Prosocial Helping in Dogs: A Strategy to Secure Loyalty?

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Madeleine Marino

Advisor: Laurie Santos

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Abstract

Humans are a phenomenally helpful species: we donate our time and resources to others in need even when we know the favor may never be returned. Do non-human animals display these same behaviors? This study investigated whether dogs would take proactive measures to help others in need. Dogs witnessed a thief steal a book from either their owner or a stranger, and then had the opportunity to try to help out by chasing after the book. As a control, dogs also watched a non-theft scenario in which an individual walked out of the room with her own book. To test whether dogs offered help differentially in each condition, we measured how long dogs spent looking at the door after the book was taken through it, how long dogs spent located at the door, whether dogs approached the door, and how quickly they approached. Although we did not find significant differences in the first two measures across conditions, Chi-Square analysis revealed that dogs approached the door with significantly different frequencies in each of the three conditions, X^2 (2, N = 60) = 8.08, p = 0.02. We found that every dog chased after the stolen book when their owner had been reading it, some dogs chased after the stolen book when a stranger had been reading it, and fewer dogs chased after the book when it had not been stolen. Furthermore, we found that dogs' latency to approach the door was marginally significant across conditions, following the same trend (p = 0.08). These findings suggest that dogs may use prosocial helping as a mechanism not only to maintain the loyalty of their owners but also to obtain newfound loyalty from strangers.

Introduction

Prosocial helping can be defined as voluntarily helping others without receiving a direct benefit (Clark, 1991; Dovidio et al., 2006). This behavior is surprisingly common in humans: we go out of our way to hold the door for others, and will donate food, money, and medicine to those in need. We engage in these costly behaviors even though our favor may never be returned and we may never know the people we are helping.

Recent work suggests that prosocial helping in humans develops early in ontogeny (e.g., Eisenberg et al., 2006; Warneken et al., 2007; Svetlova et al., 2010; Batson, 2011; House et al., 2012; Warneken, 2013; Warneken, 2015). For example, Warneken & Tomasello (2006) found that human toddlers as young as 18 months will engage in prosocial helping. In this study, toddlers watched an adult experimenter, who was a stranger to them, struggle with various tasks. For example, in one of the tasks, the experimenter accidentally dropped a marker on the floor and repeatedly tried to pick it up unsuccessfully. Toddlers consistently took proactive measures to help the unfamiliar experimenter pick up the marker. They helped significantly more often in this scenario than in a control condition in which the experimenter threw the marker on the floor deliberately. Infants also helped immediately in almost all cases, so did not have time to be motivated by an adult looking at them or speaking to them.

What evolutionary pressures could have selected for prosocial helping in human infants? One theory is that prosocial helping is a strategy that infants use to try to secure the loyalty of those around them. Human infants generally grow up in contexts where many adults other than their biological parents—such as relatives or family friends—may take care of them. Securing the loyalty of multiple caregivers may have provided a fitness advantage. In this light, prosocial

helping would function much like costly signaling in mating contexts—infants would signal helpfulness to potential caregivers in hopes of securing their loyalty.

Evidence for this hypothesis comes from the finding that children make more prosocial giving choices when others can see them than when they cannot be seen (Buhrmester et al., 1992; Leimgruber et al., 2012). Such "audience effects"— cases in which individuals are helpful specifically in the presence of others— are exhibited not only in childhood, but also into adulthood as people strive to demonstrate their cooperative tendencies (Andreoni & Petrie, 2004; Barclay & Willer, 2007; Bohnet & Frey, 1999; Danheiser & Graziano, 1982; Hardy & Van Vugt, 2006; Piazza & Bering, 2008; Satow, 1975; Shapiro, 1975). For instance, Alpizar et al. (2008) found that adult humans in a natural field experiment contributed 25% more when in front of a solicitor than when in private.

Prosocial helping has not just been demonstrated in humans; indeed it has been found in non-human primates as well (Melis et al., 2010; Warneken & Tomasello, 2009a; Warneken & Tomasello, 2009b; Yamamoto et al., 2012; Bullinger et al., 2014; Drayton & Santos, 2014). In one experiment, capuchins systematically favored a prosocial feeding option that gave food both to themselves and to a conspecific over a selfish feeding option that gave food only to themselves (de Waal et al., 2008; although see Skerry et al., 2011 for contrasting findings). In another experiment, Warneken & Tomasello (2006) found that young chimpanzees helped a familiar human by reaching for an object that was too far away for the human to grasp (see also Barnes et al., 2008 for similar findings in capuchins). Thus, evidence demonstrates that at least in certain contexts primates are willing to offer instrumental help to others. The literature is silent, though, regarding whether this prosocial helping behavior may have evolved to secure the loyalty of others.

To investigate whether prosocial helping may have evolved to secure the loyalty of caregivers, we may turn to a species that is excellent at securing the care of adult humans: the domestic dog. Colloquially, dogs are often referred to as "man's best friend," implying anecdotally that they are highly loyal to humans. The question remains, though, why humans are so loyal to domestic dogs: humans provide dogs with food, water, shelter, and healthcare, while dogs reciprocate none of these. What mechanisms do dogs use to secure the loyalty of human caregivers? It is possible that prosocial helping could be one of these mechanisms.

No studies to date have researched prosocial helping in dogs directly. However, Kaminski et al. (2011) investigated whether dogs would communicate with their owners to request and/or to inform them in a helping context. To test this question, the researchers showed dogs events in which their owner was using one of two objects, such as tape and scissors, to engage in a task (e.g., using the scissors to cut paper). The owner would then leave the room and the dog would watch while an experimenter hid each of the objects in a different location. After the objects were hidden, the owner came back into the room. The researchers then measured whether dogs preferentially guided their owner towards the object they had been using. Kaminski et al. found that dogs did not guide the owner to the object they had been using significantly more often than they guided the owner to the other object. The researchers interpreted this finding to mean that dogs could not understand when their owner needed their help.

One limitation of Kaminski et al.'s study involved the stimuli they chose to use: pairs of office supplies (Figure 1). The study rested on the assumption that dogs would believe that if their owner started using one office supply, they would want to use the same one again later. However, even if dogs understand how humans use office supplies, Kaminski et al.'s assumption

is not bulletproof: often when people are in offices, they have a variety of office supplies, and switch between using each one frequently.

Figure 1 Kaminski et al. used these sets of office supplies as stimuli in their study (2011).

Moreover, dogs may not have been interested enough in the office supplies to remember which one was hidden where. In this case, even if dogs did believe that their owner would want the object they had previously been using, they might not remember where it was. Due to these limitations, it is possible that this task may have been too cognitively demanding to accurately measure the question the researchers sought to test.

To test whether prosocial helping is a strategy that dogs use to secure the loyalty of human caregivers, we presented dogs with situations in which they had the opportunity to be prosocial helpers. We sought to test not only whether dogs would engage in prosocial helping, but furthermore whether they would do so differentially for different humans. We ran a between-subjects study in which dogs had the opportunity to help either their owner or a stranger. In these two experimental conditions, dogs watched as their owner or a stranger read a book. A thief then stole the book and ran out the door with it—without the reader noticing. At this point,

dogs had the opportunity to approach the door to try to get the book back. We then compared the amount of helping dogs offered in each condition to see if there was a significant difference. We also ran a third control condition, in which there was no theft, to be sure that the behaviors we were measuring as prosocial helping behaviors weren't simply the dog's response to the experimental set-up.

If dogs offer more prosocial helping to their owner than to a stranger, this would suggest that prosocial helping may function as a mechanism that dogs use to *maintain* the loyalty of caregivers that they already know. If dogs offer any prosocial helping to a stranger, this would suggest that prosocial helping may also function as a mechanism that dogs use to *obtain* the loyalty of new potential caregivers. If dogs do not offer prosocial helping to their owner or to a stranger, this would suggest either that dogs do not engage in prosocial helping as a mechanism to secure loyalty, or perhaps that they did not understand our experimental task. If dogs offer as much prosocial helping in the control condition as in the experimental conditions, this would suggest that they did not comprehend the paradigm. Our hypothesis is that dogs will offer the most prosocial help to their owners, some to strangers, and the least in the control condition. This is in line with the idea that prosocial helping may function as a mechanism to both obtain and maintain the loyalty of caregivers.

Methods

Participants. We tested dogs ($N = 67$) that we recruited through the Canine Cognition Center at Yale University. We recruited dogs over the age of 16 weeks, and the mean age of dogs in our experiment was 4.5 years ($SD = 3.20$). Of our sample, 47% were male and 53% were female. All breeds of dogs were welcome to participate in the experiment. Characteristics of each participant, as described by owners on an online survey, are described in Table 1:

Subject	Breed	Sex	Age (in years, unless otherwise specified)
Subject 1	Yorkshire Terrier	F	11
Subject 2	Basset Hound	F	2
Subject 3	Bichon Frisé, Poodle	F	6
Subject 4	German Shorthaired Pointer, Rottweiler	M	2
Subject 5	Airedale Terrier	F	3
Subject 6	Labrador Retriever	M	2
Subject 7	Labrador, Pointer	M	3
Subject 8	Retriever, Shepherd	M	2
Subject 9	Standard Poodle	M	1
Subject 10	Scottish Terrier	F	1
Subject 11	Havanese	M	9
Subject 12	Labrador Retriever	F	8
Subject 13	Pomeranian	M	1
Subject 14	Rottweiler	M	1
Subject 15	Beagle, Golden Retriever, Terrier	M	10
Subject 16	Golden Retriever	M	3
Subject 17	Boxer, Schnauzer	M	6
Subject 18	Shepherd, Hound, Labrador	F	9
Subject 19	Rottweiler, Australian Shepherd	F	3
Subject 20	Labrador Retriever	M	3
Subject 21	Terrier Mix	F	4
Subject 22	Portuguese Water Dog	M	4
Subject 23	Hound, Pitbull, Great Dane	M	2
Subject 24	Whippet	M	4 months
Subject 25	Whippet	F	2
Subject 26	Whippet	F	3
Subject 27	Welsh Pembroke Corgi	M	10
Subject 28	Cavalier King Charles Spaniel	F	6
Subject 29	Bernese Mountain Dog	F	4
Subject 30	White Shepherd	F	3
Subject 31	Pembroke Welsh Corgi	F	4
Subject 32	Black Lab Mix	F	1
Subject 33	Pug, Beagle-Puggle	M	8
Subject 34	Boxer, Lab	M	3

Subject 35	Pomeranian, Schipperke	M	2
Subject 36	Chocolate Lab, Weimaraner	M	6
Subject 37	Great Dane, Shepherd	M	3
Subject 38	Goldendoodle	F	5
Subject 39	Labradoodle	M	1
Subject 40	Miniature Dauschund	F	2
Subject 41	Schnauzer, Corgi	F	11
Subject 42	Labrador Retriever, Rottweiler	M	6
Subject 43	Standard Poodle	F	2
Subject 44	Dauschund, Papillon, Cavalier King Charles	F	7
Subject 45	Labrador Retriever	F	7
Subject 46	Labrador Retriever	F	4
Subject 47	Yorkshire Terrier	M	7
Subject 48	Stephen's Cur	M	1
Subject 49	Shiba Inu	F	8
Subject 50	English Labrador Retriever	F	10 months
Subject 51	Beagle, German Shorthair Pointer	F	3
Subject 52	Black Lab, German Shorthaired Pointer	F	2
Subject 53	Schnauzer, Poodle	F	7
Subject 54	Golden Retriever, Bernese Mountain Dog, Chow Chow	M	4
Subject 55	Siberian Husky	F	13
Subject 56	Papillon	F	4
Subject 57	Beagle, Basset Hound	F	6
Subject 58	German Shepherd	F	12
Subject 59	German Shepherd	M	4
Subject 60	Bernese Mountain Dog	M	5

Table 1 Characteristics of each dog

Through an online pre-screen, we excluded dogs that had shown aggression to humans. We told owners that we could pause or stop the experiment at any point if dogs became disinterested or anxious, and in total excluded 4 trials for this reason. We also excluded 3 trials due to experimenter error. Our final dataset included 60 dogs.

Experimental Settings. The experiment took place at the Canine Cognition Center at Yale University. All trials were videotaped by an overhead camera that was operated by a research assistant outside of the testing room.

Dogs had unlimited access to water during the entirety of the experiment. Dogs were not fed during the experiment, but were fed during a warm-up immediately preceding the experiment and were given extra treats after the experiment. Dogs were fed natural balance beef treats unless otherwise requested by their owner. Between the warm-up and the experiment, the furniture in the room was rearranged, and dogs were given the opportunity to explore the new set-up before the experiment began.

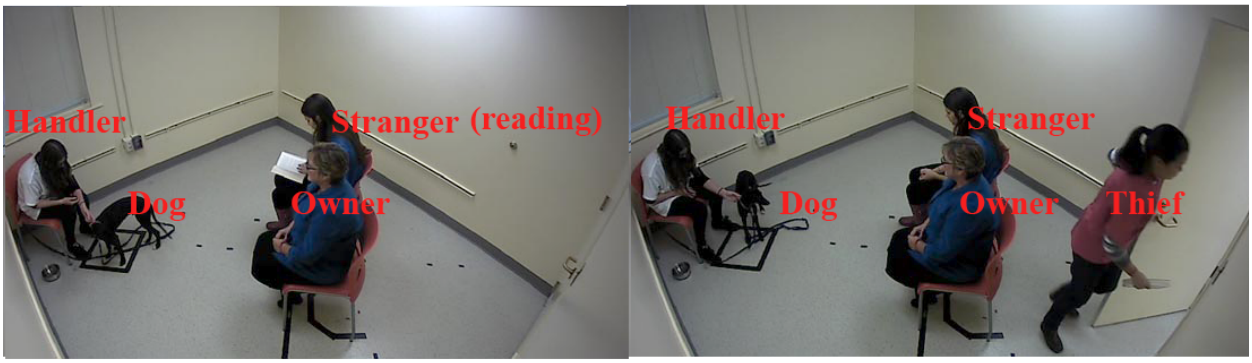
Procedure. All dogs were assigned to one of three conditions: an *Owner Condition*, a *Stranger Condition,* and a *Control Condition*. Figure 2 shows the overall experimental set-up for each condition.

In the owner condition, dogs were attached to a leash in the corner of the testing room such that they could walk all around the room while still on leash. One experimenter acted as a dog handler; she sat in a chair facing the door and held the dog in front of her. Two chairs were set up halfway between the handler and the door, facing the dog. The dog's owner sat in one chair and an experimenter who was a stranger to the dog sat in the other. The handler explained the procedure to the owner while giving the dog time to walk around the room and become familiar with the set-up.

Owner Condition

The dog's owner reads the book.

A thief then steals the book from behind the owner's back.



Stranger Condition

A stranger reads the book.

A thief then steals the book from behind the stranger's back.

Control Condition

A stranger reads the book.

The stranger then takes the book out of the room.

Figure 2 Set-up for each of the conditions

Owners were asked to sit quietly without talking for the duration of the experiment, unless their dog became anxious or uncomfortable. Owners were also asked not to reach out and pet their dogs during the experiment, and to take any distracting items such as food treats or extra leashes out of the room ahead of time. The handler held the dog by the collar while the owner read through a book silently. After 30 seconds, the handler asked the owner to set the book on the floor behind her.

At this point, the handler explained that someone would come in and borrow the book and read it outside the testing room for 30 seconds. The dog could see the thief steal the book, but the owner and stranger could not, for their backs were turned to the door. The thief stole the book quietly and left the room without speaking. Once the thief closed the door, the handler let go of the dog's collar so that the dog could walk around the room freely. At this point, the dog could try to help and get the book back by investigating the place where it was last seen: the door.

During the 30 seconds in which the thief had the book outside the testing room, the handler and the stranger kept their heads down so as not to influence the dog with the direction of their gaze. When the thief returned, she set the book back down on the floor where it was left. At this point, the handler thanked all parties for participating in the experiment. Everyone including the dog walked outside the testing room, and the handler verbally debriefed the owner about the experiment. The handler answered any questions the owner had about the experiment, and provided a written debrief form at the end of the visit.

The stranger condition was identical to the owner condition except that the stranger read the book instead of the owner. The stranger then set the book down, and thus it was her book

that was stolen and not the owner's. The control condition was identical to the stranger condition except that there was no theft: the stranger read the book for 30 seconds, and then walked out of the room with the book herself.

Dependent Variables. We measured three dependent variables to assess dogs' level of prosocial helping. The first was the amount of time that dogs spent looking at the door. Numerous studies on preverbal humans (Hamlin et al., 2007), non-human animals (Higham et al., 2011), and even dogs specifically (West & Young, 2002; Adachi et al., 2007) have found that a longer looking time can indicate greater curiosity. Thus, we thought the time the dog spent looking at the door would be a good indicator of whether the dog was interested enough in the book to try to get it back.

The second dependent variable we measured was the time dogs spent located at the door. Previous research has demonstrated that dogs use the position of their body as a "local enhancement signal" (Roberts, 1941; Polgárdi et al., 2000; Gaunet & Deputte, 2011). That is, dogs position themselves near objects they want, or near where an object they want has been (Polgárdi et al., 2000; Gaunet & Deputte, 2011). Dogs move their bodies more towards objects they want when a human is present than when a human is absent, suggesting that dogs may be trying to use their body to communicate the location of the desired object (Gaunet & Deputte, 2011). Thus, we thought that the time the dog spent located at the door would be a good measure of whether they were trying to signal to the reader that they cared about the book enough to try to get it back.

The third dependent variable we measured was dogs' latency to approach the door. As with looking time, many studies on human infants (Rothbart, 1988), non-human animals (Bailey

et al., 2007), and dogs specifically (Rooney & Bradshaw, 2006) have found latency to approach as a reliable measure of an individual's interest in the object they are approaching. Thus, we thought latency to approach the door would be a good measure of the dog's interest in trying to get the book back.

Coding. Coders assessed all DVs from video recordings after the data were collected. Two separate coders worked independently to measure the DVs. The first coder had designed the experiment so was aware of the hypothesis and condition. The second coder was blind to the hypothesis and the condition. The first coder coded all of the videos, and the second coder coded a randomly selected 10% of them. Inter-coder reliability was 85%.

The first DV—the time dogs spent looking at the door—was measured during the 30 seconds after the thief had left the room. The second DV—the time dogs spent located at the door—was measured during the 15 seconds after the thief had left the room. We measured our third DV—dogs' latency to approach the door—both continuously and categorically. As a continuous variable, we measured how long it took the dog to approach the door, if the dog did at all approach the door, during the 30 seconds after the thief had left the room. As a categorical variable, we measured whether or not the dog approached the door during the 30 seconds after the thief had left the room. We analyzed each of our continuous DVs using One-Way ANOVAs. We analyzed the categorical measure of whether or not dogs approached the door using a Chi-Square.

Results

To test the hypothesis that condition would influence the time dogs spent looking at the door, we conducted a one-way analysis of variance (ANOVA). We found no effect of condition

($F(2, 57) = 0.29$, $p = 0.75$); dogs spent equal time looking at the door in the owner condition ($M = 3.71$), the stranger condition ($M = 3.12$), and the control condition ($M = 2.49$) (Figure 3).

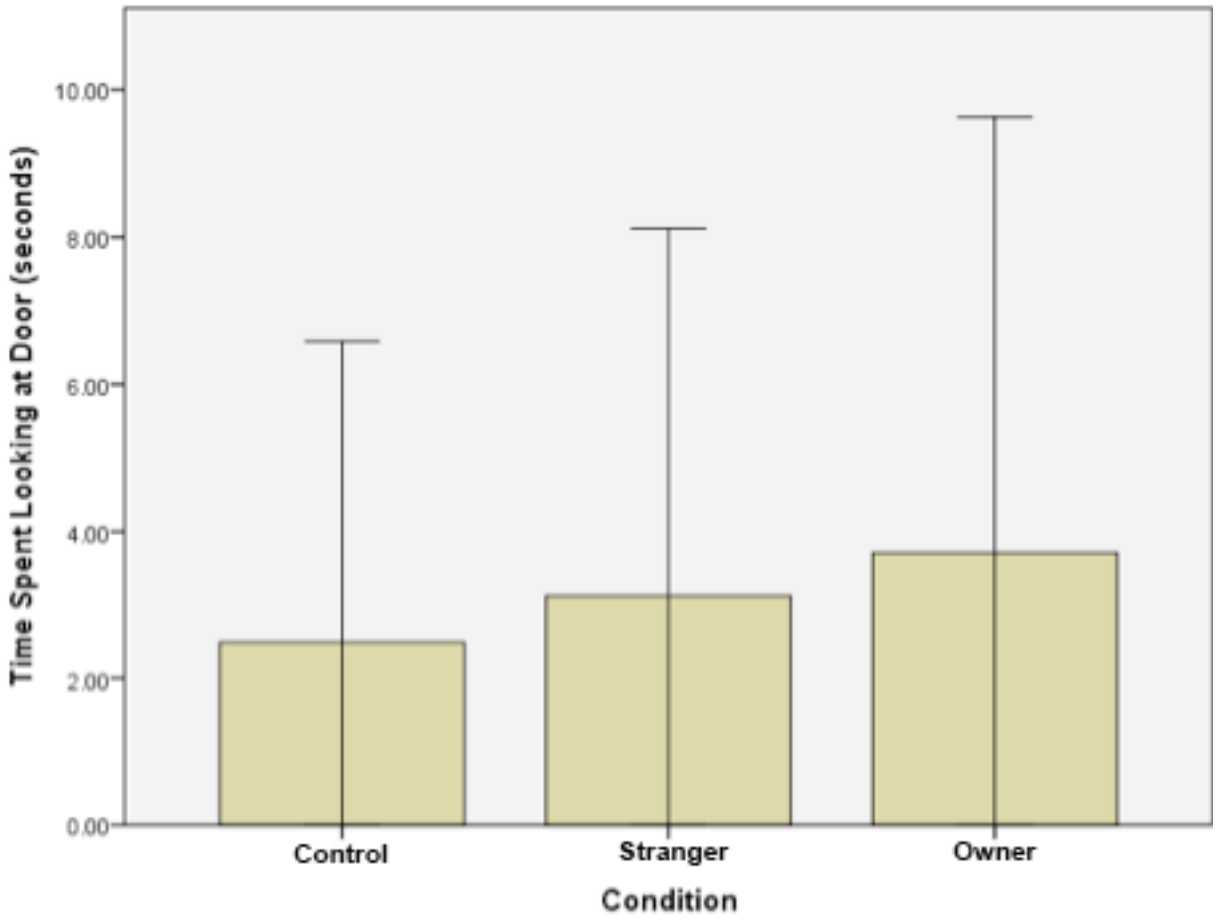


Figure 3 Time dogs spent looking at the door

To test the hypothesis that condition would influence the time dogs spent located at the door, we conducted a one-way analysis of variance (ANOVA). We found no effect of condition ($F(2, 57) = 1.66$, $p = 0.20$); dogs spent equal time located at the door in the owner condition ($M = 7.57$), the stranger condition ($M = 5.97$), and the control condition ($M = 4.93$) (Figure 4).

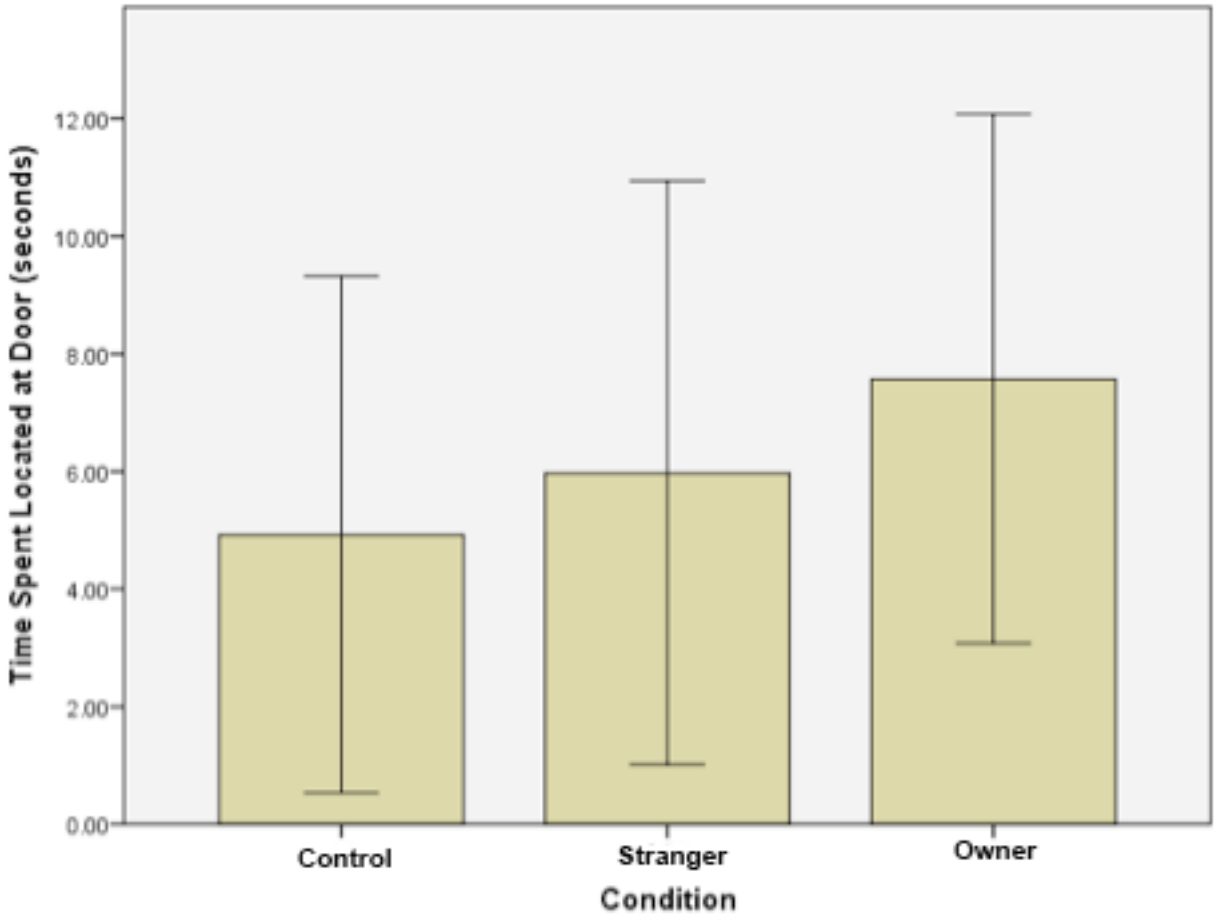


Figure 4 Time dogs spent located at the door

To test the hypothesis that condition would influence dogs' latency to approach door, we conducted a one-way analysis of variance (ANOVA). The ANOVA was marginally significant ($F(2, 57) = 2.58$, $p = 0.08$). Those in the owner condition were quickest to approach the door ($M = 5.45$, $SD = 5.61$), followed by those in the stranger condition ($M = 8.96$, $SD = 10.39$), whereas those in the control condition were slowest to approach the door ($M = 12.59$, $SD = 12.45$). We also conducted planned *post hoc* analyses to test whether the behavior of the subjects in the owner condition differed from the behavior of the subjects in the control condition. Results showed that dogs in the owner condition were marginally significantly quicker to approach the door than dogs in the control condition ($p = 0.080$), but not significantly quicker than dogs in the

stranger condition (p = 0.80). Additionally, there was not a significant difference in latency to approach door between the dogs in the stranger condition and dogs in the control condition (p = 0.76) (Figure 5).

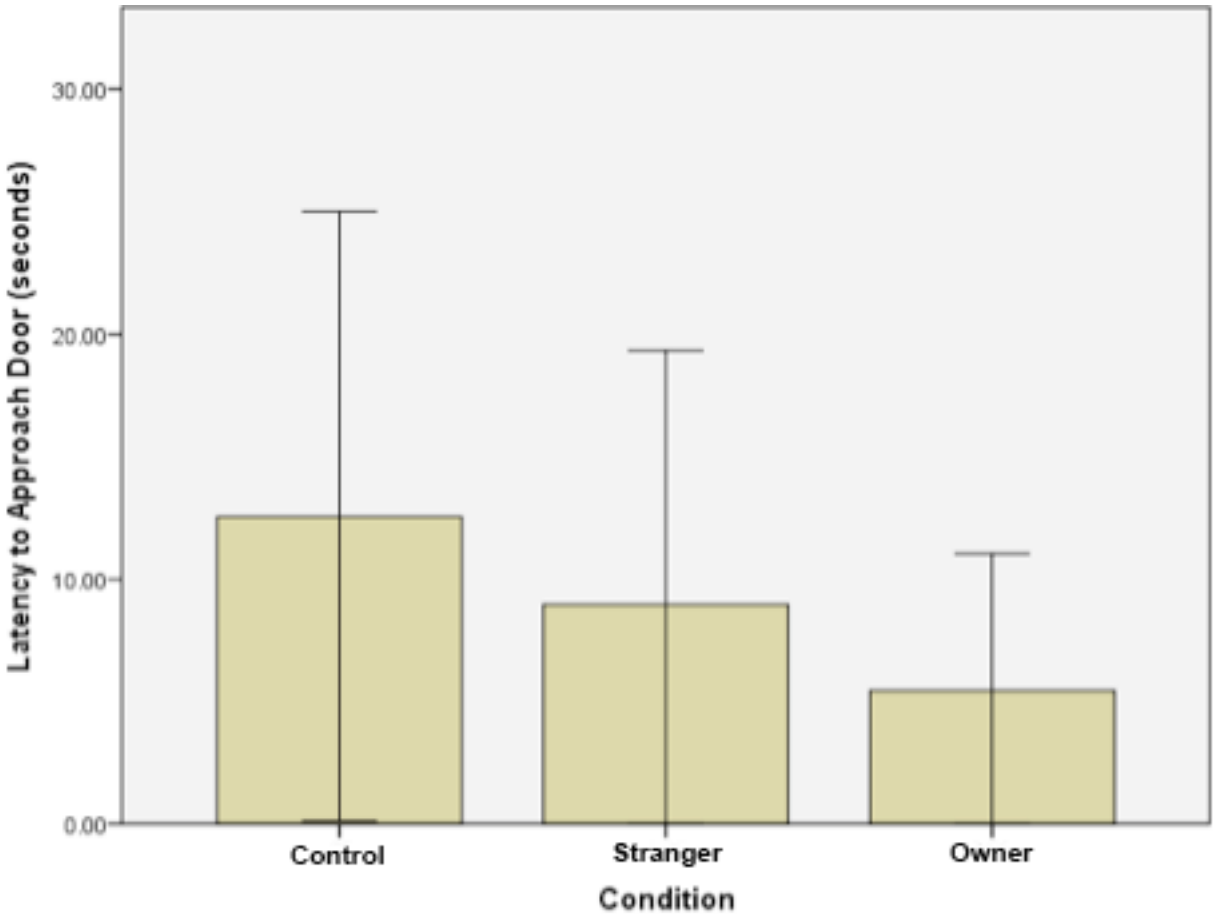


Figure 5 Dogs' latency to approach door

To test the hypothesis that condition would influence whether or not dogs approached the door at all, we conducted a Chi-Square test. We found that every dog in the owner condition approached the door (M = 1.00), many dogs in the stranger condition approached the door (M = 0.90), and the fewest dogs in the control condition approached the door (M = 0.70) (Figure 6).

The results of our Chi-Square test (X^2 (2, N = 60) = 8.08, p = 0.02) are in line with the hypothesis that condition had a significant influence on whether or not dogs approached the door.

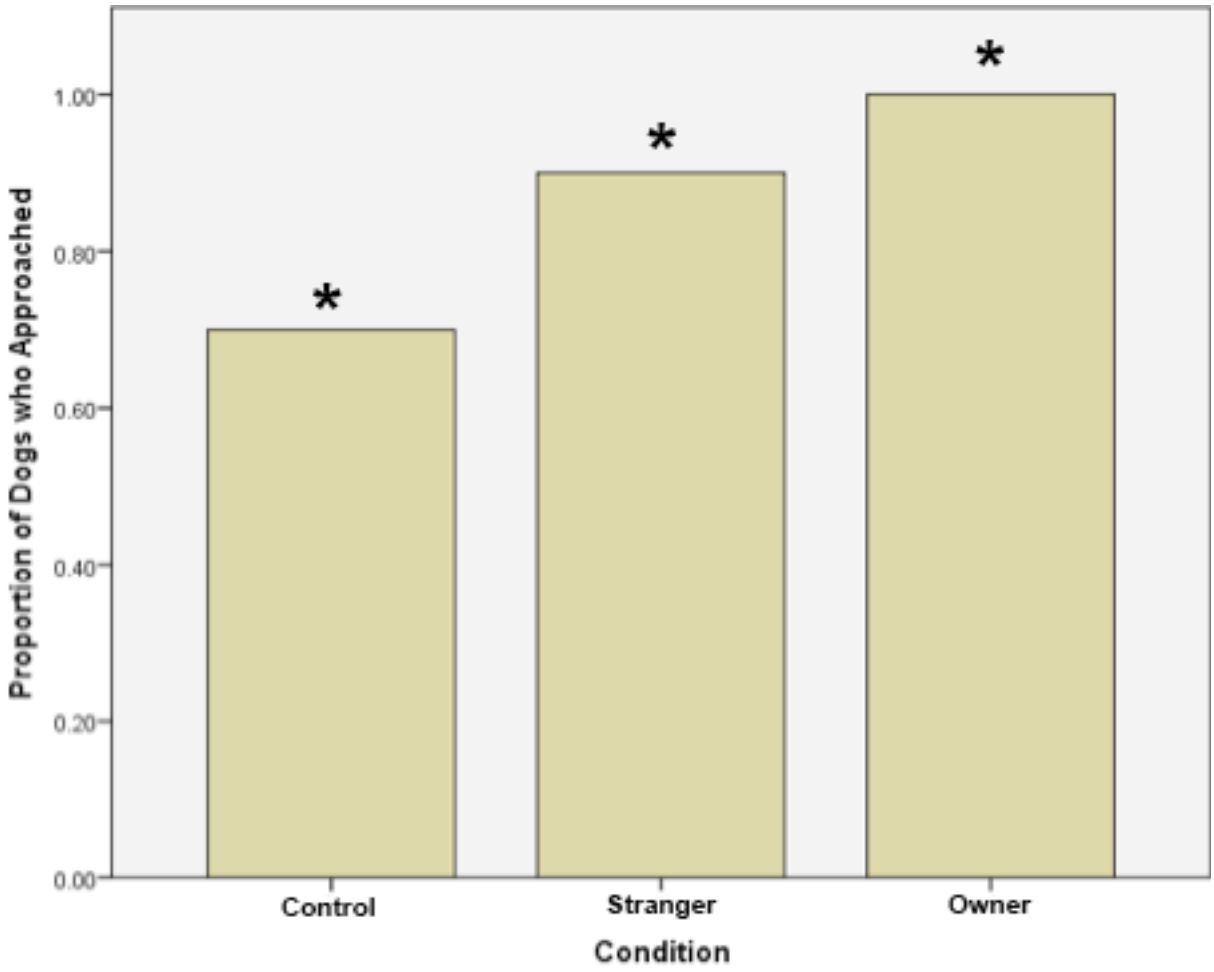


Figure 6 Proportion of dogs who approached the door in each condition

Discussion

In our experiment, we found evidence suggesting that dogs will engage in prosocial helping for their owner, and, to some degree, for a stranger. When we measured dogs' prosocial helping as the time the dogs spent looking at the door or the time dogs spent located at the door, our data did not suggest strongly that dogs did not engage in prosocial helping. The means did,

however, trend in the predicted direction for both of these variables. On average, dogs spent the most time looking at the door in the owner condition, less time in the stranger condition, and least in the control condition. Similarly, dogs spent the most time located at the door in the owner condition, less time in the stranger condition, and the least time in the control condition. Interestingly, when we measured dogs' helping in terms of whether or not dogs approached the door, or how long it took dogs to approach the door, we found stronger evidence that dogs did indeed engage in prosocial helping. Dogs approached the door most quickly in the owner condition, less quickly in the stranger condition, and slowest in the control condition. Furthermore, every dog we tested approached the door in the owner condition, many approached in the stranger condition, and the fewest approached in the control condition.

It is possible that our first two measures yielded insignificant results because dogs were not engaging in prosocial helping, but considering that our third measure did yield significant results, it is worth considering alternative explanations. One possibility is that dogs were motivated to help but that they did not use looking at the door or standing at the door as we had predicted. While looking at the door may indicate interest, this behavior is not actually a way to help retrieve the stolen book. Thus, finding that dogs do not look at the door significantly longer when a book has been stolen than when it has not does not rule out the possibility that dogs were trying to help retrieve the book. Similarly, once the dog was at the door, staying there was not an effective way to retrieve the book, since the book was already outside the door. In that light, the finding that dogs do not stand at the door significantly longer when a book has been stolen than when it has not does not rule out the possibility that dogs were trying to help retrieve the stolen book.

Our measurements of whether or not dogs ran to the door and of how quickly they did so may have been our most valid measures of prosocial helping. Indeed, since dogs were on a leash long enough to allow them to approach the door but not to go any further, approaching the door and doing so quickly were the two things dogs were capable of doing to try to get the stolen book back. In our study, dogs approached the door significantly more often when their owner's book was stolen than when a stranger's book was stolen, and approached significantly more often in either of these conditions than when no book was stolen. This evidence supports our hypothesis that dogs will offer help to their owner and will even offer some help to a stranger as well. Furthermore, the finding that dogs approach the door significantly less often when no book is stolen suggests that dogs have some understanding that help would be needed for a stolen book whereas it would not be needed in the no-theft context. More generally, this finding suggests that dogs may be using prosocial helping as a mechanism both to obtain and maintain the loyalty of human caregivers.

In future studies, it could be interesting to re-examine dogs' latency to approach the door. In our research, we found that this dependent measure yielded a marginally significant effect. It is as of yet unclear whether this is because dogs are not behaving significantly differently in different conditions, or because our sample size was too small and thus underpowered. We had based our sample size on previous research on canine social cognition (e.g. Hare et al. 2002; Bräuer et al., 2006). However, studies investigating prosocial helping in humans often use sample sizes hundreds of times larger (e.g. Aknin et al., 2013; Gray et al., 2014), suggesting that detecting these types of effects may require a larger sample in canines as well.

One other possible reason that we did not find as robust results as we may have expected is that there is mixed evidence about what aspects of Theory of Mind dogs possess and what

contexts elicit them (Horowitz, 2011). As no studies have tested prosocial helping in dogs directly before, it is unclear what cues dogs use most saliently to detect when humans need help. Perhaps dogs would demonstrate even higher levels of prosocial helping in a context where they saw a human in distress. Regardless, our results add to the growing body of canine Theory of Mind literature suggesting that dogs may be capable of tracking what others have and have not seen (Kaminski et al., 2009; Marshall-Pescini et al., 2013).

Thinking more broadly, the finding that dogs may use prosocial helping as a mechanism to both obtain and maintain loyalty probes questions about the evolution of prosocial helping in other species. Are humans who may benefit from obtaining and maintaining loyal relationships more likely to engage in prosocial helping? Or, are they perhaps equally likely to engage in prosocial helping, but more likely to display it? What are the differences in the ways dogs and humans engage in and display prosocial helping? Future research, both in canines and in humans, can help answer these questions.

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