



Owners' direct gazes increase dogs' attention-getting behaviors



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ABSTRACT

This study examined whether dogs gain information about human's attention via their gazes and whether they change their attention-getting behaviors (i.e., whining and whimpering, looking at their owners' faces, pawing, and approaching their owners) in response to their owners' direct gazes. The results showed that when the owners gazed at their dogs, the durations of whining and whimpering and looking at the owners' faces were longer than when the owners averted their gazes. In contrast, there were no differences in duration of pawing and likelihood of approaching the owners between the direct and averted gaze conditions. Therefore, owners' direct gazes increased the behaviors that acted as distant signals and did not necessarily involve touching the owners. We suggest that dogs are sensitive to human gazes, and this sensitivity may act as attachment signals to humans, and may contribute to close relationships between humans and dogs.

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1. Introduction

Dogs, *Canis familiaris*, were domesticated at least 14,000 years ago (Druzhkova et al., 2013; Nobis, 1979; Vilá et al., 1997). Since then, humans and dogs have established close relationships. Communication by means of visual information is a crucial feature in these close relationships between humans and dogs. It is especially important for working dogs, such as hunting dogs, to understand human visual communicative information to aid them in making cooperative movements. Previous studies have revealed that dogs understand visual information given by humans very well (Hare et al., 2002; Miklósi et al., 1998).

In addition, dogs are able to understand the visual attention of humans as indicated by body orientation, the turning of the head, and gaze (Hare and Tomasello, 1999). In the current theory of human cognitive development, understanding the visual attention of others links to more complex social-cognitive skills, such as understanding intentions, or "theory of mind" (Baron-Cohen, 1995). Similarly, dogs' understanding of humans' visual attention may contribute to the communication between the two. This ability

of dogs might be supported by the co-habitation between human and dogs.

Studies have examined whether dogs understand humans' attention based on their gazes (Call et al., 2003; Schwab and Huber, 2006). For example, Call et al. conducted a series of trials in which dogs were forbidden to take a piece of visible food (i.e., the experimenters spoke a "Don't take it" command). In some trials, the humans continued to look at the dogs throughout the trial (direct gaze condition), whereas in other trials, the humans closed their eyes (no-gaze condition). Call et al. reported that the dogs retrieved less food in the direct gaze condition than in the no-gaze condition, suggesting dogs respond to commands in different ways depending on whether humans gaze directly the dogs or not. Furthermore, the dogs understood the humans' attention as it was communicated by their gazes.

In Call et al.'s study, however, there are differences between the direct gaze and closed eyes condition in not only the directions of the gaze but also in the opening and closing of the eyes. Therefore, the true value of humans' gaze directions for the dogs was not clear. In humans, infants are sensitive to gaze direction, and they understand from the gaze direction whether others have directed attention to them (Farroni et al., 2002, 2000; Samuels, 1985). Therefore, in the current study, in order to examine whether dogs understand their owners' attention according to gaze direction, we

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investigated whether they change their behaviors in different ways depending on owners' gazes.

In particular, we assessed dogs' attention-getting behaviors: whining and whimpering, looking at the owners' faces, pawing, and approaching. For the reason mentioned below, we focused on the attention-getting behaviors.

Studies of children with autism have revealed that their frequencies of affective expression and spontaneous social behaviors for others, such as looking at others or making physical contact with them, were lower than those observed among typically developing children in communicative situations (e.g., Baranek, 1999; Adrien et al., 1993). Studies have suggested that the lower frequencies found in communicative situations made it difficult for children with autism to establish closer relationships with others. Accordingly, spontaneous social behaviors, including the attention-getting behaviors, were important in subsequent reciprocal communication (Leavens et al., 2005).

In the present study, we examine whether dogs change their attention-getting behaviors according to humans' gazes in communicative situations. We compared the durations of the attention-getting behaviors in the Direct Gaze condition with those in the Avert Gaze condition. We predicted that if dogs are sensitive to humans' gazes and they understand humans' attention according to gaze, then the durations of the attention-getting behaviors would be longer in the Avert Gaze condition compared to the Direct Gaze condition.

2. Materials and methods

2.1. Subjects

The subjects were 20 pairs of owners and healthy household samples. The samples consisted of three Yorkshire Terriers, two Bolognese, two Chihuahuas, and two Pekingeses, as well as one of each of these breeds: Beagle, Bernese Mountain Dog, Italian Greyhound, Boston Terrier, Labrador Retriever, Shin-tzu, Papillon, and Welsh Corgi. In addition, three mixed breed dogs (two Miniature Dachshund and Toy Poodle, two Chihuahua and Toy Poodle). Ten dogs were male, and ten were female, with a mean age of 4.2 [SD: 3.1] years. One owner was male, and nineteen were female, with a mean age of 35.5 [SD: 12.8] years.

This study was approved by the Ethics Committee of Azabu University, Japan. Informed written consent was obtained from each participant.

2.2. Experimental procedures

The experiment was conducted in a room at Azabu University (Japan). The room was divided into partitions, yielding a space for the dog of 125 × 250 cm (Fig. 1a). The front of this space was a blank wall with an acrylic window. The owner sat outside the space in front of the window, and the dog was able to view the owner's face through the window (Fig. 1b).

The experiment consisted of two conditions. In the Direct Gaze condition, the owner faced the window and gazed directly at the dog on the other side. In the Avert Gaze condition, the owner faced the window but did not gaze at the dog (i.e., they gazed to either the left or the right). We asked the owners to have a neutral facial expression in both conditions. Each condition was conducted two times (i.e., 2 trials × 2 conditions), resulting in a total of 4 trials per dog. The order of the trials was an ABBA design and was counterbalanced within subjects. Each trial was lasted for 1 min. The interval between trials was 3 min. In the inter-trial interval, owners were able to interact freely with their dogs. The total experiment duration was 16 min. All trials were video-recorded (Sony

video camera HDR-CX180 seated on a tripod) to analyze the dogs' behaviors.

2.3. Data analysis

Attention-getting behaviors, including standing in close proximity to the owner from the acrylic window (i.e., within an area of 70 × 70 cm from the windows; Fig. 1a), looking at the owner's face, whining and whimpering, and pawing, were recorded using an all-occurrence sampling. We analyzed the durations of these behaviors in the Direct Gaze and Avert Gaze conditions, using an Excel VBA-based event recorder. One of the authors (Midori Ohkita) analyzed all the videotaped data. In addition, a blind observer who did not know the purpose of the study analyzed randomly selected subjects (20%). Agreement reliability between the author and the naïve observer was excellent ($r_s = .98$). We calculated sum durations for each behavior in each condition for each subject. Statistical analyses were performed using Wilcoxon signed-ranks test with an alpha level of .05.

3. Results

Fig. 2 shows the means of the sum durations (in seconds) for each attention-getting behaviors in each condition for each subject. The durations of whining and whimpering ($Z = 2.62$, $p = .01$, $r = .59$) and looking at the owners' faces ($Z = 4.43$, $p < .001$, $r = .99$) were longer in the Direct Gaze condition than in the Avert Gaze condition. There were no differences between the two conditions in durations of pawing ($Z = 1.47$, $p = .14$, $r = .33$) or standing close to the acrylic window ($Z = 0.71$, $p = .48$, $r = .16$).

4. Discussion

We investigated whether dogs change some of their attention-getting behaviors in different ways depending on owners' direct gazes by comparing their behavior under the avert gaze. Dogs usually perform attention-getting behaviors in order to get attention from humans. If dogs are sensitive to humans' gazes and they understand humans' attention according to gaze, then the durations of the attention-getting behaviors would be longer in the Avert Gaze condition compared to the Direct Gaze condition. An interesting finding, contrary to our expectations, was that the durations of whining and whimpering and looking at their owners' face were longer in the Direct Gaze condition than in the Avert Gaze condition. These results suggest that the dogs were sensitive to the direction of their owners' gazes. Subsequently, the dogs showed an increase of their own attention-getting behaviors. The question, then, arose; Why did the owners' attention behaviors—that is, the direct gaze—increase their dogs' attention-getting behaviors.

One possible explanation for this question is that attention-getting behaviors act as appetitive behavior whereas being touched by the owners or given a reward like food acts as a consummatory behavior. In general, owners' tend to touch their dogs after gazing at them directly (attending to them) in response to the dogs' attention-getting behaviors, dogs are more likely to act out attention-getting behaviors in response to their owners' gazes until these behaviors are reinforced by their owners' touches (Bentosela et al., 2008). In the present study, in the Direct Gaze condition, the dogs did perform attention-getting behaviors in response to their owners' gazes. In contrast, in the Avert Gaze condition, dogs did act out these behaviors a little, because their owners gazes were not present. In order to ensure these behaviors mainly occurred in the Direct Gaze condition, the durations of these behaviors were longer in that condition than in the Avert Gaze condition.

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