.

Shaping with the cue. During shaping with the cue, the cue was used as a conditioned reinforcer and was initially delivered contingently upon approximations and later upon the completed target response.

During ven sessions, a trial began when the trainer was standing in the trainer's (square D6). Approximations to square A1 produced the ven cue. After delivery of the cue, the dog had approximately 3 s to begin the target response, walking to the trainer. When the dog stepped into the correct location (square D5), the trainer operated the clicker and delivered a reinforcer. If the target response was not emitted within 3 s, the trainer waited for the target response to occur. The next trial began following reinforcer delivery. During the first session, the trainer stepped out of the square at various points throughout the session to facilitate moving around the square.

During punir sessions, procedures were similar to ven sessions except approximations to square G1 produced the punir cue. When the dog stepped into the

correct location (square D5), the trainer operated the clicker and delivered a reinforcer. If the dog did not walk to the trainer within approximately 3 s of the presentation of the cue, a leash tug was delivered, resulting in the dog being pulled into the correct location (square D5). When the dog was in the correct position, the trainer operated the clicker and immediately delivered a food reinforcer. The trainer left square D6 several times during the first four sessions to facilitate movement around the grid.

The shaping phase was discontinued due to low variability of responding during the punir condition, which made it difficult to reliably shape the designated target response. Capturing was used instead. Captured behaviors were selected by viewing the videotaped sessions of the shaping phase and observing responses that occurred during both the ven and punir sessions.

Capturing: Ven (Back stepping & Walking to square A5). During capturing, a two-response sequence was developed in which the cue ven was used as a conditioned reinforcer and was delivered contingently upon the occurrence of either back stepping or walking to square A5. A trial began when the trainer was standing in the trainer's square (square D6). The trainer waited for either an approximation or the target response and said ven contingent upon the occurrence of either. When the dog stepped into the correct square (square D5), the trainer clicked the clicker and immediately delivered a food reinforcer. Back stepping approximations consisted of the front paws moving backward. This behavior was reinforced during the first session; however, a full back step was required during subsequent sessions.

Capturing: Punir (Walking to squares F7 & G4). During punir sessions, either walking to square F7 or walking to square G4 were captured. The procedures were

25

similar to those in effect during ven capturing sessions. However, the trainer waited for an approximation or for the dog to walk to either square F7 or G4 depending on the condition in effect and said "punir" contingent upon the occurrence of the target response. Returning to square D5 following the cue resulted in the trainer operating the clicker and delivering a reinforcer. Failure to begin walking to the trainer following the cue resulted in a leash tug that pulled the dog to square D5. If a leash tug occurred, the trainer operated the clicker when the dog entered square D5 and delivered the food reinforcer.

After Behaviors 1 (back stepping and walking to square F7) and 2 (walking to squares A 5 and G4) were acquired in both the ven and punir conditions, the reinforcement contingencies were reversed repeatedly for Behaviors 1 and 2. During the reversals, the trainer no longer stepped out of square D6 for the remainder of the experiment.

Reversal: Back stepping & Walking to square A5. The procedures during this condition were identical to the capturing condition correlated with back stepping and walking to square A5. However, the contingencies of reinforcement for each behavior alternated between behaviors 1 and 2. While behavior 1 (back stepping) was on extinction, behavior 2 (walking to square A5) was in effect and vice versa. Back stepping and walking to square A5 were reversed twice. Both back stepping reversals consisted of four sessions. The first Walking to square A5 reversal consisted of one session while the second reversal consisted of 3 sessions.

Reversal: Walking to squares F7 & G4. The procedures during this condition were identical to the walking to squares F7 and G4 capturing condition. However, the

contingencies of reinforcement for each behavior alternated between behaviors 1 and 2. While behavior 1 (walking to square F7) was on extinction, behavior 2 (walking to square G4) was in effect and vice versa. Walking to square F7 and G4 were reversed twice. Each walking to square F7 reversal consisted of four sessions. The first walking to square G4 reversal consisted of one session while the second reversal consisted of 3 sessions.

Experimental Design

A combination multi-element and reversal design within the components of the multi-element was used to compare the effects of the cues as conditioned reinforcers for capturing behaviors with the two training procedures: negative reinforcement combined with positive reinforcement which was associated with the cue punir and differential positive reinforcement only which was associated with the cue ven. The presentation of ven and punir conditions were arranged to avoid a set order. Ven conditions were conducted in the following order: A-B-A-B-B-A while punir conditions were conducted in this order: A-B-A-B-A-B. A represents the first behavior trained while B represents the second behavior trained.

CHAPTER 7

RESULTS

Experiment 2

Figure 6 shows the participant's performance during capturing back stepping and

walking to A5 with the cue ven (top) and capturing walking to F7 and G4 with the cue

punir (bottom). Each graph displays the number of times back stepping, walking to

square A5, F7, G4 and walking to the corner squares occurred per min. Sessions are

displayed along the horizontal axis (x-axis) and responses per min (rpm) are displayed

along the vertical axis (y-axis).

During the first capturing of back stepping in the ven condition, back stepping,

occurred at 3.94 rpm during the first session and increasing to 5.31 rpm during the final

session. Walking to square A5 and corner squares remained low and ranged from .22

rpm to 1.31 rpm while walking to square F7 never occurred.

In the next condition when capturing was changed to walking to square A5,

walking to square A5 occurred at 1.08 rpm during the first session but significantly

increased by the second session to 6.32 rpm. A sharp decrease to 2.61 rpm occurred

during session 94, possibly due to illness. However, responding again increased to 5.74

rpm during the final session of this phase. As walking to square A5 increased, back

stepping decreased to zero rpm by the end of the phase. Walking to squares F7 and G4

remained low throughout reaching a maximum of .33 and 1.91 rpm respectively.

Session 89 of this condition was erased and data were not collected.

When the target response was reversed to back stepping, back stepping initially

occurred at 2.17 rpm and was followed by a sharp increase that stabilized at around 9

rpm throughout the phase. As back stepping increased, walking to square A5 decreased from 3.04 rpm at the beginning of the phase to 1.79 rpm upon completion of the phase. On average, walking to the corner squares occurred at 2.13 rpm throughout the phase. Walking to square G4 occurred at a low rate initially (.87 rpm) but decreased to zero rpm by the end of the phase while walking to square F7 did not occur during this phase.

When the target response was reversed to walking to square A5, walking to square A5 increased over time from 4.22 to 8.89 rpm by the end of the phase while back stepping decreased over time from 4.69 to1.48 rpm. Walking to squares F7, G4, and the corner squares remained at less than 1.79 rpm throughout the phase.

During the final reversal to back stepping, back stepping immediately increased from 2.07 to 7.88 rpm by the final session. Walking to square G4 ranged from 1.82 to 3.53 rpm. Fluctuations in response rate were possibly due to sequence effects. After the first session, walking to squares A5, F7, and the corner squares occurred at less than one rpm.

During the first phase of the punir condition, capturing walking to square F7, walking to square F7 ranged from 1.75 to 3.51 rpm with the highest rates occurring during the first session. Walking to squares F7, A5, and walking to the corner squares occurred at the same rate during the last session of the phase (2.73 rpm). Back stepping and walking to square G4 remained low throughout the phase and never reached more that .73 rpm.

In the next condition when capturing was changed to walking to square G4, Walking to square G4 increased over time and leveled off at around 3 rpm and walking to square F7 decreased over time to .32 rpm during the final session. Walking to the corner squares ranged from 1.49-5.15 rpm. However, during the last three sessions walking to the corner squares and walking to square G4 produced similar response rates and by the final session, walking to the corner squares had a higher rate of responding (2.13 rpm) than the target response, walking to square G4 (1.83 rpm). Walking to square A5 remained at low levels throughout the session (.31-1.47 rpm).

When the target response was reversed to walking to square F7, walking to square F7 generated the highest response measures (1.25-3.94 rpm). Walking to the corner squares produced the second highest response rates (1.04-2.05 rpm). As walking to square F7 and the corner squares increased, walking to square G4 decreased during the first three sessions and then increased to a low rate of 1.31 rpm during the final session. Walking to A5 occurred at a low steady rate ranging from .31 to .444 rpm while back stepping never occurred.

When the target response was reversed to walking to square G4, walking to G4 occurred at 3.22 rpm while walking to squares F7, A5, and the corner squares ranged between 2.01 to 2.42 rpm. Back stepping did not occur. Only 1 session of this phase was completed due to an error.

When the target response was reversed back to walking to square F7, walking to square F7 sharply increased to 6.74 rpm during the first session and was followed by a sharp decline before increasing to 6.51 rpm during the final session. Walking to the corner squares ranged from 1.22-2.29 rpm. Behaviors associated with the ven

condition, back stepping and walking to square A5, occurred at a low steady rate with back stepping occurring at less than 1 rpm and walking to square A5 occurring at approximately 1 rpm.

During the final reversal of the punir condition, the target response, walking to square G4, increased over sessions from 1.99 rpm during the first session to 6.13 rpm during the final session while walking to square F7 decreased and leveled out at approximately 2 rpm. Walking to the corner squares steadily increased and ranged from 1.99 to 3.07 rpm. Back stepping decreased to 0 rpm during the last two sessions and walking to square A5 remained steady at less than 1 rpm.

Figure 7 displays the number of trials in which high and low tail wags, whining, snorting, and leash tugs occurred during the ven condition (top) and the punir condition (bottom). The number of trials in which each behavior occurred is shown along the vertical y-axis while sessions are shown along the horizontal x-axis.

During the capturing of back stepping in the ven condition, high tail wags occurred during each trial while low tail wags did not occur. Snorting decreased from 8 occurrences during the first session (79) to 5 occurrences during the final session (83). Whining occurred during two trials of the first session of Capturing back stepping.

During the capturing of walking to square A5 in the ven condition, High tail wags occurred during each trial, except for session 94 in which high tail wags occurred during 7 trials. Low tail wags only occurred during 2 trials of session 94 and during 1 trial of session 109. Snorting occurred during the first two sessions (8 trials and 5 trials respectively) while whining did not occur.

31

During the reversals to back stepping and walking to square A5 of the ven condition, high tail wags occurred during each trial and low tail wags occurred during 1 trial of session 109. Whining occurred during 3 trials of the second session of the last A5 reversal. Snorting occurred during each session and ranged from 1 to 8 occurrences per session.

During the capturing of walking to square F7 (punir), leash tugs occurred during each session and ranged from 2 to 4 occurrences per session. Low tail wags occurred during each 8 out of 10 trials until the final session where low tail wags only occurred during 2 trials. High tail wags occurred during most trials and ranged from 8 to 9 occurrences per session. During session 81, whining occurred during 3 trials and snorting occurred during 4 trials. Snorting decreased in occurrence to 2 trials during the next session.

During the capturing of walking to square and G4 phase of the punir condition, leash tugs occurred during each session and ranged from 1 to 2 occurrences per session until the final session, session 96, in which leash tugs decreased to 0. Low tail wags occurred during each session and ranged from 5 to 9 trials until the final session in which low tail wags decreased to 2 out of 10 trials. High tail wags occurred during most trials and ranged from 4 to 10 occurrences per session. Whining occurred during 2 trials of session 85. Snorting occurred during 2 trials of the first session and during 1 trial of session 92.

When the target response was reversed to walking to square F7, leash tugs occurred during 2 trials of the first 2 session. Low tail wags occurred during each session and increased over time from occurring during 5 trials to occurring during 9

32

trials. However, during the final session, low tail wags decreased to 3 occurrences. High

tail wags occurred during each session and were variable. On average high tail wags

occurred during 6.50 trials per session. Whining occurred during 1 trial of session 100

while snorting occurred during 2 trials. In addition, snorting occurred during 1 trial of

session 103.

When the target response was reversed to walking to square G4, high tail wags

occurred during every trial of the single session. No other recorded responses occurred

during this reversal.

When the target response was reversed back to walking to square F7, a leash

tug occurred during the ninth trial of the first session. During the next session, low tail

wags increased from 0 occurrences to 10 occurrences, high tail wags decreased from

10 occurrences to 6 occurrences, and both whining and snorting occurred during 1 trial.

During subsequent sessions, low tail wags decreased from 10 occurrences to 2

occurrences, high tail wags increased from 6 to 10 occurrences, and whining

disappeared. Snorting occurred again during 1 trial of the final session. After the first

session of this phase, session 55, leash tugs no longer occurred for the remainder of

the experiment.

During the final reversal, high tail wags occurred during most trials with the

exception of 2 while low tail wags did not occur. Snorting occurred during each session

and ranged from 2 to 3 occurrences per session. Whining occurred during 2 trials of the

first session and then disappeared during subsequent sessions.

Although a graph is not presented, it should be noted that freezing occurred

during the first or second session of the punir condition each time the criterion for

reinforcement changed. Freezing durations ranged from 1s to 235 s and occurred during 9 sessions. Freezing occurred during 4 ven sessions and lasted 8s, 1s, 5s, and 1s respectively.

Figure 8 displays the average post-reinforcement-pause (PRP) during ven and punir conditions on the top graph. The average number of seconds is shown along the vertical y-axis while successive sessions are shown along the horizontal x-axis. On the bottom graph, the number of reinforcers delivered per min is shown along the vertical y-axis while successive sessions are shown along the horizontal x-axis.

During the capturing phases, the average PRP was consistently higher during the punir condition and averaged 23 s. while ven conditions averaged 10 s. During the reversal phases, the average PRP remained higher during punir conditions and averaged 20 s while average PRP during ven conditions averaged 10 s. However, during the last sessions of the final reversal, the PRP difference was only about 1 s higher during the punir condition.

Throughout the experiment, the average rate of reinforcement was higher during the ven condition. During the capturing of target responses, reinforcers delivered per min averaged 5.06 during ven sessions and 2.80 during punir sessions. During reversals, an average of 6.21 reinforcers were delivered per min during ven sessions and an average of 3.49 reinforcers were delivered per min during punir sessions.

CHAPTER 8

DISCUSSION

Experiment 2

The results show that the ven cue was an effective conditioned reinforcer. Anecdotally, performance characteristic of the ven condition consisted of quick and energetic responding. The dog emitted the target response; the cue was given; and the terminal response immediately followed. After reinforcer delivery, the reinforcer was consumed and the dog immediately proceeded to emit the next response. In contrast, the reinforcing function of the punir cue was less unclear. Although captured behaviors were successfully maintained, performance characteristic of the punir condition consisted of slow and sluggish movement, wandering around the grid, increased errors such as emitting behaviors other than the target response, difficult transitions when the reinforcement criteria changed, and longer average post-reinforcement pauses. Similar to Experiment 1, undesirable emotional behavior was present throughout the punir condition. This occurred despite the fact that leash tugs were discontinued following session 55.

Another significant difference between the two conditions involved the ability to shape with the punir cue. Before the capturing phase, a shaping phase was conducted. The ven cue was effective in shaping new behavior. The dog emitted various behaviors, and successive approximations were easily selected. For example, back stepping, a topographically complex behavior, was shaped during the shaping phase of the ven condition and expanded upon during the capturing phase. In contrast, the contingencies in the punir condition produced little variability in behavior, which led to difficulty in the

selection of successive approximations. Responding typically consisted of wandering

around the grid and several instances of freezing lasting as long as 288 s. Due to the

limited variability in behavior and emotional responding (low tail wags and freezing), the

shaping phase was concluded and the capturing phase was initiated. These results are

similar to results reported by Hoffman and Fleshler (1959) who attempted to shape

successive approximations to key pecking with the termination of shock but found that

shaping under aversive stimulation might lead to a situation in which unlearned

responses may compete with the desired behavior. They resolved the problem by

choosing simpler responses. In this study, we also chose simpler responses that

occurred during the shaping phase and used these as the targets during the capturing

phase of the punir condition. The difficulties encountered during the shaping phase of

the punir condition suggested that the punir cue was not optimal for shaping using

successive approximations.

In addition to the problems encountered during the shaping phase, differences

were noted in the emotional behavior emitted during the punir condition. During the

capturing phase and subsequent reversals, the dog's behavior appeared to be

ambivalent; that is, a mixture of two emotional responses occurred. The high tail wags

characteristic of the ven condition occurred along with low tail wags during most

sessions of the punir condition. In addition, freezing, a behavior often associated with

fear (Lindsay, 2000) occurred at least once during each phase of the punir condition.

Typically, freezing occurred following a phase change and at one point lasted for 235 s.

Although durations of freezing decreased over time, occurrences did not. Furthermore,

observations of the videotaped sessions revealed that many of the high tail wags scored

36

during a session typically occurred following emission of the terminal response and prior to the click.

Although it appears the punir cue functioned as both a conditioned reinforcer in capturing and maintaining behavior as well as a discriminative stimulus for walking to the trainer, it was less effective than the ven cue in regards to speed, topography, and emotional behavior generated. Therefore, it was unclear as to whether the dog was emitting a number of chained behaviors (e.g., walking to the corner squares, walking to the target square) or if actual learning was occurring.

Thus, it appeared that additional reversals involving a target response in an opposite location on the grid could assist in clarifying of the function of the punir cue.

CHAPTER 9

INTRODUCTION

Experiment 3

During Experiment 2, both cues selected and maintained behavior. However, the effectiveness of the punir cue was questionable in terms of the topography of the target responses, accuracy, speed, and the emotional behavior produced when compared to the effectiveness of the ven cue.

One problem encountered during Experiment 2 that may have affected the ability to evaluate the function of the punir cue was that one of the target responses, walking to square F7, was in close proximity to a corner square. This made it difficult to assess whether the dog was walking to the incorrect square or whether walking to the corner square was part of a behavior chain.

Experiment 3 was conducted to further clarify the function of the punir cue by conducting a series of reversals in which the target responses for both the ven and punir conditions involved walking to a square that was not in close proximity to a corner square, squares A5 and G4, and were similar in distance from the trainer's square. Instead of reversing from one target behavior to another target behavior still associated with a particular cue, the reversals were between behaviors associated with the two different cues. Of additional interest, was whether emotional behaviors such as low tail wags, whining and freezing would persist during the punir condition with the elimination of leash tugs.

CHAPTER 10

METHOD

Experiment 3

Participant, Setting, and Materials

The same participant, setting, and materials from Experiments 1 and 2 were the

same as during Experiment 3.

Behavioral Measures and Recording Procedures

Six measures and 15 behaviors were recorded, measured, and defined as during

Experiment 2. Behaviors emitted by the dog included walking to squares F7, A5, G4, or

to the corner squares, back stepping high and low tail wags, snorting, whining, sitting,

lying down, and freezing. Behaviors emitted by the trainer included clicks delivered,

cues delivered, and leash tugs delivered and were defined and recorded in the same

way as Experiments 1 and 2. Session measures included the rate of reinforcement and

session duration and PRP. Data were collected electronically or by hand in the same

manner as Experiment 2.

Due to the development of possible superstitious behavior during the punir

condition, the definitions for *walking to squares A5 and G4* were modified. Beginning

with session 122 the dog was required to enter square A5 by walking in front of the

trainer or pausing briefly before entering square A5 from behind the trainer. In addition,

the dog could not leave the grid and enter square A5 from behind. During session 154,

the definition for walking to square G4 was modified to include a requirement to enter

square G4 by walking in a forward direction.

Interobserver Agreement

IOA scores were obtained by having a second observer independently collect data for 25% of the sessions. Agreement scores for each measure were collected and calculated as in Experiment 2.

For high tail wags delivered, the mean agreement was 97.7% (range, 90.0% to 100%). For low tail wags, the mean agreement was 81.1% (range, 60.0% to 100%). For whining, the mean agreement was 99.1% (range, 87.5% to 100%). For snorting, the mean agreement was 93.1% (range, 87.5% to 100%).

For leash tugs delivered, the mean agreement was 100%. For cues delivered, the mean agreement was 98.0% (range, 90.0% to 100%). For clicks delivered, the mean agreement was 97.1% (range, 90% to 100%). For freezing the mean agreement was 96.1% (range, 76.4% to 100%). For lying down, and sitting, the mean agreement was 100%.

For back stepping, the mean agreement was 98.3% (range, 93.3% to 100%). For walking to square F7, the mean agreement was 97.7% (range, 81.7% to 100%). For walking to square A5, the mean agreement was 94.6% (range, 80.8% to 100%). For walking to square G4, the mean agreement was 94.9% (range, 78.1% to 100%). For walking to the corner squares, the mean agreement was 93.5% (range, 76.7% to 100%).

Procedures

General. Procedures were the same as Experiments 1 and 2 with a few exceptions. A series of reversals were conducted in which the behaviors associated with each cue were reversed. In other words, the ven cue was delivered when the dog

walked to square G4 while the punir cue was delivered when the dog walked to square A5, and vice-versa. Unlike Experiments 1 and 2, the trainer no longer delivered leash tugs contingent on failure to emit the target response during punir conditions. Finally, a 15 m time limit was imposed for each session. Therefore, following the third session, a session began when the trainer stepped into square D6 and ended after the tenth trial or after 15 m had passed.

Cue Reversal: Walking to square G4. This condition was similar to the capture walking to square G4 condition during Experiment 2. However, square G4 was no longer exclusively associated with the punir cue. Depending on the condition in effect, the cue ven or punir was delivered contingent upon walking to square G4. The first trial began when the trainer stepped into the trainer's square (D6). The trainer waited for the dog to step into square G4. Once the dog emitted the target response, the trainer said "ven" or "punir" and waited for the dog to return to the trainer. When the dog stepped into the correct square (D5) the trainer clicked the clicker, delivered a food reinforcer, and the next trial began. If the dog failed to emit the target or terminal response within 3 s, the trainer waited until the dog emitted the correct response and ignored other responses. When the ven condition was in effect, walking to square G4 served as a cue reversal.

Cue Reversal: Walking to square A5. This condition was conducted using the exact procedures as the walking to square G4 condition except the cues ven and punir were delivered contingent upon walking to square A5. When the punir condition was in effect, walking to square A5 served as a cue reversal. During the final reversal

condition, the furniture was rearranged. This exposure lasted 10 sessions and served as the baseline for Experiment 4.

Experimental Design

A reversal design nested within a multi-element design was used to compare the effects of the cues as conditioned reinforcers for capturing behaviors with two training procedures: negative reinforcement combined with positive reinforcement which was associated with the cue punir and differential positive reinforcement only which was associated with the cue ven. The presentation of ven and punir conditions were arranged to avoid a set order. Ven and punir conditions were conducted in the following order: B-A-B-A-A. A represents the original cue while B represented the opposite cue.

CHAPTER 11

RESULTS

Experiment 3

Figure 9 shows the participant's performance during walking to squares A5 and G4 with the cue ven (top) and the cue punir (bottom). Each graph displays the number of times back stepping, walking to square A5, F7, G4 and walking to the corner squares occurred per min. Sessions are displayed along the horizontal axis (x-axis) and responses per min are displayed along the vertical axis (y-axis).

During the first cue reversal in which the ven cue was delivered contingently on a task previously associated with the punir cue, walking to square G4 was variable and fluctuated between 7.83 rpm (session 121) and 9.68 rpm (session 125) while walking to square A5 remained low at less than 1 rpm. By the second exposure of walking to square G4, responding increased from 6.72 rpm during the first session and continued to increase to 9.57 rpm during the final session. As walking to square G4 increased, walking to square A5 occurred at 5.28 rpm during the first session and decreased to 2.55 rpm by the fourth and final session. Back stepping and walking to corner squares occurred during both walking to square G4 exposures. During the first cue reversal, back stepping and walking to corner squares occurred during the first 2 sessions. Back stepping occurred at less than 4 rpm before decreasing to 0 rpm while walking to corner squares occurred at less than 2 rpm before decreasing to 0 rpm. During the second exposure, back stepping occurred at around 1 rpm during the first 2 sessions before decreasing to 0 rpm. Walking to corner squares occurred during the last 2 sessions and

43

increased from 1.41 rpm to 2.55 rpm. Walking to square F7 did not occur during either walking to square G4 phase.

When walking to square A5, the task associated with the ven cue during Experiment 2, was the target response, walking to square A5 initially occurred at 6.29 rpm but significantly increased by the second session to 10.00 rpm during the first phase. As walking to square A5 increased, walking to square G4 decreased from 2.29 rpm to 0 rpm. By the second exposure of A5, walking to square A5 began high at 9.57 rpm and leveled off to about 7 rpm during the last two sessions while walking to square G4 did not occur during the first session but increased sharply to about 4 rpm during the second session. By the third and final session (146), walking to square G4 decreased to 1.48 rpm.

When the furniture was changed, walking to A5 occurred at 9.43 rpm during the first session but decreased to 5.20 rpm by session 151. During the next session (153), responding increased to 6.32 rpm and varied between 7.23 and 10.83 rpm during subsequent sessions. Walking to square G4 ranged between 4.29 and 4.40 rpm, during the first three sessions. However, as walking to square A5 increased during session 153, walking to square G4 decreased to 1.89 rpm and remained low throughout the remainder of the phase, ranging between 0 and 2.89 rpm.

During the ven condition, walking to corner squares and back stepping remained low throughout each walking to square A5 phase while walking to square F7 never occurred. The highest rate of responding occurred during the first session (130), for both walking to corner squares (3.43 rpm) and back stepping (1.71 rpm). After session 130, walking to the corner squares occurred at less than 1 rpm while back stepping

44

ranged between .74 rpm and 1.65 rpm until the furniture was changed. When the

furniture changed, walking to corner squares and back stepping remained low and

ranged from 0 rpm to1.67 rpm and 0 rpm to 1.96 rpm respectively.

During the first cue reversal in which the punir cue was delivered contingently for

walking to square A5 (bottom graph), a task previously associated with the ven cue,

back stepping, walking to squares A5, G4, F7 and corner squares all occurred at less

than 3 rpm. The target response, walking to square A5, ranged between .40 rpm to .80

rpm with the highest rate of responding occurring during the second session (123).

Walking to square G4 gradually decreased from 1.27 rpm to .67 rpm during the final

session but remained higher than the target response. Walking to the corner squares

occurred at the highest rate and ranged from 1.20 to 2.40 rpm. Walking to square F7

ranged from .20 to .73 rpm with the highest rates occurring during the first session.

Back stepping occurred at a very low rate, (.27 rpm), during the first session and

decreased to .07 rpm by the second session. After session 123, back stepping no

longer occurred during punir conditions.

By the second exposure of A5, walking to A5 increased to 3.73 rpm during the

first session (133), decreased to 2.98 rpm during the next session and significantly

increased to about 6.5 rpm during the last 2 sessions. Walking to square G4 showed a

similar trend but occurred at a higher rate than the target response. Walking to G4

increased to 5.17 rpm during session 133, decreased to 3.72 rpm during the next

session and significantly increased to 6.53 rpm during session 138 and continued to

increase to 7.43 rpm during the last session. Walking to the corner squares began high

(4.88 rpm) but decreased to 2.65 rpm by session 139. Walking to square F7 occurred

during the first 2 sessions at less than 1 rpm and decreased to zero rpm by session 138.

When walking to square G4, the task associated with the punir cue during Experiment 2, was the target response, walking to square G4 began high (4.38 rpm) but significantly decreased during session 132 to 2.64 rpm during the first phase. This decrease is partly due to an attempt to extinguish approaching square G4 from the side. Walking to squares A5 and F7 occurred at the same rate during sessions 129 and 132, .44 and 1.06 rpm respectively. Walking to the corner squares increased from .88 rpm during the first session to 3.04 rpm during the final session, a rate higher than the target response.

During the second walking to square G4 phase, walking to square G4 increased from the previous exposure to 8.35 rpm but decreased and stabilized at around 7 rpm. Both walking to square A5, and walking to the corner squares occurred at 3.13 rpm during session 129. However, walking to square A5 decreased to 1.26 rpm while walking to corner squares increased to 4.42 rpm during session 145. Walking to square F7 remained below 1 rpm during this phase.

When the furniture was changed, walking to square G4 remained high and increased to 8.2 rpm during sessions 155 and 161. However, responding to square G4 began to decline during sessions 164 and 165 to 6.63 rpm and 4.62 rpm respectively. Walking to square A5 followed a similar pattern at a lower rate of responding. Walking to square A5 began at 2.09 rpm during session148, decreased to 1.04 rpm during the next session, increased to around 4 rpm during subsequent sessions and then decreased to 2.56 rpm during the last session. Walking to the corner squares was

variable and ranged from 1.20-4.71 rpm. During the last session walking to the corner squares and walking to square A5 had the same rate of responding as walking to square A5, 2.56 rpm. Walking to square F7 remained low throughout the phase and never reached more that 1.23 rpm.

Figure 10 displays the number of trials in which high and low tail wags, whining, snorting, and leash tugs occurred during the ven condition (top) and the punir condition (bottom). The number of trials in which each behavior occurred is shown along the y-axis while sessions are shown along the x-axis.

High tail wags occurred during every trial during each phase of the ven condition. Low tail wags occurred during 1 trial of the second cue reversal phase and during a total of 4 trials when the furniture was changed. Snorting occurred during each session and varied between 1 and 5 trials per session. Whining did not occur during the ven condition.

During punir conditions, leash tugs no longer occurred. High tail wags occurred during every session and ranged from 2 to 10 trials. Low tail wags occurred during every session except 139 and 145 and ranged from 1 to 8 trials, snorting occurred during each session except sessions 126, 129, 138, 139, and 145 and ranged from 1 to 6 trials.

During the first cue reversal (A5) of the punir condition, high tail wags occurred during 6 trials of the first session and varied between 2 and 5 trials during subsequent sessions. High tail wags increased and ranged from 9 to 10 trials during the second exposure. Low tail wags ranged from 3 to 5 trials per session during the first cue reversal and decreased to 0 by the final session of the second exposure. Whining

47

occurred exclusively during the cue reversals and ranged from 1 to 2 trials. Snorting ranged from 0 to 3 trials during the first cue reversal and decreased to 0 by session 138 of the second exposure.

During walking to square G4 conditions, high tail wags steadily increased from 7 to 10 trials until the furniture was changed. After the furniture changed, high tail wags became variable and ranged from 3 to 11 trials. Low tail wags occurred during 4 trials in the first session (129) and decreased to 0 by session 73 of the second exposure. However, when the furniture was changed low tail wags occurred during each session and varied between 1 to 8 trials per session. Snorting occurred during 2 trials of the first walking to square G4 condition and decreased to 0 by the final session of the second exposure (session 145). Snorting began to increase once the furniture changed and became variable ranging from 1 to 6 trials per session.

During ven conditions freezing, sitting, and lying down did not occur. However, during punir conditions, freezing durations ranged from 12 s to 361 s and occurred during 7 sessions (graph is not included). The most notable effects occurred during the first cue reversal in which freezing occurred during each session. During the first session, session 122, freezing occurred for 197 s and steadily increased. By the third session, session 126, freezing increased to 361 s. Freezing decreased to 351 s during the final session of this condition. During the first walking to square G4 phase, freezing occurred during both sessions. Freezing occurred again during session 132 for a brief 12 s. Sitting and lying down did not occur during this experiment.

Figure 11 displays the average post-reinforcement-pause (PRP) during ven and punir conditions on the top graph. The average number of seconds is shown along the

y-axis while successive sessions are shown along the x-axis. On the bottom graph, the number of reinforcers delivered per min is shown along the y-axis while successive sessions are shown along the x-axis.

Throughout the experiment, PRP was lower and more stable during the ven condition with the exception of 1 session, session 144. PRP ranged between 3.67 s and15.89 s during ven conditions and between 6.11 s and 263.50 s during punir conditions throughout the entirety of the experiment. During the cue reversal phases, the PRP was consistently higher during the punir condition. The clearest differences occurred during the first cue reversal, which was partly due to the extinction of approaching square A5 from behind the trainer. PRP ranged from 102.80 s to 263.50 s during the punir condition and 3.97 s to 15.89 s during the ven condition. By the second cue reversal, PRP decreased and stabilized during the punir condition ranging between 7.22 s to 11.44 s, and slightly decreased during the ven condition ranging from 3.67s to 7.89s. When the furniture was changed, PRP began to increase from 6.33 during session 149 to 16.90 s during session 165, the final session. It is during this period of time (session 154) that the requirement to enter square G4 in a forward motion was implemented. Therefore, it is possible that the increase in PRP duration is partially a function of the extinction of side approaches to square G4.

Throughout the experiment, the average rate of reinforcement was higher and more stable during the ven condition. Reinforcers delivered per min averaged 6.94 during ven conditions and 3.47 during punir conditions. During ven cue reversals (walking to square G4), an average of 6.50 reinforcers were delivered per min during and an average of 2.24 reinforcers were delivered per min during punir cue reversal

49

sessions (walking to square A5). The clearest and most pronounced divergence between ven and punir conditions occurred during the first cue reversal. The number of reinforcers per min delivered during the ven condition ranged from 3.19 to 9.68. In contrast, the number of reinforcers delivered per min ranged from .20 to .40 during the punir condition. The low rate of reinforcement during the punir condition is likely due to extinction as walking to square A5 from behind the trainer no longer resulted in the delivery of the cue. By the last 2 sessions of the second cue reversal (sessions 164 and 165), reinforcers delivered per min during the punir condition increased to about 5. A slight decreasing trend occurred during the final phase of the punir condition after session 152; this decrease is most likely due to extinction of approaching square G4 from the side.

CHAPTER 12

DISCUSSION

Experiment 3

Similar to Experiment 2, the results of Experiment 3 demonstrated that the ven cue was effective as a conditioned reinforcer. The ven cue successfully selected a behavior previously related with the punir cue. In contrast, the punir cue was less effective in the selection of a behavior initially associated with the ven cue. However, walking to square G4 improved across conditions. Accuracy, speed, and emotional behaviors such as tail wags and freezing visibly differed between the two conditions. In addition, it appeared that rearranging the furniture affected behavior during the punir condition.

The results show that responding during the ven condition was quick during each phase of the experiment. Sessions consistently lasted around 3 min or less. During the cue reversal, the dog walked to square G4 (a behavior initially, captured with punir) or square A5. The cue was delivered, and the dog returned to the trainer. High tail wags were scored as either occurring or not occurring during each trial. Unfortunately, this measure does not capture the frequency of high tail wags per trial. Visual inspection of videotaped sessions revealed that high tail wags often occurred continuously throughout many of the sessions. In addition, the dog appeared "enthusiastic" and eager to learn. To be precise, the dog moved quickly averaging about eight responses per minute for the target response, high tail wags occurred during each trial, and responding was accurate. Sessions lasted around 3 min or less.

In contrast, the initial cue reversal during the punir condition involved emitting a response that was previously associated with the ven cue (walking to square A5). This condition appeared "traumatic" for the dog. That is to say, the dog engaged in freezing behavior for long periods or quit responding altogether and other behaviors such as sitting and lying down also occurred. The dog walked slowly averaging about 1 rpm for the target response. Although responding to the target square contacted reinforcement, the dog continued to walk to square G4 (the previous punir response), wander around the grid, and walking behind the trainer to approach square A5, clearly a more effortful route to the target square. A session time limit of 15 min was imposed due to the lack of responding encountered during the first phase. In addition, it appeared that learning had not occurred during this phase. The highest response rates during this condition occurred for walking to corner squares indicating that wandering remained a problem even though we selected target responses located further from the corner squares.

During the second cue reversal of the punir condition, accuracy improved somewhat but appeared random at best and was possibly due to walking back and forth between squares A5 and G4. As a result, response rates for these two targets covaried and the occurrence of chains of behavior continued to be present.

Freezing decreased and eventually went away over time and the occurrence of high tail wags increased over time. However, low tail wags persisted. When the furniture was rearranged, high tail wags and low tail wags varied, suggesting that even the smallest environmental change had an effect on these behaviors.

Experiment 3 was conducted to clarify the function of the punir cue, the results seem somewhat clearer than the results from Experiment 2. That is, the punir cue was not as

effective as the ven cue when capturing new behavior. As Hearst and Sidman (1961) suggested, there appears to be some type of interaction between the positive and negative aspects of the cue due to the combined training procedures. Experiment 4 was conducted to examine the specific characteristics of the punir condition that seemed to function as aversive stimulation. In addition, two new behaviors were selected in yet another attempt to eliminate the chains of behavior that continued to occur during the punir condition.

CHAPTER 13

INTRODUCTION

Experiment 4

During Experiment 3, the ven cue successfully captured a behavior previously associated with the punir cue. However, it appeared that the punir cue was not as successful in selecting a behavior previously associated with the ven cue. Several reversals were conducted in Experiments 2 and 3 in an attempt to clarify the function of the punir cue. However, problems with behavior chains and topography persisted. It is not clear whether the punir cue was ineffective as a conditioned reinforcer or whether the development of behavior chains and emotional behavior interfered with learning.

Experiment 4 compared the effects of the cues as conditioned reinforcers in teaching a discrimination as well as examining the stimulus control exerted by the leash, the ven and punir cues, as well as the context. A third behavior was selected for each cue in hopes of eliminating the possible superstitious chains of behavior that developed during Experiments 2 and 3 in the punir condition.

CHAPTER 14

METHOD

Experiment 4

Participant, Setting, and Materials

The participant, setting, and materials from the previous three experiments were the same as during Experiment 4. Additional materials included a metal jewelry box, a small trashcan, and a new leash. A new setting, the foyer, was used in order to test the effects of the leash and harness in other contexts. The room contained a small table, a large round table with four chairs, and various decorative items such (e.g., a vase of flowers, china). There were four entrances to the foyer. One entrance led to the kitchen and one led to the office. Two entrances contained doors, which led to the living room and outdoors.

Behavioral Measures and Recording Procedures

The same procedures for data collection used during the first three experiments were implemented during Experiment 4 except that sessions were limited to 10 min in duration. The measures collected during Experiment 2 and 3 were also used during Experiment 4. However, walking to squares F7, A5, G4, or corner squares, and back stepping were not recorded. Instead, four other behaviors emitted by the dog were measured, including walking to square A1 and targeting an object, an approximation to walking to square A1, walking to square G1 and targeting an object, and an approximation to walking to square G1.

A *target* was defined as the dog having his face or snout above and within approximately 6 in of the target object and stepping into squares A1 during punir sessions and square G1 during ven sessions.

An *approximation* was defined as the dog stepping into squares A1, A2, A3, B1, B2, or B3 during punir sessions or squares F1, F2, F3, G1, G2, or G3 during ven sessions while walking toward the object but not targeting the object.

Response frequency was recorded for walking to a particular square and targeting an object as well as approximations to walking to particular squares. These data were converted into response rates by dividing the number of occurrences per session by session duration.

Procedures

General. Procedures were similar to Experiments 2 and 3 during the Capturing, Leash & Harness, ven cue only, and the No Leash and Harness conditions. Each session consisted of 10 trials except for sessions 87, 104, 109, and 116 of the punir condition; and sessions 169, 172, 103, 104, 108, 116, and 118 of the ven condition. A session began when the trainer stepped into square D6 and ended after the tenth trial or after 15 m elapsed.

Procedures during the testing of the leash and harness in a new context differed from the others. During testing, sessions continued to be conducted in pairs that were approximately 3 hrs apart. However, sessions were conducted in the new setting, the foyer.

Capturing: Walking to squares A1 & G1 and targeting object. Procedures were identical to capturing conditions in Experiment 2. However, walking to squares A1 & G1 were the target squares and objects were placed in each of the squares.

During ven sessions, walking into square G1 and targeting a jewelry box placed in the center of the square was required to produce the ven cue. The first trial began when the trainer stepped into square D6. Once the dog entered square G1 and targeted the object, the trainer said ven and the dog had approximately 3 s to return to square D5. When the dog stepped into square D5, the trainer clicked the clicker, delivered a treat, and the next trial began. If the dog did not return to square D5, no click or treat delivery occurred and the next trial began. During the first session of capturing, only the jewelry box was present to aid in the discrimination. However, during subsequent sessions, both objects were present.

During punir sessions, procedures were similar to ven sessions except the cue punir was delivered contingent upon walking to square A1 and targeting an upside down trashcan placed in the middle of the square. During the first session, only the trashcan was present to aid in the discrimination. However, during subsequent sessions, both objects were present.

The capturing phase continued until there were there were three successive sessions with 1 or fewer incorrect targets.

No leash or harness. Procedures during ven and punir sessions were the same as the capturing condition. However, neither the leash nor harness were worn or present during punir or ven sessions in order to examine the effects of the punir cue.

Both exposures to the No leash or harness condition were conducted for three sessions.

Leash & harness. Procedures during ven and punir sessions were the same as the capturing condition. However, the dog wore the leash and harness during both punir and ven sessions in order to examine the effects of the leash during ven sessions. The first exposure to the leash and harness condition consisted of four sessions and the second exposure consisted of three sessions for each cue.

Ven cue only. Procedures for both ven and punir sessions were the same as the capturing condition. However, the ven cue was delivered contingent upon walking into square G1 and targeting a jewelry box during ven sessions and walking into square A1 and targeting the upside down trash can during punir sessions. The punir cue was not used in this condition. Eleven sessions were conducted for both ven and punir conditions.

Leash & harness in other contexts: Testing was conducted to evaluate the potential effects of the leash and harness on the dog's behavior in other contexts. A session began when the dog sat down. When the dog sat, the trainer attached the leash that was used during the punir condition. After the leash was attached, the trainer opened the front door and took the dog for a walk. A session ended when the dog returned from the walk and the leash was removed. Then during the next condition, the leash and harness that were used during the punir condition were used to walk the dog. Sessions were videotaped but data were not collected during this condition.

Interobserver Agreement

IOA scores were obtained by having a second observer independently collect data during 25% of the sessions for tail wags, snorting, and whining; during 30% of the sessions for clicks, cues, and leash tugs; and during 31% of the sessions for targeting and approximations. Agreement scores for each measure were collected and calculated exactly the same as Experiments 2 and 3.

For high tail wags delivered, the mean agreement was 91.8% (range, 41.7% to 100%). For low tail wags, the mean agreement was 95.5% (range, 80.0% to 100%). For whining, the mean agreement was 99.4% (range, 90.0% to 100%). For snorting, the mean agreement was 89.5% (range, 75.0% to 100%).

For clicks delivered, the mean agreement was 97.6% (range, 80.0% to 100%). For lying down, freezing, and sitting, the mean agreement was 100%.

For walking to square G1 and targeting an object, the mean agreement was 98.2 % (range, 73.3% to 100%). For approximations to walking to square G1, the mean agreement was 99% (range, 81.7% to 100%). For walking to square A1 and targeting an object, the mean agreement was 96.8% (range, 45.0% to 100%). For approximations to walking to square A1, the mean agreement was 99.0% (range, 86.7% to 100%).

Experimental Design

A reversal design nested within a multi-element design was used to compare the effects of the cues as conditioned reinforcers for capturing a new behavior as well as the effects of the leash and harness. Ven and punir conditions were conducted in the following order: A-B-C-B-C-D. A represents capturing, B represents the removal of the

59

leash and harness, C represents the addition of the leash and harness to the ven condition, and D represents the use of the cue ven during punir sessions.

CHAPTER 15

RESULTS

Experiment 4

Figure 12 shows the participant's performance during capturing, no leash, and

leash conditions with the cue ven (top) and with the cue punir (bottom). Each graph

displays the number of times the ven and punir objects were targeted, the number of

approximations towards ven and punir objects and the combined number of

approximations towards ven and punir objects. Sessions are displayed along the x-axis

and rpm are displayed along the y-axis.

During the capturing walking to squares G1 and targeting an object phase of the

ven condition, targeting the ven object (jewelry box), occurred at 5.45 rpm during the

first session and increased to 7.32 rpm during the final session. In comparison, walking

to square A1 and targeting the punir object (upside down trash can) remained low and

ranged from 0 rpm to 4.16 rpm. Incorrect responses to the punir target decreased to 0

rpm during sessions 195 and 198 but steadily increased by session 204 to 2.20 rpm.

Both ven and punir target approximations occurred at less than 1 rpm. Ven target

approximations only occurred during 3 sessions (183, 189 and 200) and punir target

approximations occurred during 2 sessions (169 and 186).

When the leash was added during the ven condition, correct responding to the

ven target significantly decreased from 7.32 rpm during session 204 of the capturing

phase to .30 rpm during session 206. After session 206, response rates increased to 4

rpm during the final session. Incorrect responses to the punir target occurred at a higher

rate (.40 rpm) than correct responses to the ven target during the first session (206).

Punir targets steadily increased from .40 rpm to 3.20 rpm by the final session (212).

Both ven and punir target approximations remained low and when combined, ranged

from .10 to .40 rpm.

When the leash was removed during the ven condition, a sharp increase in

correct ven targets (9.84 rpm) occurred during session 213. However, responding

decreased to about 7 rpm during the last 2 sessions of this phase. In comparison, punir

target response rates remained significantly lower and ranged from .79 rpm to 1.30 rpm.

Punir target approximations did not occur during this phase while ven target

approximations occurred during sessions 216 and 218 at less than 1 rpm.

When the leash was returned to the ven condition, ven target response rates

once again decreased to rates similar to sessions 209 and 212 of the previous leash

condition (3.55 rpm to 4.55 rpm). Similarly, incorrect punir targets increased and

remained stable at around 3 rpm as in the last session of the previous leash phase.

Approximations to each target remained low and combined occurred at less than 1 rpm.

When the leash was once again removed from the ven condition, ven target

response rates immediately increased, averaging 8.11 rpm and ranging between 6.51

and 10.53 rpm. Punir targets on the other hand, averaged 1.87 rpm and ranged

between 0 and 3.85 rpm, and punir target approximations never occurred.

During the capturing walking to square A1 and targeting an object phase of the

punir condition, targeting the punir object (upside down trash can), occurred at 1.15 rpm

during the first session and steadily increased to 4.51 rpm during session 175.

Following session 175, response rates began to fluctuate between 3.66 rpm and 6.90

rpm. Incorrect responses to the ven target were higher than correct responses to the

punir target during the first session (170) but began decreasing from 2.65 rpm to .45 rpm across the next 3 sessions while correct punir targets were increasing. Ven target response rates again increased during sessions 180 and 192 to 1.83 rpm and 1.46 rpm and were followed by decreases to less than 1 rpm. Punir targets averaged 4.25 rpm while ven targets averaged 1.18 rpm throughout the capturing phase. Punir target approximations occurred during 3 sessions at less than 1 rpm. Ven target approximations on the other hand, occurred during most sessions and ranged from 0 rpm to 1.97 rpm.

When the leash was removed during the punir condition, incorrect responses to the ven target increased sharply to 4.97 rpm during the first session (199). However, responding decreased to 3.97 rpm during the last session of this phase. In comparison, correct responses to the punir target occurred at a lower rate (3.82 rpm) than incorrect targets. By the last session of the phase, correct responses to the punir target reached a maximum of 4.96 rpm. Punir target approximations did not occur during this phase and ven target approximations only occurred during the first two sessions (1.15 and .32 rpm).

During the next phase, the leash was returned to the punir condition and response rates for targeting the punir object, the correct response, decreased from 4.96 rpm during the last session of the previous phase to 3.82 rpm during the first session with the leash. Response rates for correct responses to the punir object occurred at around 4 rpm with the exception of session 208 in which correct targets to the punir object and incorrect targets to the ven object both occurred at .36 rpm. Excluding session 208, incorrect targets to the ven object occurred at less than 2 rpm while

63

approximations to the ven object occurred during 2 sessions (205 and 210) at around .40 rpm.

When the leash was removed again, correct targets to the punir object, immediately increased to 5.26 rpm, a rate slightly higher than the previous no leash phase. As correct responses increased, incorrect responses to the ven target also increased from 1.59 rpm during the previous leash phase to 4.21 rpm during session 214. Typically, response rates for targeting the correct object were higher than approximations to the incorrect object except during session 217 where targets to the ven object occurred at 6.11 rpm while targets to the punir object occurred at 4.44 rpm. Target approximations to either object did not occur during this phase.

When the leash was returned, correct responses to the punir target increased over time from 2.87 rpm to a maximum of 3.05 rpm during the final session. Similarly, incorrect responses to the ven target increased from 1.60 rpm to a maximum of 2.44 rpm during session 224. Response rates during this phase were similar to response rates for both correct and incorrect responses during the previous leash phase of the punir condition. Approximations to ven targets occurred at a low rate during each session and ranged between .30 and .64 rpm.

When the leash was removed and the ven cue was delivered instead of the punir cue, both punir and ven target response rates immediately increased and occurred at a similar rate, 3.73 rpm and 3.35 rpm, and approximations decreased to 0 rpm. By session 229, targeting the punir object, the correct response, reached a maximum of 10.34 rpm and averaged 7.16 rpm during this phase. Responses to the incorrect target, the ven target, occurred at around 2 rpm or lower following the first session with the

exception of session 232 (4.16 rpm). On average, correct responses to the punir target during this phase (7.16 rpm) were similar in rate to correct responses to the ven target during the final phase of the ven condition (8.11 rpm). Approximations to either target only occurred during sessions 232 (.59 rpm) and 242 (.75 rpm).

Figure 13 displays the number of trials in which high and low tail wags, whining, and snorting occurred during the ven condition (top) and the punir condition (bottom). The number of trials in which each behavior occurred is shown along the vertical y-axis while sessions are shown along the horizontal x-axis.

During the capturing phase of the ven condition, High tail wags occurred during most trials, except for session 182 in which both high and low tail wags occurred during 7 trials and session 194 in which high tail wags occurred during 1 trial while low tail wags occurred during each trial. Low tail wags rarely occurred except during sessions 182, 188, 194, and 195 in which low tail wags occurred during 7, 1, 12, and 4 trials respectively. On average, high tail wags occurred during 9.11 trials and low tail wags occurred during 1.78 trials. Whining only occurred during 1 trial of session 189. Snorting occurred during 6 sessions but never during more than 2 trials.

When the leash was added to the ven condition, high tail wags decreased from the previous phase and did not occur during the first two sessions. High tail wags during occurred again during the last 2 sessions. Initially, low tail wags occurred during only 1 trial of the first session and gradually increased to 6 trials during the third session before decreasing to occurring during 2 trials of the final session. Whining only occurred during 1 trial of session 209 while snorting only occurred during 1 trial of session 212

When the leash was removed, high tail wags increased and ranged between 8 and 10 trials while low tail wags decreased to 1 trials during the last 2 sessions. Whining did not occur and snorting only occurred during 1 trials of session 216.

When the leash was returned, high tail wags ranged from 6 to 10 trials per session and low tail wags increased and ranged from 3 to 8 trials per session. Whining did not occur and snorting occurred during 1 trial in the first and second sessions.

When the leash was removed during the final phase, high tail wags occurred during most trials (9 –11) similarly to the previous no leash phase. Low tail wags only occurred during 2 sessions (231 and 240) and occurred during 2 or less trials. Whining did not occur and snorting occurred during most sessions ranging between 1 and 3 trials per session.

During the capturing phase of the punir condition, high tail wags occurred during each trial of the first session (170) and gradually decreased 0 trials in session 184. By the next session, session 185, high tail wags began fluctuating and ranging in occurrence between 0 and 10 trials. Low tail wags occurred during only 1 trial of the first 3 sessions, followed by a gradual increase to 10 trials by session 180. Following session 180, low tail wags continued to fluctuate and ranged between 0 and 10 trials throughout the capturing phase. On average, high tail wags occurred during 6.07 trials per session while low tail wags occurred during 4.53 trials per session. Whining only occurred during 1 trial of session 187 and snorting occurred during 1 trials of session 193.

When the leash and harness were removed, high tail wags increased in occurrence and ranged between 9 and 10 trials. Low tail wags immediately decreased

to 2 trials in the first session (199) and continued to decrease to 0 trials by the final session (203). Whining did not occur during any of the sessions and snorting occurred during each session and ranged between 2 and 6 trials.

When the leash was reintroduced, high tail wags immediately decreased to 5 out of 10 trials during session 205 but increased to 9 trials by session 211. Low tail wags immediately increased from occurring during 0 trials during the previous no leash phase to occurring in 8 out of 10 trials during session 205. Whining occurred during 1 trial of the first session and snorting occurred during 1 trial of the last 2 sessions (210 and 211).

When the leash and harness were removed again, high tail wags occurred during most trials and ranged between 8 and 10 trials per session. Low tail wags only occurred during 2 trials of the first session (214) and decreased to 0 trials by the second session (215). Whining did not occur during any of the sessions and snorting occurred during each session and ranged between 2 and 7 trials.

When the leash and harness were returned, high tail wags immediately decreased to 1 out of 10 trials during session 220 but increased to 7 out of 10 trials by the next session 221. However, by the final session (224) high tail wags decreased again to 1 out of 10 trials. Low tail wags immediately increased from occurring during 0 trials during the previous no leash phase to occurring in all 10 trials during session 220. A significant decrease to 4 trials occurred during the following session (221) but returned to 10 trials by the final session (224). Whining did not occur and similarly to the previous leash condition, snorting occurred during 1 trial of the last 2 sessions (221 and 224).

Finally, when the leash and harness were removed and the ven cue was used instead of the punir cue, high tail wags occurred during every trial except during sessions 226 and 232 in which high tail wags occurred during 7 and 9. Low tail wags occurred during most sessions with the highest number of occurrences during sessions 225 and 226 (5 trials and 8 trials respectively). However, after the first 2 sessions, low tail wags varied in occurrence from 0 to 2 trials per session throughout the remainder of this phase. Whining never occurred and snorting varied with an average of 1.64 trials per session.

Although a graph is not presented, it should be noted that freezing occurred during both ven and punir conditions. During punir conditions, freezing occurred during phases in which the leash and harness were returned following a no leash and harness phase. When the leash and harness were returned the first time, freezing occurred during session 210 for 6 s. When the leash and harness was reintroduced the second time, freezing occurred during sessions 220 and 224 for 15 s and 6 s respectively. During the ven condition, freezing occurred during phases in which the leash and harness were added. During the first addition of the leash and harness, freezing, lying down, and sitting occurred. During the first two sessions, sessions 206 and 207, the dog sat on the floor or lay under the camera until the session timed out. In addition, freezing occurred for several seconds during these sessions. Unfortunately, the camera malfunctioned during both sessions and duration data were unable to be collected. Freezing also occurred during session 211 for 6 s. When the leash was added the second time, freezing occurred during session 221 for 6 s and again during session 224 for duration of 1 s.

Figure 14 displays the average post-reinforcement-pause (PRP) during ven and punir conditions on the top graph. The average number of seconds is shown along the y-axis while successive sessions are shown along the x-axis. On the bottom graph, the number of reinforcers delivered per min is shown along the y-axis while successive sessions are shown along the x-axis.

During the capturing phase, the PRP was similar for both the ven (47 s) and punir (51.22 s) conditions during the first session of the experiment (167 and 168). During subsequent sessions, the average PRP was higher during the punir condition and ranged between 6.89 s and 45.40 s while the average PRP ranged between 4.44 and 8.75 s during the ven condition.

When the leash and harness were added to ven condition, the average PRP increased from 6.22 s during session 204 of the capturing phase to 21.8 s during session 207. The PRP also increased during the punir condition from 9.67 s during the no leash phase to 12.9 s. Similar increases in the average PRP occurred during the second phase in which the leash and harness were added. During the ven condition, the average PRP increased from 7.11 s during session 218 to 11.4 s when the leash and harness were added to session 219. During the punir condition, the average PRP increased from 11.4 s during session 217 to 18.3 s during session 220. Due to camera malfunction, data were not collected during session 206 of the ven condition and session 208 of the punir condition. Overall, when the leash and harness were added to the ven condition, the average PRP ranged between 10.4 s and 21.8 s while the punir condition ranged from 12.7 s to 18.7 s.

During the first phase without the leash and harness, the average PRP ranged between 9.67 s to 16.6 s, and was similar to the average PRP during the capturing phase of the punir condition with the exception of session 170 in which the average PRP was 45.4 s. The second time the leash and harness were removed, the average PRP ranged slightly decreased and ranged between 6.11 to 11.4 s. During ven conditions without the leash, the PRP ranged between 4.11 s to 7.11 s during the first phase without the leash and harness. During each phase without the leash and harness, the average PRP remained lower during the ven condition than the punir condition.

However, during the final phase in which the leash was removed and the ven cue was used during both conditions the PRP is similar in both ven and punir conditions but remained slightly higher during the punir condition. The average PRP ranged between 3.67 s and 7.25 s during the ven condition and 4.89 s to 12.7 s during the punir condition.

Throughout the experiment, the rate of reinforcement was typically higher during the ven condition with the exception of the phases in which the leash and harness were added to the ven condition. The combined average rate of reinforcement when the leash was added was 3.17 reinforcers delivered per min during the punir condition and 3.13 reinforcers delivered per min during the ven condition. During the final phase in which the ven cue is used during the punir condition in addition to the removal of the leash and harness, the average rate of reinforcement is only slightly higher during the ven condition (8.11 reinforcers per min) than during the punir condition (7.6 reinforcers per min).

CHAPTER 16

DISCUSSION

Experiment 4

The results of Experiment 4 demonstrate that the leash and harness as well as the cue punir acquired aversive properties. The presence of the leash and harness disrupted responding and emotional responding occurred during the ven condition. During the punir condition, when the leash and harness were removed emotional responding improved but all other behavior remained similar to the behavior displayed during the conditions with the leash (e.g., behavior chains continued to develop during the punir condition). This suggests that in addition to the leash, the cue punir was also associated with aversive properties.

Performance characteristic of the ven condition without the leash consisted of quick energetic responding as reflected in high response rates and brief post reinforcement pauses. However, when the leash and harness were systematically added and removed, responding was disrupted. When the leash and harness were added to the ven condition, response rates decreased and ranged from .30 rpm to 4.58 rpm and post-reinforcement pauses increased. Errors also increased in that more targets occurred to the punir target. In addition, emotional behavior differed as well. Low tail wags, a behavior typically associated with the punir condition increased when compared to conditions in which the leash and harness were not present.

When the leash and harness were removed from the ven condition, response rates ranged from 6.90 to 10.53 rpm and accuracy immediately increased. The average post-reinforcement pause per session decreased. In addition, emotional behavior

improved in that low tail wags disappeared and high tail wags occurred during most trials. These results suggest that the leash and harness in addition to the punir cue acquired aversive properties.

Performance during the phases including the leash and harness in the punir condition consisted of slow movement, wandering back and forth between the ven and punir objects (squares A1 and G1), increased errors such as targeting the ven target or approximations to either object, and longer post-reinforcement pauses. Similar to the previous experiments, emotional behavior (i.e. low tail wags) was present. Low tail wags occurred despite the discontinuation of leash tugs. Like the previous experiments, the dog appeared ambivalent in that high tail wags characteristic of the ven condition occurred along with low tail wags during most sessions of the punir condition.

Initially, when the leash and harness were removed response rates declined and errors in the form of ven targets increased. However, during the second reversal, response rates surpassed those during the No leash phase, but they were not as high as responding that occurred during the ven condition. Post reinforcement pauses decreased with the removal of the leash and harness. In addition, emotional behavior changed. Low tail wags rarely occurred, high tail wags occurred during most trials, and the snorting typically associated with the ven condition increased. In addition to disrupted responding and emotional behavior, the behavior chains that developed during capturing persisted when the leash and harness were removed. These additional behaviors have been noted in other experiments and are considered superstitious behavior (Aeschleman, Rosin, and Williams, 2003; Hoffman & Fleshler, 1959; and

Solomon & Wynne, 1953). These results suggest that the punir cue acquired aversive properties.

When the leash and harness were removed and the ven cue was used instead of the punir cue, significant changes occurred. Response rates increased and ranged from 3.73 to 10.34 for the target response, post-reinforcement pauses became similar to the ven condition and high tail wags associated with the ven condition occurred during most trials while low tail wags rarely occurred. In addition, the chains of behavior disappeared suggesting that the chains were due to the aversive functions of the stimuli. These results suggest that changing the cue and removing other aversive stimuli was an effective treatment.

At the end of the experiment, it seemed worthwhile to explore the effects of the leash and harness in a different context. The effects of the leash used during the previous experiments and those of a new leash were examined. Subsequent sessions included both the leash and the harness. Interestingly, it appeared that the leash and harness did not generate emotional responding when placed on the dog in another room in the context of going for a walk and the effects seen during our experiments did not appear to generalize.

In summary, the cue as well as the leash and harness acquired aversive properties that affected response rates, post-reinforcement pauses, and emotional behavior. However, when these elements were removed and the cue associated with positive reinforcement was substituted accuracy increased, response rates increased, post-reinforcement pauses decreased, behavior chains were eliminated, and emotional

behavior associated with the positive reinforcement condition replaced the emotional

behavior associated with the punir condition.

CHAPTER 17

GENERAL DISCUSSION

During Experiment 1, the target response (walking to the trainer) was trained using two training procedures. In the presence of the ven cue a differential positive reinforcement procedures was implemented to train the target response. In the presence of the punir cue, both positive and negative reinforcement procedures were implemented. The results of acquisition, demonstrated that walking to the trainer was successfully acquired using both the ven and punir cues. However, overall accuracy was more consistent during the ven condition and high tail wags occurred during most trials. In contrast, more errors occurred during the punir condition and emotional responding was highly variable (i.e., high and low tail wags).

The results of the present series of experiments are consistent with literature examining the effects of punishment in that the current procedures produced emotional responses, suppressed responding, and superstitious behavior (Estes & Skinner, 1941; Solomon & Wynne, 1953; Hoffman & Fleshler, 1962). The current study adds to the literature in that the effects produced by aversive stimulation alone also occurred when positive and negative reinforcement procedures were combined. Additionally, although emotional responding improved over time in some conditions, relapses occurred if the target response changed (i.e., reversal) or if other minor changes such as rearranging the furniture occurred. These results are similar to Hoffman & Fleshler (1965) who suggest that a period of stress (i.e. presentation of free shock) can lead to a partial recovery of conditioned suppression. Although emotional responding improved at times, accuracy and speed continued to be lower than comparison conditions.

During Experiment 4, the control exerted by the leash and harness as well as the cues were examined with new target responses (i. e., walking to squares A1 and G1 and targeting an object). The results demonstrated that the punir cue as well as the leash and harness alone produced detrimental effects in regards to accuracy, post-reinforcement pauses, emotional behavior, and the development of chains of behavior that some might consider superstitious (Aeschleman et. al., 2003; Hoffman & Fleshler, 1962; and Solomon & Wynne, 1953).

In a typical conditioned suppression experiment, a warning stimulus such as a tone is paired with an aversive stimulus (e.g., shock). When the relation is established, extinction occurs when the tone is presented without the aversive event following. The extinction process, however, is sometimes slow but the effects disappear in most cases (Estes & Skinner, 1941; Hoffman & Fleshler, 1965; and Solomon & Wynne, 1953). In the current series of experiments, it was difficult to determine if emotional responding was undergoing extinction except perhaps for 2 conditions during Experiment 3. In that experiment, emotional behavior returned when the furniture was rearranged and persisted until the ven cue was substituted for the punir cue and the leash and harness were removed. Although emotional responding occasionally improved, accuracy did not improve in the presence of the punir cue. These results are counterintuitive in that our procedures also involved extinction. That is, the discontinuation of the aversive consequence. Following session 55, the punir cue was no longer paired with a leash tug and the only event following the cue was the delivery of a food reinforcer. Under these conditions, it is reasonable to expect that emotional responding would decrease and that accuracy would increase. Moreover, the addition of a food reinforcer would be

expected to accelerate the extinction process. However, this did not happen. Emotional responding, accuracy, speed, and the presence of chains of behavior persisted until we substituted the ven cue for the punir cue and removed the leash and harness.

This present results support the notion that stimuli associated with both a positive reinforcer as well as an aversive stimulus produce a different dynamic than a situation that uses positive reinforcement or punishment alone, as Hearst and Sidman (1961) suggested. This implies that the punir cue may have acquired a compound stimulus functions. That is, every time one part of the compound is strengthened the other is strengthened and thus perpetuating the ambiguity in outcomes. Although a positive consequence has occurred in the presence of the cue, a negative consequence has occurred in its presence as well. Therefore, the outcome is unclear each time the stimulus is present. For example, imagine a situation in which you have a particular history with a certain individual. Sometimes this individual calls, provides numerous social reinforcers and the conversation is stimulating. Occasionally the same individual calls and an argument will ensue and the conversation is rather unpleasant. Other times, the individual calls and you have both elements are present. After several occurrences, the number on the caller ID becomes an S^D that predicts a positive consequence (pleasant conversation or praise), a negative consequence (unpleasant conversation or arguing), or both. You might find yourself hesitating to answer the phone when you identify the caller because you are unsure of the outcome. Extinction does not occur because the consequence remains unclear. It is also important to note that the stimulus control effects produced by the combination of positive and negative

reinforcement are complex and subtle. As these results show, other environmental events as well as the punir cue were poisoned.

In practice, examples of the combination of positive and negative reinforcement procedures can be found in various fields including animal training, education, performance management, and behavior analysis to name a few. At times, the combination of these procedures occurs accidentally. However, oftentimes, these procedures are advocated (Axelrod, 1990; Frawley, 2005; and Clark, 2006). Unfortunately, the laboratory research has concentrated on studying cues established with either positive or aversive stimuli alone and therefore, have not been fully informative about the combination. The natural environment; however, is rich with stimuli, some positive, some aversive and some associated with both. Therefore, it is imperative that cues established through the combination of positive and negative reinforcement are systematically investigated to further understand their effects. For example, consider the following training situation involving a child with autism. The trainer says, "Please come to the table." After several seconds of waiting, the child does not come to the table. The trainer stands up and brings the child to the table. In this type of situation, the table as well as the trainer might acquire aversive properties and extraneous behaviors might occur such as stereotypy might interfere with learning.

The field of Behavior Analysis does not distinguish between discriminative stimuli established through positive or negative reinforcement. Both are considered discriminative stimuli. However, the field is likely to call discriminative stimuli established through positive reinforcement cues or clues while discriminative stimuli established through negative reinforcement are described as a warning stimulus, a pre-aversive

stimulus, or a command. A discriminative stimulus with a combined function produces different effects than a discriminative stimulus established through positive or negative reinforcement alone. Therefore, Pryor (2002) coined the term the "poisoned cue." However, terms such as the poisoned cue, command, or warning stimulus are not a technical terms. Clearly, there is room for a new taxonomy that distinguishes these three types of discriminative stimuli, each of which produces different effects.

Figure 1. Diagram of the grid that was taped to the floor. The location of the trainer and each target response during Experiments 1-3 are shaded. Back stepping, the first behavior taught in the ven condition, occurred across several grid coordinates.
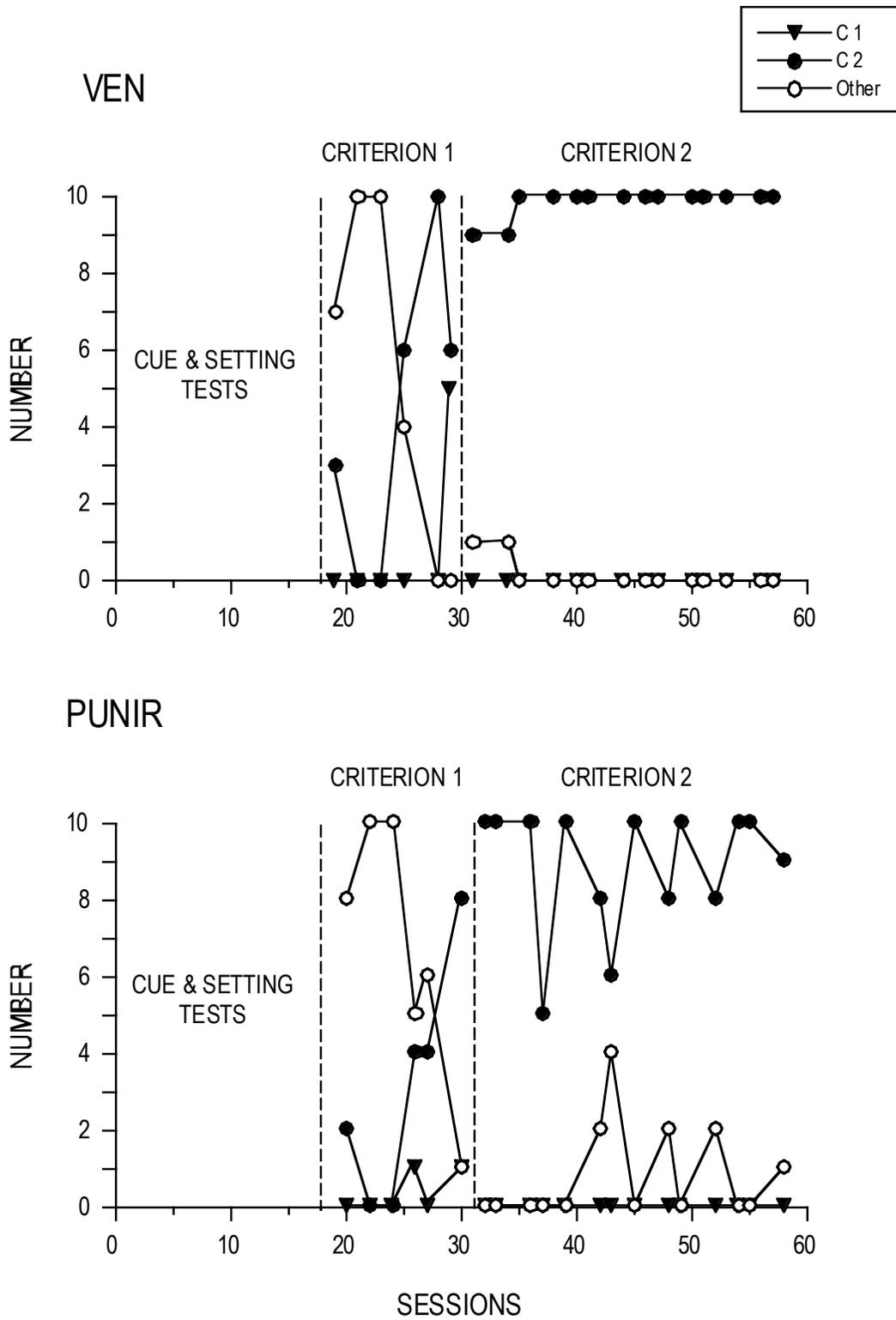
Figure 2. Number of trials in which Criterion 1, 2, and other (approximations) occurred

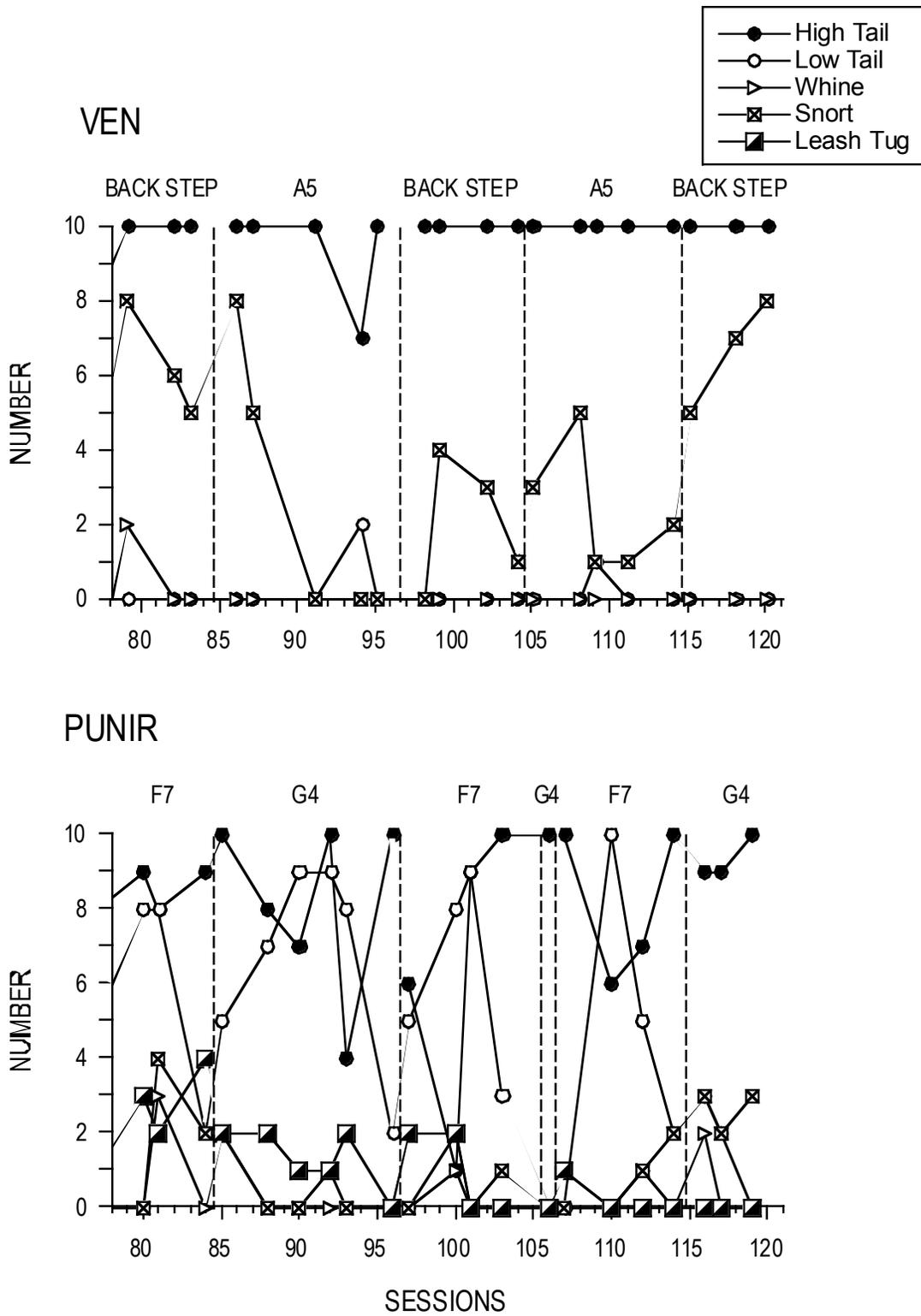during ven and punir conditions in Experiment 1.

81
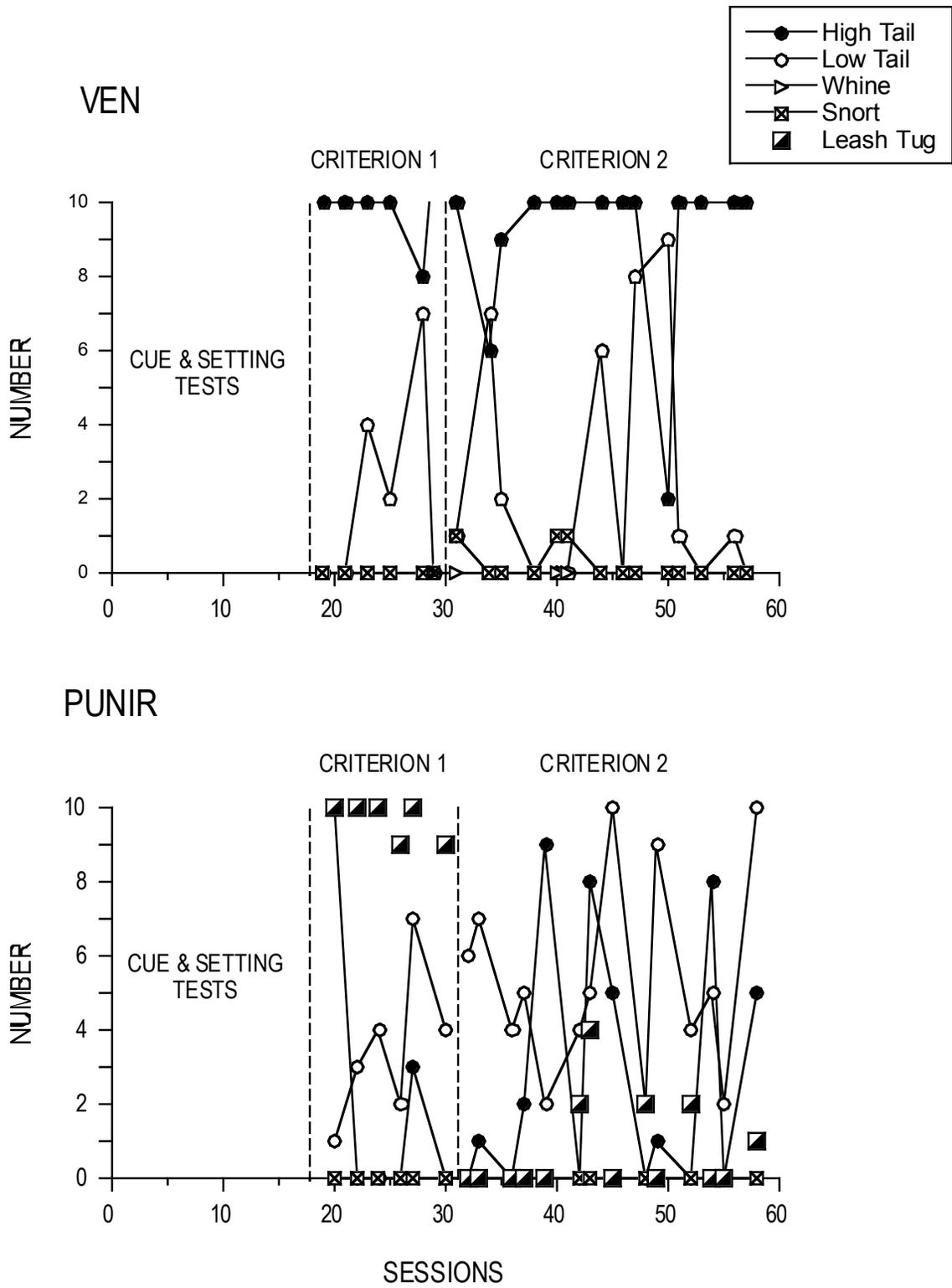
Figure 3. Number of trials in which leash tugs, high tail wags, low tail wags, whining, and snorting occurred during ven and punir conditions in Experiment 1.
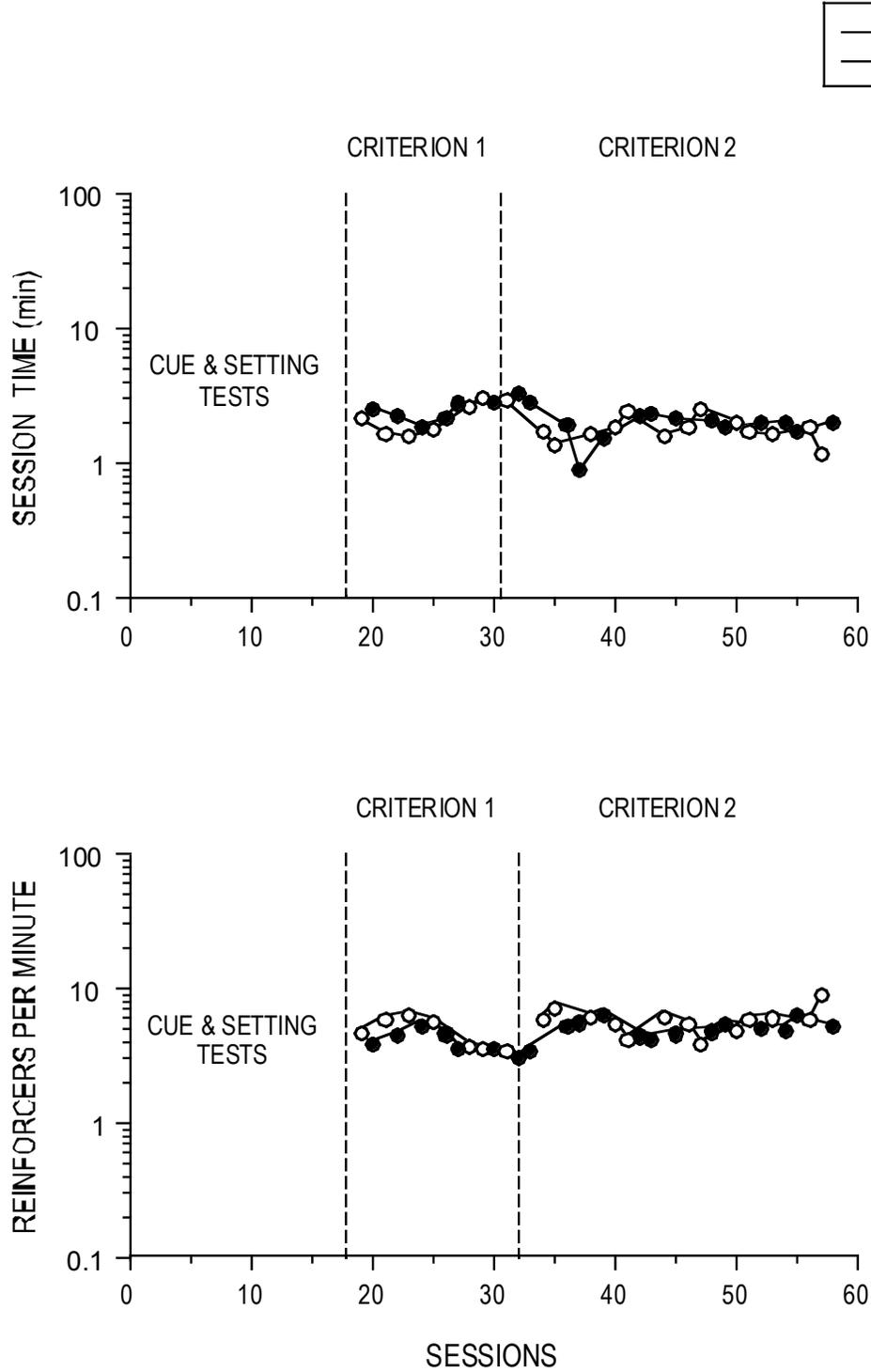
Figure 4. Session duration (top) and the number of reinforcers delivered per minute (bottom) during ven and punir conditions in Experiment 1.

	A	B	C	D	E	F	G
1	**X** Punir						**X** Ven
2							
3							
4							
5							
6				Trainer Square			
7							

Figure 5. Diagram showing the location of target responses and approximations during Experiment 4. Shaded boxes represent responses scored as approximations while cells marked with an X show the location of the object targeted by the dog.
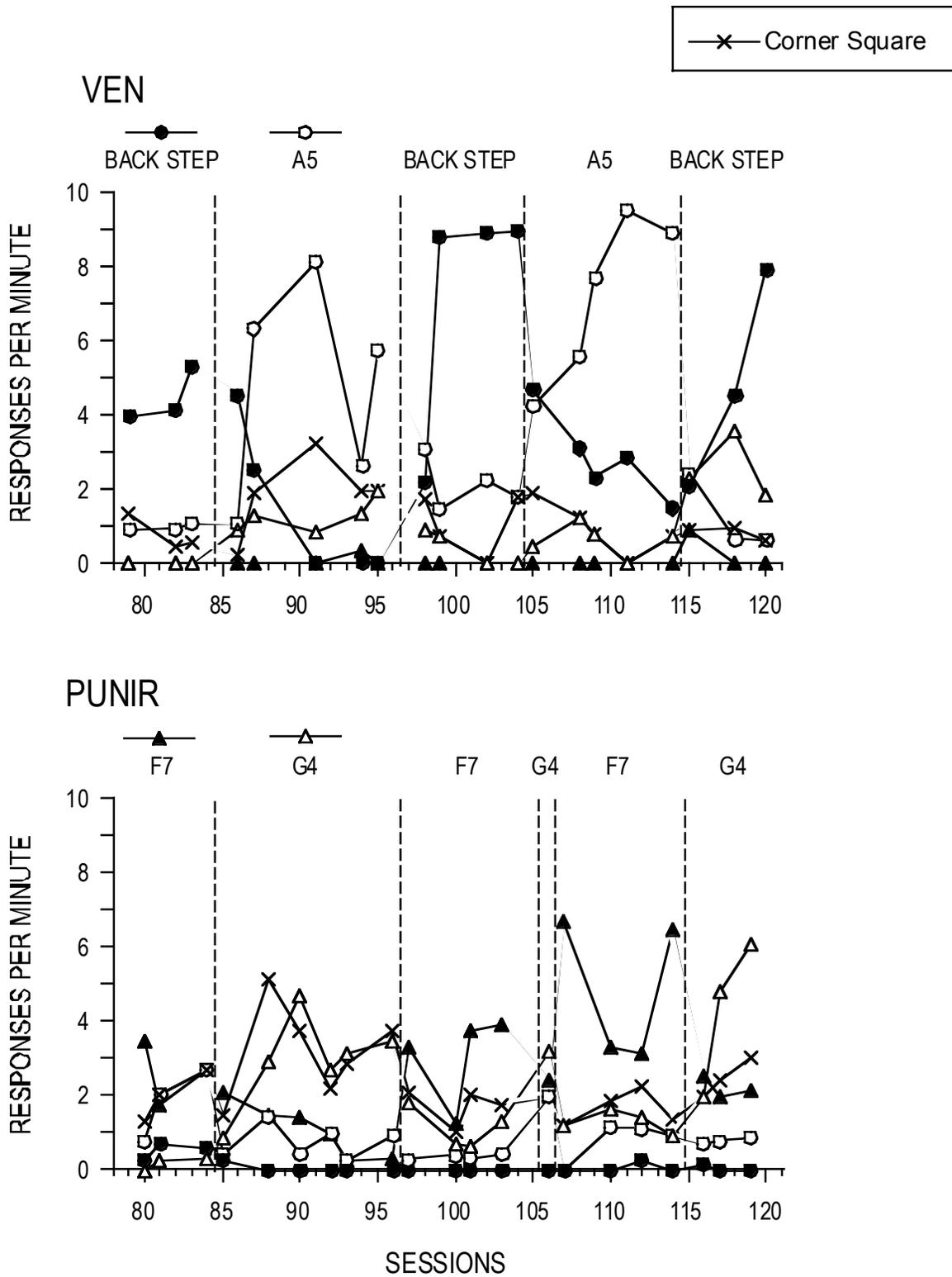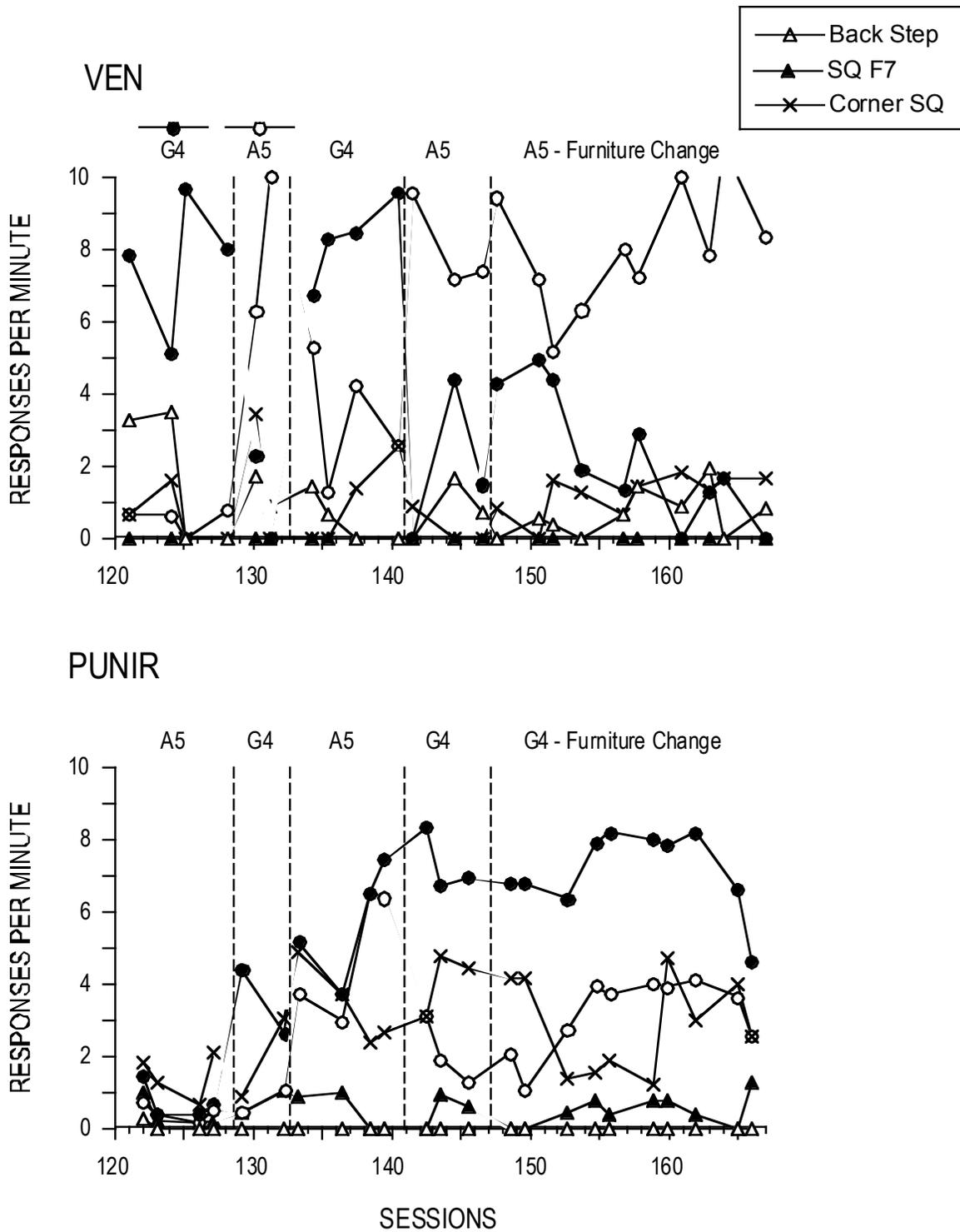
Figure 6. Responses per minute for back stepping, walking to squares A5, F7, G4, and

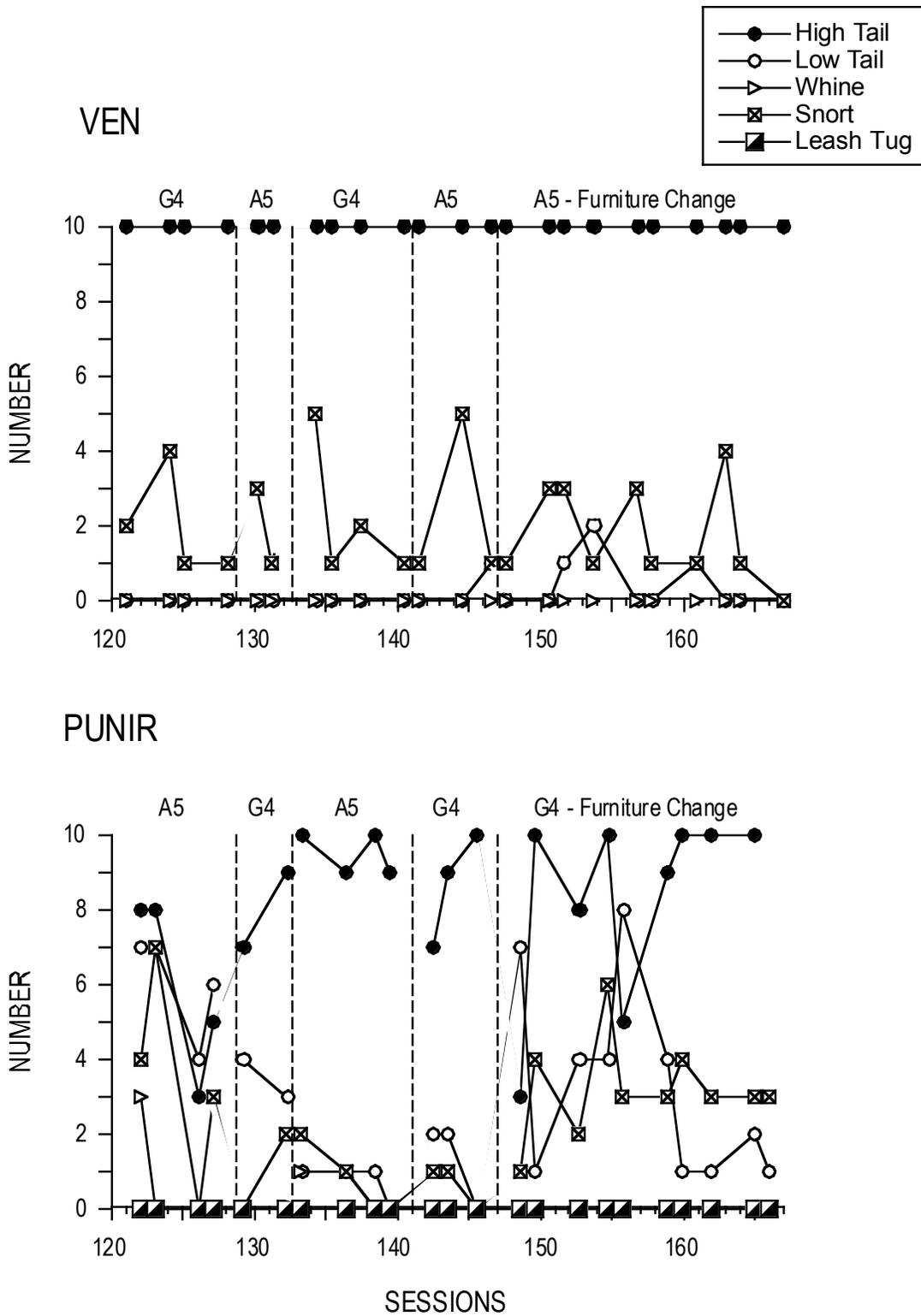the corner squares during ven and punir conditions in Experiment 2.

Figure 7. Number of trials in which leash tugs, high tail wags, low tail wags, whining, and snorting occurred during ven and punir conditions in Experiment 2.
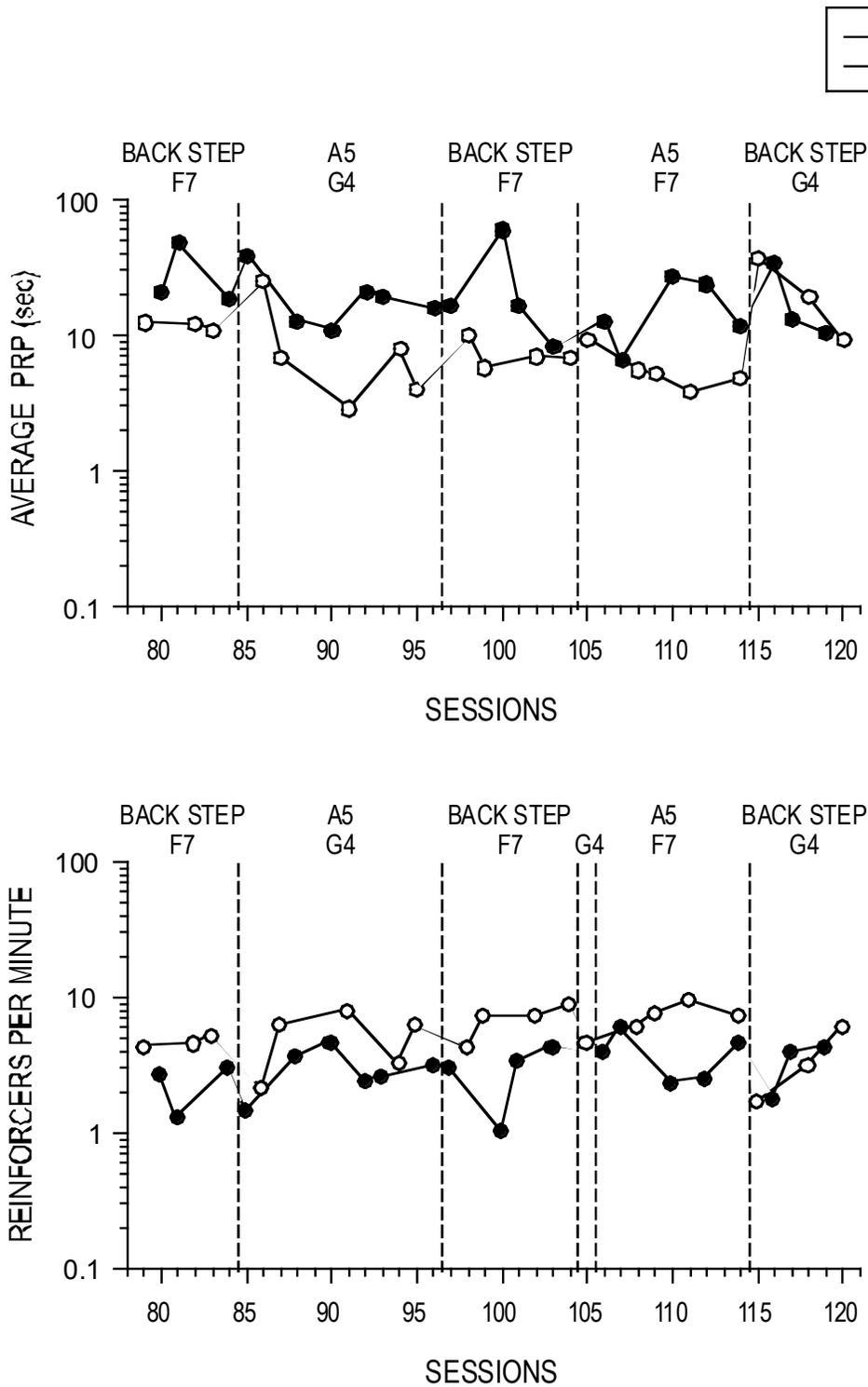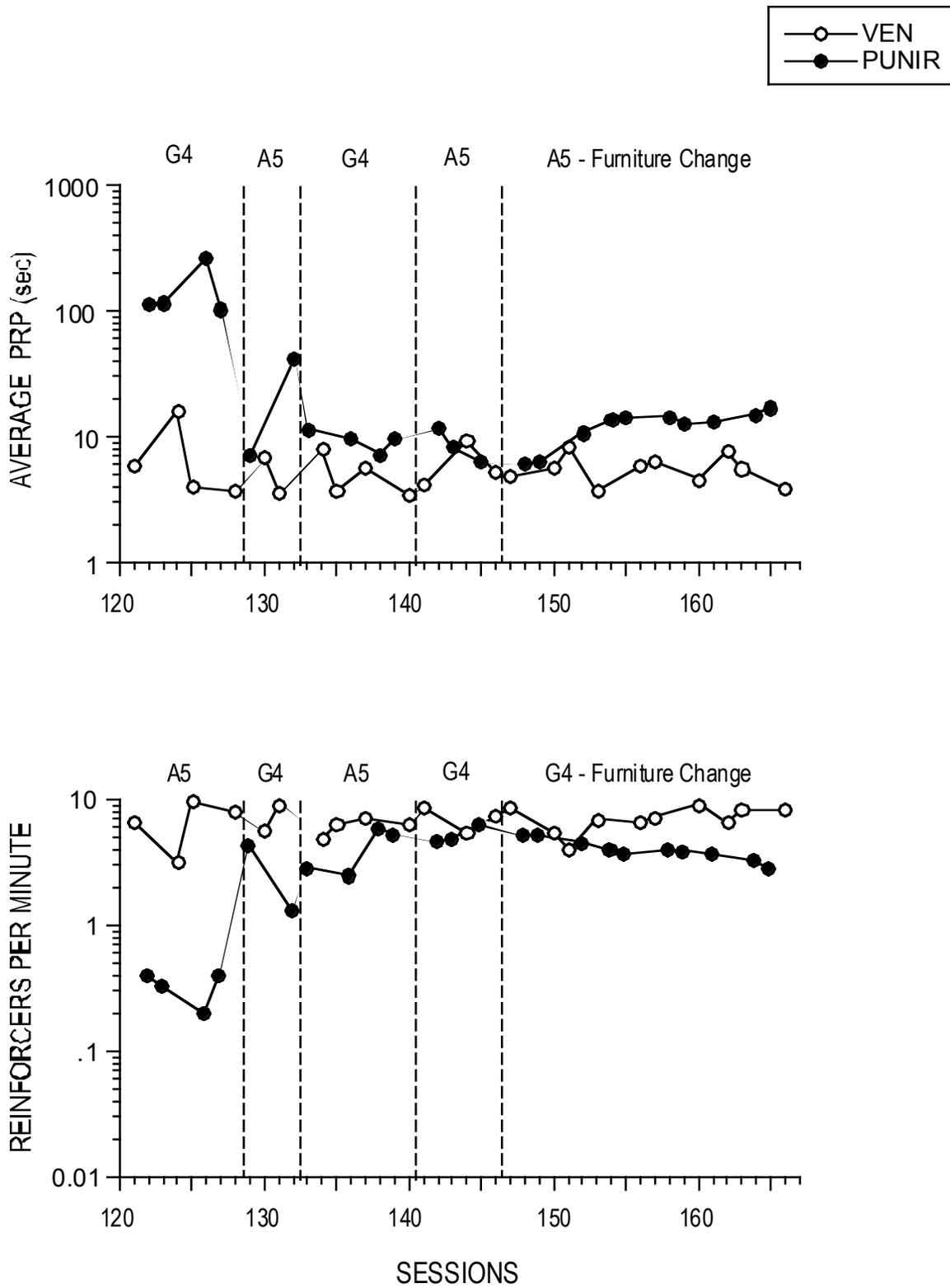
Figure 8. Average post reinforcement pause per session (top) and reinforcers per minute (bottom) during ven and punir conditions in Experiment 2.

Figure 9. Responses per minute for back stepping, walking to squares A5, F7, G4, and the corner squares during ven and punir conditions in Experiment 3.

Figure 10. Number of trials in which leash tugs, high tail wags, low tail wags, whining, and snorting occurred during ven and punir conditions in Experiment 3.

Figure 11. Average post reinforcement pause per session (top) and reinforcers per

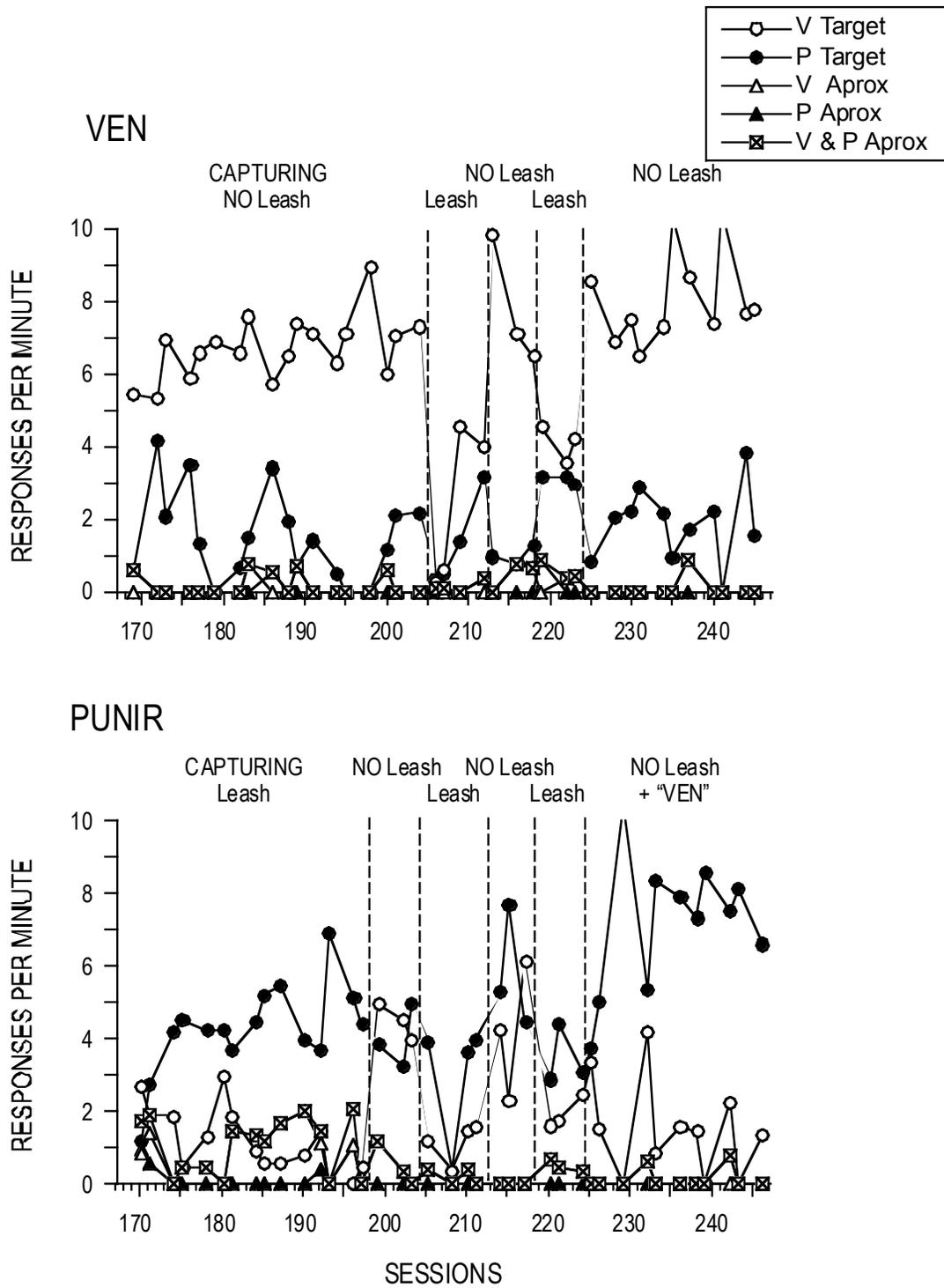minute (bottom) during ven and punir conditions in Experiment 3.

Figure 12. Responses per minute for ven targets and approximations, punir targets and approximations, and combined ven and punir approximations during ven and punir conditions in Experiment 4.
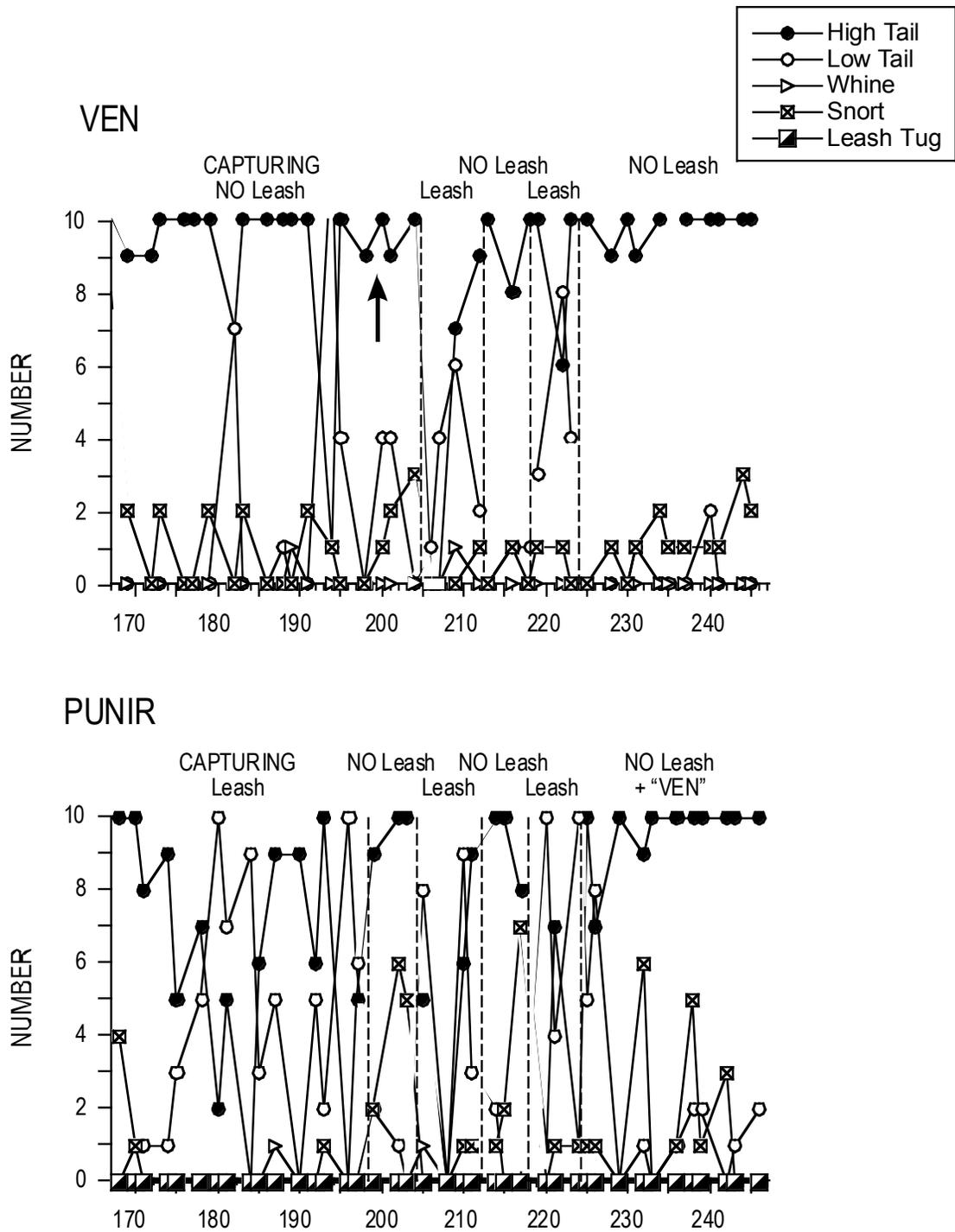
Figure 13. Number of trials in which leash tugs, high tail wags, low tail wags, whining, and snorting occurred during ven and punir conditions in Experiment 4. The arrow shows where during the Ven condition the leash was removed from the Punir condition.
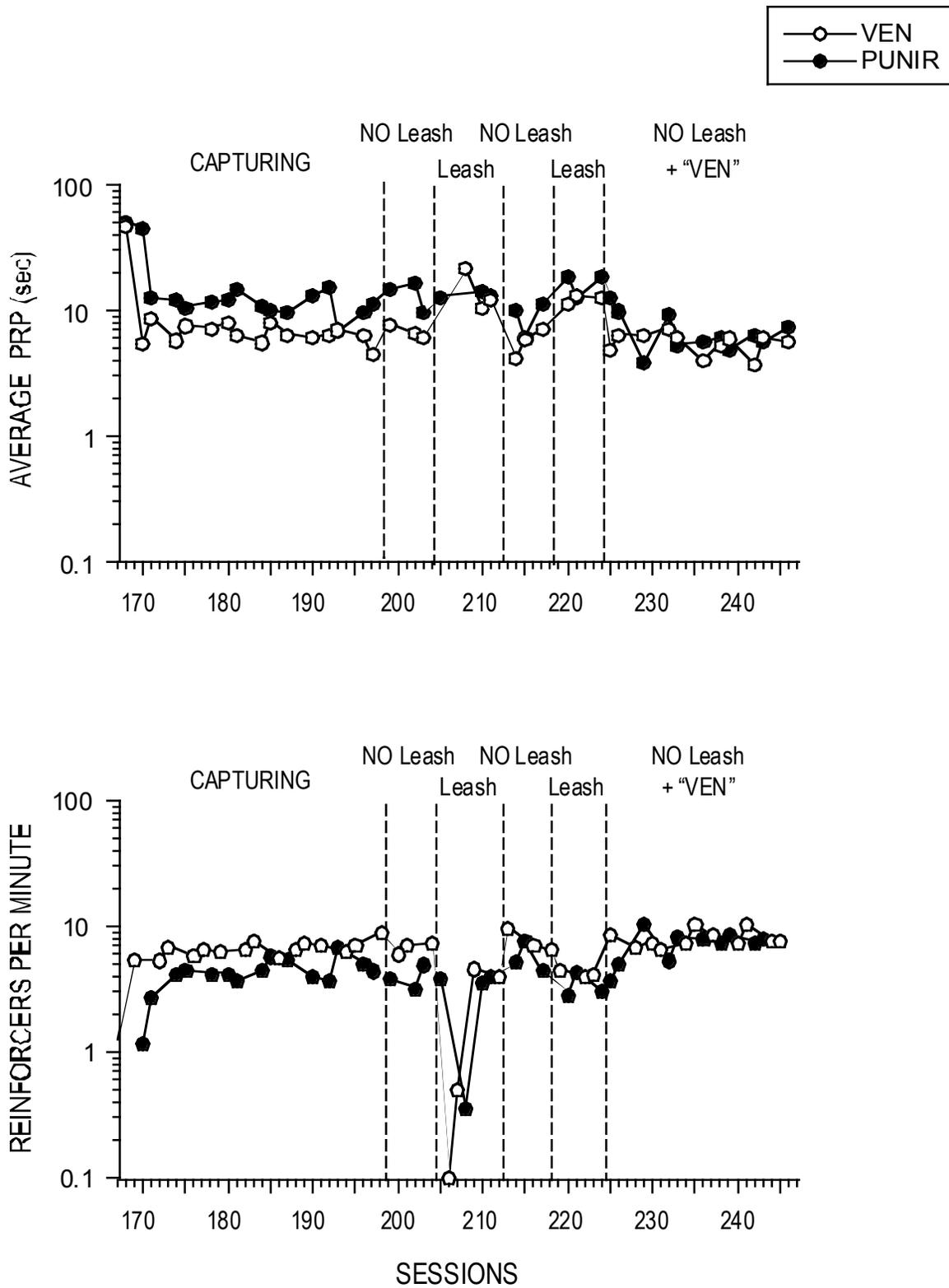
Figure 14. Average post reinforcement pause per session (top) and reinforcers per

minute (bottom) during ven and punir conditions in Experiment 4.

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