CAN POSITIVE REINFORCEMENT OVERCOME FEAR? AN INVESTIGATION OF COMPETING CONTINGENCIES

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Escape maintained behavior in dogs is generally displayed by one of two behaviors-fleeing or aggression. Once aggression is negatively reinforced by the removal of the aversive stimulus, it is very difficult to eliminate from the organism’s repertoire. Counterconditioning is the process of pairing a positive reinforcer with an aversive stimulus in the attempts that an organism will no longer exhibit fear responses in its presence. This process must be done gradually with small approximations. Many organisms have been trained to tolerate the presence of aversive stimuli via counterconditioning. However, this process can be time consuming and has inconsistent results. The purpose of this experiment was to monitor the effects of counter conditioning around an aversive stimulus while simultaneously training an identical behavior in the presence of a neutral stimulus. The results demonstrated that even though counterconditioning produced approach to the aversive stimulus the subject still exhibited numerous fear responses when results were compared to the control condition.
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INTRODUCTION

Fear is a complex set of physiological and behavioral responses (Damasio, 2005). Although conceptualizations of fear have varied over time, the behavioral interventions to treat clients with extreme fear have changed very little since the 1950’s.

Psychiatrist Joseph Wolpe was the first individual to publish a successful procedure to overcome fear. He conducted an experiment in which he repeatedly shocked domestic cats inside of an experimental chamber. Over time, his subjects refused to enter the chamber for fear of being shocked. He then found that by placing small amounts of food near the chamber and working with small approximations, the cats seemed to gradually overcome their conditioned fear of the stimulus. He hypothesized that the food “…might inhibit neurotic reactions” (Wolpe, 1958, p.55). Over time, he was able to train the cats to once again enter the experimental chamber by offering food. He called this procedure of placing reinforcers closer to the aversive stimulus to encourage approach counterconditioning. The physiological mechanism at work he defined as reciprocal inhibition. Wolpe said, “…the complete or partial suppression of the anxiety response is a consequence of the simultaneous evocation of other responses physiologically antagonistic to anxiety” (Wolpe, 1954, p. 71). In other words, when an organism is engaged in a positive activity, such as eating or relaxing, the fear or anxiety is inhibited because the animal is physiologically incapable of being relaxed and afraid at the same time.

Over the years, counterconditioning has been adapted into many forms, such as systematic desensitization, active desensitization, and contact desensitization. Despite the changing names, the underlying procedure remains the same: present a reinforcer
contingent on “non-fearful” behaviors in the presence of an aversive stimulus, and the organism should overcome its fear. These procedures are different from habituation and extinction. Habituation is the relatively persistent waning of a response as a result of repeated stimulation (Thorpe, 1956). Because of the repeated presentation of the stimulus, the organism will eventually stop exhibiting fearful behaviors and exhibit calm behaviors in its presence. Extinction consists of withholding reinforcement delivery, resulting in a decrease of behavior (Miller, 2006). When the reinforcer (usually, escape or avoidance of the aversive stimulus) is no longer delivered, the organism will eventually remain calm in its presence. However, counterconditioning has been shown to be a faster, more humane approach (Herron, Shofer, & Reisner, 2009), and thus it is the most commonly used procedure to treat fear related behavior.

During the 1960s counterconditioning was adapted into systematic desensitization and used by many therapists to treat people who suffered from phobias. Lang and Lazovik (1963) conducted a well known experiment in which they taught subjects to imagine relaxing scenes and practice breathing techniques while simultaneously being presented with an aversive stimulus (in this case, snakes). They found that the treatment was effective in teaching clients to relax while in the presence of snakes. Despite a declining interest in systematic desensitization in the 1970’s due to newer, more popular methods of therapy such as flooding and implosive therapy (McGlynn, Smitherman, & Gothard, 2004) and a shift towards cognitive approaches (Bandura, Blanchard, & Ritter, 1969), studies can still be found using this specific procedure in psychological and behavioral journals.
A study by Koegel, Openden and Koegel (2004) used systematic desensitization on three children with autism that were extremely afraid of loud auditory stimuli. By introducing the aversive stimuli in a hierarchy from least to most aversive, all three children were able to remain in the presence of the aversive stimuli at the end of the experiment.

Another study by Ricciardi, Luiselli and Camare (2006) used contact desensitization to treat a child with autism who had a severe phobia of animatronic toys. They did this by providing “positive reinforcement … contingent on completion of steps in an exposure hierarchy.” They found that the contact desensitization procedure was effective at shaping approach responses.

Bhala, O'Donnell, and Thoppil (1982) found that systematic desensitization was effective in teaching individuals with ptopophobia (fear of falling) how to walk again. They did this by gradually shaping walking and reducing the likelihood that the client would fall by the use of ambulatory aids. The authors also stressed the importance of positive interactions between physical therapist and client. By providing positive social reinforcement, the behavior was shaped more effectively.

In the animal training field, the most commonly used method to shape approach to a novel or feared stimulus is counterconditioning (Ramirez, 1999; Bergman & Janssen, 2005; Arthur, 2009; Royal Society for the Prevention of Cruelty to Animals [RSPCA], 2010; Animal Humane Society, 2011; Butler, Sargisson & Elliffe, 2011). Counterconditioning has been used to treat many fear related behavioral problems in animals such as separation anxiety (Butler et al., 2011), fear of loud noises (Animal Humane Society, 2011), fear of novel situations (Bergman & Janssen, 2005, Ramirez,
1999), and fear of other animals or people (Horwitz, 2005; Arthur, 2009; Royal Society for the Prevention of Cruelty to Animals [RSPCA], 2010).

Research has shown that using positive reinforcement techniques instead of punishment is more effective, and also reduces the likelihood of the animal engaging in more aggressive or fearful behavior (Herron et al., 2009). By pairing a positive reinforcer (such as food) with an aversive object or location, the trainer can shape approach responses and other behaviors. This method is very popular in zoos and aquariums (Ramirez, 1999). A variation of this procedure uses a conditioned reinforcer such as a lure to encourage the animal to move towards the aversive stimulus. An example of this is using a “target stick.” Animals are trained to touch the target stick with their nose to earn a reinforcer (such as food), so the target stick becomes a conditioned stimulus for food. By moving the target stick closer to the aversive stimulus, escape behaviors can be eliminated (Bailey & Bailey, 1997; Ferguson & Rosales-Ruiz, 2001).

Another variation of counterconditioning is having the organism remain stationary while the aversive stimulus moves closer. Many trainers advocate the use of “stay” training (Arthur, 2009). If an animal is given the cue “do not move,” and then rewarded for not moving, then it will be less likely to engage in escape behaviors (PetSmart, 2005). This is also known as teaching a “replacement behavior” (Pryor, 1984). Dog trainers use other cues such as “watch me” to teach the dog to ignore the environment and focus on the trainer (Horwitz, 2005). If the trainer presents positive reinforcement for the appropriate behavior while the aversive situation is occurring simultaneously,
then eventually the animal may “overcome” their fear, and perhaps the aversive situation could become a discriminative stimulus for positive events.

Alexandra Kurland (2011) has discussed using an aversive stimulus as a cue for an incompatible behavior. The subject of her study was a horse that ran away from saddles. First, she taught a horse to lower its head on a verbal cue using positive reinforcement. She then used counterconditioning to transfer the verbal cue to a saddle. By teaching the horse to lower its head in the presence of the saddle, then reinforcing the head lowering with food, the horse was able to remain calm and accept the saddle (Kurland, 2011).

However, there are some inconsistencies in using counterconditioning techniques. A study by Butler et al. (2011) used counterconditioning as well as desensitization, exercise and positive reinforcement training to help treat dogs with separation anxiety. Unfortunately, none of the dogs in the study had identical treatments, and there were so many confounding variables that even the authors were only able to tentatively suggest which procedure was cause for the behavior change reflected in the data. Anecdotally, this is often the case for many dog owners. There are numerous resources available suggesting a variety of treatments. Because owners often implement numerous procedures at once, identifying the most effective treatment is nearly impossible.

In addition to inconsistencies with its application, counterconditioning is a lengthy, time consuming process. The length of time it takes to train an organism to “overcome” its fear of an aversive situation depends on a variety of factors. History with the aversive situation, biological makeup and trainer mechanics are the primary points
of focus (Bailey & Bailey, 1997). Many trainers agree the most important factor in training animals with anxiety or fear is to be vigilant of the animal’s fear threshold (Bailey & Bailey; Ramirez, 1999, Arthur, 2009). Keeping an animal under threshold means the trainer must constantly monitor the animal for observable signs of stress. If any anxiety or aggressive responses are observed, then that animal’s threshold has been exceeded. Because keeping an animal under threshold is such an important factor in counterconditioning, the procedure itself can take a very long time. Bailey and Bailey reported that a group of cats they were working with took thousands of trials over many months to overcome their fear of crowds, children, and loud noises. This procedure can be even more time consuming when working with an animal that has been classified as “prey” because of the animal’s instinct to flee when under stress (Bailey & Bailey).

Finally, there is very little known about why these procedures are effective. The mechanisms are difficult to explain at a behavioral level, and therefore any explanation becomes circular, using the definition as its own explanation. If an organism no longer exhibited fear responses in the presence of a stimulus, we say that desensitization was effective, but then if one was asked why the organism no longer feared the stimulus, the behavioral explanation would be the observation of a lack of responding. For now, scientists must tolerate this lack of observable explanation until more effective data collection methods are developed.

Despite these challenges, many studies have reported success using counterconditioning procedures (Pearce & Dickinson, 1975; Bailey & Bailey, 1997; Ferguson & Rosales-Ruiz, 2001; Bergman & Janssen, 2005; Ricciardi et al., 2006;
Kurland, 2011). These studies have focused on a variety of dependent variables, including distance from the object or anxiety rating scales. However, these dependent variables give us no indication as to what the subject’s behavior should look like during the study. No studies were found that have simultaneously compared a trained behavior around an aversive stimulus and around a neutral, or non-feared, stimulus.

The purpose of this research was to study the effects of counterconditioning on a dog. A vacuum cleaner functioned as the aversive stimulus. Simultaneously, approach to a neutral stimulus (a barstool) was also trained using shaping with positive reinforcement. By having a control condition, we were able to determine whether or not the subject’s frequency of aggressive, avoidance and calm behaviors had reduced or increased to the same levels as the neutral stimulus.
METHOD

Subject

Hunter was a 6-year-old Rhodesian Ridgeback mix dog that lived with the author as a family pet. Hunter was adopted at approximately one year of age, and his previous history was unknown. His basic command repertoire included sit, stay, lay down, speak, shake, and play dead. These commands were trained using clicker training.

Hunter had exhibited fearful responses towards the vacuum cleaner since he was adopted. These fearful responses include bolting out of the room when the vacuum was presented, and whining if forced into close proximity with the vacuum. Within the last 2 years, Hunter had become increasingly aggressive towards the vacuum cleaner. His aggressive responses included lunging, snapping, biting, and growling at the vacuum. A formal intervention had never been conducted before the experiment; however, his aggression had generalized to other household objects, such as the Swiffer®, mop, and broom.

Setting and Materials

The setting for the experiment was a 13x4 meter room in the author's home. There were three exits (one on the north side and two on the south side) that were blocked with furniture. A camera on a tripod was placed in the northwest corner of the room. A 6 meter path was measured out on the floor in 0.3 meter increments using painters tape. Please refer to Figure A.1 for more details.

The materials used for this experiment included a 33x33x74 centimeter wooden barstool, a Bissell Cleanview II® vacuum cleaner, digital timer, digital camcorder, beef
dog treats, clicker, and a target stick consisting of a 61 centimeter wooden dowel rod with a tennis ball on the end.

Dependent Measures

A total of eighteen behaviors were recorded. These behaviors were categorized into avoidance responses, aggressive responses, and task responses.

Avoidance responses were categorized into Passive avoidance responses and active avoidance responses. Passive avoidance responses included walking, sitting, laying, or yawning.

Walking consisted of moving forward or backward using 3 or more strides. When Hunter engaged in another behavior, or paused while standing for three or more seconds, another instance of walking could be recorded.

Sitting consisted of the front legs being extended and haunches remaining on the floor. If Hunter was observed sitting before the trial began and continued to sit after the target was present, sitting was recorded.

Laying consisted of the trunk of body being in contact with the floor and no weight remaining on the feet. If Hunter was seen laying before the trial begun and continued to lay after the target was presented, laying was recorded.

Yawning consisted of opening the jaws wide enough to wrinkle the brow and close the eyes.

Active avoidance responses included leaving the session, bolting, and whining. Leaving the session consisted of exiting the experimental room.

Bolting consisted of taking three steps away from stimulus at a pace faster than a walk.
Whining consisted of emitting an audible high pitched vocalization with the mouth open or closed.

Aggressive behaviors included lunging, snapping, biting, and growling.

Lunging consisted of moving towards the aversive stimulus at a pace faster than a walk.

Snapping consisted of opening the mouth towards stimulus while lunging, but not making contact with it.

Biting consisted of opening the mouth towards the stimulus and closing the jaws hard enough to make contact with the object.

Growling consisted of emitting an audible guttural vocalization with the mouth open or closed.

Task Responses included redirections, incorrect responses, stationary targets, traveling targets, initiations towards object, wagging, and travel time.

Redirections consisted of the author verbally calling the subject’s name (“Hunter”) during or just before an aggressive behavior and the subject turning away from the stimulus and looking at the experimenter.

Incorrect responses consisted of any behavior emitted after a cue that did not match the cue given, such as an incorrect “target” or “redirection.” It also was defined as a latency of more than 3 seconds to respond after the cue was delivered.

Stationary targets consisted of the mouth and/or nose making contact with the tennis ball on the end of the target stick while Hunter was in a stationary position (such as standing, sitting or laying).
Traveling targets consisted of Hunter following the target stick across the room to the desired location.

Initiating to object consisted of spontaneous touching of the mouth and/or nose to an object other than the target.

Wagging consisted of the tail moving back and forth 3 or more times in succession while dog was stationary (sitting, standing, or laying). Because this behavior generally occurred for an entire trial or not at all, it was recorded using the one-zero method described by Martine and Bateson (1993).

Travel time consisted of the time the cue “target” was delivered and the behavioral response of targeting onto the object is observed.

All behaviors were recorded by frequency recording except for travel time and wagging. Travel time was recorded as a durational measure, and wagging was recorded using the one-zero method as defined by Martin and Bateson (1993).

Recording

All experimental sessions were videotaped and data were collected after the sessions were complete. Observations were made from the videotapes. Sessions began upon the first verbal cue of “target” and the presentation of the target stick. A trial began when targeting onto the specified object was observed. Trials ended when targeting back into the base position was observed. Sessions ended when the five trials were completed.

Interobserver Agreement

A trained observer collected interobserver agreement data (IOA). The behavioral definitions were explained to her and she was given a list to refer to during the data
collection process. She was able to ask questions before the data collection process had begun, and was also able to stop the video at any point to ask questions to ensure data collection was performed correctly. The observer was requested not to discuss her results during the data collection process, nor was she allowed to alter them after the fact. Data were collected using the data sheet depicted in Appendix B. Hash marks were made next to the label of each behavior on the datasheet as it was observed in the video.

IOA for the occurrence of behaviors and successful trials was calculated using the formula \( \frac{A}{A+D} \times 100 \). IOA was 100% across 20% of trials for the first condition, 98% across 8% of trials for the second condition, 94% across 10% of trials for the third condition, 95% across 10% of trials for the fourth condition, and 92% across 12% of the probe trials.

Procedures

First Probe

Before the baseline trials were conducted, an initial probe was conducted to determine what characteristics of the vacuum cleaner evoked the most aggressive responses. During each session, the vacuum cleaner was presented in a specified manner. No criteria were set for Hunter, and he was allowed to explore the experimental chamber freely. Fifteen 2 minute sessions were done using the vacuum cleaner. The first 5 sessions consisted of the vacuum cleaner being placed in the room while remaining off and stationary. The second 5 sessions consisted of the vacuum cleaner being moved back and forth 3 feet while remaining off. The third 5 sessions consisted of the vacuum cleaner being moved back and forth 3 feet while on. All
behaviors occurring during the 2 minute sessions were recorded. This study was done over three consecutive days. Figure B.2 shows the results of the first probe.

Baseline

Baseline sessions were conducted before every experimental session. Baseline sessions consisted of 5 trials. Trials began upon delivering the verbal cue “target” and the presentation of the target stick. The target was not presented until the subject made eye contact with the trainer. Hunter was then lured with the target stick to a previously chosen neutral stimulus (a barstool). The time that it took to travel from the base position to target onto the neutral stimulus was recorded as travel time. When Hunter successfully traveled from the base position to the neutral stimulus, a timer was set for 45 seconds and any spontaneous initiations to the neutral stimulus were recorded. All observed behaviors occurring during the trial were recorded. When the 45 seconds were complete, Hunter was then lured back the base position and a 5 to 10 second inter-trial break was taken. During the break, Hunter was allowed to rest, and interaction with him (petting) was noncontingent. Sessions were ended when 5 trials were complete, or when 10 minutes had passed.

Condition 1 – Vacuum Off and Stationary

The first 5 sessions were conducted in the manner stated above. During the experimental trials, the vacuum cleaner was placed in the same location as the barstool and was left off and in a stationary position. The trials were then conducted with the same procedures as stated in the baseline section. If a latency of longer than 3 seconds was observed from the time the target was presented to when Hunter touched it with his nose, the target was removed and an “incorrect response” was recorded. The
target was then represented 0.3 meters closer to the subject. This was repeated until Hunter was participating in the trial again. All behaviors occurring during the trials were recorded.

Condition 2 – Vacuum On and Stationary

Phase 1 – Reinforcing Initiations

This group of experimental sessions consisted of placing the vacuum cleaner in the same location as the barstool and leaving it in a stationary position. However, it was now turned on, thus creating a loud sound. The trials were then conducted following the same procedures as stated in the baseline section. If Hunter refused to target directly onto the vacuum, the experimenter moved one marker back from the vacuum and presented the target again. This was repeated until Hunter was participating again. A shaping plan was also implemented to encourage Hunter to continue participating in the sessions. When he targeted to the target stick, the experimenter moved forward one marker at a time until Hunter targeted onto the vacuum. When he targeted onto the vacuum the trial began. If Hunter did not target onto the object within 10 minutes, or 5 trials were not completed within 10 minutes the session was ended. During this phase, only the behavior of initiating to the vacuum (spontaneous touching of the mouth and/or nose to an object other than the target) was reinforced. All other behaviors were ignored. All behaviors occurring during the trials were recorded.

Phase 2 – Reinforcing Approximations

During this group of experimental sessions the vacuum cleaner was stationary and turned on. Previously, only initiations to the vacuum were reinforced. In these trials, however, approximations were now reinforced as well. In these five sessions,
approximations were defined as “the subject’s head being oriented towards the vacuum cleaner.” All approximations were reinforced, and all behaviors occurring during the trials were recorded.

**Phase 3 - Shaping**

During this group of experimental sessions, another shaping procedure was introduced. The vacuum cleaner remained in the stationary on position, but now approximations were defined as “an increase in proximity to the object.” During the first session, Hunter’s behavior of “head being oriented towards the vacuum” was reinforced. This was the first approximation before increasing the criteria, and no other behaviors were reinforced. During the next 9 sessions, increasing proximity to the vacuum cleaner was reinforced. Each 5-centimeter approximation was reinforced 3 times. Then, the criteria were raised so that Hunter was required to move another 5 centimeters closer to the item, and that approximation was reinforced 3 times again. This continued until Hunter began initiating to the object again. All behaviors observed during the trials were recorded.

**Phase 4 - Mastery**

Five sessions were conducted to determine if Hunter’s rate of initiating to the aversive object could reach the same rates as baseline trials. When Hunter had exhibited mastery of initiations to the aversive object (his frequency of initiating to the vacuum matched those in baseline levels) a probe was conducted to determine if Hunter had generalized calm behaviors in the presence of the vacuum outside of the experimental setting.
Second Probe

The first probe session was conducted before the experiment began. Only three conditions were conducted for the first probe (vacuum off and stationary, off and moving, and on and moving). For the second probe, the four conditions (off and stationary, on and stationary, off and moving, on and moving) were conducted over five sessions. During the sessions, the vacuum was presented in the specified manner, and no contingencies were required. His behavior was free operant, and any behaviors Hunter exhibited were recorded. All sessions were videotaped and the data collected at a later date.

Calling Probe

A second group of probe sessions were conducted to determine if Hunter could exhibit calm responses using a different form of lure. Hunter was placed in the base position, twenty feet from the stimulus, and given a “sit, stay” command. The experimenter then walked to the location where Hunter would normally be lured to (adjacent to the stool or vacuum). Then he was called using a verbal “come” command. When the experimenter had said the “come” command, this marked the beginning of the trial. If Hunter’s latency to come exceeded 3 seconds, the experimenter used verbal encouragement and praise. When Hunter touched the experimenter’s hands with his nose, the trial was ended, and he was praised, petted, and taken back the base position and given an edible reinforcer. This sequence was repeated three times in during baseline and four experimental conditions. Incorrect responses, travel time, and avoidance and aggressive behaviors were recorded. When the probe phases were complete, the intensity of the aversive object was increased by adding movement.
Condition 3 – Vacuum Off and Moving

    Phase 1 – Targeting Beside Vacuum

    During the next group of trials, the vacuum was pushed back and forth for 3 feet, with a 2 second pause in between pushes, and the power left off. During the first trial, a shaping procedure was used to gradually decrease Hunter’s proximity to the moving vacuum. Hunter was targeted across the room in 0.3 meter increments (marked on the floor), and his proximity to the vacuum was reinforced 3 times at each marker. Each target that was presented on each increment was recorded as an “approximation”. When he was targeted at the last marker adjacent to the vacuum (0.3 meters from where it was being pushed) the 45-second trial was begun and he was required to target onto the target stick. This procedure was chosen due to the challenges of having him target onto a moving object. These target presentations were recorded as “stationary targets”. If any aggressive attempts were observed during the shaping procedure or during the 45-second trials, he was redirected by calling his name. This was done to interrupt the behavior and also to give an opportunity to re-present the target. If Hunter removed his attention from the vacuum and looked at the experimenter, the behavior was recorded as a “redirection”. If his name was called and Hunter did not stop the aggressive behavior, an “incorrect response” was recorded. All other behaviors observed during these trials were recorded.

    Phase 2 – Targeting Onto Vacuum

    When Hunter completed at least 5 non-successive sessions with no aggressive attempts, the proximity to the aversive stimulus was increased by increasing the criteria
from targeting next to the vacuum to targeting onto the vacuum. Now, stationary targeting was defined as “targeting while the target stick rested on the vacuum itself”.

Condition 4 – Vacuum On and Moving

Phase 1 – Targeting Beside Vacuum

Sessions were carried out in the same manner as the previous group. During these sessions the vacuum cleaner was moved back and forth for three feet with a 2 second pause in between pushes, and the power was on. Hunter was lured across the room in 0.3 meter increments and proximity to the vacuum was reinforced 3 times at each marker. When he was lured to the last marker adjacent to the vacuum (0.3 meters from where it was being pushed) the 45 second trial began. Any aggressive attempts observed during the shaping period or the 45 second trials were recorded. Any redirections or incorrect responses were also recorded. This continued for 5 sessions.

Phase 2 – Targeting Onto Vacuum

After Hunter had completed 5 sessions of targeting adjacent to the object, the experimenter then conducted another 5 sessions identical to the previous manner. However, now Hunter was required to emit a “stationary target” onto the vacuum cleaner instead of beside it. This meant that the target stick rested directly on the vacuum cleaner and Hunter was required to touch it in order to gain his reinforcer. This was done for 5 sessions, and all behaviors observed during these trials were recorded.

Phase 3 – Reinforcing Initiations to Vacuum

When Hunter was able to target onto the vacuum successfully for 5 sessions, the target was removed from the experiment altogether. This was to discover if Hunter would initiate to the moving vacuum without the target used as a lure. Hunter was again
lured across the room to the object, and when he had targeted onto the object the 45 second trial began. During the 45 seconds, the experimenter stood stationary and no additional targets were presented. All observable behaviors were recorded.

Final Probes

A third probe session was conducted to determine Hunter’s success rate with the counterconditioning procedure. It was conducted identical to the previous probes. Following the third standard probe session, a second calling probe session was conducted as well, identical to the first calling probe session. Finally, a fourth and final standard probe was conducted, with 1 trial per condition, to determine if Hunter’s rates of aggression and avoidance matched those seen during the control conditions.

Experimental Design

This experiment was conducted using a changing criterion design. To ensure a slow, gradual exposure to the increase in aversive intensity only 1 session was conducted a day. Sessions were conducted at varying times of day, never before 10am or after 10pm. Hunter was kept on a regular diet schedule for the duration of the experiment. Each session consisted of 5 baseline trials and 5 experimental trials. The 5 baseline trials were always conducted before the 5 experimental trials. A 5 to 10 minute break was taken after the 5 baseline trials were completed and before the 5 experimental trials were begun. This was to allow time to refill treats, check the camera position, set up the vacuum cleaner and give Hunter a break.
RESULTS

Figures A.2 through A.4 are represented by number of responses per session. All other graphs (except those for wagging) are represented by number of responses per trial. Wagging was the only behavior to be represented cumulatively on Figures A.5, A.10, A.31, A.32, A.33, and A.34.

Probes

Figures A.2, A.3, A.4 and A.5 represent the probe data that were collected throughout the experiment. Figure A.2 shows the total number of aggressive responses per probe session of each condition of the experiment. The lowest occurrence of aggressive responses was observed during the first probe, while the highest number of aggressive responses in majority of conditions was observed during the second probe. During the third probe the aggressive numbers dropped slightly, except for the first condition, where aggressive responses were at their highest rates. The fourth probe had the lowest total number of aggressive responses across the majority of conditions. This was because only 1 trial, and not 5 trials, was run. The most significant observation was that in the fourth condition, the fourth and final probe had the highest number of aggressive responses.

Figure A.3 shows the total number of active avoidance responses per probe session of each condition of the experiment. The first probe had the highest number of active avoidance responses in the first condition, but the lowest number of responses in the fourth condition. Active avoidance responses during the third probe are at their highest number of responses in second and third conditions then drop significantly in the fourth condition.
Figure A.4 represents Hunter’s total number of passive avoidance responses during the four standard probe sessions. The first probe had the lowest number of behaviors, while the third probe had the highest number of responses per condition overall. In the third and fourth conditions, there appeared to be an increasing trend across probe sessions (not including the fourth probe).

Figure A.5 represents Hunter’s occurrence of wagging across trials. During the second and third condition of the first probe, his occurrence of wagging diminishes. During the second, third and fourth probe his rates of wagging remained stable at 1 occurrence per trial.

Figures A. 6, A.7, A.8, A.9, and A.10 represent the calling probes that were run during the middle and end of the experiment. Because the criteria were different during these probes, there were more behaviors to record and represent graphically. Figure A.6 shows the incorrect responses exhibited by Hunter during the first and second probe. The first probe had a higher rate of incorrect responses. The most incorrect responses were observed during Trial 4 of the first condition. The second probe had lower rates of incorrect responses overall, however, Trial 15 of the fourth condition had higher rates than the first probe.

Figure A.7 shows the aggressive responses exhibited during all of the experimental conditions of the calling probes. Aggressive responses were not seen until Trial 13 during the fourth condition. During the second probe, Hunter exhibited no aggressive responses until Trial 13, and then the rates dropped to zero again.

Figure A.8 represents both the active and passive avoidance responses Hunter exhibited during the calling probes. During the second and fourth conditions there were
three instances of passive avoidance observed during Trials A.8, A.9, and A.14. There were no active avoidance responses seen during the probes.

Figure A.9 shows Hunter’s travel time during each of the calling probes. His travel time during the first probe remained fairly stable (around four seconds) until Trial 8 when it escalated to 16 seconds, and then again during Trials 14 and 15 when it escalated to 58 and 42 seconds. During the second probe his time remained stable (four second average) throughout all of the trials, though it escalated slightly during the fourth condition (to eight seconds).

Wagging was the final behavior observed during the calling probes. Figure A.10 shows that Hunter wagged at least once during all trials of each probe, except for Trial 6 of the first probe.

Initiations

Figure A.11 represents Hunter’s initiations towards the stool during the first condition (vacuum off and stationary). These Initiations ranged between 4 and 11, averaging at 9 Initiations per trial. His initiations toward the vacuum during the first condition ranged between 1 and 10, averaging at 7 per trial. There was an increasing trend across trials that stabilized at Trial 16.

During the second condition (vacuum on and stationary), Hunter’s initiations towards the stool ranged between 4 and 13, averaging at 10 per trial, as represented by Figure A.12. Initiations toward the vacuum cleaner ranged between zero and 16, averaging at 5 per trial. There are no initiations towards the vacuum cleaner observed until Trial 60 during the reinforcing approximations phase of the second condition.

When Hunter began initiating towards the vacuum, there was an increasing trend in
Initiations observed, however, the rates never stabilized completely until the mastery phase. In some trials, initiation rates were even higher towards the vacuum than they were towards the stool, though the average rate of Initiations towards the vacuum was only half that of the stool.

Figure A.13 represents Hunter’s initiations towards both objects during the third condition (vacuum off and moving) and its two phases (targeting beside the vacuum and targeting onto the vacuum). His initiations toward the stool ranged between 7 and 12 per trial, averaging at 10 per trial. Hunter’s stationary targets beside the vacuum ranged between zero and 10, averaging 7 per trial. Though the rates of initiations and stationary targets remained stable throughout the two phases of the third condition, the rates of stationary targets while in the presence of the vacuum were never as high as the initiations towards the stool.

The final initiations graph, represented by Figure A.14, shows Hunter’s initiations and stationary targets during the fourth condition (vacuum on and moving). His initiations towards the stool ranged between 7 and 15, averaging 11 per trial. His stationary targets while in the presence of the vacuum cleaner ranged between zero and 11, averaging 7 per trial across the first two phases. During the final phase, Hunter was not presented the target. Instead, the vacuum was moving and on, and any spontaneous initiations towards the vacuum were recorded. His initiations ranged from zero to 2, averaging zero per trial. There was a subtle increasing trend across trials for his initiations towards the stool, and a decreasing trend across trials for stationary targets while in the presence of the vacuum.
Incorrect Responses

Figures A.15, A.16, A.17, and A.18 represent Hunter’s incorrect responses while in the presence of the stool and vacuum. Figure A.15 shows Hunter’s incorrect responses during the first condition (vacuum off and stationary). There were no incorrect responses observed in the presence of the stool. However, incorrect responses ranged from zero to 1 in the presence of the vacuum, averaging zero per trial. Incorrect responses were observed during Trials 8, 21, 23, and 24.

Figure A.16 shows Hunter’s incorrect responses during the three phases of the second condition (vacuum on and stationary). His incorrect responses in the presence of the stool ranged between zero and 2, averaging zero per trial. His incorrect responses, in the presence of the vacuum, ranged between zero and 6, averaging 1 per trial. During Phase 1 (reinforcing initiations) of the second condition, incorrect responses were observed during Trials 11 through 20, and again during Trial 25. During Phase 2 (reinforcing approximations), incorrect responses escalated and were observed during Trials 27 through 59, then dropped to zero after Trial 60. During Phase 3 (shaping), incorrect responses resurfaced at Trial 76 and continued until Trial 89. After Trial 90, no more incorrect responses were observed, even during Phase 4 (mastery) of the second condition.

Figure A.17 represents Hunter’s incorrect responses during the third condition (vacuum off and moving). His incorrect responses in the presence of the stool remained at zero throughout the third condition. Incorrect responses around the vacuum ranged between 11 (Trial 1) and zero for Phase 1 (targeting beside vacuum).
There also appeared to be a decreasing trend across trials with some resurgence seen in Trials 41 and 45 of Phase 2 (targeting onto vacuum).

The final incorrect responses graph is represented by Figure A.18, and shows the responses observed during the fourth condition of the experiment. Hunter's incorrect responses around the stool remained at zero for the duration of the fourth condition. His incorrect responses in the presence of the vacuum, however, ranged between zero and 4, with an average of 1 per trial. The only obvious trend seen during the three phases of the fourth condition is that during the last four trials of each phase, Hunter’s rate of incorrect responses drops to zero. There were, however, other trials where his rates dropped to zero and then raised again a few trials later.

Aggressive Responses

Figures A.19, A.20. A.21, and A.22 represent Hunter's aggressive responses in the presence of the vacuum and stool. During the first condition (vacuum off and stationary), there were no aggressive behaviors seen in the presence of either stimuli. This is represented by Figure A.19.

Figure A.20 shows Hunter's aggressive responses during the four phases of the second condition of the experiment. No aggressive responses were made while in the presence of the stool, and only 1 was made in the presence of the vacuum (Trial 16) during the reinforcing initiations phase.

Figure A.21 shows Hunter's aggressive responses during the two phases of the third condition (vacuum off and moving). Aggressive responses in the presence of the stool remained at zero. However, there was a dramatic increase in the amount of aggressive responses observed while in the presence of the vacuum. The aggressive
responses ranged from 11 to zero, averaging 1 per trial. During the beginning of the Phase 1 (targeting beside vacuum) of the third condition, aggressive responses were at their highest and then decreased over trials. There was one instance of resurgence seen during Trial 20 of Phase 1. During Phase 2 (targeting onto vacuum) resurgence was observed again during Trials 40, 41, 45, 46, 47, and 48.

Figure A.22 represents Hunter’s aggressive responses during the fourth condition (vacuum on and moving). Once again, no aggressive responses were observed in the presence of the stool. Aggressive responses, in the presence of the vacuum, ranged between zero and 8, averaging 2 per trial. There were no apparent trends during the three phases (targeting beside vacuum, targeting onto vacuum, and reinforcing initiations towards the vacuum). There was an increase in aggressive responses observed during Phase 3 (initiations to vacuum). Eight aggressive responses were observed during Trial 56, the highest quantity recorded during the fourth condition.

Avoidance Responses

Figures A.23, A.24, A.25, and A.26 show Hunter's active and passive avoidance responses during the multiple conditions of the experiment. Figure A.23 shows Hunter’s avoidance responses during the first condition (vacuum off and stationary). There was one passive avoidance response in the presence of the stool during Trial 21. There were no active avoidance responses observed while in the presence of the stool. In the presence of the vacuum, however, there were numerous observations of avoidance responses, ranging between zero and 2. Although there were no active avoidance responses observed in the presence of the vacuum, there were passive avoidance
responses observed during Trials 1, 2, 3, 4, 7, and 8. After Trial 8 there were no more avoidance responses observed in the presence of the vacuum.

Figure A.24 shows Hunter’s avoidance responses during the four phases of the second condition (vacuum on and stationary). There were no active avoidance responses in the presence of the stool, and only 1 passive avoidance response in the presence of the stool observed during Trial 95. There were no active avoidance responses observed in the presence of the vacuum, but there were numerous trials where passive avoidance responses were exhibited. Hunter's passive avoidance responses in the presence of the vacuum ranged between zero and 3, averaging 1 per trial. There were no obvious trends across trials, but after Trial 94 Hunter’s rate of responses fell to zero for the rest of the fourth condition.

Figure A.25 shows Hunter’s avoidance responses during the 2 phases of the third condition (vacuum off and moving). There were no avoidance responses observed in the presence of the stool. In the presence of the vacuum, however, there were numerous passive avoidance responses observed, but no active avoidance responses. During Phase 1 (targeting beside vacuum), there was 1 occurrence during Trials 1 though 5, and then resurgence seen during Trials 14 and 24. When Hunter was required to target onto the vacuum (Phase 2), resurgence was more obvious, and there was 1 occurrence observed during the majority of the trials conducted. The only trials where there were no passive avoidance responses seen were Trials 26, 27, 33, 43, 46, 49, and 50.

Figure A.26 shows Hunter’s avoidance responses during the fourth condition (vacuum on and moving). During this condition there were more avoidance responses
observed than any of the previous conditions. There were 2 instances of passive avoidance responses observed in the presence of the stool (Trials 62 and 65) but no active avoidance responses exhibited. During the presence of the vacuum, however, passive avoidance responses ranged from 1 to 6 per trial, averaging 1 per trial. The least amount of passive avoidance responses observed was during Phase 1 (targeting beside the vacuum). The highest quantity of responses was observed during Phase 2 (targeting onto vacuum), and it is during Trial 26 that the most responses exhibited during any of the sessions were observed. During Phase 3 of the fourth condition, the quantity of responses per trial dropped, but there was at least 1 response or more exhibited during all but 3 of the trials. There were no obvious trends observed.

**Travel Time**

Figures A.27 through A.30 show Hunter’s travel time in seconds towards the stool and the vacuum. Figure A.27 shows Hunter’s travel time during the first condition (vacuum off and stationary). Hunter’s travel time towards the stool averaged at 4.5 seconds, ranging from 3.8 to 6.7 seconds. His travel time towards the vacuum averaged at 5.1 seconds, ranging from 3.5 to 19 seconds. His rates traveling towards both stimuli remained fairly constant across trials.

Figure A.28 shows Hunter’s travel time in seconds towards the stimuli during the second condition (vacuum on and stationary). During Phase 1 (reinforcing initiations) of the second condition, Hunter’s travel time towards the stool ranged between 3.07 and 5.09 seconds, averaging 3.75 seconds. There was a very slight decreasing trend across trials in the presence of the stool, but in the presence of the vacuum, the data were very erratic with one outlier present at Trial 11. Travel time towards the stool
during Phase 1 ranged between 4.48 seconds and 58 seconds, averaging 13.49 seconds. During Phase 2 (reinforcing initiations) of the second condition, travel time towards the stool remained constant, ranging from 3.12 to 5.6 seconds and averaging 3.75 seconds per trial. Travel time in the presence of the vacuum for Phase 2 ranged from 4.04 seconds to 78.46 seconds and averaging 20.6 seconds per trial. There was a decreasing trend across trials after Trial 55. During Phase 3 (shaping), travel time towards the stool continued to remain constant, ranging from 3.19 to 5.6 seconds, averaging 3.64 seconds per trial. Travel time towards the vacuum during Phase 3 ranged from 3.45 to 38.31 seconds, averaging 9.15 seconds. Phase 4 of the second condition (mastery) showed that Hunter’s travel time towards the stool remained constant, ranging from 3.09 to 3.82 seconds, averaging 3.38 seconds per trial. Travel time towards the vacuum dropped significantly, and ranged from 3.13 to 6.44 seconds, averaging 4.02 seconds. However, there was a subtle increasing trend repeated across sessions. Overall, during the second condition, Hunter’s travel time towards the stool averaged 3.6 seconds, while his travel time towards the vacuum averaged 9.6 seconds.

Figure A.29 shows Hunter’s travel time during the third condition (vacuum off and moving). His travel time towards the stool ranged from 2.5 to 7.91 seconds during Phase 1 (targeting beside vacuum) and Phase 2 (targeting onto vacuum). He averaged 3.35 seconds across all trials traveling towards the stool, and his time remained constant during the third condition with only one outlier at Trial 12. Travel time towards the vacuum ranged from 3.12 to 5.83 seconds (after Trial 1 where shaping was used). His average was 4.01 seconds across all trials (excluding Trial 1). Travel time towards
both stimuli remained constant across trials, though travel time towards the vacuum was always slightly higher than travel time towards the stool.

Travel time during the fourth condition is represented by Figure A.30. Hunter’s travel time towards the stool remained constant across all three phases (targeting beside vacuum, targeting onto vacuum, and reinforcing initiations to vacuum), and ranged from 2.7 to 5.5 seconds, averaging 3.37 seconds per trial. Travel time towards the vacuum ranged from 2.81 to 8.5 seconds (after Trial 1 where shaping was used), averaging 5 seconds per trial (excluding Trial 1). Once again there was a subtle repeating increasing trend across sessions with the vacuum that is apparent in all three phases.

Wagging

Figures A.31 through A.34 show Hunter’s wagging in the presence of the vacuum and the stool displayed cumulatively. Figure 31 represents Hunter’s wagging during the first condition (vacuum off and stationary). There was one instance of wagging recorded for all trials with the stool except for Trial 9. In the presence of the vacuum, wagging is not observed for Trials 6, 8, 9, and 10.

Figure A.32 shows Hunter’s wagging during the second condition (vacuum on and stationary). There was no wagging observed for Trials 1 through 5 because the data were lost due to camera malfunction. For Trials 6 through 25 (Phase 1, reinforcing initiations), wagging was observed for all trials in the presence of the stool. In the presence of the vacuum, wagging was not observed for Trials 6, 11, 12, 15, 23 and 25. During Phase 2 (reinforcing approximations) of the second condition, wagging behaviors dropped in the presence of both the vacuum and the stool. This was due to a
bad camera angle for most of Phase 2, and Hunter's tail was out of the shot. In the presence of the stool, Hunter's tail was unobservable for Trials 2, 5, 8, 9, 15, 16, 17, 18, 19, 20, 22, 24, 25, 26, 29, 33, 35, 37, 38, and 40. During all other trials of Phase 2, however, his tail was in view and was wagging for the majority of trials in the presence of the stool. Hunter's tail was also out of view for many trials of Phase 2 in the presence of the vacuum. His tail was unobservable for Trials 11, 31, 33, 37, 39, 41, 44, 48, and 50. During all other trials of Phase 2, his tail was in view but not wagging the majority of the time. During Phase 3 (shaping) and Phase 4 (mastery), Hunter's wagging in the presence of the stool remained constant, with one occurrence per trial. In the presence of the vacuum wagging was intermittent, and most trials there was no wagging observed at all.

Figure A.33 shows Hunter's wagging during the third condition (vacuum off and moving). During Phase 1 (targeting beside vacuum) of the third condition, Hunter's wagging in the presence of the vacuum was constant at one occurrence per trial. Wagging in the presence of the vacuum was more intermittent, and again there are several trials where wagging was unobservable. These are Trials 4, 5, 7, 8, 9, 10, 12, 13, 14, 15, 19, 20, 21, 22, and 23. For all other trials, Hunter's tail was visible, and wagging the majority of the time. For Phase 2 of the third condition, there were no unobservable trials, and Hunter's wagging remained constant in the presence of the stool. In the presence of the vacuum his wagging rates appeared to increase after Trial 28, but then they decreased at Trial 43.

Figure A.34 shows Hunter's rate of wagging during the fourth condition (vacuum on and moving). Wagging rates in the presence of the stool remained constant during
all three phases (targeting beside vacuum, targeting onto vacuum, and initiations to vacuum) with one occurrence per trial. Wagging in the presence of the vacuum was still intermittent until Phase 3. After Trial 58, wagging was stable with one occurrence per trial.
DISCUSSION

The results of this study show that although Hunter received six months of counterconditioning treatment in the presence of the aversive stimulus (vacuum cleaner), his number of responses was unable to match those seen in the presence of the neutral stimulus (stool). Also, Hunter’s number of aggressive responses was highest during the fourth probe of the fourth condition, suggesting that the counterconditioning not only was ineffective during this condition but actually increased aggressive responses instead of decreasing them.

An important aspect of this experiment was the ability to monitor Hunter’s behaviors in the presence of both the aversive and neutral stimuli at the same time. Many counterconditioning procedures only monitor the organism’s behavior in the presence of the aversive stimulus and assess improvement by comparing the behavior seen during baseline to behavior at the end of treatment. Although this practice can give us some measure of improvement, there are no other bases for comparison to judge if the aversive stimulus is no longer aversive. Simultaneously observing his responses in the presence of the neutral stimulus (barstool) gave the experimenter the ability to observe how quickly Hunter walked to the stool, how many initiations he exhibited in 45 seconds, how many aggressive or avoidance responses were made, and how many incorrect responses were exhibited.

During the standard probe sessions, Hunter’s behaviors appeared to worsen over time in the presence of the vacuum. The probe sessions were conducted at various times during the experiment to assess whether Hunter was generalizing “calm” behaviors in the presence of the vacuum. It is possible that when the experiment was
first begun, the vacuum was so aversive that Hunter refused to exhibit any behaviors whatsoever, due to extreme fear. Extreme fear in dogs can be measured in what are called “submissive postures”, observed by a complete lack of physical movement, crouching, and head lowering (Arthur, 2009). After providing reinforcement in the presence of the stimulus, Hunter did not necessarily become more “calm” around the vacuum, but instead, was calm enough to approach and attack it. It is possible that an unintended side effect of the counterconditioning was creating “brave” behaviors. In addition to the increase in aggressive responses was the increase in aggression intensity. When the experiment first began, Hunter’s bites to the vacuum were frequent, but short in duration. He lunged at the vacuum, bit, and then immediately let go and retreated. As the experiment went on, however, Hunter’s biting frequency decreased but the intensity increased. Hunter’s behavior towards the end of the experiment during a bite consisted of lunging, biting, jerking the vacuum forcefully and then letting go. During one trial Hunter bit and pulled the vacuum so hard that it nearly came out of the experimenter’s hand. This aggression could be the result of extinction (Lerman, Iwata, & Wallace, 1999), or just an unintended side effect of the counterconditioning.

Hunter’s aggression and avoidance resurged throughout the experiment. When movement of the vacuum was added during the third and fourth conditions, Hunter’s aggressive and avoidance responses never truly stabilized to the same levels as the stool. There appeared to be a decline during the third phase of the fourth condition, but when the probe was conducted at the end of the experiment, Hunter’s aggressive and avoidance behaviors were the highest they had been during the study. Also, even with six months of counterconditioning and repeated presentation of the aversive stimulus,
Hunter still bolts from the vacuum and then attempts to bite it. This suggests that Hunter was unable to generalize the “calm” replacement behaviors that were reinforced for the duration of the experiment.

Although the travel time from the base position to the vacuum decreased over time, there were many topographical changes observed during the experiment, that unfortunately were not recorded except for tail wagging, that also indicated that Hunter was not “calm”. When Hunter was required to approach the stool during the baseline trials, his gate was bouncy, his muscles relaxed, and, in some trials, he ran towards the stool. When the stool was replaced with the vacuum cleaner to conduct the experimental trials, Hunter still approached, but his gate was slower, more hesitant, and his head and tail were hung down towards the floor. It is important to note the changes in topography because it shows that although Hunter was able to approach and tolerate the aversive stimulus, he was unable to exhibit the calm behaviors that were observed in the presence of the neutral stimulus. Another change in topography was noted in the manner Hunter initiated to the target stick. In the presence of the stool, his targeting was very brief and relaxed. In the presence of the vacuum cleaner during the third and fourth condition when movement was added, Hunter’s stationary targeting became more forceful. He would take the target stick into his mouth and pull, similar to what was observed when he would bite and pull the vacuum during an aggressive response. It is possible that this is an instance of generalized aggression. This is extremely important to note because of the frequency of fatalities in the animal training world. If the trainers use counterconditioning in a free contact setting (such as SeaWorld) and have gone over the animal’s predetermined threshold, a large animal could easily
exhibit aggressive responses towards the trainer instead of an inanimate object, severely injuring or killing them.

Another behavior change observed was Hunter’s stereotypic initiations to the vacuum during the experimental trials. Over the course of the experiment (roughly six months), Hunter’s initiations towards the stool became more variable; at first, he only touched the seat of the stool with his nose. Then, over the next few months, he touched the legs of the stool, or the connecting pieces between the legs. Initiations towards the stool were always reinforced, no matter what location on the stool he touched. This variability maintained throughout the rest of the experiment. In the presence of the vacuum, however, when Hunter was required to initiate to it without the use of the lure, he touched the same spot repeatedly (when the vacuum was stationary). Interestingly, the location he chose to initiate to was directly beside the power button. This reduction in variability in the presence of the aversive stimulus suggests that Hunter’s fear of the vacuum was not totally eliminated (PetSmart, 2005).

There was also some debate on whether having the object being moved by a person may have affected Hunter’s behavior. Many students and colleagues asked if Hunter was simply trying to “protect” the person by reacting aggressively, and if we removed the person from the experiment would the aggressive behaviors remain? Though there is no data to reflect this, the experimenter did set up an opportunity to investigate this account. The vacuum cleaner was set up in the usual location for experimental trials. Then, the experimenter (who was twenty feet away) pulled the vacuum across the room by the power cord. Hunter still bolted, and then lunged and bit
the vacuum. Hunter still emitted fearful responses in the presence of the vacuum itself, regardless if a person was near it.

Suggestions for further study include adding generalization as part of the study rather than an experimental probe. It has been suggested that generalization cannot happen just because a training procedure was implemented and successful. For generalization to be successful it should be a part of the training program itself (Stokes & Baer, 1977). Dogs are especially sensitive to changes of stimuli in their environment. By counterconditioning in a variety of situations, perhaps future studies could show more success using this procedure.

Another suggestion for future research would be to present the vacuum in an even wider variety of ways. There are numerous characteristics about the vacuum that could have affected the dog’s behavior, not just sound and movement. Other suggestions include laying the vacuum on its side, or trying to control the odor emitted by the motor. All of these would be important additions to the research.

This research adds to the literature by demonstrating that despite six months of seemingly effective counterconditioning, an organism can still demonstrate a variety of fear responses when behaviors are compared to a neutral stimulus. When there is a basis for comparison, previously effective methods no longer seem so effective. Alexandra Kurland once said, “What we want is not just the behavior, but the behavior in an exuberant state” (Kurland, 2009). By finding methods that teach organisms not just to tolerate aversive situations, but truly overcome their fears, we can then observe exuberant behaviors in action.
APPENDIX

DATA SHEET AND FIGURES
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Figure A.32. Hunter’s rate of wagging in the presence of the stool and vacuum displayed cumulatively during the second condition.

Figure A.33. Hunter’s rate of wagging in the presence of the stool and vacuum displayed cumulatively during the third condition.

Figure A.34. Hunter’s rate of wagging in the presence of the stool and vacuum displayed cumulatively during the fourth condition.
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**DATE OF SESSION(S):**

**DATA COLLECTOR:**

**EXP. PHASE:**

HUNTER'S DATA SHEETS
REFERENCES


