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Research

Reciprocal attention of dogs and owners in urban contexts

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ABSTRACT

Laboratory-based studies have shown that paying attention to humans is an important determinant of dogs' behavior. However, there are no data on how gaze is deployed between dogs and owners in non-laboratory conditions. This study aimed at characterizing dogs' and owners' attention to each other in 2 urban contexts, characterized by a different density of dynamic stimuli. Short videos of 176 dog–owner couples walking in streets and squares of the city center (CC) or green areas (GAs) of the center of Padova (Italy) were recorded. Continuous sampling was used for recording when dogs and owners were visually oriented toward their respective partners. These data allowed calculation of the average length of continuous gazes, number of gazes per minute, and the percentage of time in which dogs and owners were oriented toward their partners; also computed were the frequency and duration of mutual gazes. Eighty-three dogs and 32 owners never looked at their reciprocal partners for the entire duration of the video. On average, dogs were oriented to owners for 0.6% of the time and looked at them 0.5 times per minute, in bouts of 0.5 seconds. All parameters of dogs' attention were higher for off-leash dogs in GAs than for on-leash dogs in both GAs and CC. Although such limited attention to owners may reflect the requirements of ongoing action, it also suggests that most dogs do not need to look at their owners during walks, possibly because they are not confronted with situations of uncertainty. Owners were oriented to their dogs for 5.3% of the time and looked at them 1.7 times per minute, in bouts of 1.4 seconds. Owners' attention was lower in CC than in GAs, which may reflect differences between contexts in the number of distracting stimuli or in owners' motivations for looking at their dogs while walking in these different contexts.

Introduction

Paying attention to other group members is an essential feature in the social life of a species. Dogs are distinctive in this regard as living in human societies may require them to direct attention toward heterospecific companions. Indeed, dogs' propensity to look at humans seems so embedded in the species that it was proposed as a distinguishing feature between dogs and wolves (Miklósi et al., 2003). Dogs' ability to exploit visual information from humans takes many forms: dogs are predisposed to follow overt human communicative gestures to locate resources (Hare and Tomasello, 2005; Virányi et al., 2008) and to refine this ability through experience (Udell et al., 2010). Witnessing human demonstrators influences dogs' performance in detour (Pongrácz et al., 2001) and manipulative tasks (Miller et al., 2009) and, with appropriate training, dogs can learn to imitate some human motor patterns (Topál et al., 2006; Fugazza and Miklósi, 2014). Dogs can also determine humans' attentional states by looking at them and can modify their behavior accordingly: they prefer to obey and beg from attentive rather than nonattentive humans (Gácsi et al., 2004; Virányi et al., 2004) and can take advantage of inattention, for instance by eating forbidden pieces of food when the forbidding human appears not to be looking at them (Call et al., 2003; Schwab and Huber, 2006).

The mentioned studies offer substantial evidence that dogs resort to looking at humans in a variety of situations. Nonetheless, dogs will not pay the same level of attention to *any* person in a given context. A few studies have been focusing on the role of the identity of the human partner on the distribution of gazes, showing, for instance that the dogs' owner involved in a manipulation task will receive higher attention than an unfamiliar person performing

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Figure 1. Video still of a dog–owner dyad walking in the city center. Arrows (N = 10) indicate the position of people and objects in motion, exemplifying the high density of stimuli in this context.

the same activity (Range et al., 2009). Another manipulation situation used by Horn et al. (2013) indicated that such increase in attention levels requires a close relationship, rather than mere familiarity. The owner's capacity to elicit particularly high levels of attention by dogs becomes especially evident if the animal is presented simultaneously with 2 human "targets," a condition in which dogs will look at their owner with much longer gazes than at a stranger (Mongillo et al., 2010).

The studies cited so far have all been conducted in strictly controlled experimental conditions. However, a possible limitation of these laboratory-based studies is that they may not adequately model how attention is deployed between dogs and owners in more natural circumstances, for a laboratory can hardly incorporate the quantity and types of stimuli to which dogs are likely to be exposed in real life. Although there are a few studies that focused on dogs' social interactions in natural contexts (Bekoff and Meaney, 1997; Westgarth et al., 2010; Řezáč et al., 2011), there are no data on dog–human attention in such contexts.

This study aimed at providing a characterization of attention between dogs and owners in non-laboratory conditions; to this aim, we chose to run the study in urban areas, which allowed us to observe a great number of dogs and owners engaging in spontaneous behavior, which would have been harder to obtain otherwise, for example, by recording in owners' private properties. The urban environment also provides well-characterizable contexts, varying in the type and density of stimuli, which gave us the opportunity to assess, as a further aim of the study, how dogs' and owners' attention is deployed in the presence of a great number and type of stimuli as opposed to a relatively less rich context.

Materials and methods

Subjects and procedure

The present study was carried out in the city of Padova (Italy). Short videos were taken of 176 dog–owner couples walking in various areas of the city. In detail, 2 types of contexts were chosen: (1) the streets and squares of the old city center (CC), characterized by a relatively high density of people and of objects in motion (e.g., bicycles, baby carriages, wheelchairs; Figure 1) (median N of stimuli/video frame = 11; minimum = 5, maximum = 22), as well as by sounds and noises, and (2) the grassy embankments of the canals in the city (green areas [GAs]), with fewer stimuli (median N of stimuli/video frame = 2; minimum = 0, maximum = 11; Mann–Whitney U test = 128, $P < 0.000$). The number of couples recorded was balanced between the 2 types of area (N = 88 per type). The videos were taken between May and November 2010 in good weather conditions, in sessions of 60-120 minutes in daylight, during hours in which owners and dogs are typically found in the two contexts. A total of 23 sessions was necessary to complete the recordings. The operator had the camera mounted on a tripod with a rotating video head and monitored a sector of approximately 40 m of radius and 160° angle in front of him. Each time a dog–owner couple entered in this field, the operator started recording, moving the camera so to keep the two subjects in the frame, and continued recording as long as they were frontally visible; while recording a given dog–owner couple, other couples entering the mentioned field were ignored. Also ignored were subjects who had been recorded previously in this study or couples engaged in activities different from walking (e.g., playing, jogging). No other criterions were used for sampling. Notices stating that the area was subjected to video recording were placed in these areas, in accordance with the Italian law. Apart from such notices, the owners were not aware in advance of being recorded, and the position of the camera and its operator was chosen so that it was unlikely that the latter were seen or noted by dog owners. Immediately after they had been filmed, another experimenter approached the dog owners to ask their explicit consent for collecting data from the video and to acquire information about the dog's age and sex. All the interviewed owners consented to have their videos analyzed and provided the requested information.

Data collection

Video recordings were imported into Noldus Observer XT software (Noldus Information Technology, Wageningen, The Netherlands). Data were collected from all videos by continuous sampling on focal subjects, recording at any point in time whether the dogs were visually oriented toward their owners' body or not, and vice versa. As the distance did not allow to determine the exact orientation of the eyes, head orientation was used as a proxy for gaze direction. These data supplied 3 measures of dogs' and owners' attention: the average gaze length (GL), gaze frequency (GF, gazes/minute), and the percentage of time (looking time [LT]) in which dogs and owners were oriented to the respective partners. The same data were used to compute parameters of mutual attention, that is, GL, GF, and the percentage of time in which dogs and owners were concurrently oriented toward each other. Intervals in which the head orientation of dogs or owners could not be clearly determined were excluded from the computation of attention parameters. Last, data were recorded on whether the dogs were on leash or off leash.

Data analysis

Because none of the variables was normally distributed, nonparametric statistical tests were used for all analyses. Interobserver reliability was assessed by computing correlations between data collected by two independent observers on 20% of the videos (N = 36) and was found to be good for all the parameters of dogs' and owners' attention (Spearman rho > 0.7, $P < 0.01$ in all cases).

After obtaining a descriptive analysis of dogs' and owners' attention, to explore whether attention levels of dogs were somehow correlated to that of their owners, Spearman signed rank correlations were calculated between GL, GF, and LT of owners and dogs. Because the relatively high number of cases in which dogs and owners were never oriented to their partners would have provided misleading results, only cases in which both dogs' and owners' LT