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EVALUATING A HUMANE ALTERNATIVE TO THE BARK COLLAR: AUTOMATED DIFFERENTIAL REINFORCEMENT OF NOT BARKING IN A HOME-ALONE SETTING

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The aim of this study was to develop a humane alternative to the traditional remote devices that deliver punishers contingent on home-alone dog barking. Specifically, we evaluated the use of remote delivery of food contingent on intervals of not barking during the pet owner's absence. In Experiment 1, 5 dogs with a history of home-alone nuisance barking were recruited. Using an ABAB reversal design, we demonstrated that contingent remote delivery of food decreased home-alone barking for 3 of the dogs. In Experiment 2, we demonstrated that it is possible to thin the differential-reinforcement-of-other-behavior (DRO) schedule gradually, resulting in a potentially more acceptable treatment. Our results benefit the dog training community by providing a humane tool to combat nuisance barking.

Key words: animal welfare, differential reinforcement of other behavior, dog training, problem behavior

Dogs that bark in the absence of their owner, as occurs in a home-alone setting, can be a difficult problem behavior to treat. According to the Association of Professional Dog Trainers (APDT), the accepted treatment for barking involves the management of the dog's environment depending on the hypothesized function of barking. For example, for the alert barker (a dog who barks in a manner that alerts the owner to potential intruders), confinement to a room or a crate and the closing of blinds or curtains are recommended. In the case of a "lonely" barker, increasing exercise and time with the owner are recommended. These treatments are intended to decrease the dog's motivation to bark, but empirical evidence to support these recommendations is currently lacking. Furthermore, medication may be recommended if separation anxiety is suspected (APDT, 2013) and has been found to be effective in certain cases (King et al., 2000; Podberscek, Hsu, & Serpell, 1999; Takeuchi, Houpt, & Scarlett, 2000).

Another way to influence dog behavior is to alter the consequences for barking. Several studies have reported that devices that deliver punishers remotely, such as citronella sprayed onto the muzzle or shock delivered to the neck,

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reduce nuisance barking (Juarbe-Díaz & Houpt, 1996; Moffat, Landsberg, & Beaudet, 2003; Sargisson, Butler, & Elliffe, 2011; Steiss, Schaffer, Ahmad, & Voith, 2007; Wells, 2001). Milder punishers such as citronella collars, even if considered more humane by owners (Juarbe-Díaz & Houpt, 1996), may not be as effective as more powerful punishers in every case. Juarbe-Díaz and Houpt (1996) reported a greater decrease in barking when electric shock was delivered contingently compared to the contingent delivery of the citronella spray.

Although punishment-based interventions often immediately suppress problem behavior, ethical concerns have been raised about these interventions. Aversive stimulation in the form of shock or citronella spray may elevate species-specific stress responses (yawning, freezing, trembling, lowering of body posture; Cooper, Cracknell, Hardiman, Wright, & Mills, 2014; Sargisson et al., 2011; Schilder & van der Borg, 2004; but see Salgirli, Schalke, Boehm, & Hackbarth, 2012; Schalke, Stichnoth, Ott, & Jones-Baade, 2007; Steiss et al., 2007), lesions from the rubbing of the electrodes on the skin (Polsky, 1994), and pain responses (high-pitched yelps, squeals, redirected aggression; Schilder & van der Borg, 2004). Furthermore, punishment may be unfavorable as a training technique because it does not teach any alternative behaviors and may even suppress other appropriate behaviors (Friedman, 2010; Rooney & Cowan, 2011) or evoke aggression (Herron, Shofer, & Reisner, 2009). Because of these concerns, the Certification Council for Professional Dog Trainers (2009) recommends the use of differential reinforcement of other behavior (DRO) as a safer alternative to positive punishment, and the APDT (2013) rejects the use of bark collars to combat barking, even if they are convenient for the owner. Professionals in the field of applied behavior analysis also generally agree on the use of positive reinforcement procedures whenever possible (Vollmer et al., 2011).

The DRO procedure has been used extensively to treat problem behavior in humans (Lennox, Miltenberger, Spengler, & Erfanian, 1988; Poling & Ryan, 1982), including disruptive behavior, seizure-like behavior, self-injury, aggression, stereotypy, thumb sucking, and vomiting (Vollmer & Iwata, 1992). Despite the extensive literature on the use of DRO schedules in the treatment of human problem behavior, much less research has been conducted on the use of DRO schedules to treat problem behavior in companion animals. In one notable example, Butler, Sargisson, and Elliffe (2011) delivered food to dogs contingent on the nonoccurrence of problem behavior during the owner's departure. The results suggested a successful treatment of vocalization and destruction of household items during the owner's absence; however, the DRO schedule was part of a broader treatment, thus preventing clear conclusions on the effectiveness of the DRO schedule alone. The aim of our study was to develop an alternative to the traditional remote devices that deliver punishers contingent on barking by evaluating the use of an interval DRO schedule as a treatment for nuisance barking.

EXPERIMENT 1

Using an ABAB reversal design, we assessed whether the remote delivery of food contingent on a preset interval of not barking would result in lower rates of barking in pet dogs left home alone.

Method

Subjects and setting. Eight pet dogs with a history of reported nuisance barking when left home alone were recruited through advertisements on the social media website for our laboratory and by word of mouth. Three of the subjects failed to bark during the first two sessions of baseline (data not shown) and were thus removed from all data analyses.

Table 1
Age, Breed, and Problem Behavior, as Reported by the Owner, of the Dogs in This Study

Dog	Age	Breed	Problems
Ruby	8 months	Belgian malinois	Barks, whines, and digs in crate; dog aggression; fearful
Nina	5 years	Miniature dachshund	Barks when owner leaves room or house
Darby	6 years	Labrador retriever mix	Barks and whines when owner leaves room or house
Bruce	3 years	American pit bull terrier	Barks, whines, and digs in crate; dog and human aggression; fearful
Sully	9 months	American bulldog mix	Barks and whines in crate

Information on the remaining five dogs is listed in Table 1. All sessions were conducted at each dog's home with no conspecific or human household members in the room. All procedures were approved by the University of Florida Institutional Animal Care and Use Committee.

Response measurement and interobserver agreement. An experimenter recorded the frequency of barks using a software program designed by the second author that time-stamped each response when the experimenter pressed a key to indicate that a bark had occurred. The bark frequency, interresponse times, and the number of treats delivered were logged using the software. Treatment effects were assessed by comparing the rate of barking (frequency of barking divided by total number of minutes in a session) in the baseline sessions to the rate of barking during the treatment sessions through visual analysis of the data.

For 43% of randomly selected sessions, an additional observer recorded the frequency of barks from the video recording and compared with the frequency of barks logged during the sessions in order to assess interobserver agreement. The correlation between the number of barks recorded during the session and the number of barks recorded by the additional observer in the same sessions was assessed using a Pearson product–moment correlation. The correlation between these scores across all dogs was .87 (Ruby: .59; Nina: 1.0; Darby: 1.0; Bruce: .99; Sully: .83).

Procedure. All sessions lasted 20 min unless otherwise noted. Session duration was based on previous research that demonstrated that problem behavior after owner departure can be assessed in 20 min. In fact, the average latency to bark after owner departure for dogs that exhibit behaviors associated with what is commonly called *separation anxiety* has been reported to be as short as 3.25 min (Palestrini, Minero, Cannas, Rossi, & Frank, 2010). However, the rate of barking in the initial baseline phase for three dogs in the current study was so high that subsequent sessions were shortened to 10 min. Because of the high rate of barking, the DRO interval was set to only 5 s during the treatment sessions for Ruby and Nina and to 7 s for Sully, resulting in a very high quantity of food consumed. The shorter session duration prevented the dogs from overeating.

During all sessions, the dog was positioned alone in an area of the house that was typically used when the owner departed. For Nina, this was the living room with all doors to bedrooms closed. Ruby, Bruce, and Sully were placed in metal dog crates, and Darby was placed in a bathroom. Before beginning the session, the experimenter placed a video camera in the designated area, left the room, and quietly positioned herself at a desk with a laptop, ready to record barks. The session began when the owner placed the dog in the designated area, said goodbye, and left the house. However, because Nina, Darby, and Bruce barked excessively when left alone, the owner entered a different room and closed the door instead of leaving the house.

During baseline, the feeder was not present in the room, and the experimenter logged the frequency and interresponse times of barks. During treatment, the software alerted the experimenter when to deliver the treat. After each alert, the experimenter activated a remote, which, in turn, operated the feeder located in the room with the dog.

The software was programmed to alert the experimenter to deliver food on a fixed-time (FT) schedule. The interval duration of the FT schedule was determined from the interresponse times of barking during the initial baseline sessions. The interval length was set at 90% of the baseline interresponse interval to ensure that the dog was able to contact the contingency. For example, if the time between barks averaged 100 s during baseline, the interval length of the FT schedule was set at 90 s during treatment. The minimum interval was set at 5 s. If the experimenter pressed a key, the software logged a bark and restarted the interval to food delivery, producing a DRO schedule.

Design. Each dog experienced both baseline and treatment sessions sequentially in a reversal ABAB design. Each dog began with baseline sessions to measure the initial barking frequency and to set the initial interval of the DRO schedule during treatment. When the baseline was stable, as determined by at least two sessions with similar rates of barking, treatment was implemented. After a stable rate of barking was achieved in treatment, the dog was returned to baseline, followed by the reinstatement of treatment.

Results and Discussion

Visual analysis of the data suggests that the remotely delivered DRO schedule decreased the rate of home-alone barking for three of five dogs (Figure 1). The average rate of barking across all dogs was 9.69 (SD = 6.23) barks per minute in baseline and 3.79 (SD = 2.02) barks per minute during treatment. On average, dogs barked more in baseline than in treatment (t = 2.91, df = 5, p = .03).

Ruby exhibited a high and stable level of barking in the initial baseline. In the first treatment phase, her rate of barking dropped, followed by variable but low responding. The second baseline phase resulted in a high level of barking, followed by very low rates in the second treatment phase. Ruby barked at an average rate of 18.6 barks per minute (a bark every 3.2 s) during baseline, and at an average rate of 5.8 barks per minute (a bark every 10.3 s) during treatment.

Similar patterns were seen with Nina and Darby. Nina showed a clear effect of treatment, with barking entirely eliminated during the last treatment phase. During all baseline sessions, Nina barked at an average rate of 13.5 barks per minute (a bark every 4.4 s), and during treatment sessions, she barked at an average rate of 2.3 barks per minute (a bark every 26.6 s). After more variable responding in the first baseline, a clear decrease in barking was evident during treatment with Darby. During all baseline sessions, Darby barked at an average rate of 3.9 barks per minute (a bark every 15.6 s), which decreased to an average rate of 1.2 barks per minute (a bark every 51.7 s) during treatment.

However, treatment effects were not evident for two dogs (Bruce and Sully). Bruce initially barked at a relatively low rate, followed by similar levels of barking in the treatment phase. During all baseline sessions, Bruce barked at an average rate of 5.2 barks per minute (a bark every 11.6 s) and persisted at a similar average rate of 4.2 barks per minute (a bark every 14.8 s) during treatment. Sully, on the other hand, barked less during the treatment phase, but responding did not return to initial baseline levels during the second baseline, suggesting that other factors outside the study could have contributed to the decrease. During all baseline sessions, Sully barked at an average rate of 7.3 barks per minute (a bark every 8.3 s) and an average rate of 5.4 barks per minute (a bark every 11.1 s) during treatment.

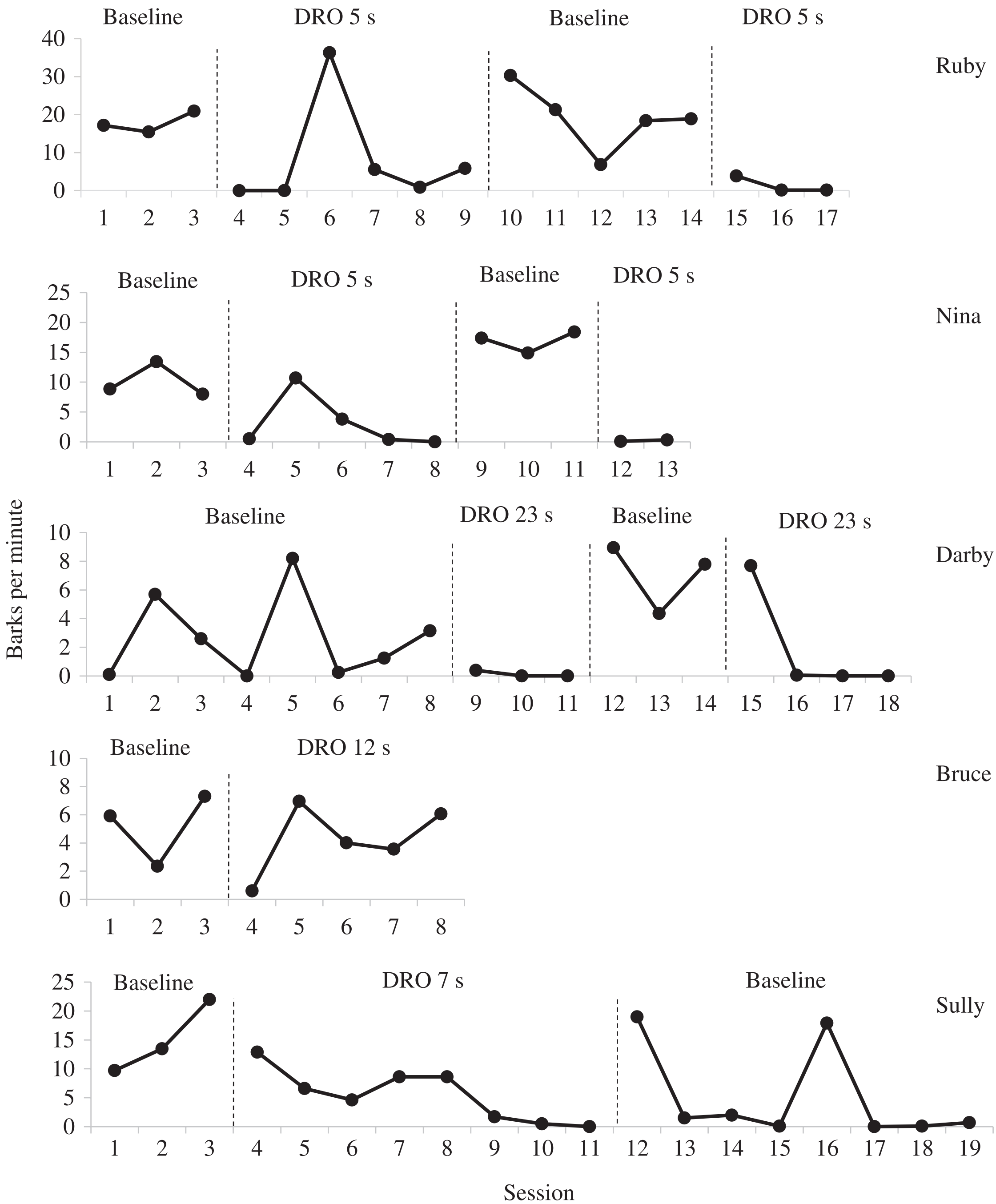

Figure 1. Individual rate of barking for all dogs in Experiment 1.

EXPERIMENT 2

In Experiment 1, we demonstrated that contingent remote delivery of food can decrease home-alone barking for some dogs. However, because of the high rate of barking during the experimental sessions, the intervals of the DRO schedules were very short, resulting in the dogs getting a treat every 5 to 23 s (Table 2). This treatment, although effective for some dogs, would not be feasible for longer durations of owner absence due to the large quantity of food that would be consumed. Therefore, in Experiment 2, we explored whether it was possible to increase the DRO interval lengths gradually, thus resulting in less consumed food while still maintaining low rates of barking.

Method

Subjects and setting. Only the dogs for whom the treatment was effective (Ruby, Nina, and Darby) in Experiment 1 participated in Experiment 2. All sessions were conducted in the dogs' homes, as in Experiment 1. All procedures were approved by the University of Florida Institutional Animal Care and Use Committee.

Response measurement and interobserver agreement. The experimenter recorded the bark frequency, interresponse times, and the number of treats delivered as described for Experiment 1. For 45% of randomly selected sessions, an additional observer recorded the frequency of barks from the video recording. The correlation between the number of barks recorded during the session and the number of barks recorded by the additional observer in the same sessions was assessed using a Pearson product–moment correlation. The correlation between these scores across all dogs was .99 (Nina: 1.0; Darby: 1.0; Ruby: .98).

Procedure. After completion of Experiment 1, the dogs immediately entered Experiment 2. After a stable, low rate of behavior was established (defined as at least two sessions with similar low rates of barking), the DRO interval was doubled for the next session. Because the goal of the study was to assess the feasibility of gradually increasing the interval of the DRO schedule but not necessarily to find the most effective way of doing so, the most efficient method of doubling at each phase was chosen.

The session duration was returned to 20 min for the dogs that had a decreased session length due to the short DRO interval in Experiment 1. To verify that session duration did not influence the rate of barking, an additional 20-min baseline was conducted for Ruby and Nina. However, for Ruby, it became apparent that she engaged in barking only in the initial 10 min of the longer session. These data were supported by an informal owner report that Ruby barked only immediately after the owner's departure. Therefore, all subsequent sessions with Ruby lasted 10 min, started at DRO 5-s schedule, and the schedule increased across sessions to DRO 10 s, 20 s, 40 s, 80 s, 160 s, 320 s, and 600 s.

Nina experienced an initial 20-min baseline followed by the increasing DRO intervals across sessions. She also began at a DRO 5-s schedule, which increased to 10 s, 20 s, 40 s, and 80 s. Due to human error, the last two schedules were DRO 180 s (instead of 160 s) and DRO 360 s (instead of 320 s). Nina did not experience leaner schedules because her responding increased at DRO 360 s.

Darby began at DRO 23 s and then increased to DRO 46 s and 92 s. At that point her owner

Table 2
The Average Number of Treats Delivered in the Treatment Phase in Experiment 1 and in the Last Session in Experiment 2

Dog	Average (*SD*) number of treats delivered in Experiment 1	Number of treats delivered in the last session in Experiment 2
Ruby	103.7 (19.5)	1
Nina	117.6 (6.8)	0
Darby	49.5 (5.6)	1
Bruce	82.4 (8.5)	
Sully	67.3 (8.2)	

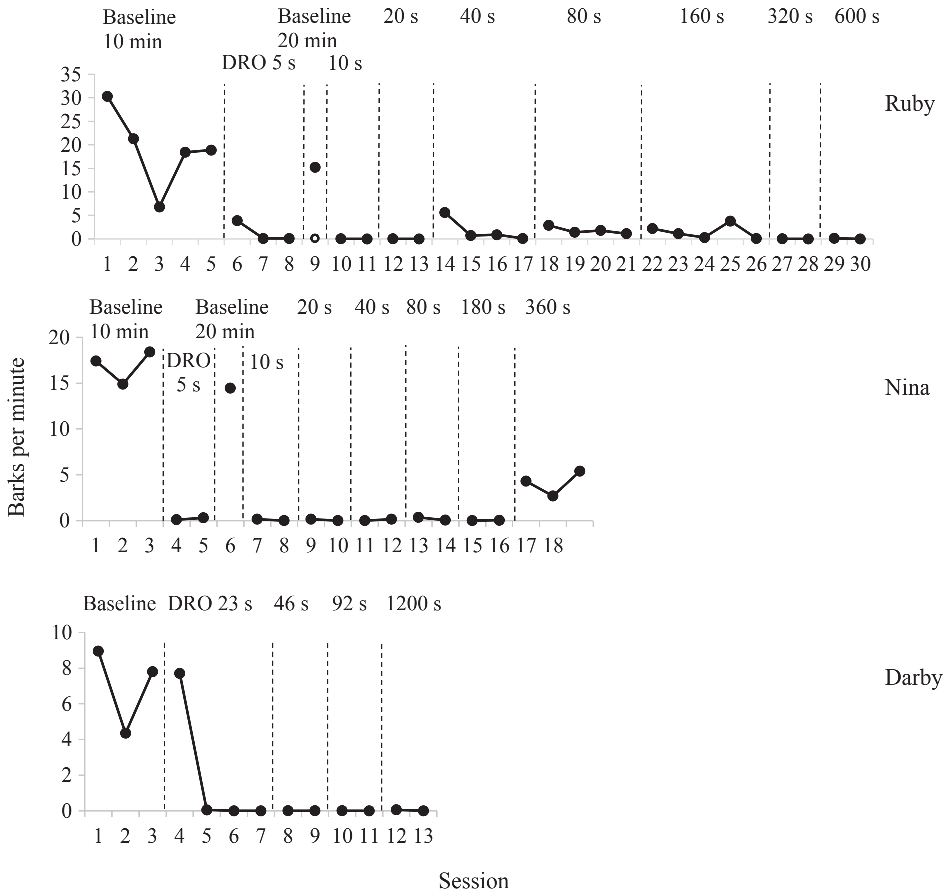

Figure 2. Individual rate of barking for all dogs across different schedules of the DRO treatment in Experiment 2.

reported that she no longer barked in this specific context (when she was placed in the bathroom with the owner in a different room); thus, the schedule was increased to the maximum of DRO 1,200 s to verify the owner's report.

Results and Discussion

Figure 2 shows the results across the different DRO schedules for the three dogs. For ease of comparing rates of barking, the first panel in Figure 2 includes the data from the second baseline of Experiment 1 for each dog. As mentioned above, Ruby barked only during the first half of the 20-min session (black dot) and did not bark at all during the second half (white dot). Ruby's barking rate was zero during the DRO 10-s and 20-s schedules. At DRO 40 s, responding was elevated in the first session, but was followed by very low responding in subsequent sessions. Responding remained low for DRO 80 s and 160 s and was at zero for DRO 320 s and DRO 600 s. Thus, she earned one treat in the last session (Table 2). Nina exhibited a high rate of barking during the 20-min baseline sessions, followed by close to zero barks in DRO 10 s, 20 s, 40 s, 80 s, and 180 s. At 360 s, barking resumed, but at a much lower rate than during baseline. Because barking returned, albeit at low levels, she did not receive any treats in the last session (Table 2). After an initial high rate of barking in the first session of the second phase of the DRO 23-s schedule, Darby's barking was eliminated and remained at zero for the DRO 46-s, 92-s, and 1,200-s schedules. Thus, Darby earned one treat in the last session (Table 2).

GENERAL DISCUSSION

In Experiment 1, we found that remote delivery of food using a DRO schedule reduced and even eliminated home-alone nuisance barking for three of the five dogs. The treatment was not effective for one dog (Bruce), and there was not enough evidence for one dog (Sully) to determine whether the treatment was effective.

In Experiment 2, we demonstrated that it is possible to thin the DRO schedule gradually, resulting in a potentially more acceptable treatment. For two of the three dogs, barking was completely eliminated even during the thinnest DRO schedule. However, more research is needed to identify best practices in decreasing home-alone barking. It is possible that, for Nina, more gradual increases of the interval lengths might have been more successful at suppressing barking. It is also possible that increasing intervals during each session might have permitted the schedule to be thinned even more. Therefore, future research could compare the efficacy and efficiency of within-session increases as well as assess more gradual increases of the schedule across sessions.

One limitation of the present study was that the experimenter manually recorded barks, and, therefore, had to be in the same house as the dog, albeit in a different room. A replication of the current study with fully automated equipment that could detect barks and deliver food accordingly would permit a better assessment of this treatment for home-alone barking. A fully automated feeder would also be more convenient. Research with automatic feeders could shed more light on the use of reinforcement to combat problem behavior while the owner is not home.

Another limitation was that the feeder was absent during baseline sessions; therefore, we do not know whether the presence of food or food-related cues would suppress barking in the absence of any contingent relation to behavior. Recently, Protopopova and Wynne (2015) found that noncontingent delivery of food decreased various behaviors, including barking, exhibited by kenneled shelter dogs. Future research should establish whether the simple presence or noncontingent delivery of food may similarly decrease barking in pet dogs.

Questions remain regarding the relative effectiveness of humane treatment compared to treatment using aversive stimulation, such as citronella or shock collars, because several studies have shown that punishment-based interventions can decrease barking in pet dogs (Juarbe-Díaz & Houpt, 1996; Moffat et al., 2003; Sargisson et al., 2011; Steiss et al., 2007; Wells, 2001). Understanding how the different treatment plans vary in efficacy is no doubt useful, but the ethical concerns with the use of aversive tools remain, regardless of the results.

A potentially interesting aspect of our study was that the same treatment was applied regardless of the hypothesized motivation behind the excessive barking. For example, most of the dogs in this study could have been diagnosed as having separation anxiety by veterinary behaviorists, whereas Nina might have been labeled a "lonely" or "attention" barker. The diagnosis of separation anxiety is often applied when the dog engages in behaviors (e.g., inappropriate elimination, destructive behavior in the home, self-injury, excessive vocalization) that suggest severe distress when the dog is separated from the owner (Overall, 1997). Ruby, Darby, Bruce, and Sully all exhibited behaviors consistent with this diagnosis. In contrast, Nina only barked excessively and did not engage in other related behaviors, so she would likely not have been diagnosed with separation anxiety. In our study, no clear correlations were established between the success of treatment and this hypothesized motivation. Future research should explore whether this treatment would be effective regardless of the hypothesized motivation for barking or whether other accompanying problem behaviors might predict treatment efficacy.

Finally, another future direction for research is to assess and manipulate the functional reinforcer for home-alone barking. Previous research has suggested that the use of functional reinforcers maximizes the effect of DRO schedules (Vollmer & Iwata, 1992). In the current study, a potent reinforcer (highly palatable food treats) was used instead of functional reinforcers identified through a functional analysis (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994). It is possible that identification of the reinforcers that maintain barking and their delivery contingent on increasing intervals of not barking would be more effective than the procedures evaluated in the current study. However, this modification might present additional problems. If owner attention is a reinforcer (as was found for some dogs in Dorey, Tobias, Udell, & Wynne, 2012; Hall, Protopopova, & Wynne, 2015), reinforcement of alternative behavior with human attention (i.e., owner entering the house) might be effective, but would also be less practical than providing food reinforcers. Alternatively, it is possible that barking is automatically reinforced (e.g., the sound of the bark is the reinforcer); thus, providing a functional reinforcer would not be feasible. Nevertheless, additional research on understanding the function of home-alone barking will provide further direction for new and improved treatments.

This study provides evidence of the efficacy of an alternative (DRO) to the devices that deliver aversive stimulation to decrease home-alone excessive barking for at least some dogs. Furthermore, the study extends the scientific literature of the treatment of problem behavior in nonhuman animals with the use of positive reinforcement. Future development and evaluation of positive reinforcement to combat problem behavior are necessary as the field of animal training moves away from the use of force and intimidation.

REFERENCES

Association of Professional Dog Trainers. (2013). *Barking.* Retrieved from http://apdt.com/docs/resources/barking.pdf

Butler, R., Sargisson, R. J., & Elliffe, D. (2011). The efficacy of systematic desensitization for treating the separation-related problem behaviour of domestic dogs. *Applied Animal Behaviour Science, 129*, 136–145. doi: 10.1016/j.applanim.2010.11.001

Certification Council for Professional Dog Trainers. (2009). *Application of the humane hierarchy position statement.* Retrieved from http://www.ccpdt.org/wp-content/uploads/2015/01/Application-of-the-Humane-Hierarchy-Position-Statement.pdf

Cooper, J. J., Cracknell, N., Hardiman, J., Wright, H., & Mills, D. (2014). The welfare consequences and efficacy of training pet dogs with remote electronic training collars in comparison to reward based training. *PLOS One*, *9,* e102722. doi: 10.1371/journal.pone.0102722

Dorey, N. R., Tobias, J. S., Udell, M. A. R., & Wynne, C. D. L. (2012). Decreasing dog problem behavior with functional analysis: Linking diagnoses to treatment. *Journal of Veterinary Behavior: Clinical Applications and Research, 7*, 276–282. doi: 10.1016/j.jveb.2011.10.002

Friedman, S. G. (2010). *What's wrong with this picture? Effectiveness is not enough.* Retrieved from http://www.behaviorworks.org/files/articles/APDT%20What%27s%20Wrong%20with%20this%20Picture%20-%20Dogs.pdf

Hall, N. J., Protopopova, A., & Wynne, C. D. L. (2015). The role of environmental and owner-provided consequences in canine stereotypy and compulsive behavior. *Journal of Veterinary Behavior: Clinical Applications and Research, 10*, 24–35. doi: 10.1016/j.jveb.2014.10.005

Herron, M. E., Shofer, F. S., & Reisner, I. R. (2009). Survey of the use and outcome of confrontational and non-confrontational training methods in client-owned dogs showing undesired behaviors. *Applied Animal Behaviour Science*, *117*, 47–54. doi: 10.1016/j.applanim.2008.12.011

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, *27*, 197–209. doi: 10.1901/jaba.1994.27-197 (Reprinted from *Analysis and Intervention in Developmental Disabilities, 2*, 3–20, 1982)

Juarbe-Díaz, S. V., & Houpt, K. A. (1996). Comparison of two antibarking collars for treatment of nuisance barking. *Journal of the American Animal Hospital Association, 32*, 231–235. doi: 10.5326/15473317-32-3-231

King, J. N., Simpson, B. S., Overall, K. L., Appleby, D., Pageat, P., Ross, C., … Wren, J. (2000). Treatment of separation anxiety in dogs with clomipramine: Results from a prospective, randomized, double-blind, placebo-controlled, parallel-group, multicenter clinical trial. *Applied Animal Behaviour Science*, *67*, 255–275. doi: 10.1016/S0168-1591(99)00127-6

Lennox, D. B., Miltenberger, R. G., Spengler, P., & Erfanian, N. (1988). Decelerative treatment practices with persons who have mental retardation: A review of five years of the literature. *American Journal on Mental Retardation*, *92*, 492–501.

Moffat, K. S., Landsberg, G. M., & Beaudet, R. (2003). Effectiveness and comparison of citronella and scentless spray bark collars for the control of barking in a veterinary hospital setting. *Journal of the American Animal Hospital Association, 39,* 343–348. doi: 10.5326/0390343

Overall, K. L. (1997). *Clinical behavioral medicine for small animals*. St. Louis, MO: Mosby.

Palestrini, C., Minero, M., Cannas, S., Rossi, E., & Frank, D. (2010). Video analysis of dogs with separation-related behaviors. *Applied Animal Behaviour Science*, *124*, 61–67. doi: 10.1016/j.applanim.2010.01.014

Podberscek, A. L., Hsu, Y., & Serpell, J. A. (1999). Evaluation of clomipramine as an adjunct to behavioural therapy in the treatment of separation-related problems in dogs. *The Veterinary Record*, *145*, 365–369. doi: 10.1136/vr.145.13.365

Poling, A., & Ryan, C. (1982). Differential-reinforcement-of-other-behavior schedules: Therapeutic applications. *Behavior Modification*, *6*, 3–21. doi: 10.1177/01454455820061001

Polsky, R. H. (1994). Electronic shock collars: are they worth the risks? *Journal of the American Animal Hospital Association, 30*, 463–468.

Protopopova, A., & Wynne, C. D. L. (2015). Improving in-kennel presentation of shelter dogs through response-dependent and response-independent treat delivery. *Journal of Applied Behavior Analysis, 48,* 590–601. doi: 10.1002/jaba.217

Rooney, N. J., & Cowan, S. (2011). Training methods and owner–dog interactions: Links with dog behaviour and learning ability. *Applied Animal Behaviour Science, 132*, 169–177. doi: 10.1016/j.applanim.2011.03.007

Salgirli, Y., Schalke, E., Boehm, I., & Hackbarth, H. (2012). Comparison of learning effects and stress between three different training methods (electronic training collar, pinch collar and quitting signal) in Belgian malinois police dogs. *Revue de Médecin Vétérinaire*, *163*, 530–535.

Sargisson, R. J., Butler, R., & Elliffe, D. (2011). An evaluation of the Aboistop citronella-spray collar as a treatment for barking of domestic dogs. *International Scholarly Research Notices Veterinary Science,* 1–6. doi: 10.5402/2011/759379

Schalke, E., Stichnoth, J., Ott, S., & Jones-Baade, R. (2007). Clinical signs caused by the use of electric training collars on dogs in everyday life situations. *Applied Animal Behaviour Science, 105*, 369–380. doi: 10.1016/j.applanim.2006.11.002

Schilder, M. B. H., & van der Borg, J. A. M. (2004). Training dogs with help of the shock collar: Short and long term behavioural effects. *Applied Animal Behaviour Science, 85*, 319–334. doi: 10.1016/j.applanim.2003.10.004

Steiss, J. E., Schaffer, C., Ahmad, H. A., & Voith, V. L. (2007). Evaluation of plasma cortisol levels and behavior in dogs wearing bark control collars. *Applied Animal Behaviour Science, 106*, 96–106. doi: 10.1016/j.applanim.2006.06.018

Takeuchi, Y., Houpt, K. A., & Scarlett, J. M. (2000). Evaluation of treatments for separation anxiety in dogs. *Journal of the American Veterinary Medical Association, 217*, 342–345. doi: 10.2460/javma.2000.217.342

Vollmer, T. R., Hagopian, L. P., Bailey, J. S., Dorsey, M. F., Hanley, G. P., Lennox, D., … Spreat, S. (2011). The Association for Behavior Analysis International position statement on restraint and seclusion. *The Behavior Analyst, 34*, 103–110.

Vollmer, T. R., & Iwata, B. A. (1992). Differential reinforcement as treatment for behavior disorders: Procedural and functional variations. *Research in Developmental Disabilities, 13*, 393–417. doi: 10.1016/0891-4222(92)90013-V

Wells, D. L. (2001). The effectiveness of a citronella spray collar in reducing certain forms of barking in dogs. *Applied Animal Behaviour Science, 73*, 299–309. doi:10.1016/S0168-1591(01)00146-0

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