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Journal of Applied Behavior Analysis

JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2015, **48,** 1–12 NUMBER 3 (FALL)

IMPROVING IN-KENNEL PRESENTATION OF SHELTER DOGS THROUGH RESPONSE-DEPENDENT AND RESPONSE-INDEPENDENT TREAT DELIVERY

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In a sequence of studies, we evaluated 2 behavioral interventions designed to decrease undesirable in-kennel behaviors of shelter dogs. In Experiment 1, we compared the efficacy of a simple pairing of person with food (response-independent treat delivery) to an increasing interval differential-reinforcement-of-other-behavior (DRO) procedure and a control condition. Both procedures decreased the median percentage of undesirable behavior from baseline (88.13%, interquartile range [IQR] = 52.78% and 66.43%, IQR = 89.06% respectively), and the control condition increased behavior by 15.13% (IQR = 32.08%), $H(2) = 6.49$, $p = .039$. In Experiment 2, we assessed the efficacy of a response-independent procedure on the whole shelter population. We found a 68% decrease from baseline in the number of dogs that behaved undesirably ($U = -4.16$, $p < .001$). Our results suggest that a response-independent procedure is equivalent in efficacy to a DRO procedure to decrease undesirable in-kennel behavior of shelter dogs.

Key words: adoption, animal behavior, animal welfare, shelter dogs

Millions of dogs are euthanized each year in animal shelters because of a lack of adoptive homes (ASPCA, 2011). Even for those animals that are eventually adopted, the extended stay in an environmentally deprived kennel, often in social isolation, may pose serious behavioral health risks (see review by Wells, 2004). Solving the problem of pet overpopulation may require several different approaches. Programs may focus on many aspects of the human–animal bond, such as reducing relinquishment of pet dogs into shelters, encouraging the sterilization of pets, and promoting adoption rather than buying from a breeder or pet store. Improving adoption rates for dogs already at the animal shelter is an approach that has recently received attention from researchers.

Currently, several types of largely unvalidated behavioral programs exist that are designed to promote appropriate behavior in kenneled dogs. The programs may be categorized broadly as enrichment programs that mainly focus on targeting the motivation behind the inappropriate in-kennel behaviors, such as providing additional exercise (e.g., Pooch to 5K, poochto5k.com; Playing for Life, dogsplayingforlife.com). Other programs are more direct in attempting to reduce behavior through operant conditioning methods, such as training dogs to sit when a trainer approaches the kennel, or through encouraging appropriate approach behavior, such as pairing the trainer with food (e.g., Open Paw, www.openpaw.org). Luescher and

We thank the administration, staff, and dogs of Alachua County Animal Services; Nathaniel J. Hall for assistance in graphing; and Brian A. Iwata for helpful advice. We also thank Jennifer Higgins for assistance with data collection and Brooklyn Howard and Jaclyn Haft for assistance with data coding.

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doi: 10.1002/jaba.217

Medlock (2009) encouraged the dogs in their study to decrease barking in the kennel by delivering food contingent on the absence of barking. Furthermore, the volunteers were told to throw food treats into the kennel each time they passed by the dogs, thus pairing the visual stimulation of person with food in an attempt to encourage approach behavior. The authors found that such an intervention in conjunction with a variety of other out-of-kennel obedience exercises (e.g., sitting on command, not jumping on visitors, and walking on a loose leash) increased adoption rates. The effects of in-kennel training on dog behavior were not clear, because no behavioral data were collected. More recently, Herron, Kirby-Madden, and Lord (2014) assessed the effects of an in-kennel training program on adoption rates. The program consisted of training the dogs to make eye contact, not to bark, to sit or lie down, and to approach the front of the kennel. All food was delivered by experimenters contingent on appropriate behavior. Herron et al. found that although the dogs' target behavior increased, adoption rates were unaffected. The mixed success of these training programs may be a result of the target behaviors being chosen based on assumptions and questionnaire data on what makes dogs attractive to adopters (Wells & Hepper, 1992) rather than on observational data. Also, before the effects of training on adoption rates are assessed, the first step must be to evaluate which, if any, in-kennel training programs are capable of reducing inappropriate behavior.

Protopopova, Mehrkam, Boggess, and Wynne (2014) found that leaning on the kennel walls, increased activity, and facing away from the front of the kennel predicted a longer time to adoption. Dogs that leaned or rubbed on the kennel walls had a stay at the shelter that increased by a median of 30 days. Dogs that engaged in back-and-forth motion in the kennel had a stay increased by 24 days. Dogs that faced away from the front of the kennel had a stay increased by 15 days. No behaviors that decreased length of stay were found, suggesting that adopters focus more on the undesirable behaviors than on the desirable behaviors (Protopopova et al.). These observational findings provide a starting point for a systematic evaluation of training programs and, subsequently, an assessment of targeted training to affect adoption rates. Thus, in a sequence of experiments, we aimed to assess the efficacy of two interventions to reduce undesirable in-kennel behavior of shelter dogs (where *undesirable* means "likely to prolong the time to adoption," as found in Protopopova et al.).

The aim of the first experiment was to compare two procedures to improve in-kennel presentation: withholding food reinforcement for undesirable in-kennel behavior while reinforcing other behavior deemed to be desirable (differential reinforcement of other behavior [DRO]) and simply pairing the visual presentation of a person with food (response-independent treat delivery). A response-independent procedure was included in the evaluation because of practical benefits to animal shelters. Response-dependent procedures such as DRO require trainers to observe the animal's behavior and adjust their own behavior as a consequence of the animal's behavior. However, a response-independent procedure does not require expertise or observation of the animal's behavior. Therefore, we explored whether simple pairing of a person with food reduced undesirable behavior in shelter dogs as reliably as a more labor-intensive DRO procedure.

The aim of the second experiment was to assess the efficacy of the response-independent pairing procedure as a whole-shelter intervention. Because most animal shelters in the U.S. are managed on scarce private donations or limited public funds, any intervention must be efficient in decreasing inappropriate behavior in many animals at once. This experiment assessed the percentage of animals at a shelter that would benefit from this type of intervention.

EXPERIMENT 1

In a mixed between-subjects multiple baseline design, we aimed to assess whether both a response-dependent procedure (DRO) and response-independent pairing could decrease inappropriate behavior. The University of Florida Institutional Animal Care and Use Committee approved all procedures.

Method

Animals and housing. Twenty-four adoptable dogs, housed at the Alachua County Animal Services, served as subjects. Adoptable dogs were seized or surrendered dogs that were determined to be safe and healthy by staff. Dogs were included in the experiment if they had at least 4 days of high rates (exhibited in at least 50% of 5-s intervals) of undesirable behavior during the initial 5 days of baseline sessions. Dogs were housed in rows of adjacent kennels with cement walkways in front and in back. They were singly housed in kennels (1.0 m by 4.6 m by 2.1 m), with two thirds of the pen outdoors and the rest indoors. All kennels had cement floors and cement walls (1.2 m high) that were connected to the ceiling of the kennel with a chain-link fence. Each kennel contained a water dish, a food dish, and a small plastic bed in the inside portion of the kennel. The public could view dogs from the outside walkway 5 days per week. Staff fed the dogs and cleaned kennels daily before 9:30 a.m. Volunteers at the shelter unsystematically exercised, trained, and played with the dogs approximately one to three times per week on the shelter premises. Dogs left the shelter through adoption into a home, placement into a rescue organization, or through humane euthanasia.

Design and response measures. All participating dogs were randomly assigned into one of three conditions: DRO, response-independent pairing, or control (baseline-only) conditions. Furthermore, to ensure that any behavior change was due to the experimental condition and not extraneous variables, dogs in the two experimental conditions were further randomly assigned into either a short (5 days) or long (10 days) baseline. Due to experimenter error, three dogs that were assigned to the 10 days of baseline instead received 11 days (Wendy in the DRO condition and Twizzler and Barkley in the response-independent condition). All dogs were enrolled in the study until they either left the shelter or 15 days had passed. After 15 days, the remaining nonadopted dogs entered a follow-up condition. Dogs in the response-independent pairing group for which the intervention was ineffective (Strider and Twizzler) were entered into the DRO condition. Unfortunately, only one dog (Barkley) remained at the shelter after completing the response-independent condition and was subsequently entered into a generalization phase followed by a maintenance phase.

The target behavior, undesirable in-kennel behavior, was an aggregate measure of the behaviors that had been previously found to predict a longer stay at the shelter (Protopopova et al., 2014). In addition, although barking was not found to predict a longer length of stay at the shelter, it was included in the aggregate measure because previous research had found that barking negatively affects the health and welfare of both shelter animals and staff (Coppola, Enns, & Grandin, 2006; Sales, Hubrecht, Peyvandi, Milligan, & Shield, 1997). Table 1 lists the operational definitions of each behavior that was included in the aggregate measure.

Procedure. To differentiate the experimenters from the multitude of people who walk by the kennels throughout the day, a salient stimulus (a bell) was chosen. An auditory rather than visual stimulus was chosen to ensure that the dogs were able to perceive it regardless of their position in the kennel. Furthermore, a bell ensured that the stimulus remained salient no matter who was holding it (which was assessed in the generalization condition). Before we assessed generalization of the intervention to a real-world application, the effects of the intervention on

Table 1
Operational Definitions of All Behaviors That Comprised the Measure of Undesirable Behavior

Behavior	Operational definition
Back of kennel or out of sight	Dog is located behind the midpoint of the outdoor portion of the kennel or in the inside portion of the kennel.
Facing backward	No eyes are visible to the camera.
Contact with kennel walls	Physical contact with the kennel wall, such as leaning or jumping on the wall (excludes contact with the cage door).
Barking	Dog emits a bark, howl, or yelp.

dog behavior needed to be evaluated. Therefore, a salient stimulus allowed a clear experimental demonstration of the effect of the independent variable (condition) on the behavior of dogs. Each dog received one session per day. The treats (Canine Carry Outs beef-flavored dog treats) were chosen for their relatively uniform shape, high palatability, and low cost.

All sessions started with a probe trial, in which an experimenter approached the kennel and began to video record the dog for 20 s while she rang a bell for the initial 2 s of the 20-s trial. All data on undesirable behavior were collected during the probe trials when no food was present.

Baseline. Baseline sessions consisted only of the probe trial. During these sessions, no further experimental procedures occurred for that day.

Response-independent pairing. After the probe trial, the experimenter conducted 10 pairing trials. The experimenter approached the kennel, rang a bell for approximately 2 s, and then threw a treat into the kennel, regardless of the dog's behavior. After an approximately 2-s intertrial interval, the experimenter approached the kennel and began the next trial.

DRO. After the probe trial, the experimenter conducted 10 training trials. Training consisted of an increasing interval resetting DRO. Each training trial began with an experimenter ringing the bell for approximately 2 s. The interval began at 2 s and increased by an additional 2 s with each reinforcer delivery. For example, if the dog did not exhibit undesirable behavior in Trial 1 (DRO 2 s), then Trial 2 consisted of DRO 4 s. Thus, each consecutive trial increased the interval by 2 s, for a maximum of DRO 20 s in Trial 10. If the dog exhibited an undesirable behavior, the trial immediately ended, the dog was not provided a reinforcer, and the interval of the next trial was decreased by 2 s. If the dog failed to earn a reinforcer on the shortest interval (i.e., DRO 2 s), the experimenter vocally prompted the dog to reposition itself (i.e., whistling or clicking the tongue) and gave a treat if the prompt resulted in no undesirable behavior for 2 s. After delivery of the food item, the experimenter walked away from the kennel for approximately 2 s and either began a new training trial or moved to the next dog.

Generalization and maintenance. For one dog (Barkley) in the response-independent pairing condition, two additional types of sessions were conducted: generalization and maintenance. The generalization sessions were identical to a probe session, but an unfamiliar experimenter approached the kennel, rang the bell for approximately 2 s, and video recorded the dog for the remaining 20 s. The maintenance sessions consisted of the familiar experimenter conducting the daily probe sessions (identical to the baseline sessions).

Data analysis. All data collection occurred during the probe trials. Videos from the probe trials were coded using a partial-interval recording method, in which the occurrence or nonoccurrence of the target aggregate behavior was scored in 5-s bins. A randomly selected 43% of videos (172 of a total of 398) were coded by an independent observer who was blind to the

hypothesis of the study. Interobserver agreement was calculated by dividing the number of intervals in which an agreement occurred (both observers agreed whether the aggregate undesirable behavior occurred or not) by the sum of agreements and disagreements and converting the result to a percentage. Interobserver agreement was 89% (range, 25% to 100%).

The multiple baseline design permitted an assessment of the effectiveness of each intervention on an individual level through visual analysis of the data. Furthermore, the median proportion of engagement in undesirable in-kennel behavior in the intervention was subtracted from the median of the baseline sessions and divided by the median of the baseline for each dog to calculate the percentage change from baseline. To calculate percentage change for the control group of dogs, the median proportion of engagement in undesirable in-kennel behavior in the second half of the baseline sessions was subtracted from the median of the first half of the baseline sessions and divided by the median of the first half of the baseline sessions. The medians of all dogs in the three conditions (response-independent pairing, DRO, and control) were compared using Kruskal-Wallis tests with Mann-Whitney post-hoc tests.

Results

Individual results provide evidence of the effectiveness of the DRO intervention for six dogs (Portia, Maggie, Droopy, Tanner, Noah, and Wendy) and of the response-independent pairing for four dogs (Julia, Diamond, Kenya, and Barkley; left and center panels of Figure 1). Portia, Droopy, Tanner, and Wendy showed decreases to almost zero levels of undesirable behavior with little variability in responding during the DRO intervention. Maggie and Nash showed decreases during the DRO intervention, but their responding was more variable. No Name and Halle did not show any decrease in undesirable behavior during the DRO intervention. Diamond, Kenya, and Barkley showed decreases to almost zero levels with little variability during the response-independent intervention. Julia showed a decrease, but engaged in very high rates of undesirable behavior during two of eight response-independent intervention sessions. One additional dog, Bonnie, showed moderate improvement during response-independent pairing, marked by increased variability and a slightly lower level of responding compared to baseline. Tyler, Strider, and Twizzler did not show a decrease in undesirable behavior during the response-independent intervention; in fact, Twizzler's rate of responding increased. Strider and Twizzler both did not show improvement when they were moved from the response-independent condition to the DRO condition. Barkley showed a treatment effect that generalized to another person ringing the bell. Barkley's target behavior maintained for four sessions in extinction and rose to baseline levels by Session 5. No dogs displayed an abrupt change in behavior in the control condition; however, one dog (Trey) gradually improved with time alone (Figure 1, right).

The median percentage decrease in undesirable behavior from baseline in the DRO condition was 88.13% (interquartile range [IQR] = 52.78%); in the response-independent condition it was 66.43% (IQR = 89.06%); and in the control condition an increase of 15.13% (IQR = 32.08%) was observed (Figure 2). A Kruskal-Wallis test revealed that the difference between conditions was statistically significant, $H(2) = 6.49$, $p = .039$. Mann-Whitney tests revealed that both DRO and response-independent conditions differed from the control condition ($p = .02$ and $p = .04$, respectively) but not from each other ($p > .05$).

EXPERIMENT 2

To evaluate the effectiveness of the response-independent pairing on a whole-shelter population level, a multiple baseline design across

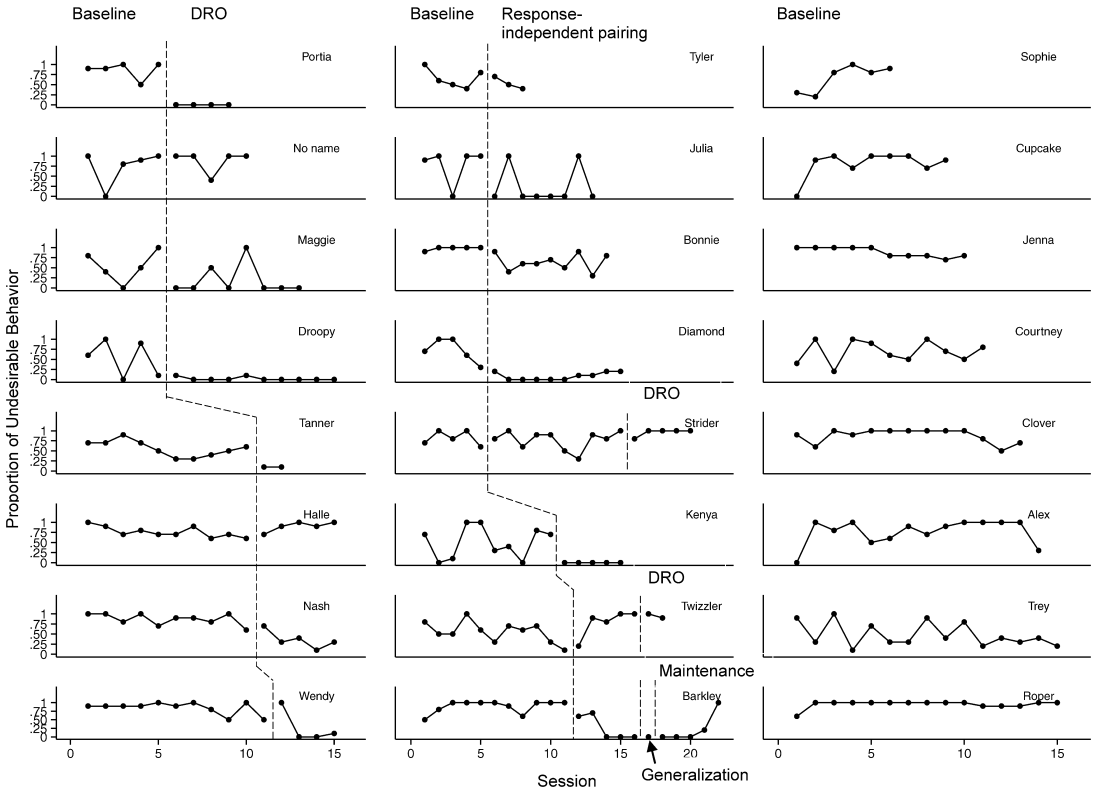

Figure 1. The proportion of undesirable in-kennel behavior during probe trials by dog and experimental condition in Experiment 1. Barkley received a generalization session (Session 17) followed by five maintenance sessions (Sessions 18 through 22).

shelter sides was conducted. The University of Florida Institutional Animal Care and Use Committee approved all procedures.

Method

Animals and housing. Adoptable dogs from the same shelter as in Experiment 1 were used. The shelter's 70 dog kennels were divided into two halves of 35 kennels each: the front half that faced the entrance of the shelter (Side A) and the back half that faced the back of the shelter (Side B). All adoptable dogs in a given day were included in the study; therefore, the total number of animals varied daily ($M = 64.1$; range, 56 to 70). Assignment of dogs to each half was conducted by the shelter staff, who were not informed of the purposes of the study. As a dog became available for adoption, staff unsystematically placed the dog into any empty kennel on either side.

Design and response measurements. Both sides received four sessions of baseline (one session per day), after which Side B entered into four sessions of the intervention while Side A remained in baseline. After eight sessions, Side A also entered into the intervention condition.

Undesirable in-kennel behavior was coded as either occurring or not occurring for each kennel, resulting in a percentage of dogs in each side of the shelter that engaged in undesirable in-kennel behavior. A second independent observer, who was blind to the hypothesis of the study, coded all videos. Interobserver agreement was calculated by

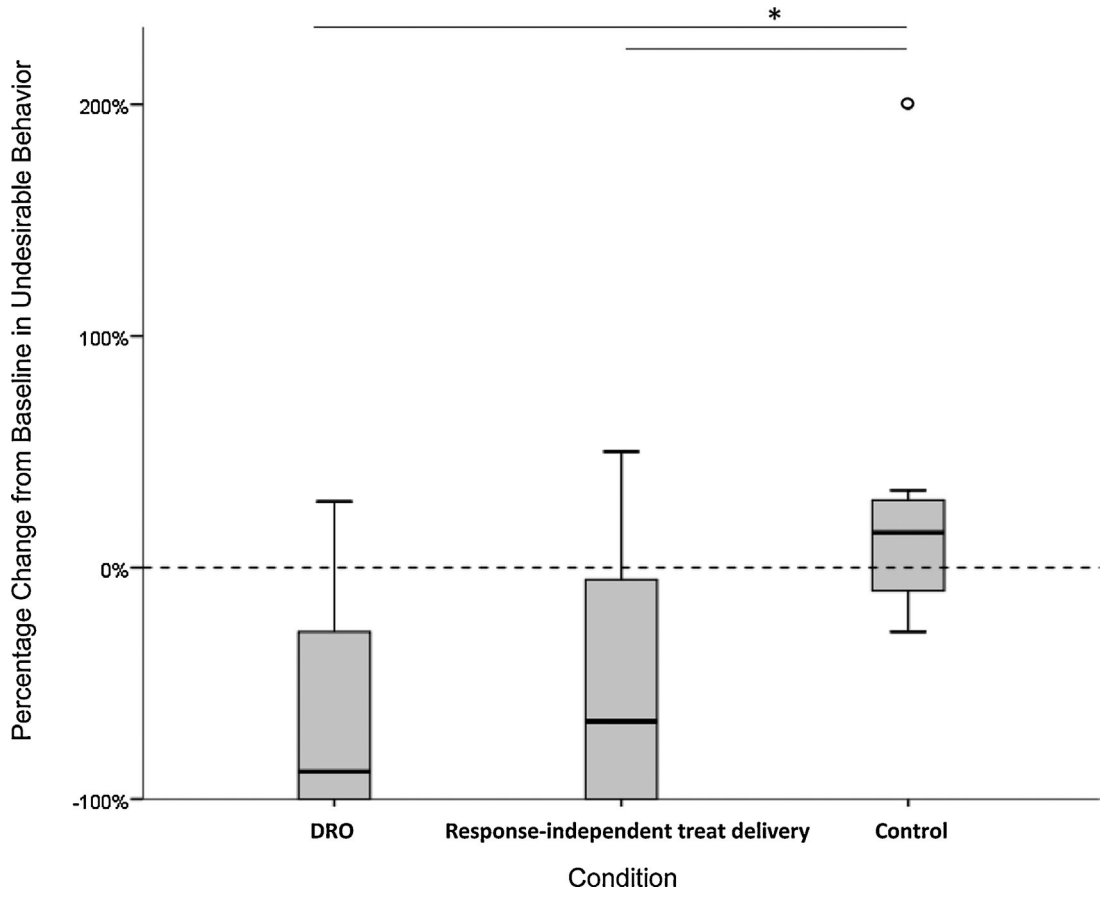

Figure 2. The median percentage change from baseline to the intervention condition (or to the second half of baseline in the control condition) of undesirable behavior across all dogs in each condition of Experiment 1. The shaded boxes show the interquartile range (IQR), the whiskers show the maximum 1.5 IQR, and dots show outliers.

dividing the number of agreements (both observers agreed that the dog was behaving undesirably or not) by the sum of agreements and disagreements and converting the result to a percentage. Average interobserver agreement was 95% (range across days, 91% to 100%).

Procedure. To conduct a baseline session for one side of the shelter, the experimenter walked in front of each kennel and rang the bell for approximately 2 s in front of each kennel while video recording each dog for those 2 s. To conduct intervention sessions, the experimenter walked in front of each kennel in consecutive order, rang the bell for approximately 2 s, and then threw a treat to each dog. The experimenter walked in front of the kennels in this way for a total of 10 pairing trials. Because the experimenter trained all of the dogs on one side consecutively, the intertrial intervals varied from 2 s to approximately 40 s (the amount of time it took to walk by 35 kennels). All data were recorded during the initial 2 s in both baseline and intervention sessions.

Data analysis. The effectiveness of the intervention on a whole shelter level was assessed using descriptive statistics and visual inspection of the data. The median percentage of dogs that engaged in undesirable behavior across days

during baseline and intervention was compared using a Mann-Whitney test.

Results

Both sides of the shelter contained a high number of dogs that engaged in undesirable behavior, but this number decreased on each side as soon as the dogs were entered into the intervention condition (Figure 3). The median percentage of dogs that engaged in undesirable behavior in baseline was 41% (IQR = 15.9%) for Side A and 41.4% (IQR = 3%) for Side B. During the intervention, the median percentage decreased to 4.8% (IQR = 3%) for Side A and to 16.8% (IQR = 6.1%) for Side B. The total median percentage decrease from baseline to intervention for both sides was 67.5%. A Mann-Whitney test confirmed that the percentage of dogs that engaged in undesirable behavior was larger during baseline than during intervention days ($U = -4.16$, $p < .001$).

DISCUSSION

A response-independent treat-delivery intervention both decreased undesirable behavior in kenneled shelter dogs and decreased the number of dogs that engaged in undesirable behavior in the shelter population as much as a more labor-intensive DRO procedure. Experiment 1 demonstrated that both the DRO and response-independent interventions decreased undesirable in-kennel behavior in shelter dogs. More dogs exposed to the DRO condition showed a treatment effect (six dogs in the DRO condition and five in the response-independent condition),

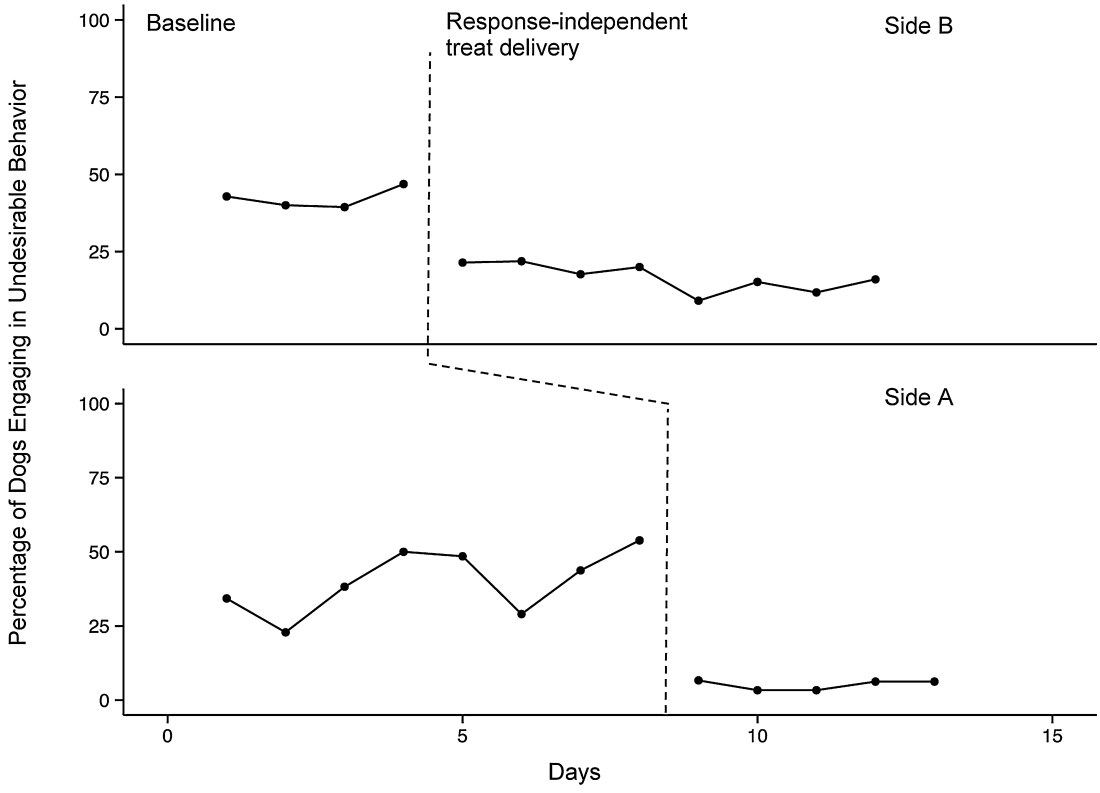

Figure 3. The percentage of dogs that engaged in undesirable behavior by shelter side in Experiment 2.

but on a group level, the effects of the two conditions were not statistically different from each other.

As an intervention, response-independent treat delivery presents several advantages over DRO. First, the amount of time it takes to administer the response-independent intervention is substantially less; this is an important advantage, because animal shelters often have many animals that need intervention but not enough staff members or volunteers to administer it. For example, the shelter in which the study was conducted can house 70 adoptable dogs at one time. The DRO intervention required about 2 hr per day for the shelter (about 110 s per dog), whereas the response-independent procedure could be completed in just over 20 min (about 20 s per dog). Second, the response-independent intervention is much easier to administer and does not require any particular skills related to animal training. However, to administer a DRO on an increasing interval schedule successfully, the trainer needs to observe the animal's behavior, count interval lengths, and deliver treats at precise times. Response-independent intervention, on the other hand, simply requires the trainer to throw a piece of food into the kennel without observing any behavior and largely regardless of timing.

In Experiment 1, aggregating data for group comparisons showed seemingly larger differences between the intervention and the control conditions when compared to differences apparent in individual data. To aggregate the measures of undesirable behavior, the medians of all sessions in a phase were measured. Through this statistical manipulation, sessions with unusually high or low rates of behavior did not influence the outcomes. Also, by aggregating across all dogs, individual variability was lost. Therefore, the final medians were not necessarily representative of the effect of the interventions on any individual dog. Furthermore, it is clear from individual data that the intervention was not, in fact, effective for all dogs. Therefore, Experiment 2 aimed to determine what percentage of dogs would benefit from the response-independent pairing intervention. Questions remain as to why the interventions were effective for some dogs and not for others. Identification of variables that can predict success of interventions might be worthwhile to pursue in future research.

The results of Experiment 1 showed that a decrease in inappropriate behavior is possible through response-independent pairing; however, the proportion of the animals for which this intervention would be effective was unclear. Experiment 2 showed that response-independent pairing was an effective way to reduce undesirable behavior at the population level. The intervention significantly reduced the number of dogs that engaged in undesirable behavior and was effective for the majority of the animals at the shelter.

It is important to note, however, that the dogs' behavior was monitored for only 20 s in Experiment 1 and for 2 s in Experiment 2. Previous research has shown that visitors spend an average of approximately only 20 s looking at each shelter dog (Wells & Hepper, 2001; data derived by including dogs that were not viewed by the visitors). Therefore, 20 s was chosen as the target interval for Experiment 1. Nevertheless, it is possible that observing dogs for longer durations would have provided more information about the effects of training on undesirable behavior.

One limitation of the present study is that the use of a salient stimulus, the bell, might decrease the external validity of our results. The bell was used to enhance the discriminability of training sessions from extinction sessions (in which staff members, volunteers, and members of the public visited the dogs). Because the aim of the study was to demonstrate the effect of training and food pairing on the behavior of dogs and to avoid extraneous variables, a stimulus unique to the study was used.

It remains to be shown whether other stimuli, such as the visual presentation of shelter visitors

in front of the dogs' kennels, can be substituted for the bell. A follow-up study might evaluate a response-independent pairing procedure in which all people who walk by the kennels deliver treats to the dogs. However, such a procedure presents several challenges. First, the use of a visual cue rather than an auditory cue may present a challenge for the dogs. Many shelters are designed in such a way that the dogs are able to enter a different portion of the kennel away from the public. If the dogs are facing away in the back compartment of the kennel, they are unlikely to detect a quickly passing visual stimulus of a person walking by. One solution may be to prevent the dogs from entering the back portion by designing kennels without compartments, or closing the door to the back compartment (most kennels have a divider between compartments for ease of cleaning). However, this solution may present welfare concerns because dogs use both compartments for different purposes: the front for toileting and the back for eating and resting (Wagner, Newbury, Kass, & Hurley, 2014). Another solution may be to evaluate a compound stimulus of the visual presentation of a person together with an auditory cue that may be presented only once when a visitor enters the shelter. For example, a bell on the door to the entire shelter might function as a discriminative stimulus to alert the dogs that visitors will be walking by and delivering treats.

A second concern, which could be overcome with staff training, is that the dogs might encounter many extinction trials in which shelter staff members do not deliver any treats when they walk by the kennels. An assessment of how many extinction trials dogs can withstand before undesirable behavior increases would address this concern. In Experiment 1, we attempted to evaluate this resistance to extinction with maintenance sessions. Unfortunately, only one dog, Barkley, stayed long enough at the shelter to enter these sessions. Barkley exhibited low rates of undesirable behavior for four consecutive maintenance sessions, in which the bell was rung but no food was presented, but reverted to original levels of undesirable behavior by the fifth session. Thus, it appears that, at least for Barkley, the pairing procedure resulted in behavior that was quite resistant to extinction; however, many more dogs need to be assessed before any firm conclusions can be drawn.

Another limitation of the current study was that we decided on a fixed number of sessions that each dog would stay in baseline and in intervention conditions instead of changing phases based on visual analysis of the data. This decision was made to facilitate statistical analysis for group comparisons. However, this decision sacrificed experimental control, because some dogs exhibited changes in behavior immediately before the phase changes. For example, Twizzler, Diamond, and to a lesser degree, Nash all showed decreasing trends during baseline. Therefore, for Diamond and Nash, it is difficult to determine whether the experimental condition was responsible for the decrease in undesirable behavior or whether other variables, such as maturation, played a role. Furthermore, it was unfortunate (from an experimental standpoint) that several dogs left the shelter before definitive conclusions could be drawn from their data. Tanner experienced only two sessions of DRO. We suggest that the intervention was effective based on the low rate of responding during those sessions; however, drawing a clearer conclusion would require similar low rates across at least a few more sessions. We determined that Tyler did not show an improvement during the response-independent intervention; however, he exhibited a decreasing trend that may have resulted in a substantial decrease if more sessions had been conducted.

A theoretical question remains as to whether the bell in the response-independent condition functioned as a conditioned stimulus, a discriminative stimulus for approaching the food, or both. One argument against the hypothesis that

the bell functioned as a conditioned stimulus is that it was sometimes presented in a backward conditioning arrangement. For example, a dog in Kennel 1 heard the bell, then received food, then heard the bell again repeatedly over an extended period of time while the 34 other dogs on its side of the shelter received treats. This would argue against considering the ringing of the bell as a conditioned stimulus. It is possible, however, that the individual pattern of bell ringing audible to each kennel became the conditioned stimulus and not the ringing of the bell in front of any one kennel alone. Furthermore, the bell may have been part of a compound stimulus that included the visual presentation of the experimenter. In both experiments, dogs could theoretically hear the bell while the experimenter was working with other dogs, thus suggesting that the compound stimulus might have been in effect.

If the bell indeed elicited conditioned behavior, then it is interesting that these responses happened to correspond with what adopters desire in a kenneled dog. Pavlov (2003) described the conditioned stimulus in his studies as eliciting motor patterns such as orienting towards the experimenter (p. 184), turning of the head towards the conditioned stimulus, licking and smacking of the lips, and, of course, salivation (p. 30). Jenkins, Barrera, Ireland, and Woodside (1978) showed orientation and approach to a conditioned appetitive stimulus; however, some of the dogs barked in response to the buzzer that signaled food delivery. Similarly, in the present study, several dogs continued to bark and behave undesirably in the kennel. Surprisingly, little research has focused on conditioned appetitive stimuli in the dog throughout the history of psychology (Feuerbacher & Wynne, 2011). To determine whether the observed effect was Pavlovian, a control condition, in which the bell and food were delivered in a random sequence, should be conducted.

It is also possible that the response-independent delivery of food may be considered a noncontingent reinforcement intervention (e.g., Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993) and decreased behavior either through disruption of the contingency between the undesirable behavior and the food reinforcer or by satiating the dogs with food and thus creating an abolishing operation. However, the functional reinforcer for the undesirable behavior was probably not food; thus, this interpretation is unlikely to be correct. An alternative mechanism for the decrease in undesirable behavior may be the differential reinforcement of incompatible behavior, in that the consumption of the food in the front of the kennel was incompatible with any undesirable behaviors (i.e., barking, staying in the back of the kennel, turning away, etc.). Thus, the bell might have functioned as a discriminative stimulus that signaled the possibility of reinforcement for the incompatible and competing behavior associated with food consumption.

In conclusion, a response-independent treat-delivery intervention, regardless of the actual mechanism of action, in which a salient stimulus is paired with food, can decrease undesirable in-kennel behavior, such as increased pacing, staying in the back of the kennel, rubbing or leaning on kennel walls, and barking, in shelter dogs. This procedure was found to be as effective as a more labor-intensive DRO procedure and thus presents an effective and efficient method to decrease undesirable behavior. Therefore, this procedure can be easily used in animal shelters to improve in-kennel presentation and, subsequently, might increase the adoption rate of dogs.

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Received September 30, 2014
Final acceptance February 10, 2015
Action Editor, Matt Normand