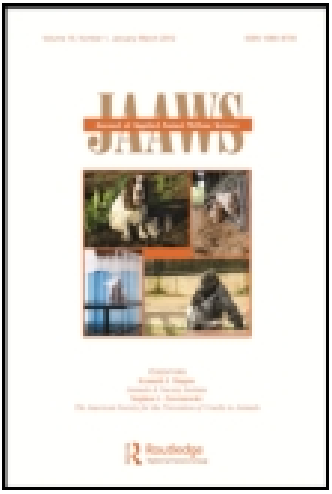

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During extinction a previously learned behavior stops being reinforced. In addition to the decrease in the rate of the instrumental response, it produces an aversive emotional state known as frustration. This state can be assimilated with the fear reactions that occur after aversive stimuli are introduced at both the physiological and behavioral levels. This study evaluated frustration reactions of domestic dogs (*Canis familiaris*) during a communicative situation involving interactions with a human. The task included the reinforcement and extinction of the gaze response toward the experimenter's face when the dogs tried to obtain inaccessible food. The dog's frustration reactions during extinction involved an increase in withdrawal and side orientation to the location of the human as well as lying down, ambulation, sniffing, and vocalizations compared with the last acquisition trial. These results are especially relevant for domestic dog training situations in which the extinction technique is commonly used to discourage undesirable behaviors.

Keywords: *domestic dogs, frustration, extinction, communication*

There are numerous cases where expectations of certain environmental stimuli are not met. Imagine a dog who normally enters the house every time he or she scratches the door, and one day he surprisingly finds that the door is locked. In this case, the most commonly observed reaction in the dog would be to start scratching the door more intensely, followed by barking, whining, and jumping or even digging, and then he gradually stops. Technically, this nonhuman animal

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is extinguishing the instrumental response (scratching the door) that was used to achieve its desired outcome (to open the door). During instrumental extinction, a previously acquired response stops being reinforced. This usually produces an abrupt increase of the response known as invigoration (Amsel, 1992), followed by a gradual decrease (Domjan, 1998). Extinction is one of the dog training methods most commonly used to discourage undesirable behaviors (e.g., Reid, 2009). Its main advantage compared with other techniques used to eliminate unwanted behaviors is that it avoids punishment.

Data gathered from other species shows that in addition to the decrease of the instrumental response, extinction produces a general reaction that modifies the animal's behavioral pattern (Bouton & Moody, 2004). For example, in rats, birds, and pigs, after an increase in the levels of locomotor activity, exploration and rearing were observed (Papini, 2003). Aggressive behaviors toward conspecifics and escape responses from the place where downshift/omission of reward took place were also observed. In addition, the emission of odors and ultrasound vocalizations in infant rats and an increase of crying behavior in human babies were reported (Papini, 2003). In animals in captivity and in the laboratory it was also observed that frustration produces an exacerbation of stereotypic behaviors (Latham & Mason, 2010).

These behavioral changes reflect an aversive emotional reaction known as frustration (Amsel, 1992). Frustration is operationally defined as the animal's reaction after surprising incentive omissions, that is, the absence or reduction of an appetitive reward in the presence of signals previously paired with a larger incentive (Papini & Dudley, 1997). These reactions would be similar to the fear and stress responses that occur when aversive stimuli are introduced (e.g., Gray, 1987) given that they imply an increase in the cortisol levels and are influenced by anxiolytic pharmacological treatments (Papini, 2003; Papini, Wood, Daniel, & Norris, 2006). From an applied point of view, this is especially relevant when it is taken into account that stress has widely been associated with changes in learning abilities (e.g., McEwen & Sapolsky, 1995). This is an extremely complex relation considering that stress can enhance or impair memory, and this effect depends on several factors such as whether the stressor is acute or chronic (e.g., Bisaz, Conboy, & Sandi, 2009). In this sense, it could be possible for frustration to modulate memory, in the same way stress does, by changing the learning rate for different tasks during training.

Previous studies with domestic dogs showed that operant responses like gazing toward the human face and pointing following behavior increased when they were reinforced and decreased when reinforcement ended (Bentosela, Barrera, Jakovcevic, Elgier, & Mustaca, 2008; Bentosela, Jakovcevic, Elgier, Mustaca, & Papini, 2009; Elgier, Jakovcevic, Mustaca, & Bentosela, 2009). Moreover, Bentosela et al. (2008) indicated that in addition to a decrease in gaze duration during extinction, dogs also moved away, oriented their bodies toward the side of the experimenter who omitted the delivery of food, and changed their body positions. Unfortunately, Bentosela et al. (2008) have not carried out an exhaustive analysis of the behavioral pattern, and the number of subjects tested was low.

The aim of the present study is to identify frustration markers that could come up during training. This is especially relevant when modifying communicative responses, like gazing behavior, that may have an impact on dog–human relationships. Moreover, Braem and Mills (2010) indicated that "dog's attention," defined as whether the dog was looking at the handler at the time the command was given, was one of the most important factors affecting obedience learning.

METHOD

Subjects

The subjects were 27 adult companion dogs (*Canis familiaris*; 15 males and 12 females; M age = 59.72 months, SD = 29.02). In addition, we also used the data of another 18 dogs (10 males and 8 females; M age = 38.53 months, SD = 24.47). The gazing behavior of this last group was already analyzed in a breed comparison study (Jakovcevic, Elgier, Mustaca, & Bentosela, 2010), but their extinction behavioral pattern was not evaluated before. The final sample included 45 adult dogs from eight different recognized breeds (6 poodle, 1 Shih Tzu, 7 Labrador retriever, 1 golden retriever, 4 cocker spaniel, 4 German shepherd, 4 Old English sheepdog, 2 Great Dane, 2 boxer, 2 Bracco, 3 Weimaraner, 2 Brittany, and 7 beagle). All lived in human households and were recruited voluntarily from their caregivers. Dogs had free access to water and the last meal before training sessions had been received approximately 7 hr earlier.

Experimental Setting and Apparatus

All sessions were scheduled in a location familiar to the dogs in a restricted area allowing some degree of free movement or in an open space. In the latter case, an approximately 2-m leash was put on the dog to restrict his or her movement.

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 dogs. Incentives were placed in a container located on a high shelf. The container was visible to the animals, but it was out of their reach. The experimenter stood next to the food. 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. All trials were videotaped with a Sony DCR TRV 310 camera. 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 during the experimental procedure.

Procedure

The procedure was the same as the procedure used in Jakovcevic et al.'s (2010) study. It consisted of three phases: warm-up, acquisition, and extinction. Considering that in a previous study (Bentosela et al., 2008) gazing behavior diminished during a baseline trial, it was not included in the present study.

During warm-up, a single session lasted 3 to 5 min in which dogs were brought to the location where training took place so that they could explore it. The experimenter called the dogs by their names and actively sought physical contact. To evaluate dogs' motivation for food, they received three pieces of liver directly from the hand of the experimenter.

During acquisition, which occurred immediately after warm-up, dogs had three trials in which they were reinforced for gazing at the experimenter. Each trial lasted 2 min with an intertrial interval (ITI) of approximately 2 min. Acquisition trials started with the experimenter standing by the food container and calling the dog's name once. Dogs were reinforced each time they gazed at the experimenter. The 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 she reached for the food. A new incentive was delivered when the dog turned his or her gaze back to the experimenter's face for 1 s. At the end of each trial, the experimenter went to a different location, out of the dog's visual scope, while the dog remained in the training area. All of the dogs in this experiment responded to their names and gazed at the experimenter at least twice during each trial.

Three extinction trials, 2 min each, were performed with a 2-min ITI. The interval between acquisition and extinction phases lasted for 2 min. This phase was identical to the acquisition phase except that the reward was never delivered. It started by calling the dog's name once but without giving him or her any food. The experimenter remained in the same place as in previous trials, and she was looking at the dog during the entire trial. At the end of each trial she left the area. During acquisition and extinction the experimenter remained in the same position gazing at the dog's face.

Behavioral Observations

Ten dependent measures were scored from videotapes during the course of the trial (Table 1). Six variables were registered in a continuous way: the duration of gazing at the human face(s) and the frequencies of ambulation, sniffing, vocalizations, rearing, and yawning. An instantaneous sampling carried out every 5 s was used to measure the frequency of the other four behavioral variables: distance from the experimenter (far–near), orientation (experimenter–side), body

TABLE 1
Definition of Behaviors and Registration Method

Behavior	*Registration Method*	*Definition*
Gaze duration	Accumulated frequency	Cumulative duration(s) of visual contact of the dog with the trainer.
Distance from experimenter	Instantaneous sampling for 5 s	Near: if the dog was within 1 m of the experimenter. Far: if the dog was more than a meter.
Orientation	Instantaneous sampling for 5 s	Experimenter: dog remains oriented toward the experimenter with body and head, independent of the dog's gaze direction. Side: dog orients toward either side relative to the experimenter, independent of dog's gaze direction. When body and head were oriented differentially, the position of the head determined how orientation was categorized.
Body posture	Instantaneous sampling for 5 s	Sitting/Upright: sitting down with the rump leaning on the ground or standing up on four legs. Lying down: the whole body on the ground in a relaxed position. Crouching: a pronounced lowering of the posture.
Tail position	Instantaneous sampling for 5 s	Three positions of the tail: tense (the tail's angle is significantly higher than 45°), settled or calm (the tail's angle is within −30° to 30°), and anxious (the tail's angle is lower than −45°).
Ambulation	Accumulated frequency	Each behavioral unit involved the action of walking or running at least two steps without stopping. A sequence ends when the dog stops for at least 1 s.
Sniffing	Accumulated frequency	Putting the muzzle on the ground, on the wall, a person, or objects; also includes sniffing the air, which is when the dog raises his or her head, moving the nostrils and breathing the air to perceive odors. A unit was assessed when the dog put his or her muzzle on the surface until he or she raised it again.
Vocalizations	Accumulated frequency	Included barks, groans, and snorts. When there was at least a 1-s interval between vocalizations, a new unit was scored.
Rearing	Accumulated frequency	To jump or to stand on hind legs with front paws on a person or object.
Yawning	Accumulated frequency	Opening the mouth and inhaling and exhaling air.

position (sitting/standing, lying down, and crouching), and tail position. To assess tail position we used the classification of Mizukoshi, Kondo, and Nakamura (2008) that involves three positions identifying the following states: tense, settled or calm, and anxious.

To evaluate the change in the behavioral pattern as a consequence of the surprising reward omission, behaviors were registered in the last acquisition trial and during the three extinction trials.

Data Analysis

Two trained observers analyzed the videotapes. Interobserver agreement for all measures combined was above 90%. For continuous variables, reliability was calculated in 50% of the videos by means of Cronbach's alpha except for gaze duration, which was analyzed in a 100% of the material. In all cases, the alpha value was greater than 0.99. Reliability was calculated for 42% of the subjects for the distance from the experimenter, and body position and orientation, whereas tail position was calculated in 100% of the cases by means of Cohen's Kappa coefficient. In all cases, the alpha value was greater than 0.99.

To evaluate the effect of training over the instrumental response, a repeated measures analysis of variance (ANOVA) comparing gaze duration across the three acquisition trials and across the three extinction trials was performed. To analyze the presence of an extinction burst, a paired-samples t test comparing the last acquisition trial and the first extinction trial was performed. The remaining behavioral measures violated assumptions of parametric tests, so nonparametric tests were performed. Friedman's ANOVA was used to compare behavioral changes across the last acquisition trial and the three extinction trials. After that, we compared the last acquisition trial with each of the three extinction trials using Wilcoxon signed-rank tests in order to assess the changes associated with the omission of the reward during extinction. In all cases, the alpha value was set at 0.05. All analyses involved two-tailed tests.

Crouching position was never observed. Also, yawning was observed in only 4 subjects, so it was not included in the analysis. The extreme anxious (low) tail position was never observed and therefore it was not analyzed. In addition, this variable could be registered in only 15 subjects (33%) due to the fact that many dogs remained seated during training or their tails were too short. As a result, we used a frequency rate (times behavior observed divided by the total number of observations in each trial).

We also analyzed sex and age effects for each behavioral variable for the extinction phase. A mean frequency of the three extinction trials was calculated. To test for sex differences, Mann–Whitney U tests were used. To assess age effects, Spearman rank correlations were performed. However, there were no significant sex differences in any extinction behavior (ps > .05) or significant correlations between ages for any of the measured variables (ps > .05).

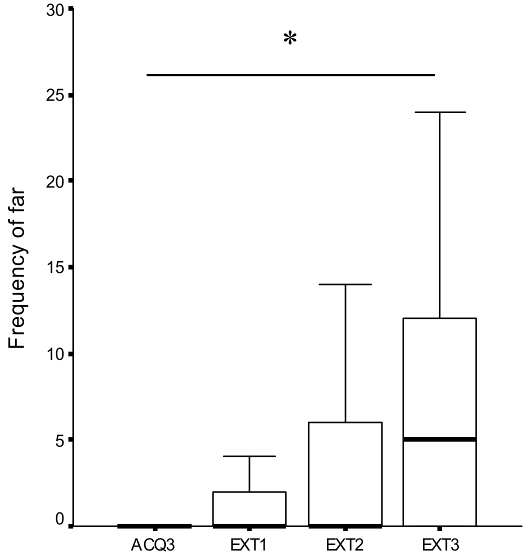
RESULTS

During acquisition, an increase in the instrumental response of gazing at the human face was observed (Trial 1: 12.91 s, *SEM* ± 7.64; Trial 2: 17.41 s, *SEM* ± 8.14; and Trial 3: 19.66 s, *SEM* ± 7.67), and that change was significant, $F(2, 88) = 34.4$, $p < .001$. During extinction, gaze duration diminished (Trial 1: 44.17 s, *SEM* ± 25.69; Trial 2: 26.93 s, *SEM* ± 20.15; and Trial 3: 17.21 s, *SEM* ± 19.75) showing a significant effect, $F(2, 88) = 40.67$, $p < .001$. A comparison between the last acquisition trial and the first extinction one indicated a significant increase in the operant response, $t(44) = -6.97$, $p < .001$, suggesting the presence of an extinction burst.

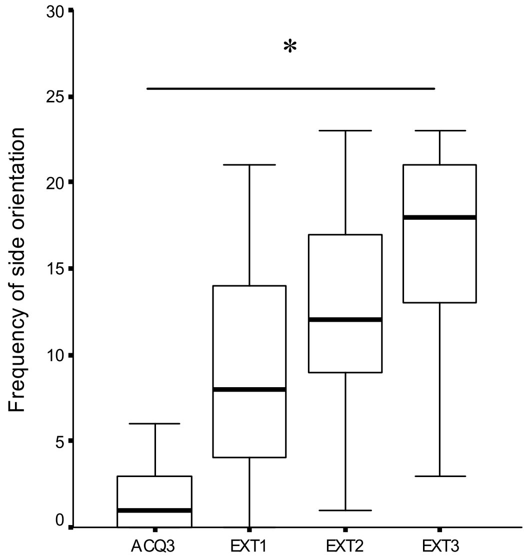
During the last acquisition trial, all of the dogs (100%) remained near the experimenter, 0 (0%) moved away, 30 (67%) orientated sideward at least once, and only 1 subject (2%) lay down. On the contrary, during extinction, 20 subjects (44%) moved away, 44 (98%) orientated sideward to the experimenter, and 13 (29%) lay down.

The statistical comparison across the last acquisition trial and the three extinction trials indicated significant changes in frequency of distance from the experimenter ("far" $\chi^2_3 = 53.06$, $p < .001$, Figure 1a), orientation ("side" $\chi^2_3 = 96.27$, $p < .001$, Figure 1b), and body position ("lying down" $\chi^2_3 = 22.35$, $p < .001$, Figure 1c). Paired comparisons indicated that during the last acquisition, trial dogs increased their distance from the experimenter (Acquisition 3 vs. Extinction 1, $z = -2.95$, $p < .001$; Acquisition 3 vs. Extinction 2, $z = -3.92$, $p < .001$; Acquisition 3 vs. Extinction 3, $z = -4.46$, $p < .001$), side orientated (Acquisition 3 vs. Extinction 1, $z = -5.49$, $p < .001$; Acquisition 3 vs. Extinction 2, $z = -5.78$, $p < .001$; Acquisition 3 vs. Extinction 3, $z = -5.65$, $p < .001$), and lay down (Acquisition 3 vs. Extinction 1, $z = -2.67$, $p < .01$; Acquisition 3 vs. Extinction 2, $z = -3.3$, $p < .01$; Acquisition 3 vs. Extinction 3, $z = -3.3$, $p < .001$).

During the last acquisition trial, settled tail rate was 76%; during the extinction trials, it reached 66% in Trial 1, 64% in Trial 2, and 53% in Trial 3. Nevertheless, this difference was not significant ($\chi^2_3 = 3.81$, $p > .05$). Also during the last acquisition trial, 2 subjects (4%) ambulated, 23 (51%) sniffed, 1 (2%) vocalized, and 12 (27%) reared. During extinction 27 dogs (61%) ambulated, 37 (84%) sniffed, 18 (41%) vocalized, and 18 (41%) reared. The vocalization most frequently observed was whining: 75% of cases in acquisition and 81.5% during extinction, whereas barking occurred only in 25% of cases in

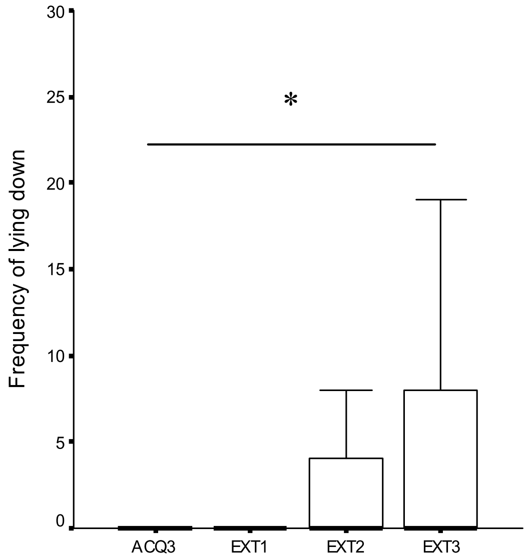


(a)



(b)

FIGURE 1 (a) Distance from the experimenter, far; (b) orientation, side; and (c) body posture, lying down, during the last acquisition trial and the three extinction trials. The box represents the interquartile range, which contains 50% of the values, and the bold lines indicate the median. The error bars extend from the box to the highest and lowest values. Variables were registered by an instantaneous sampling method and analyzed by Friedman's analysis of variance. ACQ = acquisition trial; EXT = extinction trial.
$*p < .05$. (*continued*)



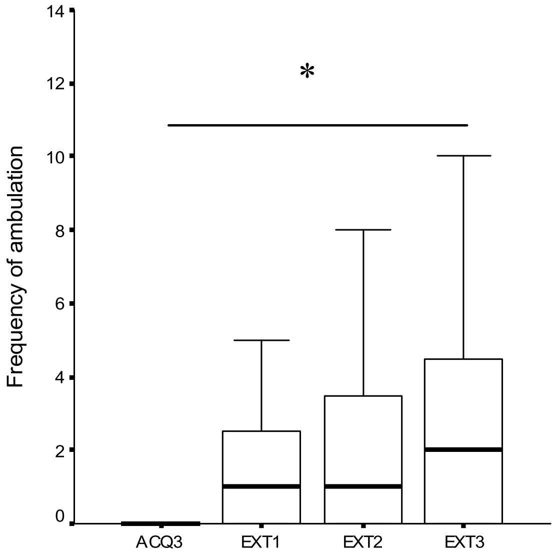
(c)

FIGURE 1 (*Continued*)

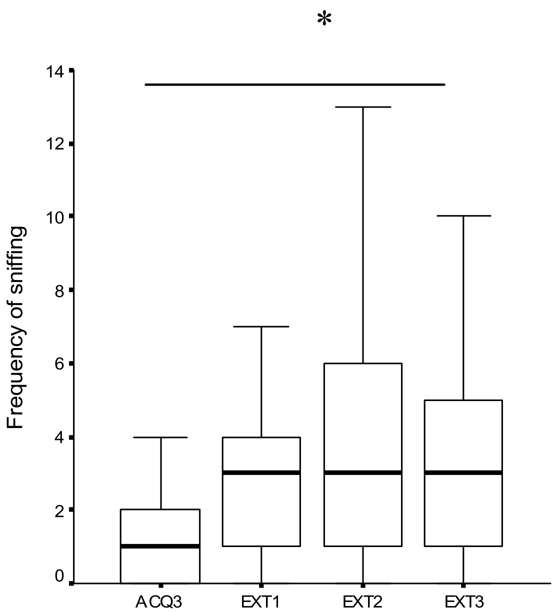
acquisition and 16.8% during extinction. Other kinds of vocalizations accounted for only 1.7% during extinction.

Friedman's ANOVA indicated significant changes in the frequency of ambulation ($\chi^2_3 = 52.86$, $p < .001$, Figure 2a), sniffing ($\chi^2_3 = 28.09$, $p < .001$, Figure 2b), and vocalizations ($\chi^2_3 = 24.56$, $p < .001$, Figure 2c) across trials. No differences were observed in rearing frequency ($\chi^2_3 = 4.9$, $p > .05$, Figure 2d). Paired comparisons indicated that during the last acquisition, trial dogs increased their frequencies of ambulation (Acquisition 3 vs. Extinction 1, $z = -4.25$, $p < .001$; Acquisition 3 vs. Extinction 2, $z = -4.56$, $p < .001$; Acquisition 3 vs. Extinction 3, $z = -4.80$, $p < .001$), sniffing (Acquisition 3 vs. Extinction 1, $z = -3.82$, $p < .001$; Acquisition 3 vs. Extinction 2, $z = -3.99$, $p < .001$; Acquisition 3 vs. Extinction 3, $z = -3.46$, $p < .001$), and vocalizations (Acquisition 3 vs. Extinction 1, $z = -3.63$, $p < .001$; Acquisition 3 vs. Extinction 2, $z = -3.41$, $p < .01$; Acquisition 3 vs. Extinction 3, $z = -3.53$, $p < .001$). These results suggest that after the surprising reward omission dogs ambulated, sniffed, and vocalized more frequently.

In short, during extinction, concomitantly with the decrease in the instrumental response, dogs tended to move away from the experimenter who omitted the



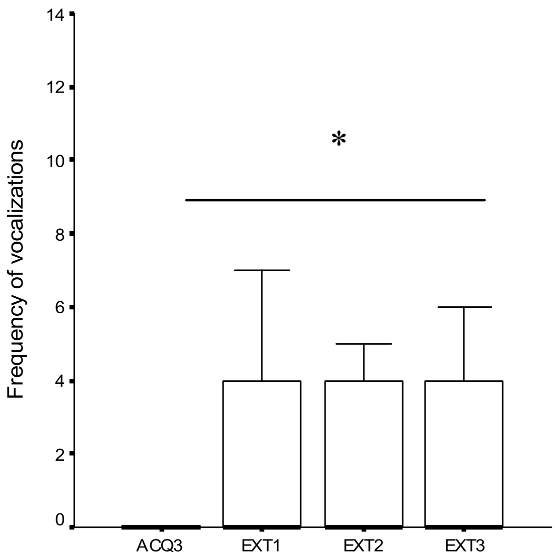
(a)



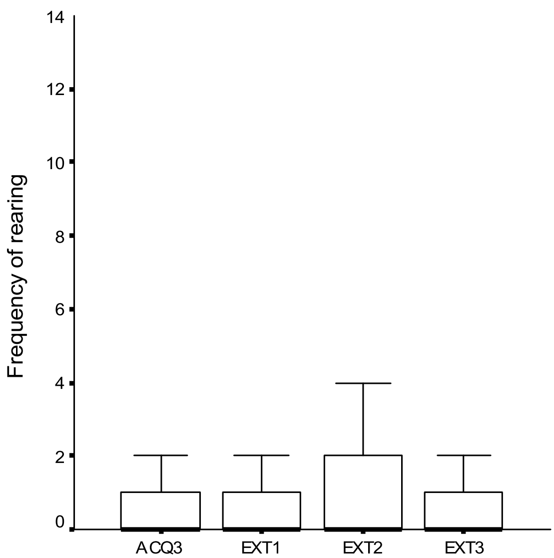
(b)

FIGURE 2 (a) Ambulation, (b) sniffing, (c), vocalizations, and (d) rearing during the last acquisition trial and the three extinction trials. The box represents the interquartile range, which contains 50% of the values, and the bold lines indicate the median. The error bars extend from the box to the highest and lowest values. Variables were registered in a continuous way and analyzed by Friedman's analysis of variance. ACQ = acquisition trial; EXT = extinction trial.
*$p < .05$.

(continued)



(c)



(d)

FIGURE 2 (*Continued*)

food, orienting their bodies and heads to the other side and adopting a lying down position. In addition, increased frequencies of ambulation, sniffing, and vocalizations were observed.

DISCUSSION

The results show that when a human surprisingly omits the delivery of food in a training context, behavioral changes are observed. During acquisition, dogs remained near the experimenter, orienting toward her, and stayed seated or standing. However, during extinction, they moved away from the experimenter, avoiding orienting their bodies toward her, and lay down. These results replicate previous studies about reward omission in domestic dogs (Bentosela et al., 2008; Bentosela et al., 2009).

It is important to note that we have shown for the first time that domestic dogs also significantly increased their frequency of ambulation, sniffing, and vocalizations, further extending previous knowledge about frustration behaviors in domestic dogs.

Withdrawal and the change in body orientation to a different location from that of the experimenter might be interpreted as escape responses from the person who avoids delivering the food (Bentosela et al., 2009). Also, it could reflect the loss of motivation in the task. Vocalizations are probably related to a more nonspecific emotional reaction. Meanwhile, the increase in the frequency of ambulation and sniffing could be interpreted as searching behaviors of the lost reward as was also observed in frustration procedures with rats (Pecoraro, Timberlake, & Tinsley, 1999). However, sniffing was also related to stress reduction processes during a test measuring shelter dogs' reactions toward a friendly stranger (Tod, Branden, & Waran, 2005), so its role in aversive contexts is not clear and probably depends on the characteristics of the situation assessed. Overall, all of these behavioral reactions match the ones observed in other species (Papini, 2003).

Unlike the results obtained in rodents (Pecoraro et al., 1999), there was not an increase in the frequency of rearing. A possible explanation is that dogs learned not to rear because it is a response that owners generally try to discourage.

The dogs remained with their tails in a middle position, and there were no changes during extinction. This position was associated with a calm or settled state (Mizukoshi et al., 2008). Like crouching and yawning, this behavior was observed only in response to intense stressors such as a loud noise, a falling bag, or electric shocks (Beerda, Schilder, van Hooff, de Vries, & Mol, 1998; King, Hemsworth, & Coleman, 2003). However, it could be recorded in only a very low number of subjects; therefore, more studies are needed to achieve a conclusion.

Additionally, the percentage of subjects performing each behavior was different. Change in the orientation regarding the experimenter and the food location, as well as ambulation and sniffing, were the most common responses and were observed in the majority of the cases, whereas withdrawal, change in body position, and vocalizations were observed in only a lower percentage of subjects. These differences would suggest that the first group of behaviors entails more general indicators of frustration.

It could be argued that instead of being a frustration reaction, these behavioral changes may be the consequence of the mere passage of time throughout trials. However, Bentosela et al. (2009) showed that the pattern of acquisition behavior remained invariable even when this phase lasted up to eight trials, and the frustration responses did not appear until the reward contingencies changed.

When interpreting the results, another important point to consider is the absence of a baseline. Even though this prevented a decrease in gaze duration before the beginning of the acquisition phase, it limited the comparison of dogs' behaviors across phases. Therefore, the conclusions about the specificity of the behaviors observed during extinction are restricted. Nevertheless, it is unlikely that the behaviors observed during extinction have been affected by the absence of a baseline, and the comparison with the acquisition phase suggests that they are due to the absence of the reward in an appetitive context. In further studies it would be interesting to describe dogs' spontaneous behavioral patterns during a test with visible food that is out of their reach.

On the other hand, some of the behavioral changes match the responses observed in dogs under stressful situations. The increase in activity (Beerda et al., 1998) and withdrawal (King et al., 2003) were also observed after the introduction of aversive stimuli. Moreover, the emission of vocalizations was also registered as an indicator of stress after the separation from the attachment figure (Palestrini, Prato-Previde, Spiezio, & Verga, 2005; Pettijohn, Wong, Ebert, & Scott, 1977; Tuber, Hennessy, Sanders, & Miller, 1996).

Other typical stress responses in dogs like tail tucking, crouching, or yawning were not observed. However, these behaviors were more commonly observed as a consequence of intense stressors (Beerda et al., 1998). Nevertheless, this also could be due to the specific characteristics of the stressor used. Domestic dogs' behavioral patterns of stress change in agreement with the nature of the stimulus (Beerda et al., 1998). When a human approached in a threatening way, behaviors like withdrawal, averted gaze, crouching, and contact seeking with the owner were observed (Horváth, Igyártó, Magyar, & Miklósi, 2007; Vas, Topál, Gácsi, Miklósi, & Csányi, 2005). Crouching was also observed after sudden stimuli (Beerda et al., 1998). In response to threatening stimuli that could be moderately anticipated, the behaviors registered were restlessness; crouching; trembling; mouth licking; and to a lesser extent, yawning and opening the mouth (Beerda et al., 1998). When the stimulus was staying in a novel environment, there were increases in locomotion, jumps, fleeing attempts, and vocalizations (Hennessy et al., 2001).

Our results suggest that the evaluated situation—the surprising omission of food in a context of social interaction with a human—produces a mild or moderate stress state as only some of the typical stress behavioral reactions were observed. The stressor used in our study produced an increase in withdrawal and side orientation regarding the experimenter position as well as a major frequency of lying down, ambulation, sniffing, and vocalizations (mainly whining). Some of these behaviors appear to be related to the communicative nature of the task. In this sense, the human would be associated with the disappearance of the reward and therefore dogs moved away and oriented sideward. The increase in ambulation and sniffing as well as the position changes would be most generally associated with frustration reactions. Further studies may investigate frustration signs in a nonsocial task to evaluate the generality of these responses. Finally, it would also be interesting to evaluate if the physiological parameters elicited by this experimental situation are similar to the ones observed in aversive contexts.

One of the most important aspects to consider is that, unlike laboratory studies, in this procedure frustration was evaluated in a familiar place for the animals and in a learning situation with a trainer. Because the testing conditions were similar to those of typical training situations, there is a strong generalization of the present findings to other situations of behavioral modification. In training contexts, during the acquisition of new complex behaviors, animals commonly fail to respond appropriately and then start to lose the rewards that they had been receiving. Usually in these situations of spontaneous extinction subjects stop responding and consequently start performing against the original training purposes. Knowing the behavioral signs of frustration can help researchers make decisions regarding the appropriate moment to interrupt training or to change the strategy, optimizing the learning process.

Moreover, the frustration reaction may decrease if the behavior, prior to extinction, is reinforced under an intermittent schedule. Extinction that follows partial reinforcement produces less frustration, and there is a delay in the decrease in the response compared with the history of continuous reinforcement (partial reinforcement extinction effect; Amsel, 1992). Resistance to extinction can also be beneficial in terms of desirable behaviors. For example, it is important that dogs perform reliably during competition or through different tasks where tangible rewards are not available immediately. In addition, in some circumstances this persistence could be transferred to the learning of new responses (e.g., Nation, Cooney, & Gartrell, 1979).

CONCLUSION

Extinction produces a frustration reaction that includes several behavioral changes beyond the decrease in the instrumental response. Compared with acquisition it provokes an increase in withdrawal and side orientation to the position of the human as well as in lying down position, ambulation, sniffing, and vocalizations. These changes are essentially similar to dogs' stress responses observed during mild aversive situations.

From an applied point of view, it is important to consider that in the initial phase of an extinction procedure these frustration behaviors can occur. Having these indicators in mind can help trainers make the appropriate decisions about whether to continue or to interrupt training. Finally, if it is taken into consideration that frustration is stressful, welfare should be improved by reducing its occurrence.

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