

Comparing Environmental Enrichment in Kenneled Shelter Dogs

Subjects: Zoology

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Dogs in shelters are often exposed to unavoidable stressful events. Finding effective and novel enrichment for dogs, especially the longer they stay in that environment, is a significant welfare concern. Researchers wanted to compare the effectiveness of enrichment items as a stress buffer for shelter dogs during the acute stressor of the morning cleaning and to support a proposed prescription system of enrichment. This new system would focus on post-enrichment behaviors. Tactile items, such as blankets and the scent of lavender, were the most effective at reducing stress-related behaviors seen in kenneled dogs rather than the more commonly used food enrichment items. The results suggest that the type of enrichment item should be thoughtfully chosen during acute stress events, which would then optimize a shelter's limited resources, decrease stress-indicative behaviors, and indirectly reduce the need for euthanasia by increasing adoption rates.

Keywords: enrichment practices ; stress reduction ; captive animal welfare ; sensory stimulation

1. Introduction

At least 3.1 million dogs enter shelters annually in the United States, and just under 400,000 dogs were euthanized in 2019 ^[1]. Decreasing the euthanasia rate while providing each of these dogs with proper care and food requires substantial shelter resources. In addition, the average length of stay for dogs in shelters historically tends to rise as euthanasia decreases ^[2], and a longer length of stay means each dog is using more shelter resources, on average, compared to the past. The increased length of stay is also a priority welfare issue considering the dogs will be undergoing potential stress for long periods. Even if animals have the best physical care possible, they can still experience poor welfare if their mental requirements are unmet ^[3].

Regardless of the minimum level of welfare provided, there are particular (possibly negative) situations no organization can realistically avoid, such as surgery and general husbandry procedures. Despite their necessity, the captive animal can perceive these events as negative. In fish, for example, rigorous tank cleaning lowered survival rate and decreased their immune response compared to less invasive scrubbing ^{[4][5]}. Minimized immune responses leave animals vulnerable to sickness and may slow down their recovery, potentially leading to early euthanasia in an attempt to save resources for healthier animals. In shelters especially, cleaning procedures cannot be avoided because of the average dog's urination frequency. These practices also cannot be greatly altered, such as not using power washers, due to the need for efficiency in overcrowded and underfunded shelters.

1.1. Behavioral Welfare Measures in Captive Animals

There are different measurements that researchers can use to try to evaluate the welfare of their animal subjects. Behavior measurements are used because they are cost-effective and have been used in numerous studies to determine the animal's welfare state in question ^[6]. Observing the animal's behavior may be one of the best indications of preference or aversion ^[7]. It can indicate different emotional states ^[8]. Shelter staff can then use picture representations of correlated behaviors to determine the animal's overall stress level. These representations often include overall 'body position', body language, and other validated stress behaviors, which can be used to assign a stress score or value ^[9]. For example, common behavioral indicators of poor canine welfare include frequent vocalizations, crouching (i.e., heads below the chest line), flattened ears, or a lowered tail ^{[2][9][10][11][12]}.

One of the things welfare evaluations indirectly measure is an animal's stress level. There are two types of stress, chronic (commonly studied) and acute. The latter includes short periods where an organism undergoes higher than normal stress levels, such as being restrained. Loud and/or unpredictable daily cleaning would be a typical example of an activity that results in acute stress for a kenneled dog. With this example, the dog undergoes at least one example of acute stress

(i.e., daily cleaning) while dealing with the chronic stress of being in a new environment (the shelter). Because chronic and acute stress has adverse health effects on animals [12], understanding the effect of husbandry on stress levels is a priority welfare concern.

Shelter dogs experience both acute and chronic stress in varying degrees [12], which can lead to immune suppression in dogs [13] and illness in cats [14]. This suppression reduces the animal's ability to fight off infections, which can further drain shelter resources. Noise levels in shelters (usually over 100 dB) are above the OSHA regulations for factory workers [15] and are one example of a chronic physical stressor that dogs cannot avoid. Another potential chronic stressor (for a social species such as dogs) is the standard shelter setup of single housing, which is associated with erratic movements and increased barking [16]. A common source of acute stress for shelter dogs is being newly admitted. This change in environment usually results in a characteristic cortisol spike for at least three days after initial admittance [13] and has been shown to lead to a heightened immune response [2]. Unlike the impact of being newly admitted, the effect of the acute stress resulting from daily cleaning on shelter dogs has not been well studied.

1.2. Environmental Enrichment and Stress

Chronic stress in captive animals has been well studied. The most common method used to reduce chronic stress is adding items to the environment, referred to as enrichment, which has decreased the frequency of certain behavioral disorders [16]. Enrichment is used in shelters and has been shown to improve the overall welfare of dogs [8][15][17][18][19]. Enrichment plans are successful if they increase desirable behaviors, such as play, and decrease stereotypical behaviors or other behaviors associated with poor welfare, such as frequent vocalization [20]. Stereotypical behaviors are defined as relatively repetitive behaviors that seem to have no immediate purpose and may be a means of coping with poor welfare, either in the past or present environment [21][21]. It has been found that dogs with an enrichment program were significantly more likely to pass their behavioral test [22].

Some have categorized environmental enrichment into animate and inanimate forms, such as inanimate types of enrichment focusing on affecting different senses, such as food, scent, and tactile enrichment, including toys and blankets [23][24]. However, further classification or comparisons are currently lacking, and in practice, most organizations give out enrichment with the belief that all enrichment is equally beneficial in all situations. Despite the amount of research conducted on specific enrichment items and human contact in the shelter [8][10][12][18][20][24][25][26][27][28][29][30], the effectiveness of different types of enrichment items in reducing stress during morning cleaning is one area yet to be explored.

The categories of enrichment could be further explored based on whether the item is more calming or arousing to the animal. Calming enrichment would consist of items meant to focus the animal on a specific item. Arousing enrichment would include items that are meant to encourage the energetic mental stimulation of the dog by an item in their kennel. Rather than organizations focusing on each behavior in isolation (i.e., jumping, fly snapping, or barking), focusing on groupings of behaviors could be more helpful in decreasing the proportion of overall undesirable behavior in one situation. Calming enrichment may be effective for overactive/reactive dogs, which often display multiple negative behaviors such as wall jumping and a high barking frequency. Arousing enrichment will be more beneficial for dogs with behaviors on the other extreme, such as fear, aggression, or hiding. Investigating which enrichment items could be optimal for individual dogs or behavior problems would enhance their effectiveness as stress reducers.

Beyond the kind of enrichment items mentioned above, enrichment that can target different sensory systems may also change the behavior of animals in different ways. Food enrichment (i.e., anything that involves access to food, such as puzzle boxes) is found in almost half of all studies with zoo animals [21]. Scent enrichment is one of the newest forms of enrichment for all animals [12][24], with most of the work done with cats and felids [23]. Certain scent items have been found to have a calming effect on dogs [23]. For example, lavender has been shown to encourage calm behaviors and decrease vocalization frequency during the acute stress of care rides [28][31][32]. In contrast, few studies have examined arousing scents. Prey urine was also found to increase overall activity levels, suggesting that arousing scent enrichment also influences behavior [32]. Overall, the effect of different scents on canid behavior is not well studied [33] and therefore requires more investigation to better the understanding. Tactile enrichment, such as blankets or toys, is one of the most common forms of enrichment used in shelters; however, despite its prevalence, it has not been well studied [23]. Previous studies have suggested looking more specifically at the type of toy (i.e., hanging versus laying on the floor) presented to dogs [34] instead of treating all toys equally enticing. This suggestion is important because toys that the dog ignores illicit no interaction and therefore are not effective enrichment items. Although different types of enrichments could engage different sensory modalities, they have not been compared in a single study to determine their effectiveness as a stress buffer during morning cleaning.

2. Shelter Dogs

ANOVAs and means of the main effects are summarized in **Table 1**.

Table 1. ANOVA Tests and Means for Main Effects.

	Body Position	Vocalization
Presence		
Enrich M (SE)	1.67 (0.03)	16.57 (1.05)
Control M (SE)	1.74 (0.06)	24.17 (2.23)
Between F(p)	1.18 (0.278)	9.55 (0.002)
Category		
Calming M (SE)	1.47 (0.07)	14.14 (2.62)
Arousing M (SE)	1.72 (0.07)	18.45 (2.81)
Control M (SE)	1.57 (0.12)	26.63 (4.94)
Between F(p)	3.64 (0.027)	2.63 (0.072)
Sensory		
Food M (SE)	1.65 (0.08)	14.73 (3.21)
Scent M (SE)	1.37 (0.11)	23.55 (4.18)
Tactile M (SE)	1.72 (0.08)	10.46 (2.91)
Control M (SE)	1.57 (0.12)	26.63 (4.94)
Between F(p)	2.72 (0.043)	4.00 (0.008)

Researchers first investigated whether the presence of enrichment was significantly different from no enrichment during acute stress. As seen in **Figure 1**, enrichment significantly lowered vocalization frequency compared to the no enrichment condition ($F(1,943) = 9.55$, $p = 0.002$). Researchers also examined if there was a difference between calming and arousing enrichment during acute stress (see **Figure 2**). On days when calming enrichment was given, a lower body position score associated with a more relaxed state was observed ($F(2,862) = 3.64$, $p = 0.027$) compared to when arousing enrichment was presented. The last main effect Researchers examined was whether one of the different sensory modality enrichments—food, tactile, or scent items—was more effective at the group level (**Figure 3**). When given scent enrichment, dogs exhibited the most relaxed body position ($F(3,862) = 2.72$, $p = 0.043$). In contrast, during days with tactile items, dogs had the lowest vocalization frequency ($F(3,862) = 4.00$, $p = 0.008$) compared to the other sensory items.

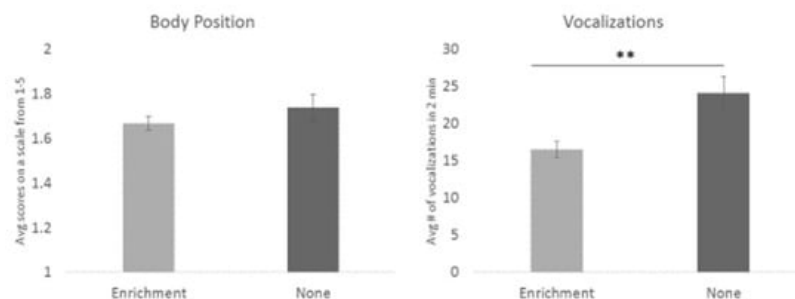


Figure 1. Comparison of the means of body position and vocalization frequency for enrichment presence to no enrichment. The presence of enrichment significantly affected vocalization frequency, such that dogs vocalized less on average when given enrichment. Asterisks denote significance below the $p < 0.01$ level. Error bars show \pm one standard error.

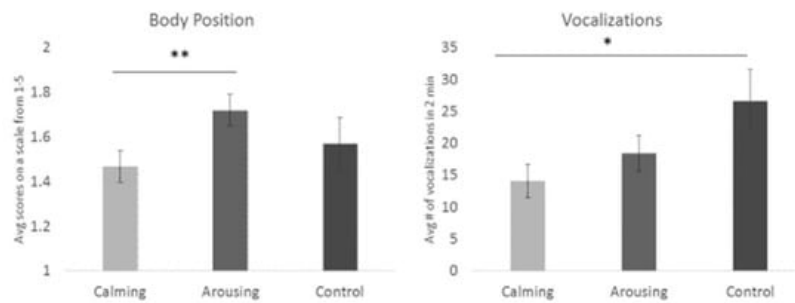


Figure 2. Comparison of the means of body position and vocalization frequency for calming to arousing enrichment. Body position score was lower (i.e., more relaxed) when dogs were presented with calming enrichment than arousing items. Calming enrichment items produced a significantly lower vocalization frequency than no enrichment. One asterisk denotes significance below the $p < 0.05$ level. Two asterisks denote significance below the $p < 0.01$ level. Error bars show \pm one standard error.

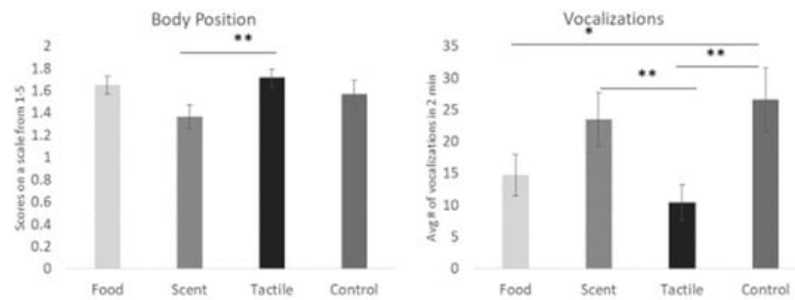


Figure 3. Comparison of the means of body position and vocalization frequency for food to scent to tactile enrichment. Scent items resulted in a lower body position score (i.e., more relaxed) than tactile items. The tactile items produced significantly fewer vocalizations than scent and no enrichment. One asterisk denotes significance below the $p < 0.05$ level. Two asterisks denote significance below the $p < 0.01$ level. Error bars show \pm one standard error.

In addition to the main effects described above, researchers also investigated if there were any interactions between the categories (calming vs. arousing) of enrichment and the different sensory modalities (food, scent, tactile) summarized in **Figure 4**. In the calming enrichment category, scent items produced a lower body position than food or tactile items ($F(2,862) = 4.05$, $p = 0.018$). When comparing the two scents (lavender vs. rabbit urine), the body position score was lowest with the calming (lavender) scent ($F(1,862) = 5.73$, $p = 0.017$), indicating that the calming scent produces the most relaxed state.

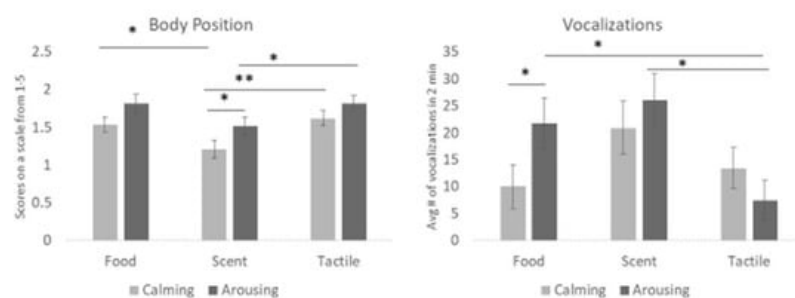


Figure 4. The figure illustrates the interaction between category and sensory modality. Calming scent items were associated with the lowest body position score (i.e., more relaxed) compared to the other enrichment conditions. Calming food had significantly lower vocalization frequency on average than arousing food. Arousing tactile items reduced vocalizations more than other arousing conditions. One asterisk denotes significance below the $p < 0.05$ level. Two asterisks denote significance below the $p < 0.01$ level. Error bars show \pm one standard error.

In contrast, there was a difference in vocalization frequency within arousing items. When tactile enrichment was given, dogs exhibited fewer vocalizations than when presented with food or scent items ($F(2,881) = 6.30$, $p = 0.002$). However, between the two food items (KONG® vs. tube), calming enrichment (KONG®) resulted in a lower number of vocalizations than the arousing item ($F(1,881) = 3.85$, $p = 0.050$).

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