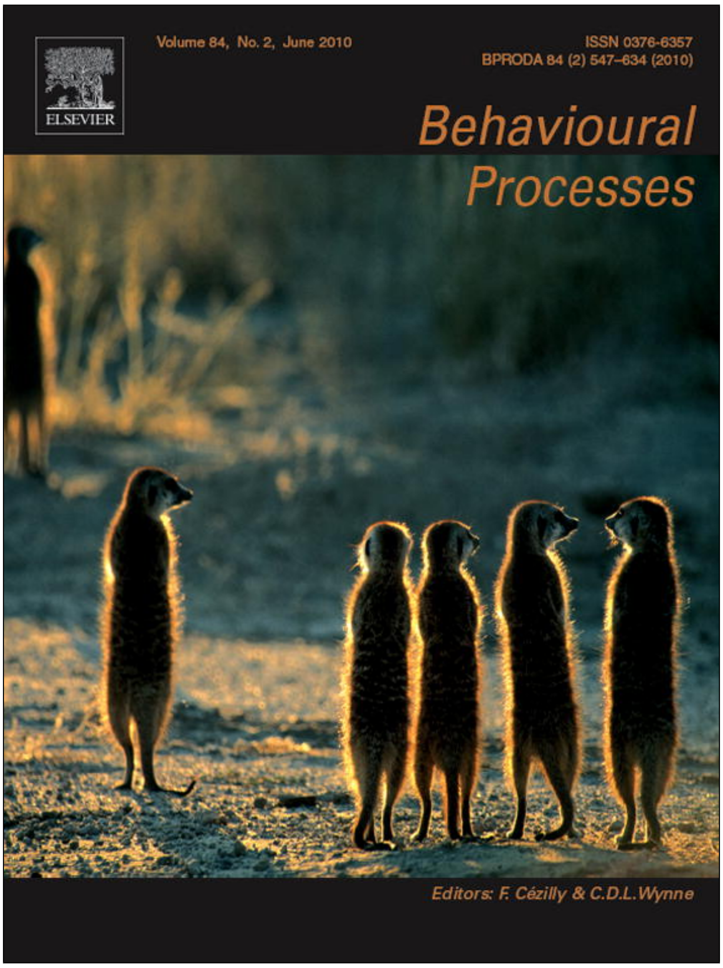
Volume 84, No. 2, June 2010
ISSN 0376-6357
BPRODA 84 (2) 547–634 (2010)
ELSEVIER
Behavioural Processes
Editors: F. Cézilly & C.D.L.Wynne

Behavioural Processes 84 (2010) 602–607

Contents lists available at ScienceDirect

Behavioural Processes

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

Breed differences in dogs' (*Canis familiaris*) gaze to the human face

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A R T I C L E I N F O

Article history:
Received 5 January 2010
Received in revised form 16 March 2010
Accepted 2 April 2010

Keywords:
Breed differences
Domestic dogs
Gaze
Interspecific communication
Learning

A B S T R A C T

Domestic dogs (*Canis familiaris*) have been submitted to a vast process of artificial selection and to date, there are hundreds of breeds that differ in their physical and behavioral features. In addition, dogs possess important skills to communicate with humans. Previous evidence indicates that those abilities are related to the domestication process and are modulated by instrumental learning processes. Very few studies, however, have evaluated breed differences in the use and learning of interspecific communicative responses. In Study 1 Retrievers, German Shepherds and Poodles were compared in the acquisition and extinction of their gaze toward the human face, in a conflict situation involving food within sight but out of reach. The groups did not differ in the acquisition of the response, but throughout the extinction phase Retrievers gazed to the human significantly more than the other groups. In Study 2, similar results were obtained in a test without any previous explicit training. These results suggest that these three major popular breeds differ in gazing to humans in a communicative situation.

1. Introduction

Domestic dogs (*Canis familiaris*) possess important skills to communicate with humans (for a review, see Miklósi et al., 2004; Hare and Tomasello, 2005; Udell and Wynne, 2008).

One of the most widely studied communicative responses is the direction of the gaze toward the human face in situations of uncertainty or conflict. In a comparative study, socialized wolves (*Canis lupus*) and dogs were trained to open a container and pull a rope to get food (Miklósi et al., 2003). Once the animals learned to solve the task, they were faced with an unsolvable version (the container was locked and the rope secured). Whereas in the first version both species performed equally, in the unsolvable version dogs began visual contact with humans more quickly and for a longer period than wolves. The latter, however, remained oriented to the devices and persevered in the task. In a similar test, dogs again looked more toward the human than another domesticated species, cats (*Felis catus*; Miklósi et al., 2005). In another task, where access to food was blocked, pet dog's and guide dog's strategies to request food were compared. Gazing toward the owner was the most frequent behavior and no differences between pet dogs and guide dogs were found, suggesting that this behavior could be independent of the visual status of the owner (Gaunet, 2008). Similar results were found using a toy as reward (Gaunet, 2009).

Besides, Miklósi et al. (2000) found that dogs who saw where food or a toy was hidden while the owner was out of the room, vocalized and alternated their gaze between the person and the hidden reward upon his return, so that the owners were able to discover the correct location of the object. Taken together, these studies indicate that, when faced with an unsolvable problem, dogs tend to approach people using their gaze as a communicative signal and humans as tools to achieve their purpose (Hare, 2004).

The high performance of dogs compared to wolves in interspecific communicative tasks led several authors to propose that these skills were a product of domestication, and independent of learning processes (e.g., Hare et al., 2002; Bräuer et al., 2006; Miklósi and Soproni, 2006). Recent studies, however, show that associative learning plays an important role in the mechanisms involved in interspecific communication (Wynne et al., 2008; Elgier et al., 2009a). Specifically, both production and comprehension of communicative cues were shown to be flexible in response to changes in environmental contingencies (Bentosela et al., 2008; Elgier et al., 2009b). A recent study has evaluated whether the outcomes of gazing at the human face modified gaze duration in a situation of conflict with food in sight but out of the dogs' reach (Bentosela et al., 2008). Each time the dog looked at the experimenter's face it received a reward so gaze duration increased significantly (acquisition), and when the reinforcer was no longer delivered (extinction) or was delivered any time the animal was not gazing to the human (omission) the response decreased. A decline in gazing was also found when rather than omitting the reward, a lower quality one was provided (Bentosela et al., 2009). These evidences indicate that such response diminishes even when food is being delivered and

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doi:10.1016/j.beproc.2010.04.003

that, at least in part, is modulated by reinforcement contingencies. Other studies have also found differences in communicative behaviors when comparing dogs with different types of training (McKinley & Sambrook, 2000; Marshall-Pescini et al., 2008, 2009).

On the other hand, dogs show considerable variation in morphology, genetics and behavior, which is manifest in the more of 400 breeds we have today (Stafford, 2006; Svartberg, 2006). Behavioral differences between breeds have often been regarded as remnants from past selection during the breeds' origins (Scott and Fuller, 1965). This artificial selection was performed with a focus on specific cognitive and behavioral skills relative to the function for which the dogs were used, such as shepherding, hunting, search-rescue, etc., which produced the different breeds that we know today (Coppinger and Coppinger, 2001; Hare and Tomasello, 2005). During recent decades, however, selection in many breeds has undergone great changes and may have influenced breed-typical behavior (Svartberg, 2006).

In an indirect way, dogs' type of work also determines their kind of interaction with humans (Miklósi et al., 2004). It may be the case that breeds with different histories of selection show differences in their communicative skills as well as in the learning of these abilities. To our knowledge there are no previous studies about breed differences in the use of gazing to the human face. Then the purpose of the present study is to perform a preliminary evaluation of whether diverse breeds differ in the acquisition and extinction of the communicative response of gazing at the human face to ask for food. The existence of breed differences in the learning of communicative responses can provide information related to within-species cognitive differences and about which are the most suitable breeds to work near humans.

2. Study 1

Although textbooks and popular literature associate dog breeds with distinct behavioral features and mental skills, comparative studies on breed differences are very scarce (Pongrácz et al., 2005). One possible reason for the paucity of behavioral studies comparing the communicative abilities of different breeds, is the large number of animals that would need to be tested even to cover a representative subset (Dorey et al., 2009). Taking this in account, we decided to focus the evaluation on three major popular breed groups: Retrievers, German Shepherds and Poodles. Although Retrievers were originally selected for hunting and Shepherds for herding tasks, most recent uses – albeit non exclusively – were as guide dogs and as police or military dogs respectively (e.g., Goddard and Beilharz, 1984; Wilsson and Sundgren, 1997; Slabbert and Odendaal, 1999). In this sense, Wilsson and Sundgren (1997) compared Retrievers and German Shepherds by means of behavioural tests founding that Retrievers were more cooperative and affable than Shepherds. Still, less information is available regarding Poodles, but they are very popular breed designed to sharing life with humans as companions (Cayuela, 2003).

Provided that the evaluated breeds differ in the function for which they were selected as well as in their behavioral characteristics, in the following study it is explored if such differences are also observed in the learning of a task involving communication with a human.

2.1. Materials and methods

2.1.1. Subjects

The subjects were 24 pet dogs (*Canis familiaris*, see Table 1 for details) that lived in human households. All were recruited voluntarily from their owners.

Table 1
Description of the subjects used in Study 1.

Subject	Sex	Age in months	Testing location	Breed
Inca	F	36	Boarding place	Labrador Retriever
Checha	F	46	Boarding place	Labrador Retriever
Benicio	F	12	Boarding place	Labrador Retriever
Brownie	M	48	Boarding place	Labrador Retriever
Giorgio	M	36	Owner's home	Labrador Retriever
Simón	F	24	Owner's home	Labrador Retriever
Rola	M	72	Owner's home	Labrador Retriever
Homero	M	18	Boarding place	Golden Retriever
Simón	M	60	Owner's home	Golden Retriever
Cameron	M	36	Boarding place	German Shepherd
Gringo	M	30	Boarding place	German Shepherd
Freak	M	30	Boarding place	German Shepherd
Olaf	M	102	Owner's home	German Shepherd
Inca	F	24	Owner's home	German Shepherd
Quidan	M	12	Owner's home	German Shepherd
Buby	M	9	Owner's home	Poodle
Brisa	F	12	Owner's home	Poodle
Cani	M	48	Boarding place	Poodle
Maia	F	60	Owner's home	Poodle
Luli	F	48	Boarding place	Poodle
Frida	F	54	Owner's home	Poodle
Rocky	M	24	Owner's home	Poodle
Lola	F	24	Owner's home	Poodle
Melody	F	16	Owner's home	Poodle

Three breed groups were evaluated: Retrievers ($n = 9$, 7 Labrador Retriever and 2 Golden Retriever, age 38.25 + 20.78 months, 4 females and 5 males), German Shepherds ($n = 6$, age 39.00 + 31.92 months, 1 female and 5 males) and Poodles ($n = 9$, age 28.43 + 20.38 months, 6 females and 3 males). As the main breed group classifications (Fédération Cynologique Internationale and American Kennel Club) cluster Labrador Retriever and Golden Retriever together we evaluated them as a single group.

All dogs in this study belonged to families who treated them as pets, and not for their original working abilities. Only one subject (a Golden Retriever) had received basic obedience training.

Dogs had free access to water and the last meal before training sessions had been received approximately 7 h earlier for large dogs (more than 10 kg in weight), but approximately 13 h before for small dogs (less than 10 kg in weight).

2.1.2. Experimental setting and apparatus

All sessions were scheduled in a location familiar to the dogs. Fourteen dogs were evaluated in a room of the owner's house, the remaining in a training/boarding establishment that was familiar to the dogs. In both cases, sessions were scheduled in a restricted area allowing some degree of free movement or in an open space. In the latter case, an approximately 2 m leash restricted movement. The leash was tied down.

The reward was dry liver between 0.6 and 0.8 g for the small dogs and between 1.3 and 1.5 g for the larger ones. Incentives were placed in a container located on a high shelf (Fig. 1). The container was visible to the animals, but out of their reach. All trials were videotaped with a Sony DCR TRV 310 camera. The person taping the trial was located behind and on one side of the experimenter, so as to be able to film the direction of the dog's gaze and head. Each session involved the dog, the experimenter, and the person operating the camera. The experimenter was always a woman unknown to the animal. Owners were not present.

2.1.3. Procedure

The procedure was similar to the one used by Bentosela et al. (2008). It consisted of three phases: warm-up, acquisition and extinction.

Fig. 1. Photo of the testing scenario.

Warm-up: During a single session lasting 3–5 min, dogs were brought to the location where training was to take place to let them explore it. The experimenter called the dogs by their names and actively sought physical contact. To evaluate dogs' motivation for food, they received three units of liver, directly from the hand of the experimenter.

Acquisition: Immediately after warm-up, dogs received three trials of differential reinforcement of gazing at the experimenter. Each trial lasted 2 min with an inter-trial interval (ITI) of approximately 2 min. Acquisition trials started with the experimenter standing by the food container and calling the dog by its name just once. Dogs were reinforced each time they gazed at the experimenter. From the second trial, dogs were required to gaze at the experimenter for at least 1 s before receiving a reward.

Usually, dogs moved their gaze from the experimenter's face to her hand as soon as the experimenter reached for the food. A new reinforcer was delivered when the dog turned its gaze back to the experimenter's face for one second. At the end of each trial, the experimenter withdrew to a different location, out of the dog's visual field, while the dog remained in the training area. All the dogs in this experiment responded to their names and gazed at the experimenter at least four times during each trial.

Extinction: Three extinction trials, 2 min each, were performed with a 2-min ITI. The interval between acquisition and extinction phases lasted 2 min. This phase was identical to the acquisition one except that the reward was never delivered. It started by calling the dog by its name once, but without giving it any food. The experimenter remained in the same place as in previous trials. At the end of each trial she left the area.

During acquisition and extinction trials the experimenter remained in the same position gazing at the dog's face.

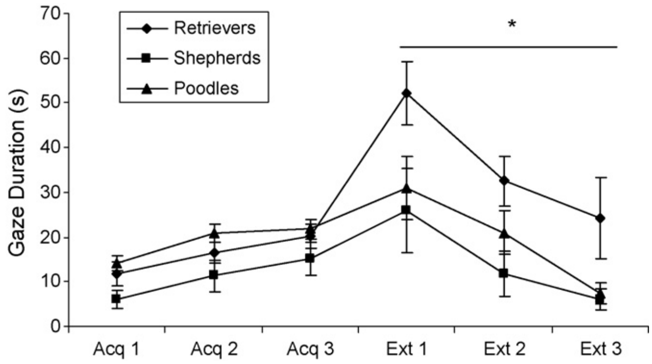

Fig. 2. Gaze duration (s) during each trial for each group in Study 1. Dogs were required to gaze at the trainer for 1 s to receive food in the acquisition phase (means ±95% confidence intervals). During extinction (no food was delivered) Retrievers gazed significantly more than Shepherds and Poodles, $^*p < 0.05$.

2.2. Data analysis

Gaze duration (s) was measured as a dependent variable. This behavior was scored on all trials by manually calculating (with a stop watch) the cumulative duration of visual contact of the dog with the trainer. Two trained observers analyzed gaze duration in the videotaped material. To test inter-observer reliability Pearson's coefficients of correlation were calculated for gaze duration for all the dogs (rs > 0.99, Ns = 24, ps < 0.01, two-tailed).

Gaze duration was found not to differ from normal distribution (Kolmogorov–Smirnov test); therefore, parametric analyses were used. In order to evaluate the breed group effect on gaze duration analyses of variance with trials as repeated measures were performed, one for the acquisition phase and another for the extinction phase. Whenever necessary, LSD post hoc tests were used. The alpha value was set at 0.05. All analyses involved two-tailed tests.

To evaluate whether other potentially relevant factors, such as gender, age (juvenile dogs 9–24 months vs. adult dogs 25–102 months) and place of training (owner's home vs. training/boarding place) affect gaze duration, a repeated measures ANOVA for each factor in the acquisition and extinction phases was performed prior to the main analysis. Neither factors, Fs < 2.49, ps > 0.05, nor the interactions, Fs < 1.75, ps > 0.05, were significant in the acquisition phase. In the extinction phase neither factors, Fs < 3.75, ps > 0.05, nor the interactions, Fs < 3.14, ps > 0.05, were significant. This would indicate that age, sex, and place of training did not affect gaze duration. On this basis, these factors were not included in the main analysis since their incorporation into an overall analysis would decrease "n", and type II error would increase considerably.

2.3. Results and discussion

Fig. 2 shows gaze duration during acquisition and extinction trials for the three groups. An ANOVA using acquisition trials as repeated measures, with gaze duration as a within-subjects factor and breed group as a between-subjects factor, indicated a significant effect of trials, $F_{1,21} = 45.9$, $p = 0.01$. Nevertheless, the effect of breed group, $F_{2,21} = 2.98$, $p > 0.05$, as well the interaction of group and trial number, $F_{2,21} = 0.1$, $p > 0.05$, were non-significant. This indicates that the animals significantly increased gaze duration during acquisition trials regardless of the breed to which they belonged.

Fig. 2 shows that in the first extinction trial the dogs increased gaze duration and then gradually decreased it. A global analysis of the extinction phase indicated significant effects of trials, $F_{1,21} = 34.93$, $p = 0.01$, as well as of breed group, $F_{2,21} = 4.54$, $p = 0.02$, this indicates that the gaze response changed throughout trials and across groups. The interaction was non-significant, $F_{2,21} = 0.33$, $p > 0.05$. The LSD post hoc comparisons between breed groups indicated that Retrievers had significantly higher gaze duration than Shepherds, $p = 0.01$ and Poodles, $p = 0.03$. Nevertheless, there were no significant differences between Shepherds and Poodles, $p = 0.51$. These results indicate that dogs in general reduced gaze duration when it was no longer reinforced and that Retrievers are more persistent in their response than the other evaluated breeds. In synthesis, dogs increased gazing toward the human face when they were reinforced and decreased it when they ceased to be rewarded. These results replicate previous evidence showing that this communicative response is modulated by environmental changes and that it responds to instrumental learning processes (Bentosela et al., 2008).

In the first extinction trial there was an abrupt increase of the response. This enhancement of the response, known as invigoration (Amsel, 1992), is characteristic of extinction procedures. In part, however, this could be due to a change in the procedure, since in extinction the animals did not have to interrupt their gaze to consume the reinforcer any longer.

During extinction the emission of the previous learned response can be considered as a measure of persistence. Persistence behaviors can also be observed when instead of delivering the favorite reward a less preferred one is offered. In this sense, Gaunet (2009) showed that dogs persevered in their communicative responses towards humans (e.g., gaze alternations between owner and target object) when an unfamiliar object instead of their favorite toy was delivered. Then, this behavior could be associated to the previous reinforcements that dogs received in their daily interaction with humans.

Importantly, a difference between groups in the extinction phase was observed. Retrievers gazed significantly more than German Shepherds and Poodles. There are several possible reasons for the fact that Retrievers persevere in the gaze response. On the one hand, Retrievers may have a greater motivation for food, but this explanation does not seem appropriate since deprivation was controlled in all groups. Nevertheless is possible that this group perceive reward quality in a different way than the other groups. It would be necessary to perform studies comparing the motivational value of food for the different breeds. Secondly, they may have difficulties in adjusting their behavior to changes in environmental contingencies. This hypothesis could be tested comparing breeds' performances in various extinction tasks. A third possibility is that the presence of the experimenter, who directs her gaze toward the animal, operates as a social reinforcer that maintains the response. In that case, results would indicate that the social factor of the task might act as a reinforcer for Retrievers but not for Shepherds or Poodles. Retrievers would look more to the human regardless of the training received during the experiment. Study 2 was performed to test this hypothesis.

3. Study 2

To date few studies have investigated breed differences in dogs' interspecific communicative abilities. In this sense, two recent studies have found that breeds differ in the comprehension of human signals to find baited food. Wobber et al. (2009) found that working breeds (Shepherds and Huskies) were better than non-working breeds (Basenji and Poodle) and this difference seem to be independent of breeds' similarity to wolves. In addition, Gácsi et al. (2009) reported that cooperative breeds selected to work in close cooperation and continuous visual contact with human partners were more skillful than independent breeds and mongrels. Nevertheless, previous works failed to find differences in the use of human cues to find food between herding and hunting dogs (Riedel et al., 2008), or among gundogs (Labrador Retriever, Golden Retriever, Cocker Spaniel and Cocker Springer Spaniel) and non-gundogs (German Shepherd, Terrier and Poodle; McKinley and Sambrook, 2000).

Table 2
Description of the subjects used in Study 2.

Subject	Sex	Age in months	Testing location	Breed
Keeper	M	36	Owner's home	Labrador Retriever
Pepe	M	84	Owner's home	Labrador Retriever
Sally	F	18	Boarding place	Labrador Retriever
Ioda	M	48	Boarding place	Labrador Retriever
Bruja	F	60	Boarding place	Labrador Retriever
Chloe	F	72	Boarding place	Labrador Retriever
Lab	M	18	Boarding place	Labrador Retriever
Lara	F	96	Owner's home	Golden Retriever
Balboa	F	72	Boarding place	Golden Retriever
Biggie	F	24	Owner's home	German Shepherd
Lola	F	42	Owner's home	German Shepherd
Tango	M	48	Boarding place	German Shepherd
Magie	F	24	Boarding place	German Shepherd
Magoo	M	18	Boarding place	German Shepherd
Freija	F	96	Boarding place	German Shepherd
Bosco	M	48	Owner's home	German Shepherd
Oso	M	12	Boarding place	German Shepherd
Roger	M	12	Owner's home	Poodle
Hana	F	24	Owner's home	Poodle
Abril	F	24	Owner's home	Poodle
Maqui	F	24	Owner's home	Poodle
Luna	F	36	Owner's home	Poodle
Pepa	F	84	Owner's home	Poodle
Luca	M	31	Boarding place	Poodle
Homero	M	24	Boarding place	Poodle
Kongo	M	84	Boarding place	Poodle

Despite of these divergent evidences about breed differences in the comprehension of human signals, to our knowledge there are no studies comparing breeds in the emission of communicative signals. The results of Study 1 suggest that the evaluated breeds do not differ in the learning of the gaze response, but there are differences in gaze maintenance during extinction. If Retrievers are more prone to use gazing to the human face in conflict situations this might also be observed in a test without previous explicit training. This possibility was tested in the following study.

3.1. Materials and methods

3.1.1. Subjects and apparatus

The subjects were 26 pet dogs that lived in domestic households (see Table 2 for details). The average age was 44.58 + 27.46 months, 11 were males and 15 females. Three breed groups were evaluated: Retrievers ($n = 9$, 7 Labrador Retriever and 2 Golden Retriever, age 56.00 + 27.98 months, 5 females and 4 males), German Shepherds ($n = 8$, age 39.00 + 26.83 months, 4 females and 4 males) and Poodles ($n = 9$, age 38.11 + 26.79 months, 5 females and 4 males). All were recruited voluntarily from their owners.

The subjects had not received specific training nor were they used for the breed's original function. Only two dogs had received basic obedience training (1 Labrador Retriever, 1 German Shepherd).

All sessions were scheduled in a familiar location for the dogs. Twelve were evaluated in a room in the owner's house, the remaining ones in a training/boarding establishment familiar to the dogs. The rest of the conditions and apparatus were similar to those in Study 1.

3.1.2. Procedure

The procedure was divided into two parts of 2 min each. In the first one, the experimenter called the dog by its name and actively

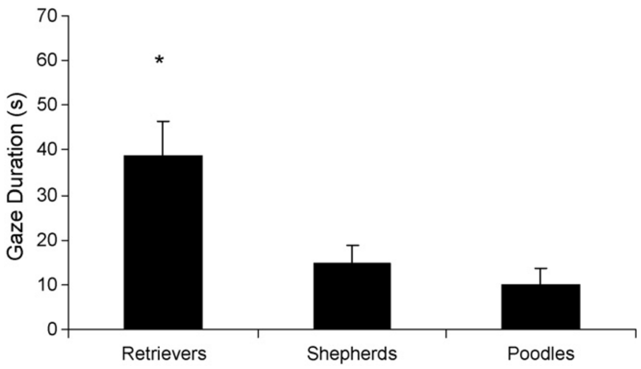

Fig. 3. Gaze duration (s) for the three groups evaluated in Study 2. This test did not include gaze training (means ±95% confidence intervals). $^{*}p < 0.05$.

sought physical contact, while giving it pieces of liver at variable intervals. The experimenter extracted one piece at a time from a container (placed on a high shelf, in sight but out of the animal's reach, Fig. 1) directing the dog's attention to the bowl. In this way, dogs could see where the food was located. A total of five pieces of food were delivered independently of where the dog was gazing. During this period, the experimenter avoided visual contact. When 2 min were over, the second part started. The experimenter stood beside the container, called the dog by its name just once and gave it one last piece of liver. At this time she initiated eye contact with the dog and maintained it during the whole trial. No more food was delivered. Gazing toward the human face was video taped.

3.2. Data analysis

During the 2-min test, gaze duration(s) at the experimenter's face was measured as in Study 1. Inter-observer reliability was analyzed in 83% of the videos by means of Pearson's coefficient of correlation ($r > 0.99$, $p < 0.01$, two-tailed).

Again gaze duration did not differ from normal distribution (Kolmogorov–Smirnov test); therefore, parametric analyses were used. In order to compare this measure between groups a one-way ANOVA was performed. Whenever necessary, LSD post hoc tests were used. The alpha value was set at 0.05. All analyses involved two-tailed tests.

To evaluate possible effects of gender, place of training or age (juvenile dogs 12–24 months vs. adult dogs 25–96 months), independent samples *t*-test were used. Neither gender, $t_{24} = -0.08$, $p > 0.05$, place of training, $t_{24} = 0.88$, $p > 0.05$, or age, $t_{24} = -1.46$, $p > 0.05$, significantly affected gaze duration.

3.3. Results

Groups differed in gaze duration towards the human face, $F_{2, 25} = 7.58$, $p = 0.003$ (Fig. 3). The LSD post hoc comparisons indicated that Retrievers had significantly higher gaze duration than German Shepherds, $p = 0.007$, and Poodles, $p = 0.001$. Instead there were no significant differences between Shepherds and Poodles, $p = 0.55$.

This data suggests that breeds differ in the production of communicative signals. Specifically, Retrievers gazed significantly more than Shepherds and Poodles when there was food in sight but out of reach and that this difference may be independent of previous explicit training. As far as this is concerned, it is less likely that Retrievers have a slower extinction rate because they are less flexible to environmental changes. Moreover, this result suggests that the presence of the human acts as a social reinforcer of a greater salience for the Retrievers.

4. General discussion

The overall results of Study 1 indicate that the gaze response to a human face is modulated by environmental changes, as it increased when it was reinforced and it decreased when it did not lead to the delivery of an expected reward. These results replicate the previous findings of Bentosela et al. (2008) and strengthen the hypothesis that instrumental learning processes modulate this interspecific communicative response.

Most importantly, breed differences were observed during extinction. Specifically, Retrievers showed a slower extinction of the gaze response compared to Shepherds and Poodles. In addition, in Study 2 the duration of Retrievers' gaze at the human face was significantly longer than that of German Shepherds and Poodles in the presence of food out of reach, even in the absence of a previous training phase.

It might be assumed that the observed differences are connected to the original selective pressures that created these breeds. In this sense, Retrievers are hunting dogs specialized in retrieving the prey and are adapted to work near humans and under their control. Shepherds come from populations of large dogs, of the molosoid type, who always protected livestock from predators. Besides, Poodles are small in stature and were bred for companionship so they have a special aptitude for sharing life with humans and can live in restricted areas (Cayuela, 2003).

Differently form Companion dogs, Retrievers and Shepherds are 'cooperative worker' breeds (Gácsi et al., 2009). The observed difference between Retrievers and Poodles is in accordance with the breed differences found in the comprehension of human cues, and supports the hypothesis that breeds not selected to work near humans are less skilled to communicate with them (Gácsi et al., 2009; Wobber et al., 2009). However, the observed difference between Shepherds and Retrievers challenges that assumption, at least with respect to the production of communicative signals. A possible explanation is that while Retrievers were aimed at getting back the prey in hunting contexts where they must constantly interact with humans, the herding task performed by Sheepdogs can be done more independently. Another unexplored possibility is that breeds' communicative abilities are different regarding comprehension or production of signals.

However, results should be interpreted with caution, since the animals evaluated were treated as pets and not trained to perform their original function. Moreover, although the differences appear to be related to breed characteristics, it is necessary to emphasize that all the dogs used in these studies were adults and lived in a highly variable human environment, where not only genes, but also epigenetic forces may shape their behavior (Pongrácz et al., 2005). In addition, these differences could be explained by an interaction between breed characteristics and the attitudes of owners who choose each breed. For example, possibly, those who choose Retrievers as pets, based on their high sociability, lead to a selection toward greater sociability in this breed. In this regard, recent studies suggest that selection pressures are currently changing the breed's original features (Svartberg, 2006). It would be interesting to investigate if owners of a specific breed treat their dogs in a particular way.

The fact that Retrievers gazed more to the human even when no food was obtained (Study 1) and when there was no previous explicit training (Study 2) could be due to the presence of another reinforcer during the tasks. It may happen that the presence of the experimenter, who directs her gaze toward the animal, works as a social reinforcer that maintains the response. In that case, results would indicate that the social factor of the tasks might act as a stronger reward for Retrievers than for either Shepherds or Poodles. On this subject, there is evidence – albeit scarce – indicating that Labrador Retrievers approach and seek human contact significantly more than German Shepherds (Wilsson and Sundgren, 1997). Svartberg (2006) found that Labrador Retrievers and Golden Retrievers are among those that score higher in sociability, described as the tendency to be friendly toward unfamiliar persons, whereas Poodles and Dobermans are among those with the lowest scores (Svartberg, 2007). Recent findings indicate that gaze duration positively correlates with sociability measures and that more sociable dogs gaze significantly more to the human face than less sociable ones (Jakovcevic et al., unpublished data). As a whole, these evidences suggest that a difference in sociability levels is a suitable explanation for the present results.

From an applied point of view, having information on the differential use of communicative signals by the different breeds might contribute to make appropriate selection for training purposes as well as for their use as pets. Gaze direction can be considered as an indicator of the attentional focus (Emery, 2000) and in that sense Retrievers would be more attentive to humans, which is an advantage at the moment of training.

Finally, the information obtained suggests that communicative mechanisms between dogs and humans involve the interaction of various factors such as environment, learning, genetics and differential selection of traits in the different breeds.

Acknowledgements

This research was supported by CONICET and AGENCIA (PICT 2005, number 38020). We would like to express our special gratitude to Clive Wynne, Nadia Justel and Eliana Ruetti for their valuable comments of a preliminary version of the manuscript. Furthermore, we would like to thank Gabriela Barrera, Sandro Fosacheca, Canine School GB and its director Gustavo Bianco for their important collaboration in data collection. Also to María Teresa La Valle for manuscript translation. We are really grateful to all the dog owners who participated in this study. Correspondence and request for reprints may be sent to the first author, Adriana Jakovcevic, at: Combatientes de Malvinas 3150, Ciudad Autónoma de Buenos Aires (1427), e-mail: adrianajak@gmail.com

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