Going to the Vet? Don’t Fret: Using Treats and Scale Mats to Promote a “Stress-Free” Veterinary Experience for Dogs

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ABSTRACT

Over 76.8 million pet dogs live in the United States and visit a veterinary clinic 2.4 times yearly, on average. For most dogs, these vet visits evoke stress, adding complications and complexity to executing necessary and routine care procedures. In a two-by-two mixed factorial study, we explored the potential effects and interactions relating to how a dog gets onto a veterinary scale, using a food lure or physical prompt, and whether a scale mat impacts procedural efficacy or efficiency. To analyze behavioral stress indicators within a veterinary context, we video-recorded a 3-min pre-experimental waiting period for each participant under both conditions. Dogs mounted the scale significantly faster if the scale was covered in a non-slip mat and a food lure was used. The handler effect was also significant, revealing that scale mounting procedural efficiency was impacted by whom the dog was handled. Lastly, behavioral analyses highlighted some key, easy-to-identify stress-related behavioral indicators that could serve as early warning signs a dog may struggle to complete necessary routine veterinary care procedures. These findings suggest simple, cost-effective strategies to reduce a dog’s stress when visiting the veterinary clinic.
ACKNOWLEDGEMENTS

My boys, Arlo and Winston. You two are my reason and inspiration.

Mom. I could not have completed this without your unwavering support and cheerleading. I love you.

Joe. You gave me a shoulder to cry on, a hand to hold, and someone to laugh with during the most stressful portion of this project. I am so grateful for you.

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Participants and their People. Thank you for volunteering your time and energy to this project. Your contribution will help improve canine welfare and well-being.

Lastly, thank you to everyone in the veterinary medicine and canine behavior fields who are working tirelessly to improve the emotional experiences of dogs everywhere. Your dedication to improving the lives of animals kept me going when I wanted to give up. I hope this project positively impacts your efforts.
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INTRODUCTION

Over 76.8 million pet dogs are living in the United States, according to the American Veterinary Medicine Association U.S. Pet Ownership statistical report ("U.S. pet ownership statistics," n.d.). Of those, the average number of veterinary visits each dog received in a year was 2.4 (AVMA, n.d). For many dogs, these vet visits can be fear-inducing. Necessary and routine veterinary care often includes restraint, discomfort, and handling procedures, all of which have been associated with negative affect in animals (Wess et al., 2022). Being approached by veterinary staff, placed on the exam room table, and being restrained have been shown to elicit stress-related behaviors in dogs at a veterinary clinic (Hernander, 2008; Riemer et al., 2021; Mariti et al., 2015). One study found that more than a third of dogs observed within a veterinary clinic walked hesitantly or hid behind their owners upon entering a treatment room, and 78.5% exhibited stress-related behaviors when on the examination table (Döring et al., 2009). More surprisingly, Hernander (2008) found that entering a veterinary clinic evoked stress behaviors in more than 71% of observed dogs. Identifying interventions that reduce the stress experienced by veterinary patients while improving outcomes during routine visits would be extremely useful and could positively impact the welfare and well-being of companion dogs.

1.1 Veterinary Care-Related Stress

The stress response is an evolutionarily adaptive system that aids an organism’s survival. Both actual and perceived stressors elicit the same physiological activation of the biological stress response system, which involves activation of the hypothalamic-pituitary-adrenal (HPA) axis, the sympathetic nervous system (SNS), and the immune system (Dreschel, 2007). A dog’s experience at a veterinary clinic can have lasting effects. Wess et al. (2022) found that one veterinary visit led to higher arousal levels during a second visit. Godbout and Frank (2011) found that puppies fearful within the veterinary context remained fearful within the same context as young adults (12 months later). The more negative
experiences a dog encounters at a vet clinic, the more likely the animal will become fearful or challenging to handle on its next visit due to associative learning (classical conditioning) between the aversive experience and the context (Lloyd, 2017). Given the numerous opportunities for encountering stressors within a veterinary clinic, visiting dogs risk developing a fear of veterinary visits due to the aversiveness of environmental or human-animal interactions (Edwards et al., 2019).

Additionally, stress during veterinary visits can make diagnosis and treatment more difficult for clinic staff. In one study, dogs rated as more stressed were less likely to engage with unfamiliar people at the clinic (Lind et al., 2017). Current veterinary standards often include vet staff needing to engage with dogs to complete necessary procedures. One such procedure is getting a dog’s weight. Based on anecdotal experience, Veterinarian Dr. Sophia Yin (2009) reports that being forced onto a veterinary scale is a stress-inducing event for her canine patients. As measured by a visual assessment scale, Hernander (2008) reported that more than half of the dogs observed in a veterinary clinic showed increased stress-related behaviors during the weighing procedure compared to those exhibited during the waiting period. Despite the experience being challenging for most dogs, obtaining an accurate and up-to-date weight each time a dog visits the vet is an integral step in acquiring a dog’s vital signs. A dog’s weight potentially affects the presence of illness or disease (Tvarijonaviciute et al., 2013), influences medication dosages, and helps inform veterinary professionals of treatment plans, thus necessitating the importance of the routine procedure.

Stress-related behaviors exhibited during veterinary clinic procedures, even as seemingly as simple as getting onto a scale, can result in owners’ reluctance to return for routine and regular checkups (Edwards, 2021). Volk et al., (2011) found that 22% of dog owners surveyed reported they would bring their dog into the clinic more often if it were not a stressful event for their dog. As such, visiting the veterinary clinic has been linked to stress in
dog owners (Carroll et al., 2022; Volk et al., 2011), thereby impacting dog well-being through reduced access to medical care.

1.2 Measuring Stress

Stress in dogs has typically been measured through physiological measures such as heart rate, blood pressure, heart rate variability, or cortisol (Dreschel, 2007). Cortisol measurements have been consistently used to analyze stress in dogs by deliberately exposing them to known stressors (Srithunyarat et al., 2018; Scalia et al., 2017; Dreschel & Granger, 2005). Specifically, previous experience and familiarity with veterinary procedures have been shown to alter cortisol levels in dogs’ blood (Srithunyarat et al., 2018).

Further research has analyzed the link between physiological stress measurements and behavior. Increases in urinary cortisol/creatinine ratios and salivary cortisol concentrations have been positively correlated with avoidance behaviors, lip licking, drinking, startling, and time spent walking or trotting in a kennel (Hekman et al., 2014; Hiby et al., 2006; Srithunyarat et al., 2018; Beerda et al., 1997; Dreschel & Granger, 2005; Scalia et al., 2017). Beerda et al., (1997) found that tongue out, snout lick, paw lift, and body shake behaviors were positively correlated with heart rate and salivary cortisol concentration levels in dogs exposed to a high-intensity acoustic stressor while lowered bodily posture was consistently linked to both high and low levels of acoustic stress. Dreschel and Granger (2005) found that when exposing dogs to a known stressor, a thunderstorm recording, most dogs pace, whine, tremble, and hide or attempt to be near their owner. However, obtaining physiological stress markers can be stress-inducing, cost-prohibitive, and challenging to interpret (Beerda et al., 1996; Hoyt et al., 2015; Cobb et al., 2016; Srithunyarat et al., 2018). Cortisol measurements can identify arousal levels but do not account for response valence (Hoyt et al., 2015). Additionally, cortisol is sensitive to diurnal fluctuations and individual variability (Cobb et al., 2016).
Given this, behavioral measurements alone are likely sufficient to accurately measure stress in dogs, particularly within real-world contexts such as veterinary visits. Commonly measured behavioral indicators of stress in dogs include yawning, shaking, trembling, cowering, tail tucking, head turns, circling, pacing, panting, salivating, howling, whining, growling, eliminating, lip licking, averting gaze, sniffing, ears flattening against the head, moving away, refusing food, scratching, chewing, or looking/acting sleepy when not tired (Guiterrez et al., 2019; Lloyd, 2017; Kartashova et al., 2021; Srithunyarat et al., 2018). Bremhorst et al. (2019) used DogFACS (Dog Facial Action Coding System) to investigate how differences in facial expressions in emotionally ambiguous contexts may be used to infer the emotional states of dogs. They found that ears adductor, blink, lips part, jaw drop, nose lick, and ears flattened were more common in the negative condition than the positive condition. Visual assessment scales of pre-determined behaviors have also been shown to effectively analyze an animal’s stress-related behavior across various contexts (Srithunyarat et al., 2018; Kartashova et al., 2021).

1.3 Interventions to Reduce Veterinary-Related Stress

Minimizing stress for dogs within the veterinary clinic setting is purportedly impactful and feasible (Lloyd, 2017). The most common recommendations for reducing canine stress within the veterinary setting include implementing low-stress handling techniques and behavior modification, specifically utilizing desensitization and counterconditioning or cooperative care training. “Fear-free” certifications are available via the fearfreepets.com website for veterinary professionals interested in reducing their patient’s fear and stress (Fear-free pets, n.d.). In addition to practical data resources being available to veterinary professionals, resources and certification courses on low-stress/”fear-free” handling are also available to a variety of pet professionals such as dog trainers, dog groomers, and dog daycare staff (e.g., cattledogpublishing.com; Fear-free pets, n.d.). The Academy for Dog Trainers provides free access to their Husbandry Project content, a
collection of how-to instructions and training plans/materials for professional dog trainers and owners to teach their dogs how to participate cooperatively in their veterinary care (The Academy for Dog Trainers, n.d.). However, despite detailed information on purported stress-mitigating protocols and how to implement them within a veterinary practice being widely accessible via articles, manuals, and textbooks written by veterinary field experts (e.g., Overall, 1997; Moffat, 2008; Yin, 2009; Horwitz & Pike, 2014; Overall, 2013; Herron & Shreyer, 2014; Hewson, 2014; Hammerle et al., 2015; AVSAB, 2016; Lloyd, 2017; Landsberg, Radosta, & Ackerman, 2023), current recommendations are primarily rooted in expert opinion, anecdotal reports, or limited and inconclusive empirical data.

1.3a Low-Stress Handling

Low-stress handling techniques encompass keeping an animal comfortable and reducing their stress. According to veterinary experts, this can be accomplished by allowing animals time to habituate to the clinic environment, avoiding situations that make the dog feel unsafe (Yin, 2009) or uncomfortable (Herron & Shreyer, 2014; Herron, 2015), physically supporting an animal in a manner that prevents them from flipping or hitting their head, minimizing restraint as much as possible (Yin, 2009), and utilizing items the individual animal finds rewarding such as treats, toys, or play as distractions or reinforcers for participating in handling procedures (Moffat, 2008; Yin, 2009; Scalia et al., 2017; Feilberg et al., 2021). Specifically, the use of food has been recommended to assist an animal in feeling safe while also potentially aiding in efforts to create a positive association (Yin, 2007; Moffat, 2008). Hammerle and colleagues (2015) recommend using food as a standard low-stress handling protocol for reactive/anxious patients in the veterinary clinic, and Lloyd (2017) reported that using food in a veterinary setting improves cooperation and helps alleviate the need for restraint.

Additionally, low-stress handling recommendations commonly involve manipulating substrate textures within the veterinary clinic (Hammerle et al., 2015; Feilberg et al., 2021).
Non-slip mats can be placed on surfaces such as floors or scales to prevent slippage and avoid an animal's discomfort (Herron & Shreyer, 2014; Herron, 2015). Overall (2013) and Lloyd (2017) report that using a non-slip scale mat can make the weighing procedure more comfortable for animals. Yet, despite this breadth of practical recommendation for using food treats and scale mats to reduce stress at the vet, no studies empirically evaluate the efficacy of these two specific low-stress handling techniques. One study conducted by Scalia and colleagues (2017) compared the effectiveness of a low-stress handling veterinary exam to a traditionally executed veterinary exam. While the results suggested that low-stress handling techniques decrease the frequency of stress-related behaviors (low head, lip licks, and whale eye) compared to traditional handling techniques, the evaluated examination procedures did not include obtaining the dog’s weight. Additionally, while the researchers did include food treats in the low-stress handling examination group (Scalia et al., 2017), the study design was not suited to parse out which factors of the examination procedures impacted overall results. Thus, data-driven research supporting practical recommendations for using food treats and scale mats as low-stress handling techniques in a veterinary setting is currently scarce and inconclusive.

1.3b Desensitization and Counterconditioning

Desensitization (DS) and counterconditioning (CC) techniques are repeatedly recommended as effective veterinary-related stress mitigators, specifically to change a dog’s behavioral response to fear-evoking stimuli (Moffat, 2008; Döring et al., 2009; Howell & Feyrecilde, 2018; Reid, 2019; Reimer et al., 2021). Reimer and colleagues (2021) posit desensitization and counterconditioning as the primary recommendations for reducing animal fear responses. Howell and Feyrecilde, (2018) purport that vet staff should use DS/CC whenever possible. Reid (2019) suggests that when treating emotional distress in animals, desensitization is most effective when combined with counterconditioning. Behaviors correlated to the appetitive system and behaviors correlated to the aversive system cannot be
elicited simultaneously (Keller & Dunsmoor, 2020), thus making appetitive stimuli such as food treats advantageous for conditioning other stimuli to become more appetitive. As such, the recommendations to use appetitive stimuli, such as food, as part of a DS/CC protocol with dogs in veterinary clinic settings is unsurprising.

However, no literature exists to support the effectiveness of DS/CC in veterinary settings for dogs, contrasting the practical recommendations that DS/CC is definitively effective for reducing and/or eliminating canine stress in veterinary settings. In a study attempting to separate the effects of extinction, counterconditioning, and desensitization, Goldstein (1969) found that respondent counterconditioning was more effective and time-efficient than extinction only when used with desensitization. Ultimately, Goldstein’s study concluded that desensitization appears to be an effective procedure in and of itself, but respondent counterconditioning is mostly ineffective without the conjunctive use of desensitization. In a study evaluating the attenuation of fear resurgence, van Dis and colleagues (2019) found that respondent counterconditioning reduced negative stimulus valence but did not reduce fear resurgence relative to extinction training. Thomas and colleagues (2019) also found fear renewal occurred following a respondent counterconditioning procedure. Numerous studies have concluded that respondent counterconditioning is unnecessary for behavior change in a desensitization protocol (Marcia & Rubin, 1969; Nawas et al., 1971). Marcia and Rubin (1969) explored whether respondent counterconditioning or expectancy change, a participant’s anticipated treatment outcome, was responsible for behavioral improvements secondary to implementing a desensitization protocol with human participants. They found that the potential impact of the expectancy change accounted for results more than the respondent conditioning component. While counterconditioning might or might not be required, respondent extinction must also be considered as a mechanism of change. One view is that respondent counterconditioning only works by keeping the animal in the presence of the stimulus long enough for respondent
extinction to occur. Nawas et al. (1971) also studied humans and found that exposure alone led to improvements, concluding that respondent counterconditioning is not a necessary mechanism of desensitization. In a study comparing the efficacy of a respondent extinction procedure and a respondent counterconditioning procedure in reducing pain-related fear in humans, results showed both procedures to be effective at changing affective valence as well as pain-related fear (Meulders et al., 2015). Other research has evidenced that teaching an alternative response during counterconditioning is essential to procedural efficacy. Thomas and colleagues assessed this in a study with rats, finding that adding a response contingency to a counterconditioning procedure (known as operant counterconditioning) successfully prevents fear renewal in rats (Thomas et al., 2012).

Researchers have begun exploring whether DS/CC protocols would produce similar results in applied settings with canine subjects. Stellato et al. (2021) aimed to evaluate the efficacy of a four-week owner-executed DS/CC protocol on dogs within a veterinary context. Results showed reduced bodily postures associated with stress during the examination but increased lip licking, typically associated with stress, during entrance into the clinic and examination room compared to a control group. Researchers reported their 4-week DS/CC, owner-led training plan to be only mildly effective at reducing pre-existing veterinary fear in companion dogs. When evaluating the efficacy of systematic desensitization and counterconditioning in alleviating separation-related problem behaviors in dogs, Butler and colleagues (2011) assessed reductions in the frequency and severity of behaviors in a within-subjects design. They found six of eight dogs had almost eliminated their problem behaviors three months after treatment. The authors reported that counterconditioning and other behavioral modification training interventions, such as positive reinforcement “stay” training exercises, were unrelated to treatment success, concluding that systematic desensitization was the critical component attributing to marked improvement.
Similarly, inconclusive but potentially promising results were found in a study evaluating the efficacy of two CD-based DS/CC programs for treating dog fireworks fears. Levine and colleagues (2007) reported no difference in video recordings of fear behaviors in dogs responding to a novel CD recording pre-treatment versus post-treatment. They reported that most changes occurred during the first month of training, and no significant changes occurred during the second month of training. Given that current literature has little data to refute or support DS/CC as an effective protocol for changing a dog’s behavior, the current practice of advising dog owners to implement DS/CC is a poor first-line strategy for reducing veterinary-related stress in dogs.

1.3c Cooperative Care Training

Practical experiences reported by animal trainers that target training techniques to reduce veterinary care-related stress in captive animals have been extremely promising for improving the welfare of such animals. In a 2012 article, animal trainer Ken Ramirez reported that the success and advantages of cooperative care training marine mammals resulted in the creation of the zoological trainers organization Animal Behavior Management Alliance (1999), leading to the documentation of cooperative care training with new species.

Reported anecdotal successes with cooperative care training techniques have prompted scientists to explore its utility and efficacy through empirically driven research studies. In one study, Gillis and colleagues (2012) trained 71% of tested black-capped squirrel monkeys to master four cooperative care-related tasks, and Bliss-Morea and Moadab (2016) successfully implemented cooperative care techniques to train rhesus monkeys to participate in a medical chair restraint task. Additionally, Lambeth and colleagues (2006) explored the correlation of cooperative care training's effect on physiological measures of stress in chimpanzees, finding that cooperative care training significantly reduces stress responses to chemical restraint. In a study on felines, kittens cooperatively trained on a
venipuncture procedure presented with less stress during blood sampling as adults (Lockheart et al., 2013).

Thus, such targeted training, known as “cooperative care training,” has recently become a commonly recommended method for reducing a dog’s veterinary visit and care-related stress experience. Although cooperative care training is now widely recommended by canine behavior and veterinary medicine experts as an intervention effective in reducing canine stress related to veterinary care visits and procedures (The Academy for Dog Trainers, n.d.; Howell & Feyrecilde, 2018; Jones, 2023), current empirical data supporting such claims are lacking. In a study evaluating the effect of an owner-trained 8–12-week cooperative care training protocol, researchers found that handling tolerance improved only in dogs perceived as challenging to handle at the beginning of the program (Wess et al., 2022). Additionally, compared to dogs in the control group, dogs who underwent cooperative care training showed reduced examination compliance during the post-intervention follow-up exam (Wess et al., 2022). Results from this study should be analyzed cautiously as improvements in handling tolerance were based on reports from the study trainer and participant’s owners. Reduced compliance could have resulted from owners’ improved ability to identify their dog’s stress during examination (Wess et al., 2022). Because this study relied on owner and trainer reports, it offers insight into the perceived effects of cooperative care training. Still, it provides little support for the evidence-based efficacy of cooperative care training programs designed to improve stress related to veterinary clinic visits.

Current literature reveals that ‘cooperative care’ training techniques have the potential to reduce stress, as measured by physiological and behavioral indicators, in a variety of captive and laboratory animal species. Professionals have strictly managed the animals’ environments and training programs in these situations. Additionally, research has shown that successful cooperative care training requires collaboration with knowledgeable veterinary
staff, dog trainers, and/or animal behaviorists, cooperation of veterinary practice teams, and high owner compliance (Stellato et al., 2019; Reimer et al., 2021; Wess et al., 2022).

1.4 Current Study

Despite the breadth of evidence identifying the veterinary clinic as a source of stress for many dogs and the increase in information on how veterinary practitioners can work toward decreasing environmental stressors within their practice, there is little evidence to support the efficacy of specific interventions or protocols. Current literature needs more data to support the effectiveness of standard suggestions conclusively, and more research is required to evaluate such recommendations empirically. Given the American Veterinary Medical Association’s recommendation for pets to get routine wellness care (AVMA, n.d.) at least once a year, and that previous studies have shown getting on a veterinary scale to be a significant source of stress and a procedure that all dogs entering the clinic must contact (Hernander, 2008), implementing a stress-reducing protocol for weighing dogs could minimize stress during the visit, thereby improving welfare. Feilberg et al. (2021) revealed that of the surveyed veterinary clinics that reported utilizing low-stress handling techniques, only 34.1% of those implemented a protocol to reduce stress during the weighing procedure. No studies have objectively evaluated which protocols for obtaining a dog’s weight on a veterinary scale are both effective and low stress.

This study assessed two protocols for getting a dog’s weight on a veterinary scale within a mock veterinary setting. Participants were assigned to a group using a food lure or leash prompt procedure to get onto a veterinary scale to be weighed. Both procedures were evaluated under two conditions by analyzing latency to obtain weight with and without a non-slip mat attached to the scale. It was hypothesized that using a non-slip scale mat could improve the procedural efficacy of obtaining a dog’s weight for both procedures. The procedures developed for this study are simple, time efficient, and inexpensive to implement and, therefore, have the potential to provide accessible and actionable steps toward reducing
dogs’ stress levels when visiting a veterinary clinic, thereby impacting well-being through increased access to medical care.

METHODS

2.1 General Overview

Our study examined the potential effects and interactions of using a lure or a physical prompt on dogs’ success and latency in getting onto a veterinary scale. We also assessed the impact a scale mat might have on these measures. We used a two-by-two mixed factorial design consisting of two scale-mounting procedural groups (Food Lure and Leash Prompt) under two treatment conditions (Mat and No Mat). Dogs participated in a 3-min pre-experiment waiting period before each condition to simulate a real-world veterinary visit experience. A 5-min between-conditions break was included in the study design so that dogs could complete participation within a single session.

2.1a Equipment

For the scale mounting latency experiment, we used A MINDPET-MED digital dog scale (dimensions 65 x 45 x 4 cm) with an accompanying non-slip scale mat. The scale was black, reflective, and not textured. The scale mat was off-white with a rubber bottom. We also used a SONY HDR-CX405 video camera attached to a tripod to record each participant’s 3-min pre-experimental waiting period in both conditions. We used a digital stopwatch timer to measure the elapsed time of the waiting period, a two-minute grace period to attempt scale mounting, and scale mounting latency.

2.1b Exclusionary Criterion

Data collection ceased immediately and without question if a dog hid from a handler or trembled and panted excessively. Data collection ceased immediately if a researcher or owner expressed verbal concern for a participant’s participation. Additionally, data collection ceased immediately if a dog did not leave its owner within 2 min of the handler taking control of its leash.
2.2 Participants and Selection

Owned pet dogs and foster dogs living in homes for longer than one month participated in this study. Recruitment attempts were made via social media, email outreach, word of mouth, and flyers posted in veterinary clinics, dog parks, coffee shops, and dog daycare centers within Moore County, NC. We collected demographic data from owners interested in enrolling dogs in our study, including the dog’s name, age, sex, neuter status, breed, and behavioral history toward unknown humans.

Owners of 74 dogs expressed interest in participating in our study. Those with dogs at least one year of age and no reported history of having bitten a human \((n=67)\) were invited to enroll. Thirteen canceled their scheduled session, and an additional four were no-shows on the day of their session. Thus, 50 dogs were enrolled to participate in the study. Dogs were at least one year old, with ages ranging up to 14 years, but the mean age was 5.06. Sex was evenly represented between male dogs \((n=24)\) and female dogs \((n=26)\). As reported by owners, breed demographics varied, with 19 reported as purebred dogs and 31 reported as mixed-breed dogs. Sizes ranged from small \((n=4)\) to giant \((n=1)\), with most participants falling within medium \((n=21)\) or large \((n=24)\) size designations (Hawthorne et al., 2004).

Information on participant group assignment demographics can be found in Table 1.

Table 1

<table>
<thead>
<tr>
<th>Name</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Breed</th>
<th>Size</th>
<th>Handler</th>
<th>Success Category</th>
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<td>S</td>
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<td>Mixed breed</td>
<td>TS</td>
<td>L</td>
<td>Excluded</td>
</tr>
<tr>
<td>Belle</td>
<td>4</td>
<td>SF</td>
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<td>TS</td>
<td>M</td>
<td>Attempted</td>
</tr>
<tr>
<td>Charley</td>
<td>6</td>
<td>SF</td>
<td>Mixed breed</td>
<td>TS</td>
<td>L</td>
<td>Successful</td>
</tr>
<tr>
<td>Cooper</td>
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<td>NM</td>
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<td>L</td>
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<tr>
<td>Waylon</td>
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<td>SF</td>
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<td>TS</td>
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<tr>
<td>Reba</td>
<td>6</td>
<td>SF</td>
<td>Mixed breed</td>
<td>TS</td>
<td>M</td>
<td>Attempted</td>
</tr>
<tr>
<td>Deke</td>
<td>11</td>
<td>NM</td>
<td>Purebred</td>
<td>TS</td>
<td>L</td>
<td>Successful</td>
</tr>
<tr>
<td>Niko</td>
<td>10</td>
<td>NM</td>
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<td>TS</td>
<td>L</td>
<td>Attempted</td>
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</tbody>
</table>

**Group: Food Lure**

<table>
<thead>
<tr>
<th>Name</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Breed</th>
<th>Size</th>
<th>Handler</th>
<th>Success Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spencer</td>
<td>8</td>
<td>NM</td>
<td>Mixed breed</td>
<td>TS</td>
<td>M</td>
<td>Successful</td>
</tr>
<tr>
<td>Edna</td>
<td>2</td>
<td>SF</td>
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<td>TS</td>
<td>M</td>
<td>Excluded</td>
</tr>
<tr>
<td>Frigga</td>
<td>2</td>
<td>F</td>
<td>Mixed breed</td>
<td>TS</td>
<td>M</td>
<td>Successful</td>
</tr>
<tr>
<td>Luca</td>
<td>1</td>
<td>NM</td>
<td>Purebred</td>
<td>TS</td>
<td>M</td>
<td>Attempted</td>
</tr>
<tr>
<td>Cody</td>
<td>4</td>
<td>NM</td>
<td>Purebred</td>
<td>TS</td>
<td>M</td>
<td>Successful</td>
</tr>
<tr>
<td>Gizmo</td>
<td>3</td>
<td>NM</td>
<td>Purebred</td>
<td>TS</td>
<td>M</td>
<td>Successful</td>
</tr>
<tr>
<td>Basil</td>
<td>7</td>
<td>SF</td>
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<tr>
<td>Charlie</td>
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<td>Successful</td>
</tr>
<tr>
<td>Charlie+</td>
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<td>L</td>
<td>Successful</td>
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<tr>
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<tr>
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<td>M</td>
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<td>L</td>
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</tr>
</tbody>
</table>

**Group: Food Lure**

<table>
<thead>
<tr>
<th>Name</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Breed</th>
<th>Size</th>
<th>Handler</th>
<th>Success Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dilly</td>
<td>2</td>
<td>SF</td>
<td>Purebred</td>
<td>L</td>
<td>MP</td>
<td>Successful</td>
</tr>
<tr>
<td>Chester</td>
<td>3</td>
<td>NM</td>
<td>Purebred</td>
<td>G</td>
<td></td>
<td>Successful</td>
</tr>
<tr>
<td>Coco</td>
<td>12</td>
<td>SF</td>
<td>Purebred</td>
<td>S</td>
<td>TS</td>
<td>Excluded</td>
</tr>
<tr>
<td>Holly</td>
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<td>SF</td>
<td>Mixed breed</td>
<td>TS</td>
<td>M</td>
<td>Successful</td>
</tr>
<tr>
<td>Pixie</td>
<td>1</td>
<td>SF</td>
<td>Mixed breed</td>
<td>TS</td>
<td>M</td>
<td>Attempted</td>
</tr>
<tr>
<td>Lucille</td>
<td>3</td>
<td>SF</td>
<td>Mixed breed</td>
<td>TS</td>
<td>M</td>
<td>Attempted</td>
</tr>
<tr>
<td>Hank</td>
<td>3</td>
<td>NM</td>
<td>Purebred</td>
<td>TS</td>
<td>M</td>
<td>Excluded</td>
</tr>
<tr>
<td>Dax</td>
<td>12</td>
<td>NM</td>
<td>Purebred</td>
<td>TS</td>
<td>M</td>
<td>Successful</td>
</tr>
<tr>
<td>Glynda</td>
<td>8</td>
<td>SF</td>
<td>Mixed breed</td>
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<td>L</td>
<td>Successful</td>
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<tr>
<td>Bailey</td>
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<td>Mixed breed</td>
<td>TS</td>
<td>L</td>
<td>Attempted</td>
</tr>
<tr>
<td>Ridley</td>
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<td>SF</td>
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<td>TS</td>
<td>L</td>
<td>Excluded</td>
</tr>
<tr>
<td>Sage</td>
<td>2</td>
<td>SF</td>
<td>Purebred</td>
<td>L</td>
<td>MP</td>
<td>Successful</td>
</tr>
</tbody>
</table>
Note. This table shows the participant demographics, group, condition order, and handler assignments. The last column shows the participation category each dog was categorized into after data collection. *F (intact female); M (intact male); SF (spayed female); NM (neutered male); S (small); M (medium); L (large); G (giant). Size designation based on weight (Hawthorne et al., 2024). Successful (6/6 trials), Attempted (0-5/6 trials), Excluded (no trials).

We first organized enrolled dogs as like pairs based on owner reports of their breed, age, sex, and neuter status. Then, using the iPhone randomization application Random, one dog per pair was assigned to the Food Lure (FL) group while the other was assigned to the Leash Prompt (LP) group. Next, each dog was assigned one of two handlers, Mackenzie Price (MP), or Tiffany Score (TS), based on handler-to-dog familiarity. Dogs with a history of reinforcement or familiarity with handler TS were automatically assigned to handler MP. Likewise, any dog with a history of reinforcement or familiarity with handler MP was automatically assigned to handler TS. Dogs unfamiliar with either handler were assigned a handler based on how many dogs were assigned to MP and how many were assigned to TS to divide handling opportunities between the two handlers evenly. Lastly, each dog's condition order was assigned using a simple four-sequence block randomization on the iPhone randomization application Random on the day of their scheduled data collection session (Jhangiani et al., 2021). Both conditions, Mat (M) and No Mat (NM), consisted of three trials to allow room for random error while limiting dogs’ exposure to unnecessary handling attempts (Yin, 2009).

All participants, including those who started the study but did not complete it, were entered to win a $50 Pet Supermarket gift card. One raffle entry was provided per participant dog. If an owner participated in the study with more than one dog, they received one raffle entry per dog.

2.3 Setting
Our study was conducted at The Pet Lodge of Pinehurst, a local dog daycare and boarding facility, during non-business hours. The daycare setting was used because it offered a close approximation to a typical veterinary clinic. It allowed us to focus on responses to a veterinary scale in a novel environment outside a veterinary clinic where dogs were likely to associate with previous exposure (Döring, 2009). Boarding dogs were present within the building but separated by multiple doors and hallways to limit interference with data collection and prevent distraction to the dogs (Yin, 2009).

Specifically, data were collected in the dog daycare’s waiting room, consisting of a front desk, a small high-top table, and two benches. The digital dog scale was placed against a wall approximately 1.8 meters from the seating area and across from the front desk (Loyd, 2017). The video camera was attached to a tripod set up at the back of the room at an angle most likely to capture the dog in full view during their session. Masking tape was placed on the floor to mark where owners were instructed to sit in the waiting room area, where handlers were instructed to turn when walking dogs to the scale, where handlers were instructed to stop at the scale, and where handlers were instructed to reset after each trial. Two researchers participated in data collection, TS and MP. One researcher was a dog handler, while the second measured and recorded timestamps. Both researchers filled each role, depending on which was assigned to handle the participant dog.

2.4 Data Collection

Owners were instructed via email (Appendix A) and text message to arrive at The Pet Lodge of Pinehurst at their designated session time with their dog and a ziplock bag containing their dog’s preferred food treat. Dogs were scheduled for a private session to participate in their assigned scale mounting procedure, FL or LP, under two conditions: M and NM. Owners were not instructed or restricted on how to interact with their dogs during the session, including the between-conditions break period. If owners asked permission to give their dogs treats, attention, praise, or support, the researcher responded by telling the
owners they may interact with their dogs as they typically would when visiting a veterinary clinic. Participant dogs remained on a 6-foot leash attached to a harness, flat collar, or cloth martingale collar for the entirety of the session.

Once owners arrived in the parking lot, the researcher, not assigned as the participant’s handler, went to their car to deliver a consent form and verbal instructions. Owners were instructed to enter the building with their dog on a leash and sit on the bench directly to their left, marked by an ‘X’ created in tape on the floor approximately 2 minutes after the researcher re-entered the building. This allotted the researchers ample time to prepare the scale condition, turn on video recording equipment, and file owner consent forms.

The scale, benches, and scale mat were cleaned with disinfectant between each data collection session. Data collection sessions began once the owner entered the building and sat down on the waiting room bench, where they remained during data collection under each experimental condition.

2.5 Procedures

2.5a Food Lure Group and Conditions

Immediately following the waiting period, the assigned handler approached the dog and owner. Owners gave the handler the bag of their dog’s preferred food treat that they brought to the session, and the handler placed the bag of treats in a treat pouch on their hip. The handler then took control of the dog’s leash, marking the start of the first trial of the condition to walk them to the scale. Dogs had a 2 min time limit to walk away from their owners with the handler to begin experimental trials. If the dog did not easily walk with the handler, the handler utilized verbal prompting to encourage the dog to walk with them. The handler did not pull the dog’s leash to prompt movement.

Handlers walked dogs just beyond the scale, turned, and approached the scale so the dog was positioned between a wall and the handler, with the handler to the dog’s right. Once the handler’s body was centered on the scale, as marked by tape on the floor, the handler
stopped walking and retrieved a piece of food from their pouch. By holding the food treat near the dog’s nose, the handler attempted to lure the dog onto the scale with one continuous gesture and a 3-sec pause to allow the dog time to respond to the food lure. If the dog stepped all its paws onto the scale, the handler released the treat to the dog and verbally called its weight aloud to signal a successful trial to the experimenter recording the latency timestamps. If the dog did not step all paws onto the scale within a reasonable time (3-10 sec), the handler placed the food back into the pouch and called ‘mistrial’ aloud so the researcher recording data could count the attempted trial.

The handler then walked the dog off or away from the scale and forward approximately 1 meter to a spot marked on the floor with tape to immediately repeat the procedure for the two subsequent remaining trials within the condition. Immediately following the third trial, the handler returned the dog to their owner. This scale mounting procedure was repeated for three trials per condition (FLM and FLNM), totaling six trials for each dog assigned to the FL group.

2.5b Leash Prompt Group and Conditions

Immediately following the waiting period, the assigned handler approached the dog and owner. The handler then took control of the dog’s leash, marking the start of the first trial of the condition to walk them to the scale. Dogs had a 2 min time limit to walk away from their owners with the handler to begin experimental trials. If the dog did not easily walk with the handler, the handler utilized verbal prompting or gentle leash pressure to encourage the dog to walk with them.

Handlers walked dogs just beyond the scale, turned, and approached the scale so the dog was positioned between a wall and the handler, with the handler to the dog’s right. Once the handler’s body was centered on the scale, as marked by tape on the floor, the handler stopped walking and used gentle leash pressure/tension as a physical prompt to guide the dog onto the scale. If the dog stepped all its paws onto the scale, the handler maintained leash
pressure while verbally calling the dog’s weight aloud to signal a successful trial to the experimenter recording the latency timestamps. If the dog did not step all paws onto the scale within a reasonable time (3-10 sec), the handler released leash pressure and called ‘mistrial’ aloud so the researcher recording data could count the attempted trial. The handler then walked the dog off or away from the scale and forward approximately 1 meter to a spot marked on the floor with tape to immediately repeat the procedure for the remaining two trials within the condition. Immediately following the third trial, the handler returned the dog to their owner. This scale mounting procedure was repeated for three trials per condition (LP_M and LP_NM), totaling six trials for each dog assigned to the LP group.

2.6 Study Measures

2.6a Scale Mounting Latency

The latency to get onto the scale for each trial was measured to the hundredth of a second. To record the first trial latency within a condition, the researcher recording timestamps started a digital stopwatch timer when the handler took control of the dog’s leash from its owner and stopped the timer once the handler verbally called “weight” or read the dog’s weight aloud. For a trial to be recorded as a success and include a latency timestamp, dogs must have stepped all their paws onto the scale and remained stationary for approximately 3 seconds while the handler verbally called “weight” or read the dog’s weight aloud. If a dog stepped all its paws onto the scale but could not remain stationary for at least three seconds for the handler to read its weight, no latency time was recorded. For the second and third trials, within a condition, the timer was restarted once the dog stepped off or away from the scale and forward approximately 1 meter to reset. This timing procedure remained constant across all scale-mounting experimental groups and conditions.

2.6b Behavioral Coding

To assess behaviors indicative of stress, each dog’s behaviors during the waiting period in each condition were coded using Behavioral Observation Research Interactive
Software (BORIS) version 8.13. Three trained coders analyzed videos against an ethogram (Table 2) consisting of 23 behaviors within seven behavioral categories: inactive body position, locomotion, environmental exploration/contact, head orientation, oral behavior, tail carriage, and others. The waiting period ethogram was adapted from Visual Analog Scales practically used within veterinary setting contexts (Dreschel & Granger, 2005; Overall, 2013; Kartashova et al., 2021; Fear Free Pets, n.d.) and previous research (Hennessy et al., 1998; Hernander 2008; Döring et al., 2009; Lind et al., 2017; Srithunyarat et al., 2018; Pritchett, Barnard, & Croney; 202) and empirical data correlating physiological measures of stress with behavioral stress indicators (Beerda et al., 1996; Beerda et al., 1997; Hennessy et al., 1998; Scalia, Walker et al., 2016; Alberghina, & Panzera, 2017; Srithunyarat et al., 2018; Guitiérrez et al., 2019; Heimbürge, Kanitz, & Otten, 2019; Wess et al., 2022).

Table 2

**Waiting Period Ethogram**

<table>
<thead>
<tr>
<th>Behavioral Category</th>
<th>Behavior</th>
<th>Definition</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inactive body position</strong></td>
<td>Resting</td>
<td>Lying on the ground or furniture with trunk of body in contact with surface. Head either resting on the ground or held up in the air. Eyes open or closed.</td>
<td>State</td>
</tr>
<tr>
<td></td>
<td>Sitting</td>
<td>Hindquarters on ground or furniture with two front legs used for support.</td>
<td>State</td>
</tr>
<tr>
<td></td>
<td>Standing</td>
<td>Dog is immobile with all paws on the floor or a stable surface; legs upright and extend supporting the body or hind legs outstretched with front paws upright and in contact with something that supports the dog’s weight (&gt;2s)</td>
<td>State</td>
</tr>
<tr>
<td></td>
<td>Hiding</td>
<td>Moves under/behind furniture or owner</td>
<td>State</td>
</tr>
<tr>
<td>Body not visible</td>
<td></td>
<td>Any portion of the dog’s trunk body is out of sight, behavior cannot be identified</td>
<td>State</td>
</tr>
<tr>
<td><strong>Locomotion</strong></td>
<td>Pacing</td>
<td>Repeatedly (&gt;3s) locomoting around in a fixed route</td>
<td>State</td>
</tr>
<tr>
<td></td>
<td>Walking</td>
<td>Dog ambulating with lateral legs moving together and two legs</td>
<td>State</td>
</tr>
<tr>
<td>Environmental exploration/contact</td>
<td>Owner contact</td>
<td>Prolonged contact (&gt;1) with the person (any part of their body) of its own accord.</td>
<td>State</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Sniffing</td>
<td></td>
<td>Muzzle/nose oriented near the ground, upwards in the air, or held close to an object with mouth closed while forcibly inhaling air through the nose</td>
<td>State</td>
</tr>
<tr>
<td>Tail carriage</td>
<td>Wagging</td>
<td>Tail moves perpendicular to the dog’s body while in a neutral, relaxed, or erect position; wagging ends once (greater than or equal to) 2 seconds of wagging ceases.</td>
<td>State</td>
</tr>
<tr>
<td></td>
<td>Tucked</td>
<td>Tail held tightly between hind legs, may be curled under genital area or ventral side, stationary or moving perpendicular to dog’s body</td>
<td>State</td>
</tr>
<tr>
<td></td>
<td>Unobservable</td>
<td>Entire tail (beginning from the dog’s sacral area to the tip) is not visible due to the dog’s body position or camera angle.</td>
<td>State</td>
</tr>
<tr>
<td>Head orientation</td>
<td>Cowering</td>
<td>Head lowered and hunched toward the ground, extending below the shoulder line. Dog may be sitting or standing.</td>
<td>State</td>
</tr>
<tr>
<td></td>
<td>Not visible</td>
<td>Dog’s entire head it out of view of the camera.</td>
<td>State</td>
</tr>
<tr>
<td>Oral behavior</td>
<td>Excessive salivation</td>
<td>Licks lips excessively, swallows a lot, dampness seen around dog’s muzzle and/or on the floor</td>
<td>State</td>
</tr>
<tr>
<td></td>
<td>Lip/nose licking</td>
<td>Part of the tongue is visible and moved along the upper lip or upwards to cover nose before retracting into the mouth</td>
<td>Event</td>
</tr>
<tr>
<td></td>
<td>Panting</td>
<td>Mouth open with extended tongue and rapid breathing.</td>
<td>State</td>
</tr>
<tr>
<td></td>
<td>Yawning</td>
<td>Mouth open wide for a period of a few seconds while exhaling.</td>
<td>Event</td>
</tr>
<tr>
<td></td>
<td>Face not visible</td>
<td>Dog’s face is unobservable due to its position in relation to the camera angle</td>
<td>State</td>
</tr>
<tr>
<td>Other</td>
<td>Auto-grooming</td>
<td>Scratching and/or licking own body</td>
<td>Event</td>
</tr>
<tr>
<td></td>
<td>Shake off</td>
<td>Motions body and/or head back and forth repeatedly and/or rapidly</td>
<td>State</td>
</tr>
<tr>
<td></td>
<td>Trembling</td>
<td>Visible shaking while the dog is stationary or cowering.</td>
<td>Event</td>
</tr>
</tbody>
</table>
2.7 Data Preparation

Dogs that participated in the scale mounting experiment \((n=41)\) were categorized into success groups based on the number of completed trials \((\text{range}=0-6)\) across both conditions. Dogs who completed all six trials were classified into the ‘Successful’ participation group \((n=28)\), while dogs who completed between zero and five trials were classified into the ‘Attempted’ participation group \((n=13)\). Dogs excluded from the experiment during their session \((n=9)\) were classified into the ‘Excluded’ from the participation group.

Information from the behavioral observations of recorded waiting periods was combined by summing across both conditions’ waiting periods to capture the total span of each dog’s behavior. Behavioral values were adjusted according to when the relevant body part was visible in the recorded videos. This adjustment was such that

\[
\text{Standardized Value} = \frac{\text{Original Value}}{\text{Amount of Visible Time}}.
\]

This adjustment effectively converted behaviors coded as count values into rates and behaviors coded as durations into proportions. Due to sparsity, several behaviors were excluded from the analysis. These included excessive salivation, trembling, pacing, hiding, and auto-grooming.

2.8 Statistical Treatment of Data

Statistical analyses were performed using Excel, JMP Pro 16, and R version 4.3.1. For the scale mounting data, we used a logistic regression model to model the probability of scale mounting success and a gamma model to model the time to mount the scale. Both the logistic and gamma models were fit using the same process. Initially, group, condition, handler, and all possible interactions between those variables were included as fixed effects. The individual dog and condition order were included as separate random intercepts. Interaction effects were removed sequentially following a backward stepwise variable selection technique. The p-values of the variables remaining in the model from the overall type 3 ANOVA were used to determine when to stop removing variables. Variables were removed
until all the $p$-values were below the 0.05 threshold. The main effects of group and condition were never removed from the models since these were the study's primary aims. Both models were fitted using R statistical software version 4.3.1. The glmmTMB() function was used for model fitting. The logistic regression model was based on the gamma distribution with a log link function.

Behavioral data was included in an exploratory analysis of the effect of behaviors exhibited during the waiting period on future scale mounting outcomes. Three observers coded the recorded videos, and inter-observer reliability was scored at 20% of the videos ($a=0.9781$). Multivariate and univariate logistic regression models were used to evaluate the effect of total standardized behavior rates and proportions on scale-mounting outcomes. As an extension of the exploration, a presence/absence version of the analysis was performed, where the behavioral predictors were coded such that 0 indicated that the behavior was never observed, 1 was that the behavior was observed in only 1 video recording, and 2 was that the behavior was observed in both video recordings. Individual Fisher’s Exact Tests were used to analyze each behavior against scale-mounting outcomes since logistic regression was not tractable given the small cell counts in several cases.

Descriptive plots and statistics were used to characterize the dogs Excluded before the scale mounting experiment for being deemed ‘too stressed’ to continue participating in the study ($n=9$) against the dogs excluded from the experiment ($n=41$). Because the experiment was designed to evaluate the scale mounting groups FL and LP and the conditions M and NM rather than behavioral factors, it was impossible to statistically consider the possible effects of waiting room behavior. Therefore, they were not directly compared to the dogs who participated in the experiment ($n=41$). This descriptive analysis was done solely to identify some of the implicit behavior recognition patterns experts used to determine a dog was inherently ‘too stressed’ to proceed with participation.

2.9 Ethical Note
All dogs participating in this study were owned or fostered and remained in the care of their owners or fosterers. The entire procedure was carried out within 30 minutes. Owners and fosterers were not instructed to withhold food, play, exercise, or any other resource that could impact their welfare. This study was conducted with the Virginia Tech Institutional Animal Care and Use Committee (IACUC #43-023) approval.

**RESULTS**

**3.1 Scale Mounting Experiment**

**3.1a Latency Measures**

Of the 50 enrolled dogs, 24 were assigned to the FL group for the scale mounting experiment, and 26 were assigned to the LP group. However, nine of the 50 dogs were excluded from the scale mounting experiment during their session because they were deemed ‘too stressed’ to continue their participation. Thus, the scale mounting experiment was reduced to 41 total dog participants ($N_{FL}=20; N_{LP}=21$).

The mean time to mount the scale within the FL group was less ($\text{mean}_{FL}=14.9s, SE=0.998$) than the mean time to mount the scale within the LP group ($\text{mean}_{LP}=16.6s, SE=0.958$). Mean times to mount the scale by group and condition was such that $LPM=16.4s (SE=1.196); LP_{NM}=15.3sec (SE=1.123); FL_{M}=12.9sec (SE=0.953); and FL_{NM}=15.3s (SE=1.166)$. Our findings revealed that dogs mounted the scale significantly faster when a scale mat was present in the FL group than when no mat was present ($p=0.0215$; Figure 1).

**Figure 1**

*Mean Latency to Mount Scale by Group and Condition*
**Note.** Means for guided (LP) and lured (FL) groups by M and NM conditions. Error bars show standard errors. Bars labeled with an asterisk indicate a significant difference in latency as determined by the zero-inflated gamma model ($p=0.0215$).

Additionally, on average, dogs handled by TS mounted the scale 3 seconds faster than dogs handled by MP ($mean_{TS}=13.5s$, $SE=0.986s$; $mean_{MP}=16.5s$, $SE=1.049s$; $p=0.0332$; Figure 2).

**Figure 2**

*Mean Latency of Successful Mounting Trials by Handler*
Note. Means for successfully recorded scale mounting trials by handler, TS and MP, are shown. Error bars show standard errors. Bars labeled with an asterisk indicate a significant difference in latency as determined by a truncated gamma regression model ($p=0.0332$).

3.1b Mounting Probabilities

A significant difference in mounting probability was found based on the mat condition ($mean_{Mat}=99.1\%, \ SE=1.18\%, \ mean_{No\ Mat}=97.0\%, \ SE=3.52\%, \ Relative\ Risk=1.02, \ p=0.03$). However, the handler showed an even greater impact on scale mounting probability than the scale mat. On average, dogs handled by MP were almost 1.5 times more likely to successfully mount the scale.

Figure 3

*Probability of Scale Mounting by Handler*
Bars labeled with an asterisk indicate a significant difference in the probability of success using the handler as a predictor as determined by a zero-inflated gamma model with a logistic regression component ($p=0.002$). As suggested by the standard error values, dogs handled by TS also varied more in their intrinsic tendency toward mounting than dogs handled by MP.

All enrolled dogs were included in this analysis, including dogs in the Excluded category, all of which had been assigned to handler TS. After removing the Excluded dogs ($n=9$) from the data set, a secondary analysis was run. Results from a Chi-squared test of dogs within the Successful and Attempted groups only showed no significant difference in scale mounting success by group or condition. Results also showed no statistical significance of the observed counts by handler ($p=0.177$, Table 3).

Table 3

*Observed Counts of Successful and Unsuccessful Scale Mounts by Handler*
<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS</td>
<td>88</td>
<td>20</td>
<td>108</td>
</tr>
<tr>
<td>MP</td>
<td>121</td>
<td>17</td>
<td>138</td>
</tr>
<tr>
<td>Total</td>
<td>209</td>
<td>37</td>
<td>246</td>
</tr>
</tbody>
</table>

Note. Table shows data on the successful and unsuccessful scale mounts by handler only for the dogs that completed the study: Successful and Attempted. ‘Yes’ denotes a successful mount, and ‘No’ denotes a mistrial. Chi-square test showed no significant difference of handler on scale mounting success ($p=0.1777$, 1 degree of freedom).

3.2 Behavioral Coding

3.2a Relation to Scale Mounting Probability

Each dog participating in the scale mounting experiment ($n=41$) was recorded during two pre-experiment waiting periods; however, due to technical and equipment malfunction, two participants’ waiting periods were not accurately captured and excluded from the multivariate and univariate logistic regression models analyses ($n=39$). We did not find statistically significant differences in observed behaviors between Successful dogs and Attempted dogs. However, owner contact ($p=0.0256$) and tail tucking ($p=0.0516$) were significantly and nearly significantly related to scale mounting success based on Individual Fisher’s Exact Tests. In both cases, dogs categorized as ‘Successful’ participants displayed lower proportions of both behaviors (Figures 4 and 5).

Figure 4

Presence of Owner Contact by Scale Mounting Success Group
Note. Bars labeled with an asterisk indicate a significant difference in the number of waiting period video recordings in which owner contact was observed within Successful and Attempted dogs, as shown by Fischer’s Exact Test ($p=0.0256$).

**Figure 5**

*Presence of a Tucked Tail by Scale Mounting Success Group*
Note. Bars labeled with an asterisk indicate a significant difference in the number of waiting period video recordings in which a tucked tail was observed within Successful and Attempted dogs, as shown by Fischer’s Exact Test ($p=0.0516$).

3.2b Descriptive Behavioral Analysis of Excluded Dogs

None of the dogs excluded ($n=9$) from the scale mounting experiment were able to attempt getting onto the dog scale. One of these was excluded within the pre-experiment 3-min waiting period, while eight were excluded after the unfamiliar handler approached and took control of the leash from their owner. These dogs differed in showing no resting, more standing, less tail wagging, more tail tucking, and less lip/nose licking (Figures 6 and 7).

Figure 6

*Mean Proportion of Behavior Durations by Success Group*
Note. Success Group 1 is Successful, Group 2 is Attempted, and Group 3 are Excluded dogs.

Figure 7

Mean Standardized Rate of Behavior by Success Group
Note. Success Group 1 is Successful, Group 2 is Attempted, and Group 3 are Excluded dogs.

DISCUSSION

4.1 Participants

Of the 50 dogs enrolled in the study, 18% (n=9) were removed from participation for signs of severe stress, and all but one were removed after the 3-min waiting period when the handler approached to walk them away from their owners towards the scale.

Research has shown that dogs display attachment to their owners, like infants and their parents (Topál et al., 1998; Palmer & Custance, 2008; Mariti et al., 2013). Gácsi and colleagues (2013) investigated the effect of the owner-dog relationship on dogs’ behavioral and physiological responses within social situations, finding that when a dog is frightened, they will seek out their owner (“Safe Haven Effect”). Mariti and colleagues (2013) found that the presence of an owner reduced the extent of the stress response in new situations, known
as the “Secure Base Effect.” Höglund and colleagues (2012) found that a dog’s blood pressure and heart rate increased during the owner's absence compared to the owner's presence, suggesting that the owner's absence can trigger a dog’s physiological stress response. Given that owners remained in the room with their dogs throughout the experiment and were never out of sight of their owners, the presence of owners during data collection is likely sufficient in providing dogs with both a “Safe Haven” and “Secure Base.”

However, with eight of nine excluded dogs removed from participation because they could not interact with the research handler, our findings suggest more than owner presence is needed in providing the level of support stressed dogs may need to interact with an unfamiliar person in an unfamiliar environment. Csoltova and colleagues (2017) investigated the effects of owner presence during a veterinary examination, finding that owner presence alone was insufficient in attenuating dogs' behavioral and physiological stress responses. Our findings align with previous research that stress levels in dogs, as perceived by their owners, is correlated with reduced social contact between dogs and an unfamiliar person inside a veterinary clinic (Lind et al., 2017). Future research should consider replicating this study. Still, instead of having two handlers unfamiliar with the dog, one group could be handled by their owners to help extract and investigate whether the unfamiliar handler is a barrier to getting a dog onto a scale for weighing.

4.2 Scale Mounting Experiment

This study investigated whether a food lure, physical prompting, and a scale mat would impact dogs’ latency, probability, or success rate of getting onto a dog scale within a veterinary clinic context.

4.2a Latency Measures

It was hypothesized that using a non-slip scale mat could improve the procedural efficacy of obtaining a dog’s weight for both groups, FL and LP. Although analysis revealed no significant differences in the mean time to mount the scale between the FL and LP groups
or the M and NM conditions, dogs lured with a treat onto a scale with a mat mounted the scale significantly faster than dogs in other groups.

The use of a food lure and scale mat to improve scale-mounting efficiency is consistent with veterinary field expert recommendations to use treats and non-slip surfaces within a veterinary clinic setting (Moffat, 2008; Yin, 2009; Overall, 2013; Herron & Shreyer, 2014; Hammerle et al., 2015). Lloyd (2017) asserts that food improves cooperation and provides a means of minimal restraint within a veterinary setting. It is possible that in this study, the salience of the food used to lure dogs onto the scale with the mat present offered the dogs an opportunity to contact the scale under a more stable and secure condition, leading to generally improved cooperation. In our study, the mat was a different color and texture than the reflective scale itself, which could have impacted our results. It would be interesting in future research to look at whether the difference in texture or color accounts for the difference in scale mounting latencies. It is possible the scale mat did not improve the procedural efficiency of the LP group because the physical pressure/tension applied to the dog’s leash by the handler functioned as an aversive controlling condition, overshadowing the salience of the scale mat. Dogs in the LP group could have been motivated to oppose the physical efforts of control, prompting them to resist via countercontrol, a functional class of escape-avoidance behaviors exhibited in response to aversive conditions established by a controller (Delprato, 2002). This is a likely possibility, as dogs were on leash and unable to escape the scale-mounting experiment easily. Countercontrol efforts do not necessarily need to be ‘effective’ insomuch as they are exhibited to oppose the controlling conditions established by the controller (Delprato, 2002).

We also found that when dogs did mount the scale, those handled by TS mounted the scale significantly faster (mean of 3 sec) than dogs handled by MP. Upon further investigation, our results are not surprising. Because TS developed the scale mounting procedures, it is possible that this served as a factor in improving the proficiency of TS as a
dog handler for this study. However, given that TS is a dog trainer who handles a variety of dogs in a professional capacity and MP does not work with dogs professionally, it is more likely that dogs handled by TS mounted the scale quicker due to a variance in handler experience. Although handlers were not systematically evaluated, professional dog trainers likely possess the skills, knowledge, and expertise necessary for making in-the-moment decisions that improve handling outcomes. In a study by Hennessy and colleagues (1998), women, but not men, were found to be effective in moderating the stress response of dogs in a shelter environment via handling (petting) as measured by cortisol levels. The women in this study had considerably more experience working with dogs in various contexts, such as dog training classes, than the men. In a follow-up study, the authors aimed to parse out the primary explanation for the differences between the efficacy of the two groups (men versus women). They found that once instructed on how to interact with dogs in a manner that lends to stress reduction, the men were as effective as the women in moderating cortisol responses in shelter dogs (Hennessy et al., 1998). These data suggest that the study could have been improved by providing the handlers with more thorough, specific instructions and standardized training on the handling procedures. Future research should consider controlling for handler effects through training and/or selecting matched pair handlers (e.g., owner and owner; dog trainer and dog trainer; veterinary staff and veterinary staff).

4.2b Mounting Probabilities

Dogs handled by MP were approximately 1.5 times more likely to mount the scale in general than those handled by TS. This was initially surprising, notably because we suggested that TS should be a more proficient and skilled handler than MP. When we accounted for dog-to-handler familiarity, we found that of the 50 enrolled dogs, 12 had a history of positive reinforcement training with handler TS. These dogs were, therefore, assigned to handler MP and accounted for 52% of the dogs handled by MP. Positive reinforcement training has been suggested to have positive impacts on future physiological measures correlated to stress.
responses (Lambeth et al., 2006; Vieira de Castro et al., 2020). Vieira de Castro et al. (2020) found that secure attachment was more consistent in dogs trained using positive reinforcement and that cognitive biases outside training contexts were improved. Positive impacts on the efficiency and efficacy of addressing target behaviors have also been suggested in animals trained using positive reinforcement (China et al., 2020).

Mounting probabilities by handler also included dogs excluded from the scale mounting experiment. This means that nine dogs who never encountered the scale mounting procedure, all of whom had been designated to TS for handling, did not mount the scale. It is possible TS was, by default, assigned to handle dogs who were inherently more stressed, fearful, or otherwise “difficult to handle.” The distribution of these dogs was unbalanced because of the dog-to-handler familiarity constraints within the study design. The efficacy of getting onto a scale in a veterinary setting may correlate to a dog’s temperament. Stellato and colleagues (2021) posit that a dog’s personality is related to fear and aggression at the veterinary clinic. The effect of a dog’s personality on their ability to cope with stressors such as veterinary clinic visits warrant further, in-depth exploration. We suggest that future studies analyzing veterinary visit stress incorporate the Canine Behavioral Assessment & Research Questionnaire (C-BARQ).

Use of the scale mat improved mounting probability by 2.1%, suggesting that a scale mat may improve the likelihood of a dog getting onto the scale. Practical advice often purports the scale mat alone to function as a helpful tool in improving a dog’s experience at a veterinary clinic (Overall, 2013; Herron & Shreyer, 2014; Herron, 2015; Lloyd, 2017). However, dogs in the group with the mat but not the food lure did not mount the scale significantly faster than dogs without the mat, suggesting that adding a scale mat alone may not be impactful enough among most dogs when visiting a veterinary clinic.

Food treats and scale mats, however, are standard practical recommendations for improving veterinary visit-related dog experiences as separate impactful factors. Our findings
revealed a statistically significant interaction between the two. As such, field experts should consider specifying practical recommendations to assert the benefit of using a food lure and scale mat conjunctively when obtaining a dog’s weight. This updated specification to current standards would be easy, efficient, and inexpensive to implement and more likely to positively impact the veterinary visit experience for a wide array of dogs.

### 4.3 Waiting Period Behavioral Coding

#### 4.3a Stress Behavior and Scale Mounting Probability

Dogs who completed all experimental trials of scale mounting displayed statistically significantly lower proportions of owner contact (Figure 4) and nearly significantly lower proportions of tail tucking (Figure 5) in the pre-experiment waiting periods. In other words, as the probability of scale mounting increased, proportions of owner contact and tail tucking, behaviors often associated with increased stress levels (Dreschel & Granger, 2005; Döring et al., 2009; Guitierrez et al., 2019), decreased.

As such, there is likely a correlation between a dog’s stress levels, as evaluated through observed behaviors, and their ability to complete a routine veterinary care procedure. The decreased presence of owner contact in Successful dogs suggests if a dog is seeking physical contact from its owner, it is more likely to experience difficulties completing a seemingly easy and routine veterinary care procedure, such as mounting a scale to record an accurate and up-to-date weight. Based on attachment theory research and the findings in our study, it could be suggested the more Successful a dog was in our scale mounting experiment (and therefore the less proportions owner contact and tucked tail they displayed); the more likely they are to have a secure attachment style. Moving away from an attachment figure in a novel environment but returning to that attachment figure when needed would indicate a secure attachment style. The design of our study parallels the design of the experiments investigating attachment styles in that we included a novel environment, a chance for exploration, and separation from the owner.
Additionally, initiating physical contact could be a behavioral indicator that a dog is attempting to cope with a stressful situation or environment. Feuerbacher and Wynne (2014) found that an unfamiliar environment might function as an establishing operation, making physical contact more reinforcing for pet dogs, mainly if the physical contact is from an attachment figure. Csoltova and colleagues (2017) investigated the effects of owner-dog interactions during a veterinary examination (stressful situation). They found that dogs indicated lowered stress levels, as measured by behavioral and physiological reactions when having physical contact with their owner. Petting has been shown to reduce stress in shelter dogs (Hennessy et al., 1998).

Although practical advice often includes advising owners to comfort their dogs during distress, owners may not be proficient in visually identifying their dogs’ stress. Lind and colleagues (2017) found that observer agreement between dog owners and veterinary professionals was higher when assessing pain versus stress. Specifically, stress behaviors most frequently identifiable by owners include trembling and whining, aggressiveness, excessive barking, and panting, while subtle behaviors such as looking elsewhere, head turning, yawning, or nose/lip licking were more rarely identified by owners as stress behaviors (Mariti et al., 2015). Owners should comfort their dogs with physical contact if they initiate that contact. In addition, veterinary staff should advise owners to freely offer physical contact to their pets if the dog attempts to make physical contact with their owner.

As with owner contact, the presence of tail tucking decreased as the probability of scale mounting increased. Our findings align with previous research that has identified tail tucking as a behavioral indicator of stress in dogs (Döring et al., 2009), offering data towards validating the correlation between a dog tucking its tail and the negative affect that dog may be experiencing. Tail tucking should be included in future research to validate visual analog scales of behavioral stress indicators.
Other commonly reported behaviors indicative of stress in dogs that we also analyzed were yawning, shaking off, panting, and lip/nose licking (Schilder & van der Borg, 2004; Döring et al., 2009; Lloyd, 2017; Srithunyarat et al., 2018; Guitierrez et al., 2019; Kartashova et al., 2021). Our findings were inconclusive. However, we found that lip/nose licking was higher in dogs that completed the experimental trials. This was the opposite of what we hypothesized, given lip/nose licking is often cited as a behavior indicative of stress. However, Beerda and colleagues (1998) cited lip licking as potentially helpful in evaluating acute stress levels in social contexts. The waiting period we video recorded and analyzed was not of a social context. Additionally, the behaviors we analyzed had great individual variation, correlating to previous research on stress-indicating behaviors in dogs (Beerda et al., 1997; Kartashova et al., 2021).

Future research should consider parsing out potentially stress-indicating behaviors relative to the contexts in which they tend to be exhibited most. This could reduce behavioral variation and provide insights into new repertoires common amongst dogs in specific contexts such as social interactions, unfamiliar environments, or stressful situations, making accurate assessment and early intervention more feasible. Specifically, future research should aim to validate a Visual Analog Scale in which owner contact and tail tucking should be included. This would offer congruency and clarity in assessing a dog’s stress levels in real time between dog researchers, professionals, and owners. A validated Visual Analog Scale could be a cost-effective and easy-to-implement tool to help assess, manage, and mitigate negative experiences dogs may have when visiting the veterinary clinic.

4.3b Descriptive Behavioral Analysis of Excluded Dogs

As an exploratory analysis of behavior exhibited in the waiting period on the future inability to participate in routine veterinary care procedures, behavioral data were coded and analyzed from the scale mounting experiment for dogs deemed ‘too stressed’ to continue
participation. Analyses show that these dogs differed in five observed behaviors: resting, standing, owner contact, tail tucking, and lip/nose licking.

Of great interest and concern, these dogs displayed no rest behavior. Solomon and Wynne (1953) found increased restlessness in dogs anticipating a shock. Given that this subset of dogs spent no time resting, it is no surprise that they also spent more time standing. If they are unable to rest, then it is likely they are engaging in another behavior. As was seen with the dogs who participated in the study, Excluded dogs also displayed higher proportions of owner contact. This aligns with the previous research discussed, further supporting the notion that dogs in distress look towards their owners for emotional support through physical contact and/or will tuck their tails. Dreschel and Granger (2005) found that most dogs wanted to be near their owner when exposed to a recording of a pre-existing fear-inducing stimulus of a thunderstorm recording at a loud volume. We suspect that Excluded dogs were likely to seek contact with their owner because they were also experiencing stress.

Contrary to what we expected, though, Excluded dogs displayed lower lip/nose licking proportions. This could result from the considerable variation in observed behaviors of enrolled dogs during their waiting periods, as we saw some dogs who displayed quite a few behaviors and others who only displayed one or two behaviors of notable interest. The lip/nose licking behavior measure included an outlier, dog observation ID 43. This dog’s overall lip/licking count was 250, while the range across all dogs who displayed the behavior after excluding observation ID 43 was 0-26. Future analysis should consider re-analyzing the lip/nose licking behavioral category with the outlier dog removed from the data set.

Overall, results support previous research correlating owner contact and tail tucking to stress in dogs (Hennessy et al., 1998; Dreschel & Granger, 2005; Döring et al., 2009; Gácsi et al., 2013; Feuerbacher & Wynne, 2014; Lind et al., 2017; Csoltova et al., 2017; Gutierrez et al., 2019). Our findings align with previous research suggesting that dogs’ behavioral
responses to stressors are highly variable (Beerda et al., 1997; Döring et al., 2009; Stellato et al., 2021).

4.4 Limitations and Future Considerations

In this study, several variables could have impacted the scale, mounting experimental outcomes on latency and the probability of a dog getting onto the scale. First, although we aimed to create an environment like an actual veterinary clinic, our study took place in a dog daycare waiting room, of which we did not collect information about potential prior familiarity with the daycare. Second, we did not screen dogs for confounding variables such as physical disabilities, behavior problems, or medical issues. Additionally, we do not the training history of dogs, other than the 12 known trained dogs.

The design inherently poses confounding variables because the study was applied in natural conditions. We could not control for the possible impact of weather or travel to the location on dogs’ behavior. Although we tried to recruit a variety of dogs to represent the general pet dog population most accurately, this study was subject to convenience sampling, consisting of nearby dogs willing to participate. We controlled for dog variability by counterbalancing our experimental groups, though our matched pairs were not precisely similar pairs.

Future research into the stress of veterinary visits should occur in a veterinary clinic. This research should include collecting detailed information from participants to investigate the effects of variations in animal personality and contextual stimuli (Bliss-Moreau & Moadab, 2016; Stellato et al., 2019; Kartashova et al., 2021; Wess et al., 2022) on the efficacy of stress-reduction methods often recommended to dog owners. Lastly, future research on the impact of owner involvement in veterinary care-related procedures, such as allowing owners to handle their dogs instead of an unfamiliar person, is needed.

CONCLUSIONS
Most dogs experience stress at some point during a veterinary clinic visit. Given the frequency with which dogs must visit a vet clinic throughout their lives, it is important to continue researching how to mitigate and manage the stress experienced during such visits. One such way would be for veterinary staff and owners to ensure food treats are accessible throughout the visit. We propose clarifying practical recommendations for obtaining a dog’s weight at the vet, including the specificity of using scale mats and food lures concurrently. Based on current evidence, a food lure and non-slip scale mat are likely to help improve the efficacy and efficiency of obtaining a dog’s weight at the vet clinic.

Dog professionals should continue to advise owners to comfort their dogs during distress while educating owners on how to identify stress-indicating behaviors such as a tucked tail or a dog soliciting physical contact from its owner. Petting and physical comfort can be reinforcers, particularly in stressful situations like a veterinary visit. This is another reason to advocate for owners to support their dogs throughout the veterinary visit and for veterinary staff to include owners in their patients’ care routines. By whom a dog is handled within the veterinary setting can affect a dog’s stress levels. For this reason, owners should become more involved and hands-on during visits to the clinic. Having owners handle their dogs onto the scale for weighing would be an additional, easy-to-implement, cost-effective (free), and immediate factor to manipulate in the real-world context of veterinary clinic visits.
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Appendix A

Email instructions to study participants

“Dear [        ],

Appointment Reminder for [Dog’s Name] on [Date & Time].

This is an email reminder about your upcoming appointment with Tiffany Score for the Canine Research Study on stress related to veterinary care. Please arrive no earlier than 5 minutes before your appointment slot. Your appointment will take no longer than 30 minutes. Upon completion, you will be entered to win a $50 gift card at a local dog shop.

What to bring: Your dog will need to be on a 6 foot leash attached to a flat collar, harness, or cloth martingale collar. Please also bring a small bag (snack ziploc size) of your dog’s preferred treat, cut into approximately 3 cm pieces.

What to expect: You will be parking in the Pet Lodge of Pinehurst Daycare Center parking lot. Please do not exit your vehicle until instructed to do so. A researcher will approach your vehicle with a clipboard and pen where you will be given a copy of a consent form to read and sign.

During the appointment: Once your appointment begins, you will enter the building and sit on the bench directly to your left, with your dog on leash, for approximately 3-5 minutes before a trained handler approaches to take your dog across the waiting room. Your dog will have a 5 minute decompression break outside between the first and second round of participation.

Your participation is so greatly appreciated, valued, and infinitely important. I look forward to seeing you and your dog during their appointment and could not be more grateful for your time and energy!

Kindly,
Tiffany Score
IACUC #23-043