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Effects of Socialization on Scent Marking in Domestic Dogs

Intro

Current research on dog marking behaviors has shown it is a dense medium for social interaction. Dogs are able to detect a wide array of each other's physical features and have intricate marking and countermarking behaviors that change over time. Thus far, research has focused on how marking behaviors change with physical differences like breed, sex, age, and castration, as well as the chemical interactions beneath it all. Given how social this pathway for communication truly is, there is still more to be discovered about how it relates to face to face interactions, and whether these two pathways clash. In this 4 week longitudinal study, researchers will analyze how the amount of socialization impacts a dog's interest in marking, as well as its interest in other dog's marks. We hope to expand current research by understanding how these two areas of dog socialization interact, and we hope to give answers to pet parents who struggle to control marking behaviors about whether more, or less socialization can help.

Background

Scent marking is a type of olfactory communication which has been observed in several species in the animal kingdom. Scent marking involves animals leaving behind their scent on features in their environment to be detected by others at a later point in time. It is mainly used as a way of marking territory ownership, and it allows animals to detect each other in their absence

(Gosling, L. M.,1982). Generally, olfactory communication allows species to identify characteristics about each other without needing to engage, which can work to avoid confrontation while allowing animals to discover features about each other. Domestic dogs are the most common example of this in our daily lives and have proven to be a flexible and convenient way for researchers to learn about scent marking.

Researchers have observed scent marking behaviors in dogs of both sexes. Most studies have focused on how marking behaviors change based on mating and physical traits like sex, age, and whether they have been neutered/spayed (gondectamy). Early research established that males have higher rates of marking behaviors, and are more likely to direct their urine on specific targets (Anisco, 1973). Because of these findings, marking behaviors were more strongly associated with males dogs until further studies established that females also direct their urine and engage in scent marking behaviors (Wirant and McGuire, 2003). Researchers have also established that scent marking is an avenue for marking territory in both sexes, with males marking territory boundaries and females marking areas close to nests with their puppies (Pal, 2003). This body of research indicates scent marking is important for both males and females.

An area of interest has been how dog marking behaviors change with age. In a recent study, researchers found that older dogs urinate more frequently, and spend more time targeting their urine when they mark (McGuire, 2016). This almost indicates that it is a learned behavior and that dogs get better at it over time.

Perhaps the most abundant area of research has been the effects of castration on marking behaviors. In a recent study, it was found castration was strongly correlated with decreased urination frequency in male dogs, but that it made no difference in female dogs (McGuire, 2018). This research confirms this behavior may be more prominent in male dogs, and that it is likely

important to mating behaviors. A popular way of researching this is by testing how dogs react to the simulated marks of other dogs. By having dogs investigate different samples, and by measuring the amount of time that a dog spends investigating a particular scent, researchers have learned that dogs can detect a whole array of things, from sex, age, or even whether they are group mates. A study with beagles found that dogs can detect the sex, and heat cycle status of another dog (Dunbar, 1978). Research has also shown that dogs can detect whether the dog has been castrated. A study found that non castrated males and females elicited longer investigation than did urine from castrated sources (Lizberg and Snowdon, 2009).

Given what researchers have learned, interest has been directed towards the chemical composition of dog urine to understand what underlays these behaviors. A series of studies have delved into the chemical relationships involved in marking behaviors. Researchers testing the association of creatine and cortisol with dog urination frequency during socialization found that there is a positive association between the two (Alberghina et al, 2019). Instead of analyzing urine compositions, other researchers have tried to directly alter urination behaviors using various drugs. In a study, researchers tested the effects of L-deprenyl, and found a decrease in directed sniffing, and a less frequent urination in males (Head and Milgram, 1992).

Other studies have combined several of these areas of research and have looked at countermarking behaviors. Researchers found that males only overmarked intact males and not castrated ones, and had a preference to overmark non castrated females (Lizberg and Snowdon, 2010). Research thus far shows marking behaviors are a dense social medium, and that it is important for dogs of all sexes, breeds, and ages.

Rationale

The current body of research teaches us a lot about how marking behaviors work, about the acute interactions between age, sex, gondectamny, and about how these interactions take place at the chemical level. Although this helps us understand marking behaviors, they do not do much to explain the relationship between marking and the social interactions dogs may have outside of times they may mark. As has been established, dogs can detect an incredible number of characteristics about other dogs, and scent marking is a much more dense pathway for information than we once thought. It's possible to think of this as a type of asynchronous communication, and it would be interesting to know how this pathway clashes with normal pathways of in-person interaction. The goal of this study is to understand if marking behaviors change based on a dog's socialization outside of times it may mark. This study seeks to answer whether dogs are more, or less inclined to engage in their habituistic marking behaviors based on outside levels of socialization. Thus far, it has not been made clear: It is possible that more socialization leads to more intensive marking behaviors due to an increased sense of competition, but it could also decrease interest in marking, since dogs may be tired of socializing with other dogs.

The previous body of research proves that dog marking is incredibly social. Dogs can detect different features about each other, and have very developed and intricate behaviors for marking and countermarking. Researchers have also found that dogs can detect urine of familiar versus unfamiliar dogs. In a study, “Male Dogs spent nearly twice as much time investigating urine from other males in the colony and over four times longer investigating urine from a stranger as they did investigating their own urine” (Dunbar and Carmichael, 1981). Along with this, studies have shown that dogs are able to detect their conspecifics versus unfamiliar dogs.

This indicates that there may be a decreased need for dogs to investigate the urine of dogs they socialize with. This indicates that socialization might actually decrease marking behaviors, since social dogs may feel less of a need to mark.

Beyond expanding our understanding of socialization and marking behaviors, this area of research is particularly important for many dog parents who are challenged to curb or manage the behavior. As researchers have established, marking is a natural behavior, and it is not a problem the majority of the time. Sometimes however, dogs will mark indoors, or on things they should not be marking on. Curbing and reducing the marking behaviors is important to dog owners, and a lot of content exists to advise dog owners on what to do, ranging from getting your dog neutered to using certain enzymatic cleaners. This study could help these pet parents by looking for any connections between socialization and reduction of marking behaviors. If your dog marks when it shouldn't, maybe giving it more, or less socialization could help.

Methods

To conduct this longitudinal study, the research team will work with local animal shelters to select 10 dogs whose adoptions will be delayed for the study and whose social schedules can be determined entirely by the research team. To elaborate, visits by potential adopters will continue normally, but the pickup date, or date of ownership, will not be until the study ends. Five of the dogs will be males and five of the dogs will be females. Previous research has shown that castration tends to reduce marking behaviors, so for the purposes of collecting more data, none of the selected dogs will be castrated. Since this is a repeated measures design, and dogs of all ages and breeds engage in marking behaviors, researchers will be selecting an even spread of these based on availability. Once dogs are selected based on these factors, the last part of the

selection process will involve researchers confirming that each dog does, in fact, engage in marking behaviors by taking them on a walk.

Working with local animal shelters provides several advantages. First, most shelters appreciate the help. Taking the time to exercise and socialize rescue dogs can be arduous and it's nice to lift a weight off the shoulders of volunteers. From personal experience, most shelter dogs are housed in separate enclosures for health and safety reasons. This is done mostly to avoid fights and to stop the transmission of any potential illnesses or diseases, since the dog's histories are not usually known. This benefits our study by reducing the potential biases that come with dogs who have already been adopted, since they tend to live in much less consistent environments. Lastly, although this is from personal experience and it likely varies, shelter dogs usually spend about a month at the shelter or pound before they are adopted. This study is designed to fit in that timeframe to avoid too much disruption to the shelter's adoption process. To ease any burden, the research team will also make a financial contribution to the shelter(s) to pay all the expenses, for each dog, during their entire shelter stay.

The 10 selected dogs will engage in an experiment with repeated measures design. This is advantageous because it requires a small sample, putting less load on shelters and logistics. It also helps to eliminate the many, many confounding factors that impact dog marking behaviors mentioned previously. This experiment will consist of two trial conditions, a "socialized" condition and a "exercise" condition. In the "socialized" condition, dogs will engage in one hour of social interaction at a local dog park preselected for this experiment. During this time, the experimenter will record all dog marking behaviors, and record the types, and numbers of social interactions the dog has. The second condition is the "exercise condition" where dogs engage in an hour of solo exercise and playtime with an experimenter in a large, open area, but without the

presence of other dogs. This allows the dogs to get an equal amount of physical exercise in both conditions, with only the level of social interaction being different. Put simply, every dog will get either 1 hour of playtime with other dogs, or 1 hour of playtime with the experimenter, each day. The 10 dogs will be split into two groups, A, and B for counterbalancing. Group A will be exposed to the 'socialized' condition for two weeks, then be exposed to the "exercise" condition for two weeks. Group B dogs will experience the conditions in the reverse order.

Along with either the hour of social time, or the hour of exercise, researchers will take each dog for a 30 minute walk along a pre chosen path for the dog which remains the same across both conditions. The experimenter will video record the dog walk, and note the number of times the dog marks. This is purely to understand whether the dogs mark at higher rates.

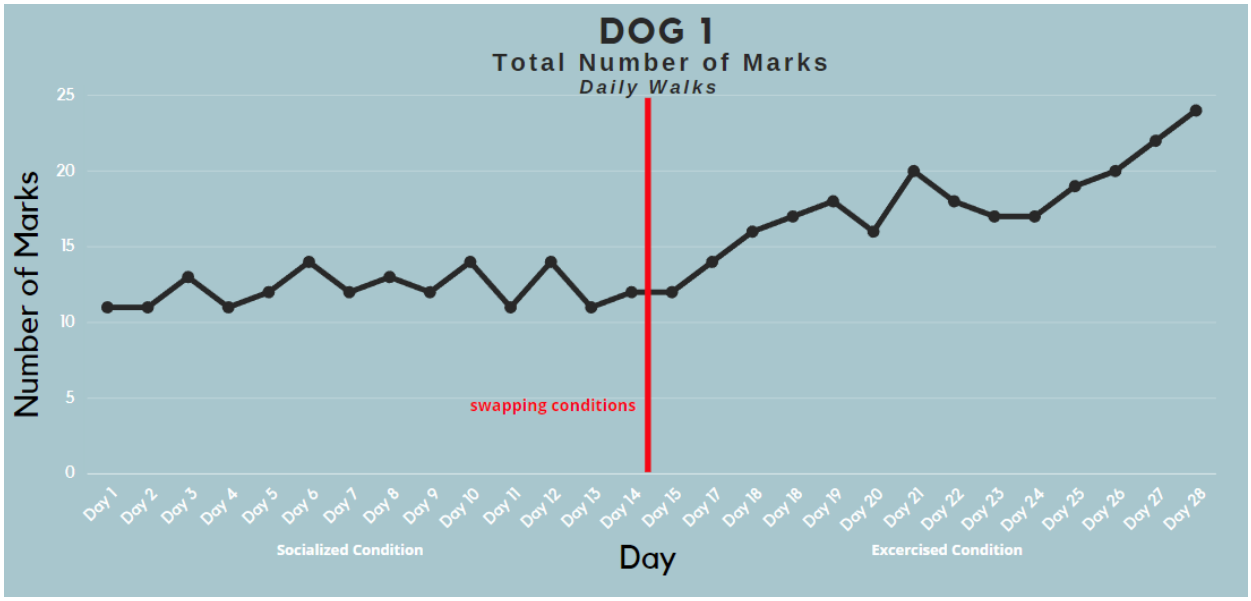
At a chosen point in the day for each dog, a researcher will take the dog through a urine course mimicking the one used by Lisberg and Snowdon in their 2009 study. Working with the shelter, researchers will collect 25 urine samples from various dogs. A urine course will be created each day in a consistent place for each dog. The urine course contains 6 wooden stakes placed 10 feet apart in a line, aligned perpendicular to the wind. Three of the stakes have urine samples from other dogs, and three of the stakes have tap water as a control. Each day, the stakes are randomized such that the control, and urine samples were in each 'stake' position at least once during the study. The researcher is to guide the leased dog through the urine course, and video tapes the process. Just like in the Lisberg and Snowdon study, researchers are to stop within 3 feet of each stake, and move on after 30 seconds unless the dog was still investigating. The researchers are not to engage in any communication and are to refrain from eye contact, and should do their best to maintain a loose leash.

As with any study, there are certain limitations. This study was designed to fit into a month, with each trial condition lasting two weeks. It must be stated that the trial conditions could have much more significant effects if the study were prolonged. This study can be seen as a pilot study, and further ones could be extended. Additionally, the results may be affected by the amount of time that passes between the “socialized” and “exercise” conditions, up until the urine course and dog walk are performed. It is possible that the longer you wait after socialization, even if a matter of hours, the more time a dog will spend investigating other urines. Another experiment would have to be run to figure this out. Lastly, it must be stated that for the 30 minute daily walks, there is a lot of variability in the smells and environmental cues that a dog may encounter, and researchers will not be able to tell if a dog is seeking out the smells of other dogs, or some kind of food, or prey. Accounting for these is practically very difficult, and could be the topic of a future study.

Predictions

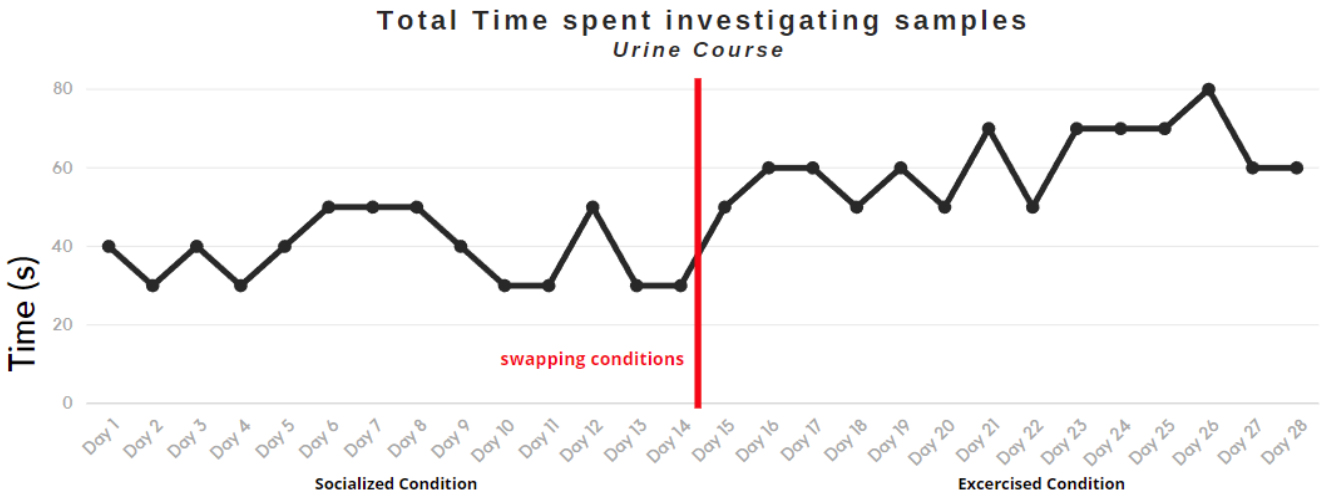
I predict that dogs who go to the dog park will be less likely to engage in marking behaviors during the walks and will spend less time investigating the samples of other dog’s urines in the urine course. An important point to note is that dog marking is natural, and has a territorial element which this study does not eliminate. Therefore, I definitely do not expect marking behaviors to drop to zero, instead, I expect a decrease of significant proportions. Fundamentally, I think the processes of socialization and marking behaviors are related. Previous studies have shown that dogs who socialize spend less time smelling familiar urines. I think dogs use scent marking as a second avenue for socialization, and that they'll be less interested in using

this avenue of communication when they have more time to pursue primary avenues for socializing with other dogs.



(Figure 1 - Predictions for Daily Marking for a single dog across both trial conditions)

My predictions about the total number of marks are illustrated in figure 1, which shows predicted results for a group A dog. Since I expect socialization to decrease dog marking behaviors, I expect to see an increase once socialization stops, as I expect the dog will resort to scent marking to reach its conspecifics. For this specific group A subject, Dog 1, I expect to see an increase in



(Figure 2 - Predictions for Urine course scent investigation for a single dog across both trial conditions)

marking behaviors once socialization stops. It must be noted, the significance of the increase may be a lot less and may change substantially from dog to dog.

Figure 2 shows a graph of predicted results for the urine course. I expect that over time, a lack of social interaction will push this particular dog to be more interested in marking behaviors as an outlet for socialization, and the dog therefore will spend more time investigating samples in the urine course. I also predict that the order of the trials may have an effect on the results. The dogs that spend two weeks socializing, then two weeks without social interaction may show a more dramatic tendency to mark, or investigate other marks than vice versa.

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