ABSTRACT

ASSESSING HUMAN ATTENTION AS A REINFORCER FOR DOG BEHAVIOR: A METHODOLOGICAL COMPARISON

According to the American Society for the Prevention of Cruelty to Animals (ASPCA, 2019), approximately 3.3 million dogs enter shelters every year. Researchers have identified behavioral factors influencing adoption and found that poor interaction with humans is a leading behavioral concern that may influence adoption. Several researchers have examined the reinforcing efficacy of human attention on dog behavior; however, these studies have produced mixed results. Procedural differences may account for this disparity. The purpose of this study was to compare two common procedures (single-operant and concurrent operant methods) used to assess human attention as a reinforcer for dog behavior. Eight dogs from a local non-open intake shelter participated and completed both methodologies. Results from six of the eight dogs showed a difference between methodologies, suggesting that the reinforcing efficacy of human attention will depend on the methodology used.

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ASSESSING HUMAN ATTENTION AS A REINFORCER FOR DOG BEHAVIOR: A METHODOLOGICAL COMPARISON

by

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APPROVED

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According to the American Society for the Prevention of Cruelty to Animals (ASPCA) nearly 6.5 million animals enter shelters every year. Of these, approximately 3.3 million are dogs. Due to the limited space available for housing and funding, nearly 670,000 of these dogs are euthanized every year (ASPCA, 2019). This euthanasia is not often due to illness or old age, but rather because the dog is not adopted and the shelters have limited space. Because of this, it is important to examine the factors that influence adoptions in order to increase adoption rates thereby decreasing euthanasia rates.

There are several factors that influence shelter visitors when looking at potential adoptees. These factors range from the physiological (e.g., breed and age) to behavioral (e.g., inappropriate behaviors and social interactions). Protopopova and Wynne (2014) examined which out-of-kennel behaviors and which physiological factors influenced adoptions from shelters. They found that over half of adopters reported that their reason to adopt was based on looks, age, and breed, whereas under 10% of adopters reported these factors as reasons to not adopt. In comparison, the behavioral factors (i.e., energetic, timid, chewing, etc.) influenced over 80% of visitors’ decisions to adopt and nearly half of the visitors’ decisions to not adopt. These results suggest that while physiological factors do influence dog adoption from shelters, the dogs’ behavior was not only more likely to influence their decision to adopt but also much more likely to influence their decision to not adopt than factors such as breed, age, and look. Additionally, social interactions with humans was the behavioral factor that accounted for the reasons most people decided against adoption.

Because shelter dogs’ physiological factors are not malleable, research on improving the adoptability of dogs should focus on behavioral factors. Unfortunately, shelter visitors on average only view a small number of dogs, spend just over a minute in
front of their kennels, and under half a minute actually interacting with dogs in the kennels (Wells & Hepper, 2001). This means that adoptable dogs have only a short amount of time to make an impression on shelter visitors. Therefore, initial social interactions between dogs and people are likely important factors in the adoption of shelter dogs.

Researchers have attempted to isolate social factors that could increase dog adoption rates. For example, Protopopova, Gilmour, Weiss, Shen, and Wynne (2012) looked at whether or not dogs trained to gaze into potential adopters’ eyes would increase adoption rates. They randomly assigned groups of dogs to a control group, a feeding group, and a training group. The control group received no additional shelter experience, the feeding group was offered a treat every 15 s for 10 min each day, and the training group’s behavior was shaped such that they would gaze into the experimenter’s eye for 15 s. While gazing towards experimenters did increase, this was not enough to decrease the average length of stay. Additionally, taking the dogs out of their kennels and offering them treats daily also did not decrease the average length of stay.

These results suggest that gazing towards humans alone is not an important social interaction when it comes to increasing shelter adoption rates. This implies that, while social interactions are the number 1 reason potential adopters choose to adopt or not, there are specific social interactions that shelter visitors look for. Based on the finding that simply gazing into the eyes of their potential adopters is not enough to increase the chances of their being adopted, other social interactions, such as approaching humans, may be more important. However, when dogs approach humans they are often met with attention either in the form of verbal or physical attention. This means that for a dog to approach a potential adopter, the attention must serve as a reinforcer for dog behavior.

Several researchers have previously looked at the reinforcing efficacy of human attention on shelter animal behavior. However, equivocal results from these studies have
left it unclear as to what type of human attention is reinforcing (i.e., vocal or physical) or if human attention is even an effective reinforcer at all. However, procedural differences between these studies may account for some of the differing results.
CHAPTER 2: LITERATURE REVIEW

There are two different procedures often used to assess the reinforcing efficacy of human attention for dog behavior. The first is a single-operant procedure. In this procedure, an arbitrary response—such as a nose touch to a hand or object—is used. The dog is then provided with a programmed consequence (i.e., food or attention) contingent on the response. Whether a programmed consequence functions as a reinforcer or not is determined by maintained responding. In other words, if the programmed consequence functions as a reinforcer, then the dog should continue to engage in the arbitrary response. Conversely, if the programmed consequence does not function as a reinforcer, then the dog is expected to discontinue engaging in the arbitrary response (i.e., extinction).

Feuerbacher and Wynne (2012) used a single-operant procedure to investigate the reinforcing efficacy of human attention for dog behaviors. The authors compared reinforcing efficacy of food versus human attention (i.e., petting and vocal praise together) with a group of shelter dogs, owned dogs, and hand-reared wolves across a series of five experiments. The purpose of using the hand-reared wolves was to test whether sensitivity to human attention as a reinforcer is a product of domestication. They chose a simple nose-to-hand touch to the experimenter’s hand as their arbitrary response and provided the programmed consequence (i.e., food or social interaction). Social interaction lasted for approximately 4 s and consisted of petting the canids around their necks while vocally praising them. This duration was chosen because it was equal to that of delivering a piece of food to the canid. Finally, during the food condition, the food was delivered with the hand that was not used as the stimulus for the nose touch. In experiment 1, the authors compared food and social interaction with nine shelter dogs. The results of the first experiment revealed that the most common pattern of responding was a higher level of responding in the food condition with low to zero levels of
responding in the social interaction condition with five of the dogs responding this way. Out of the other four dogs, three had relatively low levels of responding across conditions and one produced maximum responding in both conditions. In experiment 2, an extinction condition was added to compare responding in extinction and social interactions conditions and sessions were limited to 3 min. The time limitation was implemented to increase opportunities for dogs to engage in the nose touch and to produce more variable responding across conditions. Six different shelter dogs were tested in this experiment and results were similar to that of experiment 1 in that the dogs typically displayed high levels of responding in the food conditions. Interestingly, levels of responding in the social interaction and extinction conditions were low and nearly indistinguishable between the conditions.

Experiment 3 was identical to experiment 2 except that the subjects were six owned dogs and the person delivering the programmed consequence was their owner. Results of experiment 3 mimic those of experiment 2. A majority of the dogs displayed high levels of responding in the food conditions and indistinguishable, low levels of responding in the social interaction and extinction conditions. Experiment 4 introduced an extended exposure to the social interaction condition before being exposed to the food condition in order to determine if the extended exposure to the social interaction condition would result in the social interaction acquiring a stronger reinforcing value. The procedures were otherwise identical to experiment 2. This experiment used seven shelter dogs as the subjects and produced similar results to those of the previous three experiments. Most dogs displayed low level to zero levels of responding in the social interaction condition and high levels of responding in the food condition. Finally, experiment 5 replicated experiment 3 with nine hand-reared captive wolves. Results revealed patterns of responding very similar to those of owned dogs.
Combined, results from these five experiments suggest that human attention is not an effective reinforcer for dog behavior. The authors noted that low levels of responding during the social interaction condition persisted despite the relative state of deprivation from human attention as with shelter dogs and having a history of reinforcement with the experimenter as with owned dogs. They went onto explain that considering these states, coupled with results from all canines, the theory that domestication did not occur due to an inherent sensitivity to human attention is supported. The authors gave the following four explanations for their results: brief human social interaction does not function as a reinforcer, human social interactions must be conditioned as a reinforcer, human social interaction does function as a reinforcer but that satiation occurs very quickly, and finally alternating between a weak and potent reinforcer may have enhanced the difference observed in levels of responding between the food and social interaction conditions (i.e., behavioral contrast).

In an effort to expand upon this study, Payne and Salazar (2019) researched the efficacy of human attention as a reinforcer for shelter dog behavior while controlling for the delivery of human attention across all conditions. Additionally, the study assessed whether human attention could be conditioned as a reinforcer through the use of a response-stimulus pairing procedure. Experiment 1 used a single operant procedure to compare food and human attention as a reinforcer. Nose touches to a target wand were recorded as the arbitrary response. During the social interaction condition, both physical and vocal human attention were delivered contingent on engaging in the target response. In the food condition, an automatic treat dispenser was used to deliver food in order to control for coincidental human attention delivery with the food. Results of experiment 1 were similar to those of Feuerbacher and Wynne (2012). A majority of the dogs engaged in high levels of responding in the food condition and low levels of responding in the social interaction condition, suggesting that while food appeared to be a potent reinforcer
for the dogs’ behavior, social interaction did not. Following from experiment 1, experiment 2 examined whether human attention could be conditioned as a reinforcer for dog behavior with the dogs from experiment 1 that engaged in low levels of responding in the social interaction condition. Nose touches to the wand were also used in this study as the arbitrary response. Three dogs from experiment 1 were exposed to a pre-test, conditioning phase, and post-test. The pre- and post-test phases were identical to the attention condition in experiment 1. In the conditioning phase, both food and human attention (i.e., petting and vocal praise together) were delivered simultaneously contingent on a nose touch to the wand. Instead of using an automatic treat dispenser as in experiment 1, food was delivered by hand. Results revealed that levels of responding increased during the conditioning phase and then maintained during the post-test across all three dogs. This suggests that human attention may have been conditioned as a reinforcer for the dog’s behavior across all three dogs.

Overall, research using a single-operant methodology has concluded that human attention is a weak reinforcer, at best, for dog behavior. However, there have been several studies using the concurrent choice procedure that have demonstrated strong reinforcement effects using attention as a reinforcer. During the concurrent choice procedure, the experimenter presents dogs with two, simultaneously available potential reinforcers. Traditionally, two people are positioned apart from each other in a room and each are instructed to provide a different programmed consequence if the dog approaches them by entering into their proximity. Typically, the programmed consequence is provided continuously as long as the dog remains in the designated area. An area is marked off around the experimenter, and that area used to determine when the dog actually enters into their proximity. Sessions using this procedural methodology run anywhere from 5 to 10 min in which total duration spent within proximity is recorded for each programmed consequence. Preference is determined by which consequence the dog
allots more of their time. Previous studies have used various topographies of attention, food, and extinction as programmed consequences for entering into the experimenter’s proximity (Feuerbacher & Wynne, 2014, 2015, 2017).

Feuerbacher and Wynne (2014) used a concurrent choice procedure to evaluate dogs’ preference of attention (i.e., petting) and food. Two assistants sat in chairs that were 1.5m apart in the experimental room. Tape was placed around each of the chairs to determine whether the dog met the criteria for being in close proximity of the assistant. One assistant provided petting on a continuous schedule and the other provided small pieces of food on a progressively thinning schedule. The progressively thinning schedule for food was used to determine the schedule of food delivery at which the dog would prefer attention over food. If the dog entered the marked area for one of the assistants, that assistant would provide the programmed consequence (i.e., food or attention). As soon as the dog exited the marked area, the assistant stopped providing the programmed consequence. The authors used four manipulations to evaluate factors that may shift this preference. The first was that the dogs were in a familiar environment with their owners providing attention (Owner-Familiar). The second was that the dogs were in an unfamiliar environment with their owners providing the attention (Owner-Unfamiliar). The third was that the dogs were in an unfamiliar environment with strangers providing both food and attention (Stranger-Unfamiliar). And the fourth was that the dogs were in a familiar environment with a stranger providing both food and attention (Stranger-Familiar). Finally, they also evaluated shelter dogs. In the Owner-Familiar and Owner-Unfamiliar groups, the dogs were either deprived of their owner before the experiment began or not. Out of all of the groups, the Stranger-Familiar group allocated the most time to the food interaction and the shelter dogs allocated the most time to the petting interaction. However, the overall results of this study demonstrated that dogs in all
groups showed a preference for food over petting. However, almost every dog spent some time in proximity of the person providing petting.

Because a large number of dogs allotted time to the attention consequence, this suggests that human attention may function as a reinforcer for dog behavior. Unsurprisingly, these results also suggest that, if human attention does function as a reinforcer for dog behavior, then it is not as potent a reinforcer as food. A finding that is of particular interest is the amount of time shelter dogs spent in the proximity of the experimenter providing attention. The shelter dogs spent the overall longest time within proximity of the person providing attention than all other groups of dogs including owned dogs with their owners. This finding may be explained due to the shelter dogs’ general state of deprivation from human attention and has serious implications for the potential adoptability of these shelter dogs. If they are deprived of human attention and if human attention does function as a reinforcer for dog behavior, it is reasonable to assume that approaching humans can be reinforced with attention. As previously mentioned, it is important for shelter dogs to engage in “social” behaviors such as approach to increase the chances they may be adopted. According to this study, and others that use the concurrent choice procedure (Feuerbacher & Wynne, 2015, 2017), human attention appears to function as a reinforcer for approach behaviors.

As a follow-up on this study, Feuerbacher and Wynne (2015) assessed dogs’ preference of different topographies of human attention with shelter and owned dogs. They specifically tested vocal attention (i.e., “Good boy!”) and physical attention (i.e., petting) separately in a concurrent choice procedure. Set-up for the concurrent choice experiment was nearly identical to that of their previous study. The two differences were that the owned dogs were not separated into different groups and the assistants providing the consequences would switch what consequence they were providing half way through the 10-min session. They included this switch to see if the preference for the programmed
consequence would track with the change of assistant or if a preference for person formed. The results of the concurrent choice revealed that all dogs allotted most of their time in proximity to the person who was providing the physical attention. Additionally, the results revealed that all dogs tracked the contingency change and continued to allot their time to the physical attention. Based on these results, the authors conducted a second study where they used a single alternative choice procedure. The experimental room was set up as in first experiment, except that only one chair and one assistant was present. The assistant was instructed to provide physical attention, vocal attention, or no interaction contingent on the dog entering their proximity. Duration of time in proximity was recorded. Results from this experiment revealed that all dogs spent a longer duration in proximity to the person when they were providing physical attention versus vocal attention and no interaction.

Additionally, the duration of time spent in proximity to the person when they were providing vocal attention and no interaction were almost identical. While these results strengthen the notion that human attention can function as a reinforcer for dog behavior, specifically approach behaviors, they also expand on how different topographies of human attention function as a reinforcer. According to results from this study, vocal attention is indistinguishable from no interaction in terms of functioning as a reinforcer for these social dog behaviors. This is particularly important for shelter dogs as most potential adopters spend a very limited amount of time in front of each kennel and can often only provide limited forms of attention. If vocal attention does not function as a reinforcer for these approach behaviors, as indicated by these results, then shelter dogs are unlikely to approach the front of the kennels when being viewed by potential adopters.

Overall, results on whether or not human attention functions as a reinforcer for dog behavior are mixed. Studies that use a single-operant procedure conclude that human
attention does not function as a reinforcer for most dogs’ behavior, whereas studies that utilize the concurrent choice procedure conclude that human attention does function as a reinforcer for dog behavior. There may be several reasons for the differences found when using these separate procedures including the dogs’ preferences, the duration of attention delivered, the history of reinforcement for approach versus arbitrary responses, the inclusion of food in the assessment, or the individual reinforcement histories of the dogs in each assessment.

In some of the studies that used the single-operant procedure, there were some dogs that responded during social interaction conditions (Feuerbacher & Wynne, 2012; Payne & Salazar, 2019). While responding during food conditions was always higher, this only suggests that food is a more potent reinforcer than human attention not that human attention did not function as a reinforcer for those dogs. It could be that a majority of the dogs preferred food over human attention. Furthermore, attention was provided in very similar fashions across all studies and no preference assessment was conducted to determine the type of attention the dog preferred. As is demonstrated by the Feuerbacher and Wynne (2015) study, not all topographies of attention are equal. When concurrent choice procedures are used, dog are provided with attention continuously as long as they remain within proximity to the assistant providing attention. But they are generally petted on the area of their body that is closest to the assistant in an effort to not restrict the dog from freely moving around the experimental area. Similarly, attention is often provided when single-operant procedures are used by petting the area that is closest to the experimenter. Additionally, when vocal praise is used either concurrently or alone, preference assessments for pitch, tone, and pace are not conducted. It may be that not conducting preference assessments for types of physical and verbal attention affects the results and leads to the mixed results that have been found in the previous studies. Ultimately, a dog participating in the single-operant procedure may show comparable
levels of responding to food conditions if their preferred attention is being used as a reinforcer which would be more in line with what has been found in the studies using the concurrent choice procedure.

The duration of attention in the single-operant procedure may also have affected results in favor of food. The average duration of attention provided in single-operant procedures was approximately 4 s. This duration was often chosen to match the amount of time needed to deliver food to the canine. However, compared to the concurrent choice procedure when the dog received attention for as long as it stayed in proximity to the experimenter, this is a relatively short amount of time. Providing attention until the dog chooses to disengage during the single-operant procedure does create a risk of satiation and thereby risks the dog terminating responding. However, taking the average duration spent in proximity to the person providing the petting during the concurrent choice procedure as a basis for duration of attention delivery in a single-operant procedure is a reasonable idea. The addition of extended duration of attention delivery in the studies that used a single-operant procedure may have changed their results.

The two procedures also examine two different target behaviors. The concurrent choice procedure examined approach behaviors whereas the single-operant procedures examined arbitrary responses. These two types of behavior have very different histories of reinforcement. Approach behaviors (i.e., the dog coming up to the person, resting against the person, etc.) are often followed by physical, vocal, or physical and vocal attention as opposed to arbitrary responses, which are often followed by food. Dogs are often trained in basic obedience (i.e., appropriate leash walking, greeting manners, and household behaviors) and to “perform tricks” using food as reinforcement for the behavior. The arbitrary responses chosen in the single-operant procedures can be considered a type of trick or obedience behavior. Because approach behaviors have a history of being followed by attention and arbitrary responses do have a history of being
followed by food, the basic methodologies of these procedures might be what causes the different results.

Finally, food is a known potent, unconditioned reinforcer. As such, the addition of food in the assessment alone may have skewed the results. While the studies using a single-operant procedure attempted to control for order effects via counter balancing, once the dogs contacted the contingency that resulted in food, attention would not function as potent a reinforcer. In fact, the social interaction conditions might be seen as extinction from access to food, which may explain the undifferentiated levels of responding in Feuerbacher and Wynne (2015).

The simplest explanation is that both procedures accurately predicted the reinforcing efficacy of attention for the subjects in the study. It is possible that dogs included in the studies using the single-operant procedure did not engage in responding during attention conditions because, for those dogs, attention was not a potent reinforcer for their behavior. Dogs included in the concurrent choice procedures may have responded for attention because attention was a reinforcer for their behavior. Overall, differing reinforcement histories of the subjects may have contributed to the results, rather than any differences in the methodology. However, because no study has conducted both assessments with the same dogs, this is unclear. Therefore, the purpose of this study is to conduct both assessments with the same dogs and compare the results of the two methodologies, while also excluding food as a possible confounding variable.
CHAPTER 3: METHODOLOGY

Participants & Setting

Sixteen dogs (*Canis lupus familiaris*) were initially chosen to participate in the study. All participants were selected from a population of dogs who were available for adoption at a local no-kill, closed intake shelter in Fresno, CA. Selected dogs were nominated by staff members, but nominations were not based on any specific behavioral characteristic. Dogs were excluded from the study if they had a history of engaging in aggression towards people and were under 1-year-old in age. Additionally, a total of six dogs (Beyoncé, Twinkle, Macie, Hook, Nirvana, and Kraglin) were removed from the study due to being adopted, and two dogs (Turner and Marmaduke) were excluded due to elevated “stress” responses during sessions. Therefore, a total of eight dogs completed the study. Dolores (3 y.o., female) was a Corgi Terrier mix, Bambi (8 y.o., female) was a Chihuahua Dachshund mix, Bruno (3 y.o., male) was a Chihuahua mix, Mary (8 y.o., female) was a Labrador Retriever mix, Betty (7 y.o., female) was a Hound mix, Benjamin (2 y.o., male) was a Border Collie mix, and Mario (2 y.o., male) and Blaze (4 y.o., male) were Terrier mixes. Participants had resided within the shelter from a minimum of 1 month to over a year, but four of the participants (Dolores, Bruno, Mary, and Benjamin) had previously been adopted and returned to the shelter after a few months for various behavioral characteristics, except for Mary who was returned after 8 years due to owner death.

All sessions took part in a 7 m by 3 m room attached to the kennel complex. The room was used as the shelter’s meet-and-greet room. Due to shelter need, dogs would participate in a varying number of sessions before being returned to their kennel. The room was set-up so that there were two areas: the session area and the waiting area. The session area was approximately 4 m by 3 m and dogs were allowed to freely roam this
area during both methodologies. The waiting area was used to acclimate the dogs to the room before sessions began as well as to contain the dogs between consecutive sessions.

**Dependent Variable & Measurement**

Across both methodologies, data were collected by trained observers on smartphones using the Countee app. Data collected electronically were transferred to paper data sheets. All sessions were either recorded using a Nikon D3300™ camera or a Samsung Galaxy S8™ phone.

During the concurrent choice procedure, the dependent variable was duration spent within proximity of each assistant. Being within proximity was defined as the dog placing at least one foot within a predefined area while leaving proximity was defined as the dog removing all body parts from the predefined area. Observers started duration data collection when the dog entered an assistant’s proximity and ended duration data when the dog left the assistant’s proximity. Observers took duration for each side (i.e., left and right) and programmed consequences for each side were indicated on the paper data sheet including when the contingency shift occurred.

In the single-operant procedures the dependent variable is frequency of responding. This was defined as touching their nose to a free-standing target wand for one dog (Mario) and touching their nose to a closed fist for the remaining six dogs (Dolores, Bruno, Benjamin, Betty, Mary, Blaze, and Bambi). A response was recorded when the dog placed the front of their nose or mouth to any part of the wand or fist. Additional responses were scored when a minimum inter-response time of 5 s occurred.

**Research Design**

A concurrent operants design was used during the concurrent choice procedure. An ABAB reversal design was used in the single operant procedure to compare the effects of baseline and attention conditions.
Interobserver Agreement (IOA)

In order to obtain IOA data, two independent observers recorded data across a minimum of 33% of single-operant sessions for each dog and a minimum of 33% of all concurrent choice sessions. For the single-operant session, IOA data were calculated by determining the observers’ agreement or disagreement of the occurrence or non-occurrence of the target behavior. Sessions were divided into 10-s intervals. An agreement was scored if both observers scored either to occurrence or nonoccurrence of the response within a given interval. A disagreement was scored if one observer scored a response and the other did not. The sum of the agreement intervals was divided by the total number of intervals and then multiplied by 100%. For the concurrent choice sessions, IOA data were calculated by determining the observers’ agreement or disagreement of 30-s intervals spent within proximity of each assistant. The sum of agreement intervals was divided by the total number of intervals and multiplied by 100%.

IOA data were calculated for 37% of all single-operant sessions for Blaze. IOA results for Blaze’s single-operant sessions were 99% (range 93%-100%). IOA data were calculated for 100% of all single-operant sessions for Bambi. IOA results for Bambi’s single-operant sessions were 98.4% (range 92%-100%). IOA data were calculated for 100% of all single-operant sessions for Mary. IOA results for Mary’s single-operant sessions were 100%. IOA data were calculated for 33% of all single-operant sessions for Bruno. IOA results for Bruno’s single-operant sessions were 98% (range 91%-100%). IOA data were calculated for 89% of all single-operant sessions for Dolores. IOA results for Dolores’ single-operant sessions were 97.4% (range 90%-100%). IOA data were calculated for 47% of all single-operant sessions for Benjamin. IOA results for Benjamin’s single-operant sessions were 99.3% (range 97%-100%). IOA data were calculated for 68% of all single-operant sessions for Betty. IOA results for Betty’s single-operant sessions were 99.3% (range 91%-100%). IOA data were calculated for 42% of all
single-operant sessions for Mario. IOA results for Mario’s single-operant sessions were 99.6% (range 93%-100%).

Because each dog only experienced one concurrent choice session, IOA data were calculated for 37% of all concurrent choice sessions across all dogs. IOA data for concurrent choice sessions were 97% (range 95%-100%).

**General Procedures**

All eight dogs were exposed to both procedures. The order of procedures was counterbalanced across dogs to allow for the detection of potential order effects. Mario, Betty, Benjamin, and Blaze completed the single-operant procedure first and the concurrent choice procedure second. Dolores, Bambi, Mary, and Bruno completed the concurrent procedure first and the single-operant procedure second.

**Concurrent Choice Procedure**

The current study used procedures similar to those of Feuerbacher and Wynne (2014). The room was sectioned into two areas using a metal ex-pen. One section was used as a waiting area and the other was used as the session area. The dogs spent 2 min in the waiting area acclimating to the room prior to the start of the first session and could freely explore the area. The waiting area had two tables that held the recording device and data sheets but was otherwise void of toys or other objects. Two chairs were set up in the session area and tape was used to mark the area of proximity around each chair. Chairs were set up directly against the north wall. The “right” chair was placed a half meter from the east wall and tape was used to mark a box that was one meter from the front of the chair and a half meter to the left of the chair. This led to a proximity area that was a half meter on either side of the chair and one meter in front of the chair. The “left” chair and proximity area were set up to the left of the “right” chair in a similar fashion. One meter was left between the beginning of the proximity areas of both chairs (see
Figure 1). Trained assistants sat in the chairs and the lead experimenter stayed in the room to provide any necessary additionally instructions to the assistants. After 2 min, the ex-pen door was open allowing the dog to enter the session area. If the dog did not independently enter the session area it was first provided with some verbal encouragement (i.e., “Let’s go.”). If the dog still did not enter the session area, a slip lead was placed on the dog and he/she was led from the waiting area to the session area. Once the dog had fully passed into the session area, the ex-pen door was closed, and the dog was allowed free access of the session area.

![Room set-up during the concurrent choice procedure.](image)

*Figure 1.* Room set-up during the concurrent choice procedure.

The assistants were assigned one of two consequences to provide the dogs when they entered their proximity. They would either provide contingent attention or implement extinction. The first consequences provided on either side were counterbalanced so that attention was provided by the “left” assistant first half of the time and by the “right” assistant first the other half of the time. Both assistants began the session seated in the chair, facing forward, with their hands on their knees. When assigned to the attention consequence, assistants were trained to orient their gaze towards
the dog and provide both physical (i.e., petting) and vocal (i.e., “Good boy/girl!”) attention simultaneously. There were instructed to pet the area of the dog’s body that was closest to them in order to avoid inadvertently blocking the dog from moving freely around the session area. Additionally, they were instructed to not pet directly on top of the dog’s head and, instead, pet the dog’s chest, shoulders, chin, or ears. When assigned to the extinction consequence, the assistant was instructed to ignore the dog completely which included not making eye contact with, talking to, or petting the dog. If the dog attempted to solicit attention by pushing any part of their body into the assistant’s hands, the assistant was instructed to systematically follow the following protocol until the dog stopped soliciting attention. First, the assistant would fold their arms across their chest. Then, cross their hands to each shoulder. Next, stand up for 5 s and sit back down if the dog had stopped. Finally, turn their backs to the dog until they stopped attempting to push any part of their body into their hands. The concurrent choice session lasted for 10 min and, as in Feuerbacher and Wynne (2015), the assistants swapped programmed consequences after the first 5 min.

The assistants began providing their assigned consequence as soon as the dog entered into their proximity and provided it continuously until they left their proximity. If an assistant was providing a consequence when the contingency switch occurred, they would immediately begin providing their new consequence.

**Single-Operant Procedure**

Single-operant procedures took place in the same room as the concurrent choice procedure. The room was sectioned into two areas as in the concurrent choice procedure (see Figure 2). The waiting area was used to acclimate the dog to the room before the first single-operant session as well as to confine the dog during the inter-trial intervals. For seven of the eight dogs, a chair was placed in the middle of the session area. The lead
experimenter sat in the chair facing forward, made a fist with their right hand, and placed their right arms to the side. Efforts were made to keep the hand at approximately the same height as the dog’s nose. For the remaining dog (Mario), a free-standing target wand was placed in the middle of the session area. An assistant stood 2 feet from the wand near the southeast corner of the room.

Figure 2. Room set-up during the single-operant procedure.

This procedure consisted of baseline and attention conditions, which were structured into an ABAB reversal design. All baseline sessions lasted for 5 min. Attention sessions lasted for 5 min or until the dog did not respond for 1 min. At a minimum, the first three attention sessions were conducted so that a prompting hierarchy was initiated after 1 min of non-responding. The prompting ended after the dog responded or if the dog did not respond within 1 min of the initial prompt. If the dog responded within 1 min of the initial prompt, the dog would continue to receive a prompt after 1 min of non-responding for the entire 5 min session. If the dog did not respond within 1 min of the initial prompt, the session ended. An initial prompt was provided for all subsequent attention sessions if the dog did not respond within the first minute of the session. The
inter-trial interval was 2 min, during which time the dogs returned to the waiting area and was allowed free access of the area.

**Baseline.** The dog was allowed free access to wander the session area. No programmed consequences were provided for the dog touching their nose to the target. Assistants followed the same procedure to ignore the dog as that of the concurrent choice procedure.

**Attention.** The dog continued to be allowed free access to the session area. Contingent on the dog touching any part of their nose to the target, the assistant provided 5 s of both physical and vocal attention. When the assistant was not able to reach the dog immediately, they began the verbal attention immediately while they reached for the dog to provide the physical attention. The assistant provided petting in a similar fashion to that of the concurrent choice procedure. In all attention sessions, if the dog did not respond within the first minute, least-to-most prompting was provided. The assistant would first shake the target and wait for 5 s. If the dog had not responded, the assistant would tap the target up to three times and wait another 5 s. If the dog still had not responded, the assistant would hold the target approximately one inch away from their nose for 10 s. If the dog still did not respond, the assistant would return the target to its starting position, wait for another 10 s, and begin the prompting hierarchy again. In sessions where full prompting was provided, the assistant would begin this hierarchy after each minute in which no responding occurred and would continue until the dog had responded or until another minute with no responding elapsed. In sessions where reduced prompting was provided, this hierarchy would be presented if the dog did not respond within the first minute and was presented as described above until the dog responded or another minute with no responding elapsed.
CHAPTER 4: RESULTS

Results for Dolores are presented in Figure 3 and Figure 4. For her single-operant procedure, following the initial baseline with the introduction of attention and the prompting hierarchy, there was a large, initial increase in responding. Responding continued to increase and then levelled out. When prompting was reduced to the single prompt, responding initially decreased and then returned to levels like that of condition with full prompting. Responding initially decreased and continued to decrease to low levels in the return to baseline. Finally, responding returned to levels seen in previous attention conditions. For her concurrent choice procedure, she spent 64% percent of the time in proximity to the assistant providing attention and 5% of the time in proximity to the assistant providing no programmed consequences. In both methodologies responding was higher when she was provided with attention. These results suggest that human attention functioned as a reinforcer for Dolores’s behavior.

Results for Bruno are presented in Figure 5 and Figure 6. For his single-operant procedure, following the initial baseline with the introduction of attention and the prompting hierarchy, levels of responding did not increase though responding in the attention condition was more variable. When prompting was reduced to only a single prompt, responding did not differ from the previous condition. During the return to baseline, responding became less variable but levels did not differ. In the final attention condition, levels did not initially differ from all other conditions. However, the last two sessions show an upward trend. For his concurrent choice procedure, he spent 61% of the time in proximity of the assistant providing attention and 8% of the time in proximity to the assistant providing no programmed consequence. Bruno’s responding increased when provided with attention in the concurrent choice procedure, but not in the single operant procedure. These results suggest that human attention does not function as a reinforcer for arbitrary tasks, but may be a reinforcer for staying in proximity to a human.
Figure 3. Duration in seconds Dolores spent in proximity to both assistants.
Figure 4. Rate of responding during Dolores’ single-operant procedure.
Figure 5. Duration in seconds Bruno spent in proximity to each assistant.
Figure 6. Rate of responding during Bruno’s single-operant procedure.
Results for Mary are presented in Figure 7 and Figure 8. For her single-operant procedure, responding did not occur across either baseline or attention conditions. For her concurrent choice procedure, she spent 45% of the time within proximity of the assistant providing attention and 35% of the time within proximity of the assistant providing no programmed consequence. Mary’s responding slightly increased in the concurrent choice session, but she did not respond even when attention was provided in single operant sessions. These results suggest that human attention did not function as a reinforcer for Mary’s behavior.

Results for Bambi are presented in Figure 9 and Figure 10. For her single-operant procedure, following the initial baseline with the introduction of attention and the prompting hierarchy, levels did not increase past baseline levels but variability decreased. When prompting was reduced to a single prompt, there was an initial large increase in responding. However, for the rest of the sessions there was a downward trend and levels eventually reached zero. In the return to baseline, levels remained low with low variability. During the last attention condition, responding initially increased, but returned to zero levels. For her concurrent choice procedure, she spent 59% of the time in proximity of the assistant providing attention and 32% of the time in proximity of the assistant providing no programmed consequence. In both methodologies, Bambi’s responding was higher when provided attention. However, the responding did not maintain during the single operant sessions. These results suggest that human attention may have functioned as a reinforcer for her behavior, but not a potent reinforcer that could sustain responding.

Results for Mario are presented in Figure 11 and Figure 12. For his single-operant procedure, there was an increasing trend following the initial baseline with the introduction of attention and the prompting hierarchy. When the prompts were removed
Figure 7. Duration in seconds Mary spent within proximity of each assistant.
Figure 8. Rate of responding during Mary’s single-operant procedure.
Figure 9. Duration in seconds Bambi spent in proximity to each assistant.
Figure 10. Rate of responding during Bambi’s single-operant procedure.
completely, responding decreased to zero levels. When the single prompt was introduced, there was a large, initial increase in responding, which maintained at relatively high levels. During the return to baseline responding returned to low levels. Finally, in the last attention condition, there was a large initial increase in responding but then responding decreased to low-to-zero levels. For his concurrent choice procedure, he spent 47% of the time within proximity of the assistant providing attention and 26% of the time within proximity of the assistant providing no programmed consequence. Responding increased in both methodologies but, similar to Bambi, these results suggest that while human attention may function as a reinforcer for his behavior, it was not a potent reinforcer that could sustain responding.

Results for Benjamin are presented in Figure 13 and Figure 14. For his single-operant procedure, during the initial baseline there was a downward trend. Following the introduction of attention and the prompting hierarchy, there was a slight increase in responding. When the prompting decreased to the single prompt, responding returned to low levels. Levels of responding during the second baseline was undiscernible to that of the attention condition. Finally, in the last attention condition there was an increasing trend in levels of responding. For his concurrent choice procedure, he spent 95% of the time in proximity of the assistant providing attention and 5% of the time within proximity to the assistant providing no programmed consequence. Benjamin’s responding greatly increased in the concurrent choice methodology when provided with attention, but only slightly increased and did not maintain during the single operant methodology when the prompts were reduced. These results suggest that human attention was likely not a reinforcer for an arbitrary task but may be a reinforcer for staying in proximity to a human.
Figure 11. Rate of responding in Mario’s single-operant procedure.
Figure 12. Duration in seconds that Mario spent in proximity of each assistant.
Figure 13. Rate of responding during Benjamin’s single-operant procedure.
Figure 14. Duration in seconds Benjamin spent in proximity of each assistant.
Results for Betty are presented in Figure 15 and Figure 16. Results for her single-operant procedure (Figure 13) show an initial decreasing trend in responding during baseline. Responding slightly increased following the introduction of attention and the prompting hierarchy. When prompting decreased to a single prompt, responding became more variable. Responding was a low level during the return to baseline and became less variable. Finally, during the last attention condition there was an initial, large increase but responding during this condition was highly variable. Result for her concurrent choice procedure (Figure 14) show that she spent 99% of the time within proximity of the assistant providing attention and 1% of the time within proximity of the assistant providing no programmed consequence. Betty’s responding is similar to Benjamin’s and also suggest that human attention is likely not a reinforcer for an arbitrary task, but could be a reinforcer for staying within proximity of a human.

Results for Blaze are presented in Figure 17 and Figure 18. Results for his single-operant procedure (Figure 15) show low levels of responding and a decreasing trend during the initial baseline. Responding did not increase when attention and the prompting hierarchy were introduced and remained the same when the prompt was reduced to a single prompt. Levels of responding remained low during the return to baseline. Levels of responding did not differ during the last attention condition. Results for his concurrent choice procedure (Figure 16) show that he spent 44% of the time within proximity to the person providing attention and 13% of the time within proximity of the person providing no programmed consequence. Blaze’s responding increased during the concurrent choice methodology, but did not increase during single operant methodology. These results also suggest that human attention may have functioned as a reinforcer for staying within proximity of a human, but did not function as a reinforcer for an arbitrary task.
Figure 15. Rate of responding during Betty’s single-operant procedure.
Figure 16. Duration in seconds Betty spent in proximity to each assistant.
Figure 17. Rate of responding during Blaze’s single-operant procedure.
Figure 18. Duration in seconds Blaze spent in proximity of each assistant.
A Pearson’s r correlation analysis was computed to determine if there was a relationship between the level of responding in the concurrent choice and single-operant procedures. There was no correlation between the two procedures, $r = 0.001$, $n = 8$, $p = 0.8968$. Results from the correlation analysis are presented in Figure 19. As shown in the scatterplot, there is no relation between duration spent within proximity of the assistant providing attention and rate of nose to hand touches.

$y = 0.002197X + 0.6716$
$r = 0.001521$

*Figure 19. Linear regression graph showing the correlation between results from individual dogs in the concurrent choice and single-operant procedures.*
CHAPTER 5: DISCUSSION

The results of this study suggest that differences in the methodologies of the concurrent choice and single-operant procedures affect whether attention is determined to be a reinforcer for dog behavior. Results from individual procedures in the current study mimicked those of previous studies assessing human attention as a reinforcer for dog behavior. Previous studies that have utilized the concurrent choice procedure have found that dogs will allot some of their time to the person providing attention, even when the alternative is food (Feuerbacher & Wynne, 2014, 2015, 2017). While some dogs in the current study had a larger disparity between time spent within proximity of the assistant providing attention and time spent within proximity of the assistant providing no programmed consequence, all dogs allotted more of their time to the assistant providing attention. This suggests that human attention functions as a reinforcer for all dogs in the current study. However, only one dog in the current study (Dolores) sustained higher responding in the single-operant procedure when provided with attention as compared to baseline suggesting that human attention did not function as a reinforcer for seven out of the eight dogs. This result is also a replication of previous studies which utilized a single-operant procedure. These studies have found that dogs will not sustain responding at a higher level as compared to extinction baselines when provided with attention (Feuerbacher & Wynne, 2012; Payne & Salazar, 2019). Overall, the results from the current study suggest the efficacy of human attention as a reinforcer for dog behavior will depend on the methodology used for assessment.

These results have several implications. First, these results suggest that studies evaluating the reinforcing efficacy of human attention on dog behavior need to consider the methodology used when making concluding statements. As the results of the current study suggest that determining the reinforcing value of human attention on dog behavior
will depend on the methodology used, results from previous studies on the efficacy of human attention as a reinforcer should be interpreted cautiously, and future researchers should consider the procedure when designing methodologies and interpreting results.

Second, these results might suggest that human attention is reinforcing for dog behavior, but only under very specific parameters. Primarily, it may function as a reinforcer for those behaviors that are low in response effort. In the concurrent choice methodology, a dog can engage in a variety of behaviors and still be considered to be responding as long as they remained within proximity of the assistant. This requirement meant that the dogs could continue to access reinforcement when lying down, sitting, sniffing, barking, etc. as long as they remained within proximity. This low effort criterion might mean that responding in the concurrent choice methodology is more sensitive to changes in reinforcement. Conversely, the single-operant methodology typically uses an arbitrary task like the nose-to-hand and nose-to-wand touches used in the current study. These behaviors can be considered to have a higher response effort due to the precise criterion required for the response to be counted and may be less sensitive to changes of reinforcement as a result.

Secondarily, these results may suggest that human attention is a reinforcer for dog behavior only when provided for an extended duration. Several studies have researched the effects of reinforcer magnitude on responding in both humans (Trosclair-Lasserre, Lerman, Call, Addison, & Kodak, 2008) and non-human animals (Reimer, Ellis, Thompson, & Burman, 2018). Trosclair-Lasserre et al. (2008) assessed the effects of reinforcer magnitude on responding with children with developmental delays using a progressive ratio schedule of reinforcement after first obtaining a preference of reinforcer magnitude (i.e., 10-s or 120-s). The authors found that responding was higher when provided with the larger magnitude reinforcer (i.e., 120-s) and that this correlated to the participants’ preference assessment. The authors say that these results suggest that
preference for reinforcer magnitude might predict the reinforcing efficacy. Reimer, Ellis, Thompson, and Burman (2018) assessed what effect changes in the quantity or quality of the reinforcer had on responding and if responding correlated to the dogs’ preference from a concurrent choice procedure. The authors found that the dogs did not differ in their responding when provided with different quantities of food, but their responding did increase when provided with a higher quality of food. In relation to the current study, it may be that the extended duration of attention the dogs received during the concurrent choice procedure was not only greater in quantity, but also of higher quality due to the natural variation of speech and petting.

Finally, based on the results from the current study it appears that human attention may function as a reinforcer for dog behavior, but only for behaviors considered to be “social.” Social behaviors in this study refers to approaching and remaining in proximity of the human. All dogs in the current study allotted more of their time in the proximity of the assistant providing attention. This result replicates previous studies that have utilized the concurrent choice procedure and suggests that across multiple dogs, with a variety of backgrounds, and in several locations these “social” behaviors appear to be reinforced by human attention. As mentioned previously, this result may be due to the low response effort associated with these behaviors. However, it is also possible that this result has evolutionary ties. One of the most prominent accepted theories of the domestication of *Canis lupus familiaris* is that humans selected social traits in wild canines (i.e., reduced fear and aggression) which ultimately led to domestic dogs of today that are more social, tolerant, and cooperative (Marshall-Pescini, Schwarz, Kostelnik, Virányi, & Range, 2017).

This idea that “social” dog behaviors may be reinforced by human attention could lead to an important consideration for shelter structure. Many potential adopters make decisions on which dogs to meet based on the first few seconds of viewing while the dogs
are in their kennel housing (Wells & Hepper, 2001). Dogs who appear more sociable in this short amount of time are more likely to be brought out of their kennels for “meet and greets” and are therefore more likely to be adopted than the dogs who are not deemed as social by shelter visitors. Potential adopters have reported that dogs who come to the front of the kennel, wag their tail, and gaze into their eyes are seen as more sociable (Protopopova & Wynne, 2014).

According to results from the concurrent choice methodology, these are behaviors that are likely to be reinforced by human attention. However, shelters are designed in a way that limits the amount of attention that the potential adopters can provide the dogs while they are in their kennel housing. This limited interaction can include speaking to the dog and gazing at the dog, but does not often involve providing physical attention. Feuerbacher and Wynne (2015) concluded that physical attention is a more powerful reinforcer than vocal attention and that there was very little difference in responding when provided with vocal attention as compared to no social interaction. Payne and Salazar (2019) found that attention could be conditioned as a reinforcer, but their study used a mixture of verbal and physical attention. This means that it is likely that previously owned dogs, that have had a long and varied history of human attention being paired with other reinforcers, are more likely to come to the front of the kennel than strays or those dogs born in the shelter system. Consequently, this suggests that previously owned dog will be more likely be taken out of their kennels and thus more likely to be adopted. Changing the kennel structures to allow potential adopters to provide short durations of physical attention may decrease the overall length of stay for shelter dogs, especially those who have not had the opportunity to adequately pair human attention with other reinforcers.

Additionally, McGowan, Bolte, Barnett, Perez-Camargo, and Martin (2018) found that just 15 min of human attention provided a positive physiological effect to
shelter dogs. If shelters were able to change their kennel structure to allow for shorter and more frequent meet and greets, it is possible that there would be a positive physiological benefit to all shelter dogs.

In a similar way, results from the single operant methodology can lead to an important consideration for dog training. There has been a rise in recent years in reinforcement-based training procedures and systems for both working and pet dogs. These training programs focus on what might be considered high response effort behaviors due to their precise requirements. Based on the results from the single operant methodology, attention would be a poor reinforcer to implement in these kinds of training programs unless it had been previously paired with other reinforcers. Ultimately, results from the single operant methodology in the current study as well as results from previous research suggest that successful reinforcement-based training programs should include food and may condition human attention as a reinforcer in order to maintain responding.

While the current study adds to the on-going, growing literature on dog behavior, there were some limitations. First, this study only had shelter dog participants. Owned dogs typically have consistent and reliable access to human attention whereas shelter dogs often have restricted and limited access to human attention. This difference in attention could have affected the current results in one of two ways. First, their limited access to human attention may mean that shelter dogs have a stronger establishing operation (EO) for access to human attention. This EO may increase shelter dog responding in situations that would have little effect on owned dog responding. While most dogs in the current study did not sustain responding in the single-operant procedure when provided with attention as compared to baseline, some dogs in the current study (Betty and Benjamin) spent nearly 100% of their time in proximity to the assistant providing attention during the concurrent choice procedure. It is possible that the current study found such a large disparity between consequences in the concurrent choice
procedure because there was such a strong EO present to access human attention. Second, owned dogs have a longer history of human attention being paired with other reinforcers so that attention is itself conditioned as a reinforcer. Due to their history, owned dogs may have responded differently within the single-operant procedure than the shelter dog participants. While previous literature has shown that shelter dogs and owned dogs respond in similar ways during both single-operant and concurrent choice procedures, it is still possible that due to their history, owned dogs may have responded at higher rates in attention conditions during the single-operant procedure.

Second, the current study did not include preference assessments to determine the preferred type of verbal or physical attention. In an attempt to control for preference between verbal and physical attention, the current study used both types of attention simultaneously. Additionally, the assistants were instructed to pet the part of the dog’s body that was closest to them under the assumption that the dog would place itself in a position so that the area they preferred to pet would be nearest the experimenter. However, it is possible that conducting a preference assessment to determine the preferred form of verbal attention, preferred type of physical attention, and preferred area for physical attention may have affected the results gained from the single-operant procedure. Specifically, results could have shown attention to be a more powerful reinforcer during the single-operant procedure if the preferred type of attention had been determined through a preference assessment.

Third, the current study did not use an arbitrary task that is commonly used in dog training programs. Training programs for pet dogs typically focus on obedience commands (i.e., sit, down, stay, etc.) or other tasks that will benefit the human/dog partnership like walking with a loose leash and impulse control. Some service dog training programs do teach the dog to target an object as was required in the current study, but these targeting tasks are often the beginning of a behavior chain. For example,
guide dogs are trained to identify an empty seat, lead their handler to it, target it with their nose, and then position themselves to the side so that their handler can sit down. In the current study, the hand targeting was the only behavior required. It is possible that using a more “natural” training task would have yielded different results.

Finally, this study only sought to reveal whether the procedural differences were the cause of mixed results found in the current literature. A component analysis was not included to determine which specific procedural difference is the cause for the conflicting results. There are several components that could explain why one procedure produces different results than the other. It is possible that the task requirement in either procedure is the main reason for differing results. The single-operant procedure required the dog to perform a specific task to access reinforcement in comparison to the concurrent choice where the dogs would access reinforcement by simply exploring the environment in a species-specific way (i.e., sniffing). It is also possible that the duration of attention provided could be the cause of previous mixed results. In single-operant procedures, dogs are provided with a very short duration (i.e., approximately 5 s) contingent on engaging in an arbitrary task. In concurrent choice procedures, the dogs can access an unlimited amount of attention for engaging in low effort behaviors such as standing, lying down, and sitting as long as they are within the proximity boarder.

The results from this study have opened the doors for future research. Specifically, the parameters of attention delivery could be furthered studied. First, future research should look at the duration of attention provided during the single-operant procedure. Some dogs in the current study (Betty and Benjamin) received nearly 10 min of attention during the concurrent choice procedure and much less during the single-operant procedure. One future research possibility is the yoke the amount of attention received during the concurrent choice procedure to the amount of attention received in the single-operant procedure. Another future research opportunity could be to assess
whether the duration of attention received during the single-operant procedure could affect the results. This study could vary the duration of attention provided in various attention conditions to see if a longer duration of attention could increase responding. Second future research could attempt to conduct a component analysis to determine what part of the methodology is the cause of these result differences. Finally, this study could be replicated with owned dogs to determine if there is a difference in responding.
REFERENCES


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**Erin Ellyse Chrysafis**

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