



1996; Pitcairn and Pitcairn, 2005), stepping on a leash to prevent the dog from jumping up (Bridwell, 2007; Lindsay, 2003), and teaching an alternative behavior (such as sitting or laying down) when coming through the door (Coren, 2004; Pitcairn and Pitcairn, 2005; Yin et al., 2008). However, all of these treatments have been proposed in the absence of a standard method with which to empirically diagnose the underlying maintaining variables for the jumping up behavior.

In the field of behavior analysis, Iwata et al. (1994a,b) developed a robust procedure that has proven useful in investigating potential maintaining consequences for problem behavior in a variety of human populations (autistic children, normally functioning children, and low-functioning adults; for a review, see Hanley et al., 2003). This procedure involves the direct observation and repeated measurement of behavior across several conditions that attempt to mimic the possible situations in which the problem behavior is observed by the caregiver. Observation of the environment before the experiment begins helps in evaluating the possible situations within which the problem behavior may occur and how the caregiver reacts in those situations. Validity is assessed by calculating the different rates of responses of the target behavior in each of the conditions. The conditions are repeated until 1 or more are shown to produce the behavior of interest at a high steady rate. Some of the most common conditions are *alone*, *attention*, *demand*, and *play*. In the *alone* condition, the individual is left in a barren environment where there are no social or contrived consequences available. The purpose of this condition is to determine whether the individual's problem behavior is maintained by automatic reinforcement (Vaughan and Michael, 1982). This condition is sometimes replaced with an *ignore* condition if the individual cannot be left alone or if the behavior requires the presence of another person to be carried out (e.g., hitting a caregiver). In the *ignore* condition, a caretaker is present but entirely ignores the behavior of the target individual.

The *attention* condition is conducted to determine whether attention functions as a reinforcing consequence for the individual's problem behavior. In this condition, the experimenter gives attention when the individual engages in the target behavior. The attention given in this condition should match what the caregiver was doing before the functional analysis was implemented.

The *play* condition functions as a control procedure in which the problem behavior is not expected to occur.

This condition serves as a control because it provides the individual with an environment in which all maintaining variables are freely available (frequent attention, no demands, and tangible items).

The *demand* condition is conducted to determine whether escape from demands functions as negative reinforcement for the individual's problem behavior. The demand in this condition should be similar to those delivered in the natural environment (e.g., with a child, the demand might be to ask them to sort or stack items; Fisher et al., 1998).

Although the conditions described previously are the most common because they cover the majority of the environmental variables that have been shown to maintain problem behavior in humans (Carr and LeBlanc, 2003), some researchers have found other variables that may be maintaining the target behavior and have added additional conditions to the assessment. An example is the *tangible* condition, conducted to determine whether the contingent delivery of a preferred item functions as a reinforcer for the individual's problem behavior (Hanley et al., 2003). The item is given to the individual only if he or she exhibits the target behavior.

The present study incorporates procedures derived from those described by Iwata et al. (1994a,b) to study variables that maintain the dog behavior of jumping up on humans. This behavior was chosen because it is a common behavioral problem among dogs (Lindsay, 2003; Coren, 2004), that humans complain about, and one that can be potentially dangerous to small children or elderly individuals (Lindsay, 2003) while presenting little threat to the adult experimenters in this study.

## Materials and methods

### Subjects and setting

The subjects recruited for this experiment were 4 dogs aged between 2 and 3 years and belonging to various breeds and both sexes (Table 1). Three dogs completed the experiment. The dogs were volunteered by their primary caregivers. Inclusion criterion: We advertised for dogs who jumped up on people, a main factor was whether or not the dog was engaging in the behavior frequently enough to consider it a problem behavior. Exclusion criterion included dogs that had a history of aggression or were not

**Table 1** Breed, sex, age, and behaviors previously known and trained during the demand condition for the subjects used in this study

Name	Breed	Sex	Age	Behaviors known	Behaviors trained
Lola	Mixed breed	Female	3 years	Sit, down, paw	Roll over
Molly	Lab mix	Female	3 years	Sit, paw	Down
Pretzel	Boston terrier	Female	2 years	Sit, down, paw	Play dead
Cole	Labradoodle	Male	2 years	Sit, down, paw	Play dead

**Table 2** The Motivation Assessment Scale questionnaire given to the caregivers before the assessment phase started and the maintaining variable for which it tested

Questions	Maintaining variable
1. Does the behavior occur following a request to perform a difficult task? (i.e., roll over)	Escape maintained
2. Does the behavior seem to occur in response to you talking to other persons in the room/area?	Attention maintained
3. Does the behavior ever occur to get a toy or food that this dog has been told he/she can't have?	Tangible maintained
4. Does the behavior occur when any request is made of the dog?	Escape maintained
5. Does the behavior occur whenever you are not attending to this dog?	Attention maintained
6. Does the behavior occur when you take away a favorite food, toy, or activity?	Tangible maintained
7. Does this dog seem to do the behavior to upset or annoy you when you are trying to get him/her to do what you ask?	Escape maintained
8. Does this dog seem to do the behavior to upset or annoy you when you are not paying attention to him/her? (e.g., you are in another room or interacting with another person)	Attention maintained
9. Does the behavior stop occurring shortly after (1-2 minutes) you give the dog food, toy, or requested activity?	Tangible maintained
10. Does the behavior stop occurring shortly after (1-2 minutes) you stop working with or making demands of this dog?	Escape maintained
11. Does this dog seem to do the behavior to get you to spend some time with her/him?	Attention maintained
12. Does the behavior seem to occur when this dog has been told that he/she can't do something he/she had wanted to do?	Tangible maintained

up-to-date on vaccinations, dogs with known health or medical issues or dogs on medication (with the exception of oral flea control medications) at the time of test. All dogs volunteered for the study met the inclusion criterion initially, however one dog (Molly) ultimately had to be dropped from the study because the veterinarian prescribed medication (Benadryl; New Brunswick, NJ) for the dog's problem behavior.

Each dog was assessed in a location in which the jumping up behavior occurred most commonly. For 2 (Cole and Lola) of the dogs, this was their home, whereas for the other 2 dogs, the location was a dog "daycare" facility. The testing room for Cole and Lola was in their foyer, where they are greeted by their owners. Pretzel and Molly were tested at the daycare facility, where they went at least 3 days a week. In the daycare, the dogs were tested in the waiting room. The waiting room was the room where the dogs are greeted by their owners when they were being picked up. The testing rooms were disturbed as little as possible from its natural state; however, we did pick up all the toys of the dogs and restricted people from entering and leaving the room during testing.

Jumping up on humans was defined as a dog's front paws leaving the ground with at least one of the paws touching the experimenter. The study was approved by the Institutional Animal Care and Use Committee of the University of Florida.

## Questionnaire

Each of the caregivers was given a modified version of the Motivation Assessment Scale questionnaire (Durand and Crimmins, 1992). The questionnaire consisted of 12

questions that assessed the caregiver's assumptions about the subject's maintaining variable for the problem behavior (jumping up in this case). Caregiver's assumptions about these variables were later used to determine the experimental conditions in the functional analysis. As the questionnaire was developed to describe human behavior, it was modified for this study, so that questions that referred to a human now referred to a dog instead (Table 2).

The questionnaire contained 4 questions that addressed each of the possible maintaining variables that would be assessed in the functional analysis (*attention*, *escape*, and *tangible*). Play was not included in the questionnaire as a possible maintaining variable because it was only included in the functional analysis as a control condition. The order of questions was randomized. Caregivers were asked to rate each question on a scale of 0-6 (0 = never, 1 = almost never, 2 = seldom, 3 = half the time, 4 = usually, 5 = almost always, 6 = always). After the questionnaire, all owners were also asked to name possible items that the dog might jump up to obtain (e.g., a particular toy, type of toy or non-toy items).

## Assessment phase

Each condition (*play*, *ignore*, *tangible*, *demand*, and *attention*) was presented for 5 minutes, with 2-minute intervals between conditions until all 5 had been presented. A presentation of all 5 conditions in randomized order constituted a cycle. No more than 2 cycles were presented on any 1 day. If 2 cycles were presented on the same day, the interval between them was between 30 and 45 minutes.

All conditions started with the experimenter opening a door; verbally greeting the dog, similar to the greeting

**Table 3** Schedule of data showing the number of assessment cycles per dog

	Molly	Cole	Lola	Pretzel
Day 1	Full cycle	Full cycle	Full cycle	Full cycle
Day 2	Full cycle	Full cycle	Full cycle	Full cycle
Day 3	Full cycle	Full cycle	Full cycle	Full cycle
Day 4	Full cycle	Full cycle	Full cycle	Full cycle
Day 5	Full cycle	Full cycle	Full cycle	Full cycle
Day 6		Full cycle		
Day 7		Full cycle		
Day 8		Full cycle		
Day 9		Full cycle		
Day 10		Full cycle		
Day 11		Full cycle		

given by the caregiver (for Cole it was, “Mommy’s home!”; for Lola it was, “Hi Lola, how’s my baby doing!”; for Pretzel it was, “Pretzel, I’m home!”; and for Molly it was, “Hi sweetie”); and walking into the testing room. This was done for the following 2 reasons: (1) walking through the door served as a discriminative stimulus for the start of each condition, (2) as mentioned in the Introduction, a person entering through a door is one situation in which trainers focus on dogs that engage in the jumping up behavior (Bridwell, 2007; Pitcairn and Pitcairn, 2005; Yin et al., 2008).

During the *ignore* condition, the experimenter entered the room but did not give any attention, make eye contact, speak to, or otherwise interact with the dog even if the dog jumped up.

During the *attention* condition, the experimenter entered the room and then did not give any further attention to the dog unless it jumped up on her. When jumping up occurred, the experimenter delivered attention (tactile and verbal) to the dog, in a manner similar to that given by the caregiver (such as petting and hugging the dog, telling the dog it was a good boy/girl), for 20 seconds.

During the *play* condition, each dog was given a squeaky toy (a universal favorite among the dogs in this experiment). During this condition, the dog was allowed to play with the toy for the duration of the condition. Attention was administered by the experimenter for 5 seconds every 20 seconds during the condition. This condition functioned as a control procedure, in which little, if any, jumping up was expected to occur because the dog was receiving non-contingent social interaction, no demands, and had access to alternative activities.

During the *demand* condition, the experimenter gave 2-3 requests that were already in the dog’s repertoire and trained at least 1 new behavior (see Table 1 for a list). These requests were presented throughout the condition. If the dog complied, it received a food reward (Purina Beggin strips [Purina, St. Louis, MO] or Pup-Peroni [Del Monte Foods, San Francisco, CA], dog treats broken into bite-size pieces). If the dog did not comply or emitted

any other behavior within 5 seconds of the demand, the demand was repeated until the dog complied. If the dog jumped up, the experimenter turned her back for 20 seconds, letting the dog escape from the demand, and then asked for the behavior again.

In the *tangible* condition, the dog was given an item that the owner believed the dog would jump up to obtain. The purpose of this condition was to see if the jumping up behavior was maintained by access to a tangible item. For the majority of subjects, this was the dog’s favorite toy; however, for 1 subject, Molly, it was her leash. While the dog was participating in this experiment, the toy items used were put up out of its reach to ensure that they were not played with, except in this condition of the experiment. Before beginning the condition, the subject was given the toy to play with or was taken for a walk on a leash (in Molly’s case) for 30 seconds to make sure it was still interested in the item and so that it could see what item the experimenter had in her possession. At the start of the condition, the experimenter walked through the door holding the item in sight and at a height such that if the dog jumped up it could obtain the item. If the jumping up occurred in this condition, the toy was given to the dog or, in Molly’s case, the dog was taken for a walk for 20 seconds. After 20 seconds elapsed without any jumping up, the experimenter picked up and held the item in sight and waited for the next occurrence of the dog’s jumping up behavior.

The number of assessment cycles given to each subject varied (Table 3). Each subject did not move on to the treatment phase until a condition was identified with a significantly higher rate of jumping up than the other conditions.

## Treatment phase

After a condition in the assessment phase was identified as sustaining a higher level of jumping up than all the other conditions, a treatment phase was instigated. Treatment was based on the maintaining variable of the behavior rather than the function of the behavior. In this experiment, 2 maintaining variables were identified in different dogs: *attention* and *tangible reinforcement*.

The principle applied during the treatment phase was to reinforce each dog for *not* jumping up with the variable identified as sustaining jumping up in that dog. Thus, if the jumping up behavior was found to be an attention-maintained behavior, the treatment condition consisted of giving the dog attention for not jumping up. The experimenter would come through the door and ignore the dog. If the dog did not jump up, the experimenter would give the dog attention (both verbal and tactile) for 20 seconds. After 20 seconds of attention, the dog was ignored for a further 20 seconds. If jumping up occurred during this “ignore” period, the timer was restarted. After the dog did not jump up for 20 seconds, attention was given. This process was repeated until the end of the 5-minute treatment session.

If the jumping up behavior was found to be maintained by access to a tangible item, the treatment condition consisted of first training the dog to leave the item alone if the experimenter was holding it. After the dog was reliably leaving the item alone, the treatment condition began. This condition was exactly like the *tangible* condition in the assessment phase, except that the dog received the toy for 20 seconds for not jumping up on the experimenter. If the dog jumped up during this condition, the toy was taken out of the dog's sight for 5 seconds and then placed back in view, where the dog could receive the toy if it did not jump up for 20 seconds.

Treatment was considered successful when the problem behavior did not occur for a minimum of 2 consecutive trials.

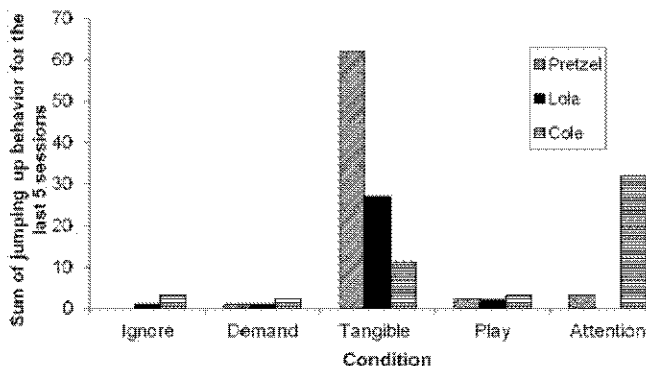
**Statistical analysis**

For each subject a Kruskal–Wallis test on the frequency of jumping up was used to determine whether there were any statistically significant differences in performance between the assessment conditions for each subject. Post hoc comparisons between conditions were performed using a method of Siegel and Castellan (1988). To test for statistically significant differences between treatment and assessment conditions, a Wilcoxon signed rank test was used. For this analysis, each dog's data were analyzed separately, with the number of jumps during each treatment session compared with the number of jumps during the assessment session.

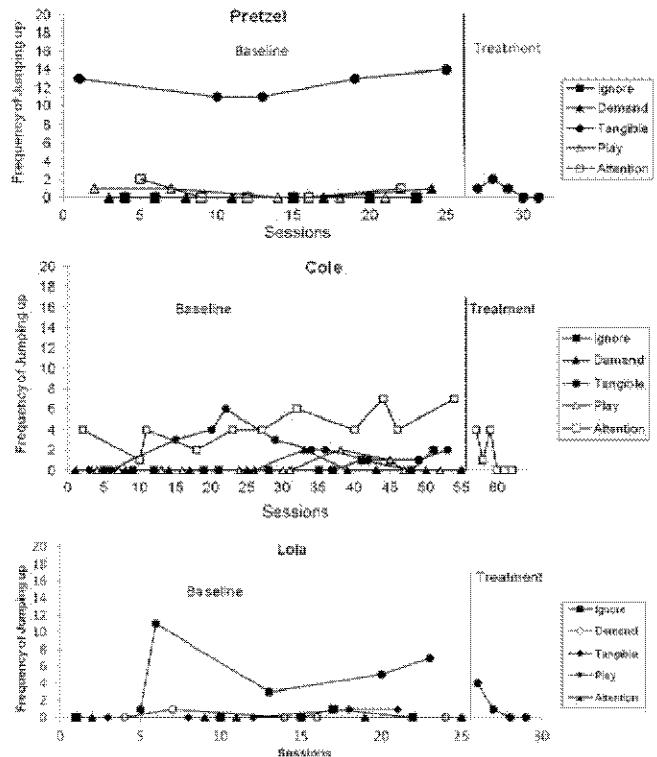
An *a priori* alpha level of 0.05 was adopted for significance for all statistical analyses.

**Results**

The Kruskal–Wallis test revealed statistically significant differences in the frequencies for each dog's jumping up behavior across conditions in the assessment phase (Lola [H = 15.6, *df* = 4, *P* < 0.01]; Cole [H = 16.1, *df* = 4, *P* < 0.01]; Pretzel [H = 36.5, *df* = 4, *P* < 0.0001]) (Figure 1). Post hoc comparisons confirmed that the *tangible* condition sustained statistically significant more responding than any other conditions for Pretzel and Lola (*P* < 0.05, Siegel and



**Figure 1** Frequency of jumping up across sessions in both the assessment and treatment phases for each subject.

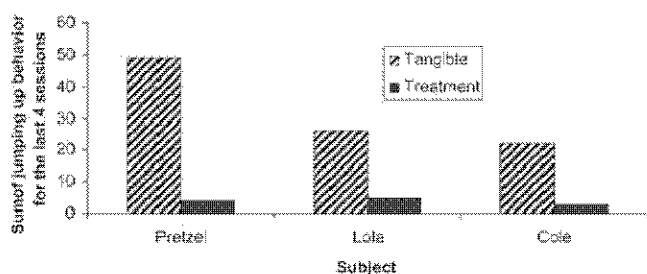


**Figure 2** Frequencies for jumping up across all cycles for each subject and treatment condition for Cole, Lola and Pretzel. Note: X-axis is different.

Castellan, 1988) (Figure 2). For Cole, post hoc comparison confirmed that the *attention* condition sustained statistically significant more responding than any other condition (*P* < 0.05, Siegel and Castellan, 1988) (Figure 2).

These results matched the Motivation Assessment Scale questionnaire given to the caregivers, except for Lola's caregiver. Pretzel's results from the questionnaire were highest for situations in which tangible might be considered the maintaining variable (scores out of 24 were 15 and 19, respectively). Cole's and Lola's results from the questionnaire were highest for situations in which attention might be considered the maintaining variable (11 and 17 out of 24, respectively).

Three dogs, participated in the treatment condition. A Wilcoxon signed rank test was used to compare all the treatment condition sessions with an equal number of the last assessment phase sessions (Pretzel, *n* = 5; Cole, *n* = 6; Lola, *n* = 4). For example, Pretzel was found to jump up on the experimenter in the *tangible* condition during the assessment phase and finished treatment in 5 sessions. To analyze her data, we used the rates found in all 5 sessions of the treatment condition and compared them with the last 5 sessions in the *tangible* condition of the assessment phase. This analysis found the rates of behavior to be statistically significantly lower in the treatment condition for all participants (Pretzel: *W* = 0, *P* < 0.0001; Cole: *W* = 0, *P* < 0.001; Lola: *W* = 0, *P* < 0.001). Figure 3 illustrates the frequency of occurrence of the jumping up behavior in assessment and treatment for each subject across session.



**Figure 3** Sum of the frequencies for jumping up for the maintaining variable found for each subject during the assessment phase and treatment for the last 4 sessions.

## Discussion

To date, only 1 previous study has used a functional analysis with a nonhuman animal (Dorey et al., 2009). Dorey et al. (2009) demonstrated that the self-injurious behavior exhibited by an olive baboon (*Papio anubis*) was maintained by caregiver attention, and successfully extinguished the problem behavior by withholding the attention and giving attention for an appropriate behavior (lip-smacking). The current experiment extends the species used and shows the method's effectiveness in identifying the maintaining variables for dogs that jump up on humans. The identification of a maintaining variable in the assessment phase was in each case confirmed by successful treatment in the treatment phase. The onset of the treatment conditions brought about an abrupt decrease in the problem behavior for all subjects, indicating that the treatment was the cause of the decrease in the behavior, as opposed to any other variable, such as a mere waning of the response with time (Figure 2).

As mentioned earlier, one method currently used in the literature is to ask the caregiver to fill out a questionnaire (Cottam et al., 2008; Hsu and Serpell, 2003; Wells and Hepper, 2000). Questions have been raised about the accuracy of caregivers' responses regarding the dogs' behavior and history (Segurson et al., 2005; Stephen and Ledger, 2007). The maintaining variable identified in our questionnaire was not uniformly the same as the maintaining variable identified in our functional analysis. This study therefore demonstrated that while questionnaires might be helpful in assessing behavioral problems some of the time, they may vary in quality and do not accurately predict the maintaining variables for unwanted behavior in all cases. Similar results have been found in studies investigating the ability of questionnaires designed to assess temperament to accurately predict future behavior in canines (de Meester et al., 2008). Lola's caregiver identified attention as the maintaining variable, whereas the data collected during the functional analysis identified gaining access to a tangible item as the maintaining variable. For the rest of the dogs, the results from our questionnaire matched that of our functional analysis. While this is the first demonstration of functional analyses used with companion animals, and only the third use with animals in general, it is not

entirely surprising that these methods are effective across human and non-human species. The procedure itself is intimately tied to learning theory developed using both human and non-human subjects, and thus may have a wide range of applicability for assessing problem behavior in a diversity of animals.

From these results, the data indicate that a functional analysis can be used to empirically assess the variables that maintain undesired behaviors in dogs, and will be especially valuable in cases where the history of the dog is unknown, such as shelter dogs or dogs acquired as strays. This procedure would also permit assessment of variables maintaining behavior, without having to depend on the accuracy of the caregiver's report. The functional analysis gives the behaviorist or caregiver unequivocal results as to what variable(s) are sustaining the target behavior.

Although the data strongly indicate that functional analysis will be useful in evaluating causes of problem behaviors, we are aware of its shortcomings. Even though the conditions can be adjusted to test any variable that may maintain a particular problem behavior, this will not be suitable for all types of behaviors. Behaviors that occur at low frequency or sporadically would not be good candidates for this method, as they might not occur at a rate that can be detected in a brief test session.

A second limitation is the setup of the *tangible* condition. We replicated the conditions as laid out in the human literature. In the human literature, if the problem behavior occurs in the *tangible* condition, the subject is given a desirable item for a specific period. After that time has expired, the experimenter takes the item away until the next occurrence of the problem behavior. Although this method is found to be effective with humans, we found that at least with 1 of our subjects, taking the desired item away could be interpreted as giving attention (Overall, 1997). Cole initially reacted to the experimenter taking the ball away from him as the start of a game. Starting in the third session of the assessment phase, when he first came in contact with the contingencies, he would play bow and then try to run away as the experimenter approached. However, as the investigation continued, his enthusiasm decreased. By the sixth session in the *tangible* condition, he was approaching the experimenter and, after jumping up for the tangible item, trying to place it back in her hand. When the experimenter ignored this behavior, he walked off. Future studies should refine this condition so that the dog does not receive any attention from the experimenter.

In principle, a problem behavior could be maintained by more than 1 consequence, and the functional analysis method would be able to identify this. Had this been the case for Cole, we would have seen rates of responding for both variables become stable and not decrease during the assessment phase.

In the current experiment, the assessment and treatment conditions were conducted by the experimenter. Future research should also test whether the procedure could be

generalized to the caregiver or other members of the dog's household and to dogs that are older and therefore may have a longer history engaging in the problem behavior.

Furthermore, researchers should focus their investigations on the optimal number of cycles needed to accurately identify the variables maintaining the problem behavior. The current study took, on average, 7 days to conduct per dog. However, the maintaining variable for all subjects could have been determined in the first 2 cycles. Thus, there might not be a need to run more than 2 cycles. Conversely, further research may identify that different behaviors require a different number of cycles for secure diagnosis.

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