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Social Contact in Shelter Dogs: Literature Review and Recommendations

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Abstract

Given the large number of dogs housed in animal shelters each year, it is important to consider how the shelter environment impacts a dog's welfare. Providing shelter-housed dogs social contact with conspecifics can increase the welfare of the dogs and benefit the shelter by increasing adoption rates. Mostly Mutts Pet Rescue and Adoption Center in Kennesaw, Georgia was investigating ways to increase social contact for the dogs in their facility. To assist with this goal, we conducted a literature review that examined the impact of social housing, playgroups, and visual social contact on dog behavior. Social housing and playgroups can provide welfare benefits, including reducing abnormal behavior and decreasing aggression, and can also increase adoption rates. There has been limited research on the effect of visual social contact on behavior, but dogs provided with visual access have been found to spend more time in the front of their crate (which has been shown to increase adoption rates). We also propose that visual access may supply the dogs with a sense of predictability and control over their environment, an important aspect of welfare. This literature review discusses the benefits, cautions of, and requirements for these three modes of increasing welfare via social contact. We conclude with recommendations for Mostly Mutts Pet Rescue and Adoption Center based on observations we conducted on site and the supporting literature. However, the benefits of these recommendations are not restricted to Mostly Mutts, as they may be of benefit to other shelters as well.

Social Housing in Shelter Dogs: Literature Review and Recommendations

Approximately 3.3 million dogs are placed in shelters annually (ASPCA, 2018). Stress, loud noises, diseases, and low predictability and control over the environment are all aspects of shelter life than can negatively impact a dog's welfare (Coppola, Enns, & Grandin, 2010). With so many dogs living in an inherently stressful environment, it is essential to utilize the best housing practices during a dog's shelter stay in order to not only increase their general welfare, but to increase their chances of finding a loving forever home.

One important factor that can aid in increasing a dog's welfare is social contact with conspecifics. Numerous studies indicate that there are major benefits to a dog's welfare when social contact is provided (Hubrecht, Serpell, and Poole, 1992; Mertens & Unshelm, 1996). Likewise, social isolation can lead to unfavorable effects. Dogs in single housing have decreased welfare as measured by increased cortisol levels (Beerda, Schilder, Van Hooff, De Vries, & Mol, 1999) and separation anxiety post-adoption (Mertens & Unshelm, 1996). Singly housed dogs also exhibit harmful and undesirable behaviors, such as aggression (Beerda et al., 1999), stool eating (Beerda et al., 1999), and excessive vocalizing (Hetts, Clark, Calpin, Arnold, & Mateo, 1992) at higher levels when compared with animals who either lived in groups (Mertens & Unshelm, 1996) or participated in play groups (Sommervile, O'Connor, & Asher, 2017).

Furthermore, having a social partner can buffer the effects of stress and anxiety (for review, see Kikusui, Winslow, & Mori, 2006). Many animals engage in symbiotic relationships with social partners that allow them to find food and protect one another from harm (e.g., Liddell et al., 2005; Regnier & Law, 1968; Seyfarth & Cheney, 2006). For example, animals in groups or pairs warn each other of incoming danger with vocalizations (Seyfarth & Cheney, 2006), visual signals (Liddell et al., 2005), and pheromones (for review, see Regnier & Law, 1968). Because

dogs have a long history of living in cooperative groups, a lack of social contact can be a significant stressor and can be detrimental to their general welfare (Hatch et al., 1965). Common means of allowing social contact can be attained through social housing, play groups, and/or visual social contact.

Benefits of Social Housing

Social Isolation and Abnormal Behavior

Researchers investigating the effects of social restrictions on both laboratory and shelter-housed dogs have found adverse effects of single housing on the dogs' wellbeing, including an increase in abnormal behaviors such as stereotypic behaviors (i.e., repetitive behaviors with no obvious function that are thought to indicate sub-optimal welfare) and self-directed behaviors. For example, Hubrecht, Serpell, and Poole (1992) compared the behavior of both laboratory and shelter-housed dogs in group housing versus single housing. While both single and group-housed dogs engaged in some repetitive behavior such as pacing, the group-housed animals' pacing behavior was classified as a form social interaction rather than a stereotypic behavior. When this social behavior was removed from analysis, group-housed dogs had significantly lower levels of stereotypic behavior (e.g. circling) when compared to group-housed dogs.

Similarly, Mertens and Unshelm (1996) investigated the effects of group housing versus single housing on shelter dogs by comparing two shelters in Germany. Both shelters had housing that included indoor and outdoor space, but one shelter housed dogs individually while the other housed the dogs in social groups except during feeding times. More of the individually housed dogs displayed behavioral problems during their stay at the shelter (31% as compared to only 11% of group-housed dogs). Additionally, 10% of the observed dogs in individual housing

demonstrated stereotypical movement, yet stereotyped behavior was not consistently observed in dogs held in groups.

Moreover, Hetts et al. (1992) compared the behavior of six dogs as they rotated through 3 months of pair-housing and 3 months of single-housing as well as through different sizes of enclosures. The pair-housed dogs spent significantly more time resting, whereas individually housed dogs spent more time moving and showed the greatest number of bizarre movements. When housed singly, dogs groomed more (a possible stress-related behavior) with increasing spatial restriction. However, this pattern was not seen in pair housing, suggesting social companionship may have a buffering effect from environmental stressors.

Beerda et al. (1999) investigated the effects of social and spatial restriction on 15 dogs by comparing their behavior during six weeks in which they were housed indoors in individual kennels to their behavior during six weeks in which they were housed outdoors (with access to shelter) in groups. While the dogs were housed singly, they showed signs of increased stress and abnormal behaviors including feces eating, repetitive behavior, paw lifting, vocalizing, and self-grooming. In addition to routine observations, researchers also challenged each dog while living in each condition by taking them outside of their home enclosures and exposing them to various potential stressors, including an unknown room and hall, a novel object, a loud noise, and an unknown dog. Compared to when the dogs were housed socially, when the dogs were challenged during their period of single housing, they reacted with increased excitement (e.g., increased circling, urinating, defecating, and displaying a higher posture) increased aggression (e.g., raised hairs, growling, dominant postures), and increased uncertainty (e.g., paw lifting, trembling). In a shelter environment, these are the behaviors potential adopters are likely to notice when dogs are removed from their kennels during adoption meet-and-greets.

Social Housing and Desirable Behavior

In addition to minimizing the risk of developing abnormal behaviors, providing dogs with social contact promotes desirable and healthy behaviors. Dogs housed in groups have been shown to display significantly higher activity levels (Hubrecht, et al., 1992). Socially-housed dogs also vocalize significantly less than those housed singly (Beerda et al., 1999; Hetts et al., 1992). Additionally, Mertens and Unshelm (1996) found that dogs housed in groups showed more appropriate and affiliative responses towards humans than those housed singly. Dogs housed singly were more likely to display fear aggression than those housed in groups, and 80% of the socially-housed dogs approached humans in a friendly manner, whereas only 43% of singly-housed dogs did so (Mertens & Unshelm, 1996). Even within singly-housed dogs, those dogs given visual access to other dogs spent more time at the front of their cages (Wells & Hepper, 1998), a behavior shown to increase adoptions (Wells & Hepper, 1992).

Social Contact and Adoption Success

Not only does social housing increase general welfare and decrease abnormal behaviors, it can also increase adoption rates and adopter satisfaction with their adopted dog. Evaluation of a program in Italy designed to increase adoptions indicated social housing was one of several integral factors contributing to an increase in shelter adoption rates. The shelter in which the program was executed saw an adoption rate that was 27.5% higher than the adoption rates of surrounding shelters (Menchetti, Mancini, Catalani, Boccini, & Diverio, 2015). In further support, Mertens and Unshelm (1996) found that, on average, group-housed dogs in shelters were placed within 10 days. In comparison, dogs housed individually were in the shelter 17 days before being placed in homes.

A successful adoption involves finding a dog a permanent home. Unfortunately, dogs adopted from shelters are sometimes eventually returned or relinquished. A study doing follow-up on adoptions found 14.7% of all adopted dogs from their shelter were returned to the shelter within 6 months of adoption (Diesel, Pfeiffer, & Brodbelt, 2008). Behavioral reasons are a common cause for relinquishment (New et al., 2000), especially in dogs acquired from shelters (Salman et al., 2000). In one study, behavioral problems were listed as the reason for return in 89.7% of all relinquishments (Wells & Hepper, 2000). Wells and Hepper (2000) found that 38.8% of owners returning dogs reported that behavioral problems, including problems with other pets in the home, were a primary reason for return. Similarly, Kwan and Bain (2013) found that aggression was a reason for relinquishment in 47% of all surrenders.

Thankfully, socially housing dogs while they are in the shelter can help to decrease these problem behaviors and increase owner satisfaction. Mertens and Unshelm (1996) found that 25% of previously single-housed dogs they tested were returned to the shelter, but only 9% of previously group-housed dogs were returned. Additionally, 52% of the owners of dogs from group kennels reported no behavioral problems with their dogs, whereas only 11% of the owners of individually housed dogs reported no behavioral problems after placement. Finally, 53% of the adopters of group-housed dogs reported complete satisfaction with their adoption. In comparison, 88% of owners of individually housed shelter dogs complained of problems post-adoption.

Providing dogs with social opportunities while in the shelter can both improve welfare and improve adoption outcomes. While full-time social housing is ideal for shelter dogs, this arrangement is not always feasible nor practical. Play groups and visual contact are additional ways shelters can allow dogs beneficial social contact.

Play Groups

Benefits

There is a plethora of scientific literature concerning the benefits of play among dogs (for review, see Sommerville, O'Connor, & Asher, 2017). There are numerous underlying reasons as to why dogs crave play with conspecifics. Play allows a dog to release their pent-up energy (Bradshaw, Pullen, & Rooney, 2014) and teaches important social skills (Bekoff, 2001). In the shelter environment, dogs in an experimental play group also showed less stress-related behaviors than those in the isolated control group (Belpido et al., 2010).

Play with conspecifics is not just a biological craving. It also increases desired characteristics such as the development of appropriate social skills, which is especially important for juvenile dogs (Bekoff, 2001). This could increase adoptability for the dog, especially in cases where the potential adopter owns another/other dog(s). Moreover, Flower (2016) found that when dogs are isolated for an extended period of time and then are introduced to another dog, they are more likely to be aggressive in that initial encounter. This behavior presents a safety hazard within the shelter and may also discourage potential adopters who already own dogs and/or who wish to take their dog on outings where they may encounter other dogs.

Rearing dogs in an environment that fosters play with conspecifics decreases the likelihood that they will develop separation anxiety (Harvey, Craigon, Blythe, England, & Asher, 2016). The prevention of separation anxiety, which is a severe and persistent illness that can result in bodily harm, is essential for shelter dogs, as they are at a higher risk for developing it and are resistant to treatment even after being homed (Schwartz, 2003; Takeuchi, Houpt, & Scarlett, 2000). Since puppyhood is a critical period for social development (Freedman, King, &

Elliot, 1961), it is especially important for puppies housed in a shelter environment to take part in play groups to lessen the likelihood of developing social anxiety.

Even brief exposure to conspecifics can influence behavior positively. Gfrerer, Taborsky, and Würbel (2017) examined the influence of short-term (once weekly) social exposure on a group of military dogs. Those dogs given weekly play session displayed fewer negative behaviors (e.g., still posture, growling, attacks) when tested with an unknown dog and with a stuffed dog model.

On a more anecdotal note, countless shelters have had remarkable outcomes. One such situation included a Pit-Bull mix introduced to a shelter after receiving a dog-to-dog temperament test that deemed him "dog-aggressive"; when introduced to a playgroup, the dog exhibited no signs whatsoever of dog aggression while in the playgroup (Jackal, 2015). Aimee Sadler, founder of Dogs Playing for Life, asserts that "Dogs behaviorally deteriorate when they have been in a shelter too long; [however,] play enriches dogs' lives and reduces stress so their true personalities show" (Jackal, 2015, paragraph 4-5).

Even more outstanding are the statistics from the shelters that utilize playgroups. These shelters report the percentage of dogs that leave the shelter alive regardless of behavior or health status, often called the live release rate (LRR). Edmonton Humane Society reported an 8% increase in their LRR following their first 30 days of playgroups. In 2001, Longmont Humane Society had an LRR of 76%, but after establishing playgroups in 2004, the humane society had a boost in LRR of more than 95%. Staff of shelters who use playgroups report that the playgroups decrease dog-dog aggression, leash reactivity, and territorial behavior, and increase the dog's focus during training. The staff also found using playgroups allowed for a more swift and convenient clean-up of kennels while the dogs are out playing (Jackal, 2015).

Cautions

Despite the many benefits that accompany the commencement of play groups, especially in the shelter setting, there are numerous drawbacks. Conducting playgroups requires more resources (e.g., increased volunteer or staff training) and increases the risk of dog fights and the risk for disease transmission. To address the risk factors, The Center for Shelter Dogs (2014) has a comprehensive manual on playgroups that suggests a shelter conducting playgroups should always have a leader, assistant, and at least one runner present whenever playgroups are in session. Personnel who facilitate play groups must be prepared and be knowledgeable on how to break up fights, group compatible dogs, provide supplies needed for playgroups, introduce new and potentially challenging dogs into established playgroups, and track a dog's behavior.

Establishing playgroups is a complicated process. In the Gfrerer et al. (2017) study involving socializing military dogs, the researchers noted that while some dogs were readily able to socialize off-lead, others were never able to be released form the leash or able to interact except through fencing. The researchers also had to use muzzles on some of the dogs in the beginning stages, and all dogs required constant monitoring and frequent intervention. With that said, some dogs may not fit into playgroups, especially dogs that have been housed in isolation for an extended amount of time.

In regard to facilities needed for conducting play groups, Dogs Playing for Life (Feeny 2014), a consulting group specializing in helping shelters set up play groups, suggest it is necessary for facilities conducting playgroups to include multiple interconnected yards as opposed to one wide-open area, catch pens at every entrance, gates that swing both ways, kiddie pools instead of water bowls to reduce resource guarding, and carabineers to clip a dog's leash to incase of an emergency situation, in addition to other tools and materials.

As for disease transmission, Mostly Mutts quarantine their dogs and give them excellent veterinary care; therefore, reducing the risk of disease transmission. However, there are viruses such as the Canine Papilloma Virus with long (1 – 2 month) incubation periods that are common in juvenile, elderly, or stressed dogs (MacPete, 2014). Viruses such as these continue to pose a risk for shelter dogs, and social contact increases this risk.

Visual Social Contact

Benefits

Visual social contact can be achieved through allowing dogs to see each other through their kennels and is a way to allow social contact between dogs while decreasing the risk of disease transmission or physical altercations. Wells and Hepper (1998) examined the effect of visual access on the behavior of shelter dogs by comparing dogs who were housed in cages that allowed the dogs to see dogs housed in kennels opposite theirs (n = 212) to dogs provided no visual contact with conspecifics (n = 195). They found that dogs with visual social contact to other dogs were more likely to stay toward the front of their cage, where they could see other dogs. Thus, when the choice is given to the dogs, they chose to see other dogs. This indicates a desire for social contact. This behavior has implications for adoption as well since dogs who stay in the front of their cage are considered more desirable by potential adopters (Wells & Hepper, 1992). These researchers found no difference in the amount of vocalization or activity between the dogs allowed visual social contact and the dogs denied visual social contact. They postulate that physical contact is likely needed to see changes in these behaviors (Wells & Hepper, 1998).

An additional benefit of visual social contact is that is gives dogs predictability and control over their environment. Both animals and humans exposed to uncontrollable or inescapable aversive events develop a condition known as learned helplessness (Seligman & Maier, 1967).

This state of learned helplessness impairs learning (Seligman & Maier, 1967) and leads to a depressed state (Seligman, 1975). However, making the aversive event predictable and/or controllable can mitigate some of these effects. A variety of species choose predictable or signaled shocks over unpredictable shocks even if the predictable shocks are more intense (see Badia, Harsh, & Abbott, 1979 for review). While shelter dogs are not subject to shocks, depending on a dog's history, aversive events in the shelter might include a neighboring dog barking or a person or dog approaching the dog's enclosure. With the limited lines of sight offered by the current housing conditions at Mostly Mutts, the dogs are not able to see a person and/or dog coming toward their kennel until they are right in front of the dog. This lack of predictability potentially leads to increased stress. Increasing the dog's line of sight (e.g., so that the door or neighboring dogs are visible), would make these events more predictable and could reduce stress and, potentially, social aggression.

The benefits of control go beyond the control of aversive events. Many consider control over one's environment to be an essential part of animal welfare (see review by Bassett & Buchanan-Smith, 2007). Giving captive animals some degree of control over noise, food, or water can lower cortisol levels and decrease social aggression, and fearful behavior (Hanson, Larson, & Snowdown, 1976; Mineka, Gunnar, & Champoux, 1986). For example, species such as rats (e.g., Voss & Homzie, 1970), pigeons (e.g., Catania & Sagvolden, 1980), and primates (e.g., Perdue, Evans, Washburn, Rumbaught, & Beran, 2014) all demonstrate a preference for having a choice (as compared with a no-choice condition) even when the eventual outcome is the same. While social contact between dogs has many benefits, it can be stressful to a dog when the dog is forced to have it. Giving the dog a choice between whether or not to be in visual or

physical contact with another dog would provide the dog with both the opportunity for social contact and a degree of choice and control over its environment.

Cautions

It is apparent that visual social contact has benefits; however, similar to play groups, there are also drawbacks. While dogs housed in adjacent kennels with visual access can interact through the bars, these interactions have been found to be minimal (Mertens & Unshelm, 1996), indicating that these limited social interactions fail to provide the benefits that full-contact social housing has. In addition, the sight of other dogs may facilitate socially-contagious barking (Solarz, 1970). Loud vocalizations can be harmful to not only the dogs in the shelter, but to the humans in the facility (Sales, Hubrecht, Payvandi, Milligan, & Shield, 1997). However, the one study that specifically examined the relationship between visual social contact and barking found no correlation between visual access and vocalizations, perhaps indicating that this is not a cause for concern (Wells & Hepper, 1998).

Observational Data

Over a period of six months, we conducted approximately 140 hours of observations at the Mostly Mutts facility. Half of these observations focused on observing the interactions and behaviors of the volunteers and dogs during walks. These observations occurred during shift times in the parking lot of the Mostly Mutts facilities where dog/walker teams come and go from the facility. We focused on dog behaviors such as reactivity to other dogs as well as on the consequences provided by volunteers (see Appendix A). The other half of the observations were focal-animal observations conducted on dogs in their crates. In these observations, we provided detailed observations about the frequency and duration of behaviors, including general activity

(e.g., position in the crate, posture, rest behaviors), vocalizations (e.g., barking, whining), and stress-related behaviors (e.g., lip licking, yawning, trembling; see Appendix B).

Walking

During our observations of volunteers walks, we paid special attention to the tautness of the leash and labeled the leash as either "loose" (lead relaxed, dog not straining against the lead or collar; bend and slack in rope is visible), "moderate" (taut leash, no slack, and dog's feet not lifted off ground), or "extreme" (taut leash with one or more of dog's front feet off ground). We found a moderate leash to be the most common state. Extreme leash tautness and leash pulls occurred most frequently when other dogs were present in the observation area. Loose leashes were rare when other dogs were present in the observation area. We also noticed frequent constricted breathing/coughing that coincided with when the leash was tight.

Mostly Mutts asks their volunteers and staff to keep dogs at a distance from one another, and this policy was largely followed. Individuals walking the dogs generally kept the dog they were responsible for several feet away from all other dogs. Many would move over so others could walk past them without coming too close or even stop and wait for the other pair to walk past. Perhaps because of this, we observed very few reactive or aggressive encounters between dogs. However, when we did see a reactive encounter, it was most commonly when dogs approached each other head-on as opposed to perpendicularly or in a parallel fashion. When reactive encounters did occur, the most prevalent response from the volunteer/staff was to pull on the leash and turn the dog in the opposite direction. Though the reactive encounters were uncommon, volunteers and staff tended to come out in clusters, and perhaps this was a contributor to the reactive encounters in the times when they did occur.

Volunteers and staff would often give the dog they were walking positive verbal attention. We did not observe frequent verbal corrections. However, whenever the walkers would use cues, dogs did not seem to respond to the cues. Lastly, we did not notice walkers giving the dogs treats.

Crate

During in-create focal observations, most dogs exhibited stress/anxiety related behaviors such as trembling, lip licking, and yawning at some point during each observation. The trembling often coincided with noise in the facility, especially with other dogs in the room barking. When the dogs would stop barking and/or the room became quiet, the trembling would cease.

When one dog in the room barked, other dogs would join. This social facilitation is common in dogs. When a person would enter the room, multiple dogs would usually react to the presence of the person in the room via moving to the front of their crate, engaging in crate-directed behavior (such as pawing or jumping up on cage door/walls), barking, and/or whining. Importantly, dogs engaging in persistent barking were much more likely to get attention from human caregivers. This attention included verbal attention (e.g., soothing, general discussion, scolding) as well as physical attention (e.g., petting through bars, letting dog out of crate). This relationship between barking and gaining caregiver attention is important to note, as human attention may inadvertently reinforce persistent barking behavior.

Some dogs preformed high levels of self-directed behaviors such as licking or biting at their fur. These behaviors can be signs of stress. A few dogs also exhibited crate-directed behaviors indicative of frustration such as pawing at or biting at the crate. There was some object (Nylabone, blanket) interaction, but it seemed to differ by dog- younger, more active dogs were more likely to play with their bones. Since the beds and blankets were generally located in the

back of the crate, and the dogs would subsequently lay in the back of their crates in their beds. Inactive and resting behaviors were common.

Recommendations

Volunteer Walks

Mostly Mutts is unique to most shelters in that the dogs get multiple walks each day with volunteers. This provides many benefits. First, human contact with shelter dogs can decrease the fear response toward humans (Conley, Fisher, & Hemsworth, 2014), and human interaction can decrease levels of stress in dogs housed in shelters (Coppola et al., 2006; Willen, Mutwill, MacDonald, Schiml, & Hennessey, 2017). Second, the frequent walks provide exercise and allow the dogs visual contact with other dogs out for walks. When things go as planned, this exposure can also teach proper leash-walking techniques. However, encountering reactive dogs and experiencing frequent leash corrections or unintentional leash constriction when other dogs approach may make dogs more likely to react aggressively to approaching dogs. This behavior could carry over into the adopted home, making it more likely the dog will be returned.

Over time, a dog who experiences frequently tightening of the leash when other dogs are nearby will begin to associate that leash tightening and pain with the presence of another dog. Through classical conditioning, the sight of a dog will begin to elicit a fear response. In addition, the constriction of the leash around the neck is an aversive stimulus. The use of aversive stimuli in training is known to cause an increase in aggression that can be directed at the organism delivering the stimulus (i.e. the handler) or at any nearby organism (i.e. other dogs in the area) (Pierce & Cheney, 2017).

To avoid the development of reactivity, walkers should be careful not to accidentally jerk the leash in reaction to seeing another dog. In instructing walkers, general advice would include

making the volunteers aware that dogs may react to their tension. Walkers should try to remain relaxed and maintain a loose leash when possible, even when other dogs are in the area. It might even be helpful to suggest that the walkers hum a song or laugh when another dog is approaching. Focusing on an incompatible behavior (humming and laughing are at least somewhat incompatible with being stressed out) can be helpful. Beyond that, one could provide the walkers with treats and take either a classical or operant conditioning approach. In the classical conditioning approach, the idea is to pair the treats (an unconditioned stimulus that elicits a positive emotional state) with the sight of a dog. This approach is not dependent on the dog's behavior. The instructions to the walkers would be to deliver treats when another dog is in proximity to the dog they are walking. They would be advised to do so even if the dog were barking or exhibiting other undesirable behavior. While somewhat counter-intuitive, this counter-conditioning procedure is easy to learn and is generally very effective. Over time, the dog's reactivity to other dogs will decrease. In fact, most dogs will begin to see another dog and immediately turn to their handler for a treat rather than reacting to the approaching dog (see Donaldson, 2004 for a breakdown of this technique).

The other option is to take a more operant approach. In this approach, the focus is on reinforcing behaviors that are incompatible with the behaviors we are trying to reduce (i.e., barking and lunging at other dogs). Dogs can be given food anytime they are in the proximity of other dogs and are exhibiting calm behaviors. Additionally, dogs can be trained to "Watch" when they see another dog. 'Watch" is when a dog focuses their attention on the walker at the sight of another dog and gets a treat. This again keeps the dog from focusing on something that may potentially frighten them and lessens the chance of a fearful or aggressive response (see McConnell & London, 2009 for details on these procedures).

The volunteers at Mostly Mutts are already reliable at maintaining proper distances between dogs and in redirecting dogs who become reactive, and we advocate for the continuation of this practice. We suggest that pacing the number of dogs leaving the facility might also set walkers up for success. Often, several dogs would leave the facility at the same time, increasing the chances of dog-dog interactions.

Play Groups

The previously reviewed research supports the idea that play groups can be beneficial to shelter dogs. However, establishing a play group program would require significant investment in staff and volunteer training. After reviewing the literature, we also feel that significant facility changes would be needed for this initiative. The benefits of social housing and play groups to both the welfare of the dog and to adoption outcomes is quite convincing though, so it is our recommendation that you consider these benefits as you look toward the future of Mostly Mutts.

Visual Contact

There is limited information about the effects of visual contact on the welfare and behavior of shelter dogs. Only one study (Wells & Hepper, 1998) has specifically investigated this, and they found limited benefit. However, of the ways in which dogs could be given social contact in the facility (group-housing, play groups, or visual contact), visual contact is the easiest to implement and assess. It also has the added benefit of giving the dog some control and choice over its environment, a key component in welfare.

We propose a pilot study in which we obtain new crate dividers and cut them so that the front third of each crate is exposed. This would give the dogs visual access to neighboring dogs if they choose to be in the front of their crate. However, if they choose to be in the back two-thirds of the crate, they could avoid social contact. The shortened dividers would also allow the

dogs more visual access of the rooms, including the ability to see people and dogs approaching before they are directly in front of the dog's crate. This would increase predictability in the environment, another component of welfare. During this study, we would compare the dogs' behavior with full barriers to the dogs' behavior with partial barriers, paying attention to levels of vocalizations, stress behaviors, and social interactions. If behavioral benefits are observed, this could be implemented throughout the facility.

Conclusion

Even brief periods of social isolation can be detrimental to the welfare of shelter dogs (Beerda et al., 1999). Providing dogs with opportunities for social contact with conspecifics has the potential to decrease stress and avoid the development of aggressive or abnormal behaviors (Beerda et al., 1999; Hetts et al., 1992). In addition, animals housed in social groups are adopted from shelters more quickly and returned less frequently than those housed by themselves (Mertens & Unshelm, 1996). However, social housing within shelters also requires significant staff and volunteer training, adjustments in facilities, and carries the risk of injury or disease. All of these factors must be weighed in determining the appropriate level of social contact for the dogs at the Mostly Mutts facility.

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APPENDIX A
WALKING BEHAVIOR ETHOGRAM

Lead Position

*One state in the lead position category should always be highlighted when a focal observation is being conducted. That is, only clear this category when there is "No Dog" as the subject. Record the initial state of the lead when the dog first enters the observation area. After that, if the lead moves up in the hierarchy (e.g., from lose to moderate/extreme or from moderate to extreme), score this immediately. However, the three-second rule applies to moving down in the hierarchy (e.g., from moderate to loose or extreme to moderate/loose). The three-second rule means that the lead must be in the new state for 3 seconds before you turn on the new state.

Term	Definition
Loose	Lead relaxed, dog not straining against the lead or collar; bend and slack in rope is visible (Based on Harvey, Craigon, Sommerville, et al., 2016).
Moderate	Lead taut (no slack). No feet are lifted off the ground
Extreme	Lead taut with one or more front paws raised off the ground and/or dog being dragged.

Focal Dog Behavior

*One state from the focal dog category must be active at all times a focal observation is occurring. "Default" state should be active if the dog is displaying no other behavior in this category.

Term	Definition
Cower	Low body posture that includes lowering of shoulders and head in response to an environmental stimulus (e.g., human approach, dog approach, noise, etc.). Often accompanied by tucked or lowered ears and a head tilt
Default	No other behavior in the ethogram applies
Jump	Dog lifts body up with two or more feet leaving the ground simultaneously. Modifiers: **On handler:** Dog touches handler or launches body towards handler **On other human: Dog t**ouches or launches body towards a person other than the handler **In air:** Does not touch anyone and body is not being launched in the direction of a person.

Term	Definition
Lie	Dog rests its weight on its belly, side, or back Modifiers: **Lateral (LR):** Side of dog touching the ground fully **Dorsal (DR):** Back of dog touches ground. **Other:** Does not definitely fit into the other 2 categories.
Lock On	Dog head and eyes are oriented toward an object while its body posture is high and rigid for at least 3 seconds. Tail is generally up.
Lunge	The dog quickly and forcefully pulls forward in the direction of a stimulus (e.g., dog, human, car, other). May be accompanied by teeth bare, snapping, biting, growling, or barking (Netto & Planta, 1997).
Out of view	Dog is still within observation area, but an object obstructs view of dog; actions cannot be distinguished
Play Bow	Dog lifts rear and tail \while its front elbows touch the floor
Snap	Mouth opens and closes quickly, possibly accompanied by showing the teeth and/or growling and/or barking associated with a quick head movement (Netto & Planta, 1997).
Teeth Baring	The dog pulls up its upper lip so that its teeth are visible
Tucked Tail	Tail bends inward between the legs
Vocalization	Dog makes audible sounds from throat area. Select this state 3 seconds after vocalization is heard and end 3 seconds after vocalization ends. Modifiers: **Barking:** Staccato vocalizations; **Growling:** Low, buzzing sound **Howling:** A long drawled, out sound through partially closed jaws. Muzzle is often raised; **Whine:** Prolonged moan at a high, sustained pitch. Muzzle is typically not raised, mouth is typically closed or slightly open; **Hoarse**: Audible, raspy, constricted-sounding breathing; **Cough:** sudden audible expulsion of air through mouth; **Other:** Does not fit into any previous category
Yawn	Dog opens mouth widely and inhales.

Walker Behavior

*One state from the Walker Behavior category must be active at all times a focal observation is occurring. "Human Default" state should be active if the walker is displaying no other behavior in this category.

Behavior	Definition
Attention	Walker interacts with dog. Modifiers: **Verbal:** Walker talks with head or eyes oriented towards the dog. Vocalizations are neutral to high in pitch and at a normal volume. Vocal content may include praise or reassurance (e.g., "Good Boy", "Good job" "There you go" "It's okay" "It's alright"). **Physical:** Walker makes physical contact with dog using hands or arms. Examples include petting, patting, hugging, or scratching the dog. **Both**: Walker is giving both physical and verbal attention as defined above
Cue	Walker gives a verbal cue to the dog to sit or lie down. A physical cue may or may not accompany the verbal cue. Modifiers: **Successful:** Dog displays cued behavior within 5 seconds of cue **Unsuccessful:** Dog displays cued behavior within 5 seconds of cue
Human Default	No other behavior for walker applies.
Leash Correction	Walker sharply and forcefully pulls leash, resulting in constriction around the dog's neck. Tension on the lead is lessened after the quick, forceful pull.
Leash Pull	Walker uses sustained pulling on the lead to move the dog closer towards their own body while the dog is standing still or actively trying to move in a different direction.
Treat	Trainer gives dog food item or toy
Turn	Trainer moves dog in a different direction than an oncoming person or dog.
Vocal Correction.	Walker loudly and sharply makes a short, staccato, sound or phrase with head or eyes oriented toward the dog. It can be just a sound (e.g., "Aye!") or a short phrase (e.g., "No!" "Hey!" "Bad Dog!" "Leave it"). "Sit" and "Down" are scored as cues, not vocal corrections.

Area Events

*One state from the Area Events category must be active at all times a focal observation is occurring.

Behavior	Definition
Dog in Observation Area	Another dog besides the subject is present in the observation area
No Dog in Area	There are no dogs other than the one being observed in the data collection area
Public	Person who is not a volunteer and who has no dog is in the observation area.
Reactive	A dog in the observation area or in sight is displaying an agonistic behavior Modifiers: **Bark only**: Only makes staccato vocalization (Netto & Planta, 1997). **Growl only:** Only makes low buzzing sound. **Lunge only**: quickly and forcefully pulls forward in the direction of a stimulus (e.g., dog, human, car, other). May be accompanied by teeth bare, snapping, biting, growling, or barking No vocalization. **Lunge w/ Vocalization:** Lunges and Barks/ growls.

APPENDIX B
CRATE BEHAVIOR ETHOGRAM

Focal Dog Behavior

Behavior	Definition
Bare Teeth	The dog pulls up its upper lip, so that its teeth are visible (Netto & Planta, 1997).
Body Shake	Quick rotation of the body starting at the head and moving caudally (Based on Overall, 2014).
Crate-Directed	Active, physical interaction with some part of the crate, including the crate pan or crate bars. This includes biting, nose pushing, licking, or pawing behaviors in which the nose, mouth, tongue, or paws is making physical contact with the crate.
Default	Dog is not engaged in any listed focal behavior
Eat/Drink	Dog laps water or orally ingests food items
Eliminate	Dog urinates or defecate (Based on Hubrecht et al., 1992).
Jump	Dog lifts body up with two or more feet leaving the ground simultaneously.
Lip lick	Dog puts tongue outside its mouth and touches its lips (upper, lower, or both simultaneously)
Object Interaction	Dog uses its mouth or body to interact with an object in the cage.
Pacing	Full body, patterned, locomotion within the crate (ex. back and forth, circles, diagonal, etc.). Recorded after 3 rotations. Turn off after 3 seconds when the dog is no longer doing the behavior.
Pant	Deep breaths with open mouth, without retracted lips (Lefebvre, Depiereux, Giffory & Diederich., 2010)
Scratch	Dog uses front or back paws to rub against body (Scaglia et al., 2013; Ley & Bennett, 2007).
Self-oral	Dog licks or bites (front teeth only) fur or skin (Lefebvre et al., 2010)
Snap	Mouth opens and closes quickly, possibly accompanied by showing the teeth and/or growling and/or barking associated with a quick head movement (Netto & Planta, 1997)

Behavior	Definition
Tremble	Small vibrations visible in dog's body.
Vocalization	Dog makes audible sounds from throat area. Score this behavior 3 seconds after first vocalization is heard and end 3 seconds after vocalization ends.
Yawn	Dog opens mouth widely and inhales.

Crate Position

Behavior	Definition
Back	The majority of the dog's head is positioned in the back half of the crate
Front	The majority of the dog's head is positioned in the front half of the crate

Dog Posture

Behavior	Definition
Lie, head down	Dog rests its weight on its abdomen, side, or back. Head rests on surface, including crate, paw, bed, etc.
Lie, head up	Dog rests its weight on its belly, side, or back, Head is lifted off ground
Move	Dogs' feet change quadrants within the crate.
Sit	Front legs are straight and erect, back legs are bent
Stand	Dog's weight is on legs, abdomen or side is not on ground. Dog is stationary.

Environmental Variables

Behavior	Definition
Bark Single	One dog that is not the focal dog and that is in the observation room is barking (staccato vocalizations).
Bark Multi	More than one dog other than the focal dog and in the observation room is barking (staccato vocalizations)
Environment Default	No dogs are barking and no other people besides researchers currently taking observations are in the room.
Person in room	Someone besides researchers currently taking observations is in the room
Physical Attention	Volunteer makes physical contact with the dog.
Treat given	Human places food item not contained in bowl either in the crate or directly into the dog's mouth. Dog is gifted a treat.

Behavior	Definition
Verbal Attention	Person talks with head or eyes oriented towards the dog. Vocalizations are neutral to high in pitch and at a normal volume. Vocal content may include praise or reassurance or general conversation (e.g., “Good Boy”, “Good job”, “There you go”, “It’s okay”,“It’s hot today, isn’t it?”)
Verbal Correction	Person loudly and sharply makes a short, staccato, sound or phrase with head or eyes oriented toward the dog. It can be just a sound (e.g., “Aye!”) or a short phrase (e.g., “No!” “Hey!” “Bad Dog!” “Leave it”).
Walk by	Person besides researchers that are currently taking observations moves by cage.
Physical Attention	Volunteer makes physical contact with the dog.

Behavior	Definition
Affiliative	Dog displays a seemingly prosocial reaction towards a dog in an adjacent crate. Dog must be in visual sight (i.e. no visual barrier between dogs). Examples include play bow, tail wag,
Aggressive	Dog displays a seemingly aggressive reaction towards another dog in view. Dog must be in visual sight (i.e. no visual barrier between dogs). Examples include lunging, snapping. Vocalizations are scored separately.
Oriented	Head and eyes are facing neighbor dog, and dog is visible (that is, no barrier between dogs)
Other Social	Behavior does not explicitly fit under “Affiliative” or “Aggression/Reactive”
Proximity	The heads of both dogs are within 2 inches of crate wall adjacent to the neighbor, and no visual barrier is between them
Social default	No behaviors in above category are occurring.