Journal of Veterinary Behavior 9 (2014) 58–65

Contents lists available at ScienceDirect

Journal of Veterinary Behavior

journal homepage: www.journalvetbehavior.com

Research

Effects of 2 training methods on stress-related behaviors of the dog (*Canis familiaris*) and on the dog–owner relationship

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ARTICLE INFO

Article history:
Received 10 March 2013
Received in revised form
1 October 2013
Accepted 22 November 2013
Available online 21 January 2014

Keywords:
dog
training
welfare
interaction
conditioning
gaze

ABSTRACT

Instrumental learning plays an important role in dog–human interactions. The recent demand for pet dog training has resulted in the development of various training methods. The present exploratory study aims to compare the effects of 2 training methods on both the behavioral welfare of the dog and the dog–owner relationship: the first method is based on positive reinforcement (appearance of an appetitive stimulus), whereas the second method is based on negative reinforcement (disappearance of an aversive stimulus). The study compared behaviors linked to signs of stress and attentive behaviors toward the owner in 2 dog training schools, which used different methods. Walking on-leash activity and obeying the "sit" command were studied. The results show that dogs from the school using a negative reinforcement–based method demonstrated lowered body postures and signals of stress, whereas dogs from the school using a positive reinforcement–based method showed increased attentiveness toward their owner. However, neither method affected avoidance behaviors. This exploratory study reveals the differential effects of the 2 training methods on dogs' behaviors; it suggests that training methods based on positive reinforcement are less stressful and potentially better for their welfare.

Introduction

Classically, animal welfare science has concerned itself with the identification of negative welfare states, using physiological parameters, aggression, boredom, and abnormal behavior as markers of pain and stress (Fraser, 2008). Behavior is often used to measure animal welfare because actions of animals can enlighten their state; it is recorded in situ in response to short-term changes in the environment or to a particular stressor/stimulus, or in a particular environment. Animals' responses in tests are used to infer their abilities or to understand what animals accept or reject (Dawkins, 2003).

The rise of urbanization and the growing number of pets in urban areas have sparked an interest from scientists in exploring social interactions between humans and animals and the effects these interactions have on animal welfare, whether positive, negative, or neutral (e.g., Ruis et al., 2001). Over time, the primary function of dogs (*Canis familiaris*) has changed from an animal of utility to a companion (Serpell, 1995). In order that they can fulfill the latter role, pressure is put on dogs to behave correctly within human society; pet dogs need to be trained to be under their owner's control.

Dogs can display social behaviors adjusted to the living constraints within the human environment. For example, research has shown that dogs can learn to communicate with humans, whether incidentally or explicitly (Reid, 2009): they follow deictic/referential gestures produced by humans, with different levels of accuracy according to their saliency (e.g., Udell et al., 2008; Ittyerah and Gaunet, 2009); they produce apparent referential and attention-getting signals to let humans know which object or action they desire from their owner (Gaunet, 2010; Gaunet and Deputte, 2011). Such abilities are one of the basics for dogs cohabitating with humans under one roof, to be managed—while unleashed—indoors and outdoors. However, dogs have to acquire more specialized abilities to live in proximity with humans. Dog training schools serve that specific purpose. A major issue revolves around determining the effects of training methods used in schools on a dog's welfare.

Most training methods are based on operant conditioning during which the animal learns that its responses to instructions/stimuli have consequences called reinforcers

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http://dx.doi.org/10.1016/j.jveb.2013.11.004

(Doré and Mercier, 1992; Domjan, 2006). The latter can vary by their nature and occurrence: they can be the appearance or disappearance of appetent or aversive stimuli. It follows that there are 4 types of instrumental conditioning procedures: 2 types result in an increase in the rate of responses (positive reinforcement, R+: appearance of an appetent stimulus; negative reinforcement, R−: disappearance of an aversive stimulus) and 2 types result in a decrease (positive punishment, P+: appearance of an aversive stimulus; negative punishment, P−: disappearance of an appetent stimulus) (Doré and Mercier, 1992; Domjan, 2006). For instance, for treating excessive barking, jumping, and crowding the door when people arrive, a multistep positive reinforcement training protocol involving a remote-controlled food reward dispenser has been shown to be efficient for a dog to place and remain in a down-stay posture (Yin et al., 2008). The use of aversive stimuli also offers an effective strategy to modify attack behaviors in gun dogs toward domestic sheep; although the owners reported no negative effect on the dogs' behavior during the year after shock treatment, an increased alertness was observed that could potentially be related to increased fear (Christiansen et al., 2001). Moreover, during free walking training, police service German shepherd dogs that previously wore a shock collar showed lower ear posture and more stress-related behaviors (lowering of body posture; high pitched yelps, barks, and squeals; avoidance; redirection aggression; tongue flicking) than dogs who never received collar shocks, although they were also trained with harsh methods (Schilder and Van der Borg, 2004). Beerda et al. (1998) also showed behavioral and cortisol effects on laboratory dogs that were administrated 6 different unpleasant stimuli; the findings suggest that stimuli like shocks or sound blasts may have been particularly stressful to the dogs because they were associated with a very low posture and an elevated level of cortisol. Concerning pet dogs, owners reported via questionnaires that aversive stimuli was related to behavioral problems such as aggressiveness or stereotypies (Hiby et al., 2004; Eskeland, 2007; Eskeland et al., 2007; Blackwell et al., 2008; Herron et al., 2009) and could lead to a decrease in obedience (Hiby et al., 2004; Eskeland, 2007; Eskeland et al., 2007). Furthermore, Haverbeke et al. (2008) showed that military working dogs that received more aversive stimuli demonstrated reduced learning performances. The number of studies on the effects of training methods on the welfare of nonworking dogs is therefore limited to studies based on verbal reports from owners (questionnaires). To our knowledge, only 1 direct observation in the home environment showed that punishment (P+ and P− pooled) may have adverse effects on pet dog's behavior and that reward-based training (R+) may improve ability to learn and being playful with the owners (Rooney and Cowan, 2011). Additionally, direct behavioral studies only involved working dogs. We thus identified a crucial need for observational studies on pet dogs that undergo different obedience training methods, especially in light of the recent increase in pet dog training schools.

The use of 1 of the 4 procedures depends on preventing the dog doing an undesired action (i.e., punishment for decreasing its rate: P+ and P−) or the dog learning a specific action (e.g., sit, down, and heel) (i.e., reinforcement for increasing its rate: R+ and R−). The present exploratory study focused on the second case; it was thus aimed at evaluating the impact of a positive versus a negative reinforcement–based method on the behaviors of pet dogs by observing dog–human pairs during training sessions at 2 dog schools, as an ecological sampling, which each relied on different training methods. Impacts of the methods were evaluated during advanced training classes to avoid interference with the novelty of the situation, have more behavioral consistency from owners and dogs, and avoid confusion by dogs about the instruction (another potential source of stress-related behaviors); finally, kind of midterm effects were found more relevant to explore. The study focused most intently on the display of behaviors known to be associated with stressful situations, for example, low posture, avoidance, or some oral behaviors (Beerda et al., 1998; Schilder and Van der Borg, 2004; Ogata et al., 2006; Bellaio et al., 2009; Döring et al., 2009): according to precited studies, these behaviors would likely be greater in dogs trained in a school that uses the R− based method.

Moreover, the study aimed to analyze the effects of the 2 methods on attentive behaviors directed at the owner. Indeed, gazing at the owner is an indicator of the attentiveness toward owners. First, the dog's gaze at its owner was a factor associated with a significant increase in obedience during a sit command exercise (Braem and Mills, 2010). Second, in situations when a reward was inaccessible and when its acquisition required the intervention of a human, pet dogs looked back toward their owners (Gaunet, 2010; Gaunet and Deputte, 2011), whereas wolves almost never did (Miklósi et al., 2003) (this behavior corresponds to 1 of the 2 referential behavior component during social referencing in mammals; Russell et al., 1997 and Merola et al., 2012); shelter dogs, who are deprived of interactions with humans (Tuber et al., 1999; Wells, 2004), gazed less toward humans during an extinction test based on getting an inaccessible reward compared with pet-owned dogs (Barrera et al., 2011). A second component of social referencing consists of behavioral regulation based on emotional information that can be gotten from the face of the informant (Russell et al., 1997; Merola et al., 2012). A difference in the frequency of gazes toward owners between the 2 methods would thus reveal different propensity in using the human partner as a reliable and safe source of information, and thus would be an indicator of the relationship within the pair. Accordingly, dogs trained with the R+ based method should exhibit more gazes toward their owners than dogs trained with the R− based method. Finally, avoidance behaviors (gaze and body) may be observed in the group trained with the R− based method, which would reveal apparent distrust on the part of the dogs. These hypotheses are also supported by the fact that gaze holding (when games began) and gaze monitoring repeat in successful human–dog play bouts —and that are often absent in unsuccessful bouts or when play collapses (Horowitz and Bekoff, 2007); they are additionally supported by the study by Rooney and Cowan (2011) who evidenced that dogs whose owners favored rewards tended to be more playful than those whose owners favored physical punishment.

Methods

Schools and participants

The observer (S.D.) first phoned a number of dog training schools. As a student in animal behavior, she explained that she wanted to observe beginner- and advanced-level training classes (with 20-30 participants in the advanced class) and intended to record her observations in a notebook; she did not reveal that schools using different training methods would be observed. A primary visit and observation of the beginner training class were the means chosen to determine the exact nature of the training method used (Doré and Mercier, 1992; Domjan, 2006): because the dogs are not yet trained in the beginner classes, the nature of training method is more visible than in advanced classes. In the positive reinforcement–based method, the handler presents the animal with an appetent stimulus (positive consequence) for every correctly performed response. For instance, the owner follows the

sit command by moving a food lure to entice the dog into the desired posture; when performed, the dog is rewarded with food. For the walking activity, the dog is praised when it walks close to the owner. In the negative reinforcement–based method, the handler ceases to perform an aversive stimulus only once the dog exhibits the correct response. For instance, the sit command is associated with the owner driving the leash upward and putting pressure on the dog's backside (2 unpleasant constraints for the dog); the behavior of the owner stops once the dog sits. For the walking activity, when the dog walks far from the owner or strained at the leash, the owner strains at the leash. The first school visited using the R+ and R− methods was selected because such practices were actually observed. In both, dogs were taught the sit and down commands and walking on-leash during the beginner's class; the advanced class was composed of dyads (i.e., dog–owner pairs) that had already mastered the basics taught in the beginner classes—this was assessed by the trainer (certificated by the Société Centrale Canine) before the dyad entered the advanced class. Any possibility of involvement of punishment (P+, P−) methods is considered in the discussion.

There were 10 km between the 2 schools; both were located in the suburbs of villages, in green areas: both were bordered with trees, and no noise was present. The first houses for the R+ and R− schools were respectively located at 103 and 95 m, and the training fields were 1150 and 2500 m^2, respectively; for the latter case, only a small surface was used during an exercise.

For the experiment, the dogs came from advanced classes in both schools. We chose to observe the advanced class because the novelty of the situation for the dogs (namely starting the training and going to a new social and spatial environment) could interfere with effect of interest (namely the training method); additionally, all these dogs mastered the basic instructions, being this way more consistent in their behaviors. Dogs had all taken a minimum of 5 classes to ensure their familiarity with the location where observations would be performed; most of them had performed more than 20 classes. Twenty-six dogs and their owners from the dog training school that used a method based on negative reinforcement (R− group; 16 males, among which 4 were neutered and 10 females, among which 7 were neutered, mean age: 2.41 years old between 8 months and 6 years) and 24 dogs and their owners from the dog training school that used a method based on positive reinforcement (R+ group; 11 males, among which 3 were neutered and 13 females, among which 9 were neutered, mean age: 2.88 years old between 1 and 7 years) participated in the study (cf. Table 1 for the dogs' characteristics).

Table 1
Dog characteristics ((x) indicates that the breed is crossed)

R+			R−		
Breed (x = crossbreed)	Age (years)	Sex	Breed (x = crossbreed)	Age (years)	Sex
Shepherd (x)	4	♂	German shepherd	3	♀
Belgian Malinois	4.5	♀	German shepherd	1.4	♀
Beauce shepherd	3	♀	German shepherd	1.7	♀
Beauce shepherd	2	♀	German shepherd	2.2	♂
Australian shepherd	1.5	♀	German shepherd	5	♀
Australian shepherd	3	♂	Belgian Malinois	2	♂
Australian shepherd	7	♀	Border collie	3	♂
Border collie	1	♂	Doberman	5	♀
Shetland sheepdog	1.6	♂	Standard schnauzer	1.5	♂
Pyrenean shepherd	2	♀	Bullmastiff	1.7	♂
Miniature schnauzer	2.5	♂	Leonberg	5	♂
Leonberg	4	♀	Newfoundland	4	♂
Bull terrier	2.5	♀	Bernese mountain	2	♀
Irish terrier	3	♀	Bulldog	2	♂
Jack Russell terrier	2	♂	Jack Russell terrier	2	♀
Jack Russell terrier (x)	4	♂	Jack Russell terrier	2	♂
Shiba Inu	3	♀	Parson Russell terrier	2	♂
Beagle	2.5	♂	West Highland white terrier	1.2	♂
Golden retriever	1.6	♂	West Highland white terrier	1.8	♀
Labrador retriever	7	♀	Cairn terrier	1.7	♂
Labrador retriever (x)	4	♂	Bull terrier	1	♀
Tibetan spaniel	1	♂	Beagle	0.7	♀
Poodle	1.2	♀	Labrador retriever	1.6	♂
Cavalier King Charles	1.3	♀	Labrador retriever (x)	6	♂
			Golden retriever	2	♂
			Chihuahua	1.3	♂

Procedure

Group training sessions took place in outdoor fenced fields. For each school, the observer (S.D.) attended 2 sessions of the advanced class; each session took place on 2 different days, and the 2 consecutive 1-hour sessions were separated by a week. Before each session, the dog trainer informed the owners that a student in animal behavior would observe 2 training sessions. The observer introduced herself to the owners; the owners were not informed which would be observed during the session. Each day, dyads observed were randomly chosen, and not all dyads that were present were observed. The observer positioned herself next to the trainer and never intervened. The behavioral collection started 10 minutes after the beginning of the training session. During the training session, while the dyads were walking within the field with leashed dogs, the trainer provided the owners the instruction to prepare to ask their dogs to sit, lie down, and so on; after a period for the exercise to be performed, the trainer asked the owners to prepare for returning to walk. Dyads' behaviors were collected when they were walking between 4 and 7 m in front of the observer and the dogs were 2-5 m apart; for the observer completing the observation of 1 dyad, the dyad had to walk in front of the observer 2 times.

Indeed, dog behaviors were collected over the course of 2 different popular training exercises: walking on-leash and responding the sit command. One instance of each exercise was observed for each dog. Identical qualitative types of bouts were recorded for each training exercise and between dogs:

Walking on-leash

This training exercise did not involve any intervention from the owner because the observation focused on an interval of time included in an ongoing walking activity and the dyads were already accustomed to walking together. The behaviors of the dyads were recorded during 5 steps that were performed in the middle of 11 consecutive steps to avoid interaction with an ongoing exercise; 3 steps were thus performed before and after recording the behaviors.

Sit command

This exercise was performed while the dyad was on a walk. It required verbal intervention from the owner for the execution of the command. The observation started when the owner gave the sit command and stopped once the walk resumed: this indicated that the dog had performed the sit action.

Owners' behaviors were collected over the course of the 2 same training exercises.

Given that dog behavior can be affected by everyday interactions between dogs and owners, individual characteristics (e.g., breeds, sex, age), and previous experiences of the dogs (Hart, 1995; Serpell and Hsu, 2005), we developed a questionnaire (partially based on the study by Eskeland, 2007) to determine the individual characteristics of the dogs and owners, the owner's and dyad's experience

Table 2
Variables obtained from the questionnaire and used for the multiple correspondence analysis

Variables	Modalities
Individual characteristics of the dogs	
Federation Cynologique Internationale group	Sheepdogs and cattle dogs (except Swiss cattle dogs)/pinscher and schnauzer–Molossoid breeds–Swiss Mountain and cattle dogs/terriers/dachshunds*/spitz and primitive types/scenthounds and related breeds/pointing dogs*/retrievers–flushing dogs–water dogs/companion and toy dogs/sighthounds*
American Kennel Club group	Herding/working/sporting/hound/terrier/nonsporting/toy/miscellaneous class*
Age	Younger than 2 years/2-3 years old/3-4 years old/older than 4 years
Sex	Male/female
Neutered	Yes/no
Where the dog was owned	Breeding kennel/family breeding/third person (family, friends, other individuals)/pet shop/shelter
Age of the dog when owned	Younger than 3 months/3-6 months/6-12 months/1-2 years old/older than 2 years
Individual characteristics of the owners	
Sex	Male/female
Age	Younger than 25 years/25-40 years old/41-60 years old/older than 60 years
Family status	Couple/single
Children	Yes/no
Experience of the owner	
Experience with dogs	The owner has already owned at least 1 dog before the present one: yes/no
Experience in dog training with another dog	The owner has already performed dog training sessions with another dog than the present one: yes/no
Experience in dog training with the present dog	The owner has already performed dog training sessions with the present dog in another dog training school: yes/no
Information taken before subscribing to the present dog training school	Yes, by visiting dog training schools/Yes, on the different existing dog training methods/No, already knew the present dog training school/No, the present dog training school was recommended by a third party/No, the present school was the closest
Attendance to the present dog training school with the present dog	
Regularity of the attendance of the classes by the same owner	Always the same owner comes to the class: yes/no
Number of training sessions already performed	Less that 5*/5-10/10-15/more than 15
Duration since when training sessions are attended	Less than 1 month*/1-3 months/3-6 months/6 months-1 year/more than 1 year
Initial reason for coming	Education/a problem was encountered with the dog/sport
Use at home of the advices taught	No, no time/home is not for training/as much as possible/always
Use when outdoors of the advices taught	No, no time/not a training session/as much as possible/always
Living conditions of the dog	
Access to the house/flat	Yes/no
Access to all the house/flat rooms	Yes/no
Access to the living room coach	No restriction/with authorization/forbidden for hygienic or dog size reason/forbidden for a matter of risk of dominancy
Average duration let alone/day	0-3 hours/3-5 hours/5-8 hours/8-10 hours/more than 10 hours
Petting frequency	Everyday/regularly/from time to time/never*
Frequency of walks	Everyday/regularly/from time to time/never*
Frequency of play games	Everyday/regularly/from time to time/never*
Frequency of sport practice	Everyday/regularly/from time to time/never

When a modality was not observed (cf.*), it was not used in the multiple correspondence analysis.

with obedience training, and the social and spatial living conditions of the dogs (cf. Table 2 for the variables extracted and used). The aim was to determine whether both groups would differ in these aspects. At the end of the session, owners filled out the questionnaire.

Data collection and analyses

To determine whether both groups would differ for the information on the dyads collected by the questionnaire, we used a multiple correspondence analysis. For the same purpose, we also compared the proportion of small and large dogs between training schools, using the Fisher exact test (bilateral threshold $P < 0.05$).

To be minimally intrusive, the observer performed direct visual observations of the behaviors and recorded them in a notebook (cf. Rooney et al., 2000 and study 1 of Westgarth et al., 2010). The observer was already skilled in behavioral recording (cf. the acknowledgments section in the paper by Gaunet and Deputte, 2011). For the data collection, the dogs were identified by breed and phenotypic color; when there were numerous dogs of a particular breed with an identical phenotypic aspect, the observer recorded the color of the owner's jacket. We used the "focal sampling" method (cf. description of walking on-leash and sit command situations mentioned previously) and collected behaviors described in the later sections according to the "1-0 sampling" method (Altmann, 1974).

To evaluate the impact of positive versus negative reinforcement–based method on the pet dogs' behaviors, we focused on the dogs' display of 6 behaviors known to be associated with stressful situations because of owner intervention and a lowered posture (Beerda et al., 1998; Schilder and Van der Borg, 2004; Ogata et al., 2006; Bellaio et al., 2009; Döring et al., 2009) compared with the breed-specific posture shown by dogs under neutral conditions (Beerda et al., 1998) (cf. Table 3). To evaluate the impact of the training methods on the quality of dog–owner interaction, we recorded gazes directed at the owner (Gaunet, 2010; Gaunet and Deputte, 2011) and avoidance behaviors (adapted from the study by Schilder and Van der Borg, 2004 and Döring et al., 2009) (cf. Table 3).

Behaviors related to stressful situations and avoidance behaviors were collected only when the owner intervened, that is, for the sit command. The 2 other behaviors were collected for both training exercises. Behaviors related to stressful situations and a lowered posture would reveal the degree of unpleasantness of the interaction, and the analysis of gaze at the owner and of avoidance behaviors would reveal the nature of the relationship within the dyad.

The aim of the present study was to address effects of R+ and R– training-based method on dogs' behaviors. As a control, the rate of R+ and R– stimuli in the advanced class was collected for

Table 3
The 4 types of behaviors of the dog recorded (1-0 sampling) according to the 2 training exercises observed

Behaviors of the dog	Description
Behaviors related to stressful situations	
For *sit command only*	
Mouth licking	The dog licked its mouth
Yawning	The dog yawned
Scratching	The dog scratched itself
Sniffing	The dog sniffed the ground or ahead
Shivering	The dog trembled
Whining	The dog whined
Posture	
For *walking on-leash* & *sit command*	
Low posture	The tail of the dog was in a lowered position, the ears were positioned backward, and the legs were bent: at least 2 of these behaviors were exhibited together
Gaze	
For *walking on-leash* & *sit command*	
Gaze toward the owner	The dog gazed with head oriented toward the owner, and gaze stopped in the owner's direction
Avoidance	
For *sit command only*	
Body	The dog performed an avoidance-like behavior with its body or a step back movement
Gaze	The dog's head turned at the opposite direction of the owner after an action of the owner

each exercise. R− behaviors accompanying the instruction were collected: the owner performed 1 jerk on the leash; the owner constrained the dog (tight leash, pressure on a dog's body part). Owners' R+ behaviors displayed after the execution of instruction had been performed were collected: the owner provided it a piece of dry food.

For each behavior, we used the Fisher exact test to compare the number of dogs or owners between the groups (bilateral threshold $P < 0.05$). Because dogs may present variability in displaying behaviors known to be associated with stressful situations, we also compared the number of dogs between the groups displaying at least 1 of these 6 behaviors.

Results

Questionnaire analysis

The comparison of the first factorial coordinates of the multiple correspondence analysis did not show a significant difference between the 2 groups (Mann–Whitney U test = 254, $P = 0.27$).

Small and large dogs

The proportion of large dogs was 67% in the R+ school and 73% in the R− school; they did not differ: $P = 0.76$.

Behavioral analysis of the dogs for walking on-leash

In both groups, few dogs displayed a low posture; no difference was found between the 2 groups ($P = 0.35$), cf. Figure 1, left.

In the R− group, very few dogs gazed at the owner, whereas they numbered 62.5% in the R+ group ($P < 0.0001$), cf. Figure 1, right.

Behavioral analysis of the dogs for the sit command

The analysis of behaviors known to be related to stressful situations shows that more dogs in the R− than in the R+ group displayed mouth licking ($P = 0.019$) and yawning ($P = 0.023$). Few dogs

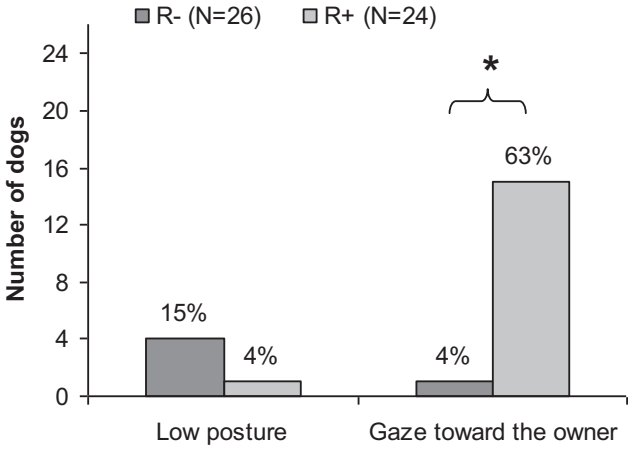

Figure 1. Number of dogs displaying (left) low postures and (right) gaze toward the owner during walking on-leash for the R+ and R− schools (using positive and negative reinforcement–based method, respectively). *Significant difference (Fisher exact test).

displayed the 4 other behaviors in each group; no differences between the groups were found ($P > 0.05$) (Figure 2). Finally, more dogs in the R− than in the R+ group displayed at least 1 of 6 behaviors known to be related to stressful situations ($P < 0.0001$). It is worth pointing out that the owners of the 2 dogs from the R+ group who displayed mouth licks (cf. 8.33% on Figure 2) both used food as a lure during the sit command, as is frequently practiced in beginners' classes.

A greater proportion of dogs displayed low postures in the R− group than in the R+ group ($P = 0.0041$), cf. Figure 3, left.

Fewer dogs gazed toward the owner in the R− group than in the R+ group ($P < 0.0001$), cf. Figure 3, right.

No dogs from the R+ group showed any avoidance behaviors, and only 3 dogs from the R− group displayed such behaviors: 2 dogs altered their head direction, and 1 dog altered its body movement. The statistical analysis could not be performed because of the paucity of records.

Behavioral analysis of the owners for walking on-leash

There was no explicit instruction for walking on-leash, but some owners performed 1 jerk on the leash: 11.54% in the R− group and 8.33% in the R+ group ($P = 0.99$). No owner constrained their dog in both groups. No owner provided a piece of food while walking on-leash in both groups.

Behavioral analysis of the owners for the sit command

For the behaviors accompanying the instruction, 30.77% of the owners performed 1 jerk on the leash in the R− group and 8.33% in the R+ group, with no statistical difference between the groups ($P = 0.07$). No owner constrained their dog in both groups.

About 41.67% of the owners provided their dog a piece of dry food after the instruction was executed in the R+ group and none did in the R− group ($P = 0.00019$).

Discussion

This exploratory study tested the effects of 2 dog training methods on pet dogs by observing behaviors known to be linked to stressful situations and others that would reveal the nature of the relationship of dogs with respect to their owner. First, the 2 groups did not differ in the proportion of small and large dogs; nor did they

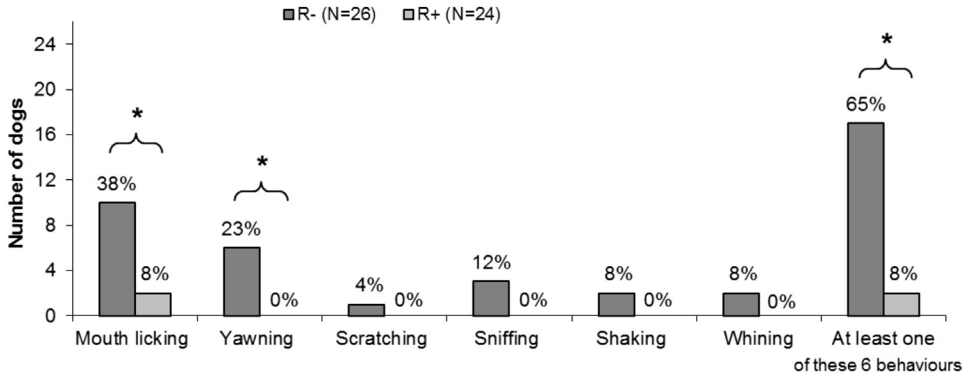

Figure 2. Number of dogs displaying behaviors known to be related to stressful situations during the sit command for the R+ and R− schools (using positive and negative reinforcement–based method, respectively). *Significant difference (Fisher exact test).

differ in their individual characteristics or that of their owner, in the experience of the owners with dogs and of the dyads with obedience training, and in the social and spatial living conditions of the dogs. Even one cannot guarantee that both groups differed only for the training method, data reported for the dogs' size and the questionnaire provide clues of such a limited effect; the present study thus pictures actual training schools using R+ and R− reinforcement–based methods, that is, an ecological sampling. Second, the results of the analyses of the owners' behaviors during the advanced classes converge with the observation of the owners' behaviors done during the visit of the beginner classes confirming the choice of the schools; they additionally revealed more food providing by the owners after the sit instruction was performed by the dogs in the R+ group than in the R− group. Third and more importantly, the results for the dogs' behaviors support our hypotheses: in the group trained with the method based on negative reinforcement, a greater proportion of dogs displayed stress-related behaviors, low postures, and avoidance behaviors (thought no statistics could be computed for the latter behavior) during the sit command, and a smaller proportion of dogs gazed toward the owners during both exercises than in the group trained with the positive reinforcement–based method. The negative reinforcement–based method altered dogs' behaviors. Although similar conclusions had been raised in behavioral studies focusing on the training of working dogs and in studies involving questionnaires addressed to pet dog owners, this is the first time that such results are documented in the pet dog by a behavioral study performed on common training methods.

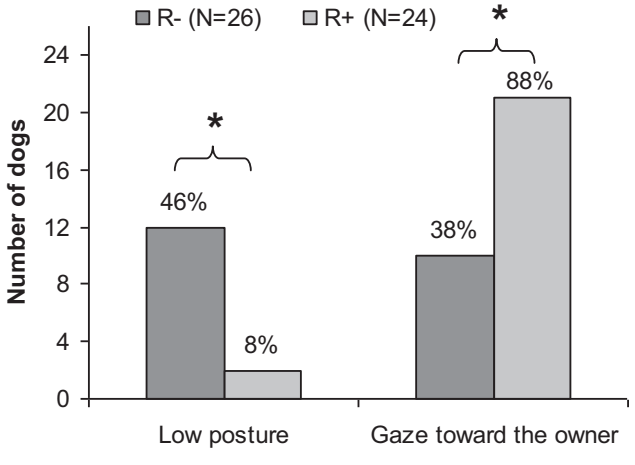

Figure 3. Number of dogs displaying (left) low postures and (right) gazes toward the owner during the sit command for the R+ and R− schools (using positive and negative reinforcement–based method, respectively). *Significant difference (Fisher exact test).

Two issues related to our attempt to minimally affect the situations observed must however be raised before discussing the data: the same person selected the schools and performed the observations, 1 expert observer collected the data (see the study by Rooney et al., 2000 and Westgarth et al., 2010), observations were short in duration, and only 1 dog school for each method was analyzed (with 24 and 26 dogs in each school though). The present findings cannot thus be generalized to larger populations, but our study is an exploratory study that provides a preliminary panorama of the nature of dogs' behaviors in natural conditions and experimental trails to lately be followed and optimized.

Effects of the training methods on stress-related behaviors

During the walking on-leash exercise, which did not involve any vocal intervention from the owner, we detected no difference for the low posture behavior among the group trained with the positive or negative reinforcement–based method. This suggests no remaining effect or generalization of the use of aversive stimuli or of the behaviors of the owner during the sit command to the walking activity for this behavior in the R− group. This result differs from the study by Schilder and Van der Borg (2004). They observed some German shepherd guard dogs that wore a shock collar in the past and some that did not, with both groups trained in a fairly harsh manner: low postures were observed in the dogs from the first group that were walked on-leash with their handler. The study does not mention whether the dogs were living in their handlers' home. The strong aversive power of shock collars (and at least, more aversive than pressure on the leash) and the living conditions may explain the discrepancy between our results and those obtained by Schilder and Van der Borg (2004). Indeed, living conditions of military dogs have been shown to contribute to their welfare as well as their obedience and aggressiveness levels (Lefebvre et al., 2007). Therefore, we suggest that the current R− based training method applied to dogs that live with their owners, as in the present study, may avoid the association of aversive stimuli to the mere presence of it (i.e., the owner) for low posture.

This is, however, not the case for an exercise requiring a vocal intervention from the owner, namely the sit command: more dogs trained with the negative reinforcement–based method displayed signs of stress compared with dogs trained with the other method. This effect was demonstrated by low postures as well as by mouth licks, yawning, and for at least 1 of all stress-related behaviors pooled (Beerda et al., 1998; Schilder and Van der Borg, 2004). This effect is revealing because the dogs in both groups were already

well trained, and the owners of the 2 groups differed only by providing a piece of food after the instruction was performed (i.e., more in the R+ than in the R− group). These results suggest that the instruction itself has become an aversive stimulus in the group of dogs trained with the negative reinforcement–based method, probably by associative learning (Reid, 2009).

Thus, the training methods affected stress-related behaviors differently according to the type of exercises. The sit command may have functioned as a conditional stimulus. The question of the effects of training method on pet dogs is therefore an issue for the dogs' welfare, especially when using verbal instructions.

Effects of the training methods on the dog–owner relationship

Interestingly, only 3 dogs performed avoidance behaviors during the sit command in the group of dogs trained with the negative reinforcement–based method. This method does not, therefore, appear sufficiently stressful for the dogs to induce any attempt to escape or avoid the situation. Consequently, in that group of dogs, the relationship of the dog toward its owner does not appear to be strongly affected: there is no apparent distrust of the owner by these dogs. However, these dogs might have alternatively learned that the leash is a constraint that prevents the display of such behaviors; in that case, it cannot be ignored that potential avoidance behaviors by the dogs would be masked by the presence of the leash.

The analysis of the gaze at the owner provides additionally illuminating information. The dog's gaze at the human partner operates as an index of the relationships of the dogs with humans (Braem and Mills, 2010; Rooney and Cowan, 2011; Merola et al., 2012). Although an equal number of dogs that did not gaze-avoid were trained with the negative or positive reinforcement–based method, we found that more dogs trained with the positive reinforcement–based method gazed at their owner than dogs trained with the other method, for both exercises. These results thus confirm our hypothesis: dogs involved in the positive-training program displayed a greater propensity to visually interact, which in turn suggests a more stable relationship within those dyads. Still, simply looking for a reward may have contributed to the gazes at the owners during the sit command exercise. The study of owner–dog pairs trained with positive reinforcement–based method but having reached a stage not requesting the presence of a regular reward would disambiguate that latter possibility.

Welfare issue related to pet dog training

Fewer behavioral problems and better command following have been found associated with the use of positive reinforcement–based method (Hiby et al., 2004; Blackwell et al., 2008; Rooney and Cowan, 2011). In contrast, immediate behaviors signaling fear and stress (Beerda et al., 1998; Schilder and van der Borg, 2004; Schalke et al., 2007) and aggressive reactions (Herron et al., 2009) are linked to aversive events. Furthermore, distraction during training, behavior problems, lower obedience, and playful behaviors were linked to negative reinforcement–based method (Roll and Unshelm, 1997; Hiby et al., 2004; Haverbeke et al., 2008; Herron et al., 2009; Rooney and Cowan, 2011). We did not study the obedience level as the dogs were already trained, but our results concur with those reported on the dogs' welfare, except that we did not observe signs of fear through avoidance-behavior observations. Although it cannot be said that the welfare of these dogs had been restrained, it may have been under threat. The relationship of the dogs toward their owners, however, can be compromised, as evidenced by the lower number of dogs that gazed at their owner in the R− group. Furthermore, a vocal intervention from the owner (e.g., sit) seemed to induce more signs of stress in this group. These results rise for possible side effects of negative reinforcement–based method on later behaviors in the dogs: they could be a lower rate of initiating interactions from the part of the dogs and less control of the owners over the dogs, based on the importance of eye contact in the human–dog bonding.

Related to the latter size issue, the proportion of small and large dogs did not differ between the training schools. These results converge with the study by Arhant et al. (2010) who found no marked differences in the types of training methods used with smaller and larger dogs. Therefore, the size of dogs does not affect the choice of training methods: big dogs may thus not be more at risk than small dogs for potentially adverse effect on welfare.

Finally, a possibility is that the 2 groups would additionally differ in terms of use of punishment methods both during training sessions and at home. The multivariate analysis did not show that the 2 groups differed in terms of dog–owner interactions; additionally, the absence of effect of the variable "Information taken before subscribing to the present dog training school" suggests that the distribution of owner's profile according to the schools would not differ from hazard. However, we cannot discard that, generally, on the field, P− stimuli is more likely used by schools using the positive reinforcement–based method —because of the use of food, its temporary withdrawal is a form of negative punition, and P+ stimuli is more likely used by schools using the negative reinforcement–based method —use of aversive stimuli. Additional behavioral microanalyses would clarify whether the inherent link between R+ and P− stimuli and between R− and P+ stimuli during formal training is still at play in dogs attending advanced classes.

This exploratory study suggests the importance of studying dog's training methods for dog's well-being. However, several experimental aspects should be considered ultimately. We suggest increasing the sample of training schools to compensate for possible school individual variations. Increasing the number of measures by dog and exercise would strengthen these preliminary results. Involving an additional blind observer for part of the data collection in a masked manner would dismiss any potential observational bias and limit the risk of intrusiveness that may affect behaviors of owners and trainers. Finally, replicating the study in beginners, as for assessing the effect of the novelty of the situation for the dogs and of the greater number of R+ and R− stimuli, as well as in more advanced dogs when food reward has disappeared from the owner's behavioral repertoire, would provide a comprehensive view on the effect of the training methods.

Conclusions

Dog–human interactions are based on instrumental learning (Elgier et al., 2009; Reid, 2009; Barrera et al., 2011), and reinforcers are mostly provided by humans (Udell and Wynne, 2008). Whether the results we obtained on the training fields can be generalized to the home context remains an open issue. As Udell and Wynne (2008) suggest, there remains a need for devising refined and easily applicable methods of training and evaluation grounded in empirical and testable approaches to behavior for more appropriate practices toward dogs; this may consolidate the relationship of the dogs with respect to their owners. The present research thus advocates more generally for performing observational studies on the effects of training methods on dog welfare (Stafford, 2012) and for considering the training methods in epidemiological studies of dog bites, never asked in survey studies (e.g., de Keuster et al., 2006).

Acknowledgments

The authors thank the presidents of associations of the 2 dog training schools, the owners, and their dogs, as well as G. Eskeland, who kindly sent questionnaires for the dogs' owners. The study complies with current laws in France for animal and human research.

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