Animal Behaviour 106 (2015) 123–127

Contents lists available at ScienceDirect

Animal Behaviour

journal homepage: www.elsevier.com/locate/anbehav

Dogs avoid people who behave negatively to their owner: third-party affective evaluation

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ARTICLE INFO

Article history:
Received 17 February 2015
Initial acceptance 18 March 2015
Final acceptance 11 April 2015
Published online
MS. number: 15-00119R

Keywords:
cooperation
dogs
helping
image scoring
moral judgement
negativity bias
social eavesdropping
social evaluation
social preference
third-party evaluation

Social eavesdropping, or social evaluation of third-party interactions, is a first step to image scoring, which is a key feature of humans' large-scale cooperative society. Here we asked whether domestic dogs evaluate humans interacting with one another over neutral objects. In two experimental conditions, the dog's owner tried to open a container to get a junk object that was inside, then requested help from an actor sitting next to her/him, while the dog watched the interaction. In the Helper condition, the actor held the container stable to help the owner to open it. In the Nonhelper condition, the actor turned away and refused to help. In the Control condition, the actor simply turned away in the absence of any request for help. A neutral person sat at the other side of the owner throughout these interactions. After the interaction the actor and the neutral person each offered a piece of food to the dog. Dogs chose food randomly in the Helper and the Control conditions, but were biased against the actor in the Nonhelper condition. The dogs' avoidance of someone who behaved negatively to the owner suggests that social eavesdropping may be shared with a nonprimate species.

Humans form large-scale cooperative societies, in which members often help one another for no apparent benefits to themselves. Indirect reciprocity has been proposed as an important factor maintaining this phenomenon (e.g. Melis & Semmann, 2010; Nowak & Sigmund, 2005). For this mechanism to work, members must be sensitive to third-party interactions. Such sensitivity is often referred to as social eavesdropping. It involves an affective evaluation of third-party interactions, and it appears to develop early in human infants. For instance, Hamlin, Wynn, and Bloom (2007) exposed infants as young as 6 months old to an animation, in which one simple-shaped character helped another to climb up a hill whereas another blocked the attempt. When the infants were asked to choose between the characters, they chose the nasty character less frequently than the helpful character. The same authors found this to be true even for 3-month-olds (Hamlin & Wynn, 2011; Hamlin, Wynn, & Bloom, 2010). Such evaluation later converts into differentiated helping behaviour; Vaish, Carpenter, and Tomasello (2010) demonstrated that 3-year-old children were less willing to give a ball to an actor who behaved harmfully to another than to a harmless person.

This sensitivity has been tested in a few nonhuman species including chimpanzees, *Pan troglodytes* (Subiaul, Vonk, Okamoto-Barth, & Barth, 2008), tufted capuchin monkeys, *Cebus apella* (Anderson, Kuroshima, Takimoto, & Fujita, 2013; Anderson, Takimoto, Kuroshima, & Fujita, 2013), common marmosets, *Callithrix jacchus* (Kawai, Yasue, Banno, & Ichinohe, 2014), domestic dogs, *Canis familiaris* (Freidin, Putrino, D'Orazio, & Bentosela, 2013; Kundey et al., 2011; Marshall-Pescini, Passalacqua, Ferrario, Valsecchi, & Prato-Previde, 2011; Nitzschner, Kaminski, Melis, & Tomasello, 2014; Nitzschner, Melis, Kaminski, & Tomasello, 2012), and *Labroides dimidiatus* cleaner fish (Bshary & Grutter, 2006). In most of these studies the participants watched third-party interactions, usually exchanges, involving food, which raises the possibility that participants simply preferred actors who were more likely to give them a better chance of getting food. Two studies by Anderson, Kuroshima, et al. (2013) and Anderson, Takimoto, et al. (2013) were more persuasive, as in those studies actors handled toys that were of no apparent value to capuchin monkeys.

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http://dx.doi.org/10.1016/j.anbehav.2015.05.018
0003-3472/

Whereas dogs are highly sensitive to human actions directed to themselves, whether they are sensitive to third-party interactions among others has been under debate. Kundey et al. (2011) showed that dogs preferred an actor who generously gave food to a begging person over another who withheld it. But in that study the dogs also preferred an actor who 'gave' food to a box rather than the beggar. Marshall-Pescini et al. (2011) reported that dogs showed no preference when there was no beggar, thus demonstrating that some interaction between the actor and the beggar was critical for the dogs' social preference.

By contrast, Nitzschner et al. (2012) argued that dogs evaluate only direct experiences; dogs preferred an actor who behaved nicely to them to an actor who ignored them, but showed no preference after watching actors behaving in these ways towards another dog. Evidence for such second-party evaluation was also obtained by Petter, Musolino, Roberts, and Cole (2009), who showed that dogs preferred a cooperative human to a deceiving human in an object choice task. Recently, Nitzschner et al. (2014) reported that dogs preferred the location, not the person, where a beggar received food. Thus, evidence for third-party social evaluations by dogs is weak.

Here we used a newly devised procedure to test whether dogs could evaluate actors who interacted with their owners either cooperatively or noncooperatively. To exclude the possibility of a preference due to association between one of the actors and attractive objects such as food, the actors never touched the object involved in the interaction; that is, the object stayed with the owner.

METHODS

Participants

Fifty-four domestic dogs and their owners participated. We excluded 26 more dogs that failed to complete the test trials due to weak motivation ($N = 16$) or experimenter error violating prescheduled test conditions and/or wrong acting ($N = 10$). Dogs were considered to be insufficiently motivated if they failed to approach the actor or the neutral person within 30 s in three repeated trials. In this case no further tests were given. Only one dog in the Control group (see below) was excluded after watching the recorded video due to failure to attend to the acting. The dogs were randomly divided into three groups of 18 (nine males, nine females), and each participated in one of two experimental conditions called Helper and Nonhelper conditions, or a Control condition. The dogs were of various breeds, and ranged in age from 7 months to 14 years, with the average age for the Helper, Nonhelper and Control groups being 4.54, 5.02 and 5.67 years, respectively (see Appendix Table A1).

Ethical Note

The experiment was approved by the Animal Experiments Committee of the Graduate School of Letters, Kyoto University. The owners signed a written informed consent before their dogs were tested.

Apparatus and Procedure

Trials started with the owner in possession of a transparent cylindrical container (13 cm in diameter and 12.5 cm high), with a lid, in which there was an object (roll of vinyl tape, diameter 5.5 cm). The actor sat to one side of the owner, and a neutral person sat to the other side. The dog was lightly restrained by an experimenter ca. 1 m from the owner (Fig. 1).

Upon a vocal cue from another experimenter, the owner started trying to open the lid of the container. For the two experimental groups, after 8–10 s of failed attempts, the owner requested help by turning towards and holding the container towards the actor. In the Helper condition, the actor responded by holding the bottom of the container. With this help, the owner successfully opened the lid, removed the object, showed it to the dog, then placed it back into the container and put the lid firmly back on. This final action ensured the same end state of the interaction as in the Nonhelper condition. In the Nonhelper condition, in response to the owner's request the actor showed unwillingness to help by turning away for 1–2 s. The owner continued trying to open the container, in vain. In the Control condition, after 8–10 s of attempting to open the lid the owner stopped and simply looked down at the container for 1–2 s while the actor turned away; critically, there was no request for help by the owner. The owner resumed trying, in vain.

All conditions ended with the owner placing the container in front of her/him. The entire demonstration lasted 15–20 s. Immediately thereafter, the actor and the neutral person extended both arms at the same time, offering a piece of the dog's favourite food on their palms. The dog was allowed to pick one reward.

To exclude any inadvertent cueing, neither the actor nor the neutral person looked at the dog during the demonstration. During the choice phase, they looked down at the floor and the owner's eyes were closed. The owner was ignorant of the purpose of the experiment. These careful procedures were followed because some dogs can be trained to use even momentary eye gaze to detect a cued container in an object choice task (Miklósi, Polgárdi, Topál, & Csányi, 1998). The dog's choice was defined as the first person the dog sniffed, licked or took the food from. This behaviour was obvious; post hoc video analyses of 20% of the dogs' choices completely matched the on-site decision.

Each dog received four trials in which the identities of the actor and neutral person were unchanged. The identity was different across participant dogs but both were females unfamiliar to the dog. The left–right positions of actors were counterbalanced across trials and on the first trial across individuals.

RESULTS

Figure 2 shows the number of times the actor was chosen in each condition. Whereas this frequency was at chance in Control (Wilcoxon signed-rank test: $V = 9.50$, $P = 0.488$, $r = 0.16$) and Helper conditions ($V = 48.00$, $P = 0.177$, $r = 0.32$), it was significantly below chance in the Nonhelper condition with a satisfactory effect size ($V = 11.00$, $P = 0.023$, 95% confidence interval 0.50–1.00, $r = 0.54$). The difference in frequency of choosing the actor in the three conditions was significant, and the effect size (η^2) was satisfactory (Kruskal–Wallis test: $\chi^2_2 = 8.18$, $P = 0.017$, $\eta^2 = 0.15$). Post hoc multiple comparisons using Mann–Whitney U tests with Bonferroni correction (corrected alpha = 0.017) revealed a significant difference between Nonhelper and Helper conditions with a satisfactory effect size ($U = 244.50$, $N_1 = N_2 = 18$, $P = 0.006$; 95% confidence interval 0.00–2.00, $r = 0.46$). There was no difference between Helper and Control conditions ($U = 127.00$, $N_1 = N_2 = 18$, $P = 0.241$, $r = 0.20$). Unfortunately, the difference between Nonhelper and Control conditions was not significant, either ($U = 215.00$, $N_1 = N_2 = 18$, $P = 0.075$, $r = 0.30$), because of one exceptional dog in the Nonhelper condition choosing the actor in all four trials (note that all other dogs in this condition chose the actor in two or fewer trials; see Appendix Table A2). However, a Fisher exact test of the number of dogs choosing the actor in different numbers of trials (see Appendix Table A2) revealed a significant difference between Nonhelper and Control conditions ($P = 0.016$).