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The effect of ostensive cues on dogs' performance in a manipulative social learning task

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ABSTRACT

In contrast to animal social learning (e.g. dogs learning from observing another dog), humans typically teach by attracting the attention of the learner. Also during the training of dogs, humans tend to attract their attention in a similar way. Here, we investigated dogs' ability to learn both from a dog and a human demonstrator in a manipulative task, where the models demonstrated which part of a box to manipulate in order to get a food reward. We varied the communicative context both during the dog and during the human demonstration comparably: a second experimenter directed the attention of the subjects to the model (dog/human ostensive demonstration) or remained silent (dog/human non-ostensive demonstration). Moreover, we investigated whether the training level of the dogs (well-trained vs. untrained) affected how the dogs performed in the manipulative tasks after the different demonstrations.

We found that better trained dogs showed significantly better problem solving abilities. They paid more attention to the human demonstration than to the dog model, whereas such a difference in attentiveness of the less trained dogs was not found. Despite slight differences in paying attention to the different demonstrators, the presence of human or the dog demonstrators exerted equally effectiveness on the test performance of the dogs. However, the effectiveness of the demonstrations was significantly reduced if ostensive cues were given during the demonstrations by a second experimenter. Analysis of attentiveness and activity of the observer dogs during the demonstrations indicates that the reason for this negative effect was a combination of distracted attention paid to the demonstration and a higher level of excitement in the ostensive than in the non-ostensive demonstrations.

This study suggests that third party communication during demonstration attracts dogs' attention to the communicator instead of paying close attention to the model. We suggest that precise timing and synchronization of attention-calling and demonstration is necessary to avoid this distracting effect.

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1. Introduction

Recent studies have shown that many animal species, including dogs, can learn from observing another individual how to solve a specific task (Adler and Adler, 1977; Slabbert and Rasa, 1997; Kubinyi et al., 2003b; Range et al., 2007). For centuries, domestic dogs have been trained by humans to perform different tasks, and it has been repeatedly suggested that dogs' performance can also be enhanced by a demonstration of a conspecific (Slabbert and Rasa, 1997; Kubinyi et al., 2009). Dog puppies learn from observing their littermates (Adler and Adler, 1977) or their mother (Slabbert and Rasa, 1997), and adult dogs can even learn from watching an unfamiliar dog solving different problems (Pongracz et al., 2004; Range et al., 2007).

Dogs pay a lot of attention to humans and readily adjust to their behaviour, most likely due to the domestication process and the social environment pet dogs live in (Kubinyi et al., 2003a; Miklosi et al., 2003). As with human infants (Topál et al., 2008), when making a choice dogs may follow communicative human actions even at the expense of loosing a reward (Szetei et al., 2003; Erdohegyi et al., 2007). They can match their behaviour rather precisely to that of a human demonstrator (Topal et al., 2006) and can profit from human demonstrations in a detour as well as in manipulative tasks (Pongracz et al., 2001; Kubinyi et al., 2003b).

Interestingly, when learning from humans, dogs seem to require attention and communicative behaviour of the demonstrator (Pongracz et al., 2004). For example, observing a human walking around a fence enhanced the dogs' detouring performance only if the human was talking to the observing dog during the demonstration. Showing the solution without communicative cues did not enhance the dogs' performance, even if the demonstrator had the reward in her hand. This is the only study so far that directly investigated whether dogs learn better from a conspecific or from a human demonstrator, and it was found that demonstration by a dog in the absence of ostensive-communicative behaviour was similarly efficient to the talking human model (Pongracz et al., 2004). It is not known, however, whether the dog demonstrator would have been more effective if the attention of the observers had been directed towards the demonstrator dog.

In a study on selective imitation in dogs, we found that observer dogs paid more attention to the details of a conspecific demonstration if human participants of the situation directed the observers' attention to it (Viranyi and Range, unpublished). Dogs only imitated selectively after demonstration in a communicative context even though the demonstrator was a dog and the ostensive cues came from a third party (Range et al., 2007). These two studies demonstrate the importance of ostensive cues on the social learning abilities of dogs with either a human or another dog as demonstrator. However, these studies differed in where the communicative cues came from and how they were given. In the detour task, the human demonstrator was giving the cues and did so continuously, whereas in the selective imitation study, the ostensive cues came from a bystander and were only given in the beginning of the demonstration or if the observer was not watching in order to (re)direct the observer dogs' attention to the task.

Thus, in this study we systematically investigated the influence of (1) human ostensive cues and (2) the demonstrator (human vs. dog) as well as the interaction between these two factors. We measured the influence of these factors on both the subjects' attention during a demonstration and on their later test performance. The comparison of human and dog demonstrations required the continuous provision of ostensive cues by a third party, similar to the protocol of the detour study (Pongracz et al., 2004). Since the training level of a dog is known to influence performance on manipulative tasks (Marshall-Pescini et al., 2008) and may influence how animals react to human ostensive communication and how attentive they are in general, we were further interested in the effect of the training level on both the attentiveness and the problem solving ability of the dogs and its interaction specifically with the effect of ostensive communication.

2. Methods

2.1. Subjects

Dogs ($N = 70$) and their owners were recruited to participate in this study in the Clever Dog Lab in Vienna, Austria, between April and December 2007. Participation in the tests was voluntary. Only dogs older than 6 months were tested and various breeds were included. Three dogs had to be excluded from the analyses due to problems with the model dog or because the owners did not follow the instructions of the experimenter. The sex ratio of the remaining dogs was balanced (male to female: 33:34). The overall training status was low with most dogs having only basic obedience training ($N = 42$), while the remaining ones ($N = 25$) had been trained extensively in obedience classes and as agility or rescue dogs. The latter dogs were regarded to be well-trained dogs, whereas the former were regarded as untrained. Two dogs, a female and a male, were used as demonstrators.

2.2. Test apparatus

The apparatus used for the experiment was a rectangular wooden box (length $\times$ width $\times$ height = 52 $\times$ 32 $\times$ 25 cm) covered by a lid. Both sides of the box consisted of wire mesh, while the front, the rear part and the lid were made out of solid wood. The lid of the box opened if a handle on the front side of the box was pushed down with either mouth or paw (see Fig. 1).

2.3. Experimental set-up

All tests were conducted in the experimental room (4 $\times$ 5 m) of the 'Clever Dog Lab' (http://cleverdoglab.univie.ac.at/). The experiments comply with the current laws of the country in which they were performed. The experimental apparatus was fixed to the floor in the experimental room (Fig. 1). The owner, its dog, three

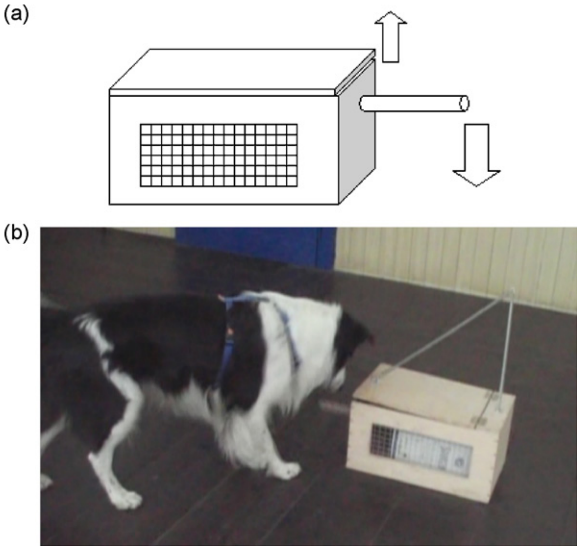

Fig. 1. (a) Sketch of the apparatus; (b) picture of a dog manipulating the apparatus.

experimenters (E1, E2, E3) and – depending on the demonstration – a further dog as demonstrator were present during the experiments (see Fig. 2). The subjects were pseudo-randomly assigned to one of the four experimental groups so that age, breed, sex and training status were balanced between groups. In each group, half of the dogs saw a demonstrator of the same sex, the others a demonstrator of the opposite sex. The experimental groups differed in the demonstrator (human or dog) and whether ostensive cues were provided:

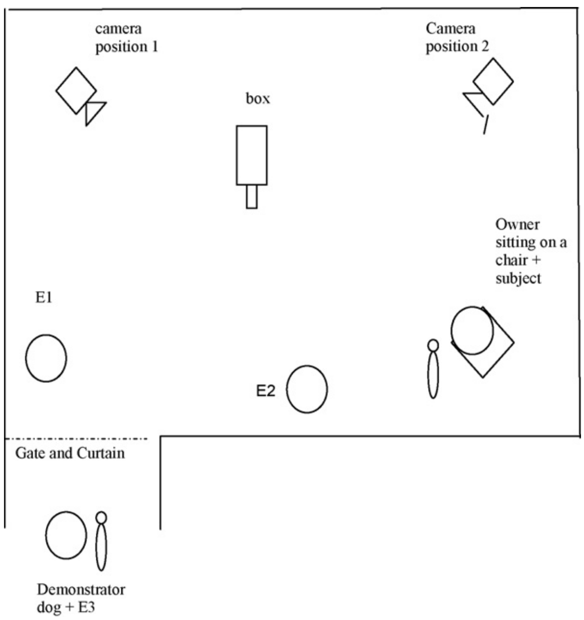

Fig. 2. Experimental set-up; E1: experimenter 1, instructing the owner during the experiment, E2: experimenter 2, hiding the food and directing the dog's attention during ostensive demonstrations, E3: experimenter 3, demonstrating how to open the box or sending the model dog in.

1A DOGOST = dog demonstration with ostensive cues ($N = 17$)
2B DOGNONOST = dog demonstration without ostensive cues ($N = 16$)
3C HUMANOST = human demonstration with ostensive cues ($N = 18$)
4D HUMANNONOST = human demonstration without ostensive cues ($N = 16$)

Each dog was allowed to watch a total of six demonstrations before it was tested on its ability to open the box by itself.

2.4. Procedure

2.4.1. Familiarization period

Upon arrival at the dog lab, subjects were given the opportunity to familiarize themselves with the location, the experimenters, and the demonstrators. During this familiarization period the subjects were allowed to move freely in the dog lab. The box was covered by a blanket in order to avoid contact and/or manipulation during this period. Owners were informed that their dog would see six demonstrations of how to open the box and then would be allowed to try to open it by itself. They were instructed what to do and what to say during the test. We only included dogs in the analyses if the owner acted in line with our instructions (see Section 2.4.2 and Section 2.4.3). The experiment started once the test dog had stopped extensive exploration.

2.4.2. Demonstration phase

The owner was instructed to sit on a chair in the experimental room (Fig. 2), holding her/his dog on the leash and to put on a mask to cover his/her eyes. While experimenter 2 (E2) baited the box and closed the lid, the owner was asked to cover the eyes of the dog with her/his hands. After baiting, E2 returned to her starting position and the eyes of the dog were uncovered to allow watching of the demonstration (details see Section 2.4.2). The owner had to keep his\her mask on and was not allowed to talk to the dog. After the dog had seen the demonstration of opening the box, E1 instructed the owner to take off his\her mask and to lead the dog to the open box where the dog could retrieve the treat from inside the box. If needed in the first trial the owner pointed to the food and encouraged the dog to take it. The dog was not allowed to inspect the box but merely was permitted to take the treat before being led away by the owner. The whole procedure was repeated immediately until each dog had witnessed a total of six demonstrations. Thereafter, the demonstrator left the experimental area and closed the gate and the curtain behind her. During the demonstration the camera was placed at position 1 (see Fig. 2) on a tripod, recording the box and the subject.

2.4.2.1. Dog demonstration with ostensive communication (DOGOST). When the observer dog's eyes were uncovered after baiting the box, E2 attracted the attention of the test dog by calling its name and directed it towards the box by talking to the dog ('Name of dog, look!) and pointing to the box. As soon as the dog was alert and watched the box, E1 silently signalled E3 hidden behind the curtain (see Fig. 2) to send in the model dog. The demonstrator dog opened the box with either the paw or the mouth and returned to E3 behind the curtain immediately without retrieving the treat. During the demonstration E2 kept looking back and forth between the observer dog and the box, telling the dog 'Look! Pay attention!' and pointing repeatedly towards the box. As soon as the model dog had left the room, E2 addressed the test dog again ('Wow, – name of the dog –, did you see that?!'). Then E2 approached the box, picked up the food without touching the lid or the handle, held and investigated it conspicuously for 3 s, and addressed the dog again ('Can you see that, – name of the dog –?!'). E2 put the food back into the box and kept eye contact with the test dog while walking back to her designated place (see Fig. 2).

2.4.2.2. Dog demonstration without ostensive cues (DOGNONOST). When the dog's eyes were uncovered after baiting the box and the dog was looking into the direction of the entrance, E1 silently signalled E3 hidden behind the curtain (see Fig. 2) to send in the model dog. The model dog opened the box exactly in the same way as in demonstration DOGOST but during the demonstration E2 looked at the box and never talked to or looked at the dog and never pointed towards the box. As soon as the model dog left the room E2 went to the box, picked up the food, investigated it silently for 3 s without looking at the dog. E2 returned the food into the box and without looking at the dog walked back to the starting position.

2.4.2.3. Human demonstration with communicative cues (HUMANOST). The demonstration was basically the same as in DOGOST, but E3 was the demonstrator. Signalled by E1, E3 entered the room, went to the box, and pushed the handle down with her right hand. During the demonstration E3 neither looked at the test dog nor talked to it and left the room immediately after the demonstration. E2 then approached the box and showed the food to the dog in the same way as in demonstration DOGOST.

2.4.2.4. Human demonstration without ostensive cues (HUMANNONOST). E3 was the demonstrator as in condition C (HUMANOST) and E2 behaved as in condition B (DOGNONOST).

2.4.3. Test phase

Right after the last demonstration, the owner was told to put on his/her mask again and to cover the dog's eyes. While the owner and his/her dog were blindfolded, E2 baited the box, took the camera to position 2 (Fig. 2) and started recording. The owner was then instructed to uncover both the dog's eyes, put his\her mask down and to start the trial by unleashing the dog and sending it to the box. Owners were allowed to encourage their dog in finding the reward, yet they were told to neither give the dog any specific commands on how to manipulate the handle nor to point to the handle. They were not allowed to approach the box closer than 1 m. If the dog managed to open the box the trial was terminated. If the dogs lost interest and stopped contacting the box for 30 s, owners were instructed to return with their dog to the chair and approach the box again. If the dog still showed no interest in the box, investigated the room or lay down for 1 min the trial was terminated, the lid opened by an experimenter and the reward given to the dog.

2.5. Analysis

The following parameters were extracted from the demonstration videos: the time the subjects were looking at the demonstrator (head of the subject turned towards the demonstrator), whether or not the subjects saw the actual opening (head of the subject turned towards the demonstrator when she/it touched the handle and pressed it down) and whether or not the dog was active (pulling on the leash or moving around during the trial independently of the head direction). The coding started when the demonstrator entered the room and ended when the box was open. The time resolution was 0.10 s. We calculated the mean percentage of observation time for each subject, the number of times the subject saw the actual opening and the number of demonstrations the subject was active. All demonstration videos were coded by the first author. Unfortunately, three demonstration video files were corrupted and thus could not be analyzed.

From the test videos, we extracted the latency to contact the front part of the box (handle, front side, anterior half of the lid), the duration of the dog's paw or nose being in physical contact with the front part of the box as well as with the rest (sides, rear or anterior part of the lid), and the success (whether or not the dog managed to open the box). The coding of the test videos started when the dog was within 1 m of the box determined by a line on the floor and ended once the trial was terminated. We excluded the sections when owners – for motivational purposes – returned with their dog to the starting position and started anew. Coding was resumed as soon as the dog returned to the 1 m periphery of the box. All parameters were coded in frames (25 per second). We calculated the relative duration of contact with the front part of the box (handle, front and anterior half of the lid) and the relative duration of contact with the rest of the box (sides, rear anterior part of the lid) in regard to the trial duration.

Test videos were analyzed blindly by C. Gruber and S. Heucke (the coders did not code dogs from the experiments they themselves participated in). To confirm scoring consistency between the two observers, eight videos were analyzed by both coders. Spearman rank correlations revealed high inter-observer reliability in the latency to the first contact with the front ($r_S = 0.98$; $N = 8$; $p = 0.0004$), contact duration with handle ($r_S = 0.83$; $N = 8$; $p = 0.015$), contact duration with the front ($r_S = 0.98$; $N = 8$; $p = 0.0004$), contact duration with the sides ($r_S = 0.97$; $N = 8$; $p = 0.0004$), contact duration with the rear ($r_S = 0.91$; $N = 8$; $p = 0.005$).

2.6. Statistics

Data that were not normally distributed were transformed using Log 10. If the data did not approach normality after transformations, we used non-parametric statistics with the original variables. Statistical analyses were performed with SPSS (2005) version 14.0.1 and with Instat 3. All reported *p*-values are two-tailed.

3. Results

3.1. Effect of communication, demonstrator and training level on the test performance

We found no significant difference in the latency to the first contact with the front part of the box across the four experimental conditions (ostensive and non-ostensive dog and human demonstrations) (Kruskal–Wallis Test: KW = 3.882; df = 3; $p = 0.275$). We also found no significant effect of training on the latency to contact the front part of the box (Mann–Whitney U:$N_{\text{no training}} = 42$, $N_{\text{well-trained}} = 25$; $z = -1.75$; $p = 0.08$).

To open the box, the subjects had to manipulate the handle in the front of the box. Thus, to analyze whether communicative cues during the demonstration, the identity of the demonstrator (dog vs. human), or the training level of the dogs had an effect on the behaviour of the subject, we first examined whether subjects spend more time in contact with the front part of the box in the ostensive and non-ostensive dog and human demonstration conditions and whether it was dependent on the training level (Fig. 3). An ANOVA with the between-subject factors 'ostension', 'demonstrator' and 'training' revealed that dogs in the non-ostensive groups spent more time in contact with the relevant parts of the box than dogs that saw the ostensive demonstration ($F_{1,59} = 7.084$, $p = 0.010$), irrespective of the demonstrator (human or dog) ($F_{1,59} = 0.424$, $p = 0.518$). The level of training also had a significant effect on the test performance ($F_{1,59} = 8.341$, $p = 0.005$), but neither the interaction between 'demonstrator' and 'ostension' ($F_{1,59} = 0.144$, $p = 0.706$), nor the interaction between 'demonstrator' and 'training' ($F_{1,59} = 0.582$, $p = 0.448$), 'ostension' and 'training' ($F_{1,59} = 0.02$, $p = 0.887$) nor the interaction between all three factors ($F_{1,59} = 2.194$, $p = 0.144$).

In order to investigate whether being in contact with the front part of the box reflects specific learning or results from being in contact with the box in general, we analyzed whether the four experimental groups also differed in terms of being in contact with the rest of the box (sides, rear). An ANOVA with the 'fixed' factors 'ostension', 'demonstrator' and 'training' revealed again that dogs in the non-ostensive groups spent more time in contact with the rest of the box than dogs that saw the ostensive demonstration ($F_{1,59} = 8.893$, $p = 0.004$), but that it did not matter whether the demonstrator was a human or a dog ($F_{1,59} = 0.030$, $p = 0.568$). It did matter, however, whether the dog was well-trained or not ($F_{1,59} = 7.355$, $p = 0.009$). None of the interactions were significant: 'demonstrator × ostension' ($F_{1,59} = 1.159$, $p = 0.286$), 'demonstrator × training' ($F_{1,59} = 0.157$, $p = 0.693$), 'ostension × training' ($F_{1,59} = 0.533$, $p = 0.468$), 'demonstrator × ostension × training' ($F_{1,59} = 0.350$, $p = 0.556$). These results show that the dogs contacted not only the front part but the whole box more after non-ostensive demonstrations and if they were well-trained.

Furthermore, we found that the groups varied in the number of animals that successfully opened the box. In the non-ostensive demonstration groups, 38.23% of the dogs opened the box and retrieved the food reward, whereas only 17.64% dogs successfully completed the trial in the ostensive demonstration groups (Fisher Exact Test: $p = 0.057$). In the dog demonstration groups, 23.53% of dogs were successful, whereas 35.29% were successful in the human demonstration groups (Fisher Exact Test: $p = 0.425$). Training, on the other hand, had a significant effect on success with 48% of the trained dogs opening the box, whereas only 19% of the untrained dogs did so (Fisher Exact Test: $p = 0.026$), suggesting that in the end, training level was the crucial factor determining if the dogs solved the problem or not.

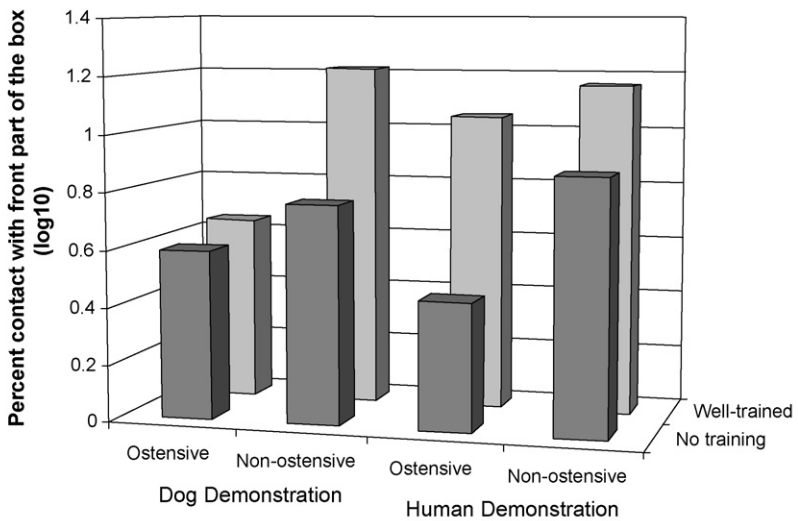

Fig. 3. The percent (mean) contact with the front part of the box (log 10) in the non-ostensive and ostensive dog and human demonstrations separated for training level (not trained, well trained).

3.2. Effect of communication, demonstrator and training level on the observer's attention during the demonstration

One possible explanation for the poor performance of dogs in the ostensive relative to the non-ostensive groups is that dogs were distracted by the nearby experimenter calling and directing their attention continuously, and thus did not pay as much attention to the demonstration as dogs that could solely concentrate on the demonstration. Attention might also contribute to the good performance of well-trained dogs if those pay more attention to a demonstration than untrained dogs. Thus, we analyzed whether dogs watched the demonstrator differently during the non-ostensive and ostensive dog and human demonstrations, and whether training level had an effect on attention (Fig. 4). An ANOVA with the 'fixed' factors 'ostension', 'demonstrator' and 'training' revealed that dogs in the non-ostensive groups observed the demonstrator longer than dogs that were presented with the ostensive demonstrations ($F_{1,57} = 24.099$, $p < 0.0001$), irrespectively of the demonstrator (human or dog) ($F_{1,57} = 0.470$, $p = 0.496$) or the dog's training history ($F_{1,57} = 0.026$, $p = 0.872$). Interestingly, the interaction 'demonstrator × training' was significant ($F_{1,57} = 4.188$, $p = 0.045$), whereas none of the other interactions were significant (all $p > 0.05$). These results suggest that that training level influenced whether the dogs paid more attention to the dog or human demonstrator. Fig. 4 shows that well-trained dogs were more attentive towards the human than to the dog demonstrator, whereas for untrained dogs no such difference between the dog and human demonstrators could be observed.

Though the difference in attention towards the demonstrator between the ostensive and non-ostensive demonstrations is significant, the absolute difference is not very large. Moreover, when analyzing how often the dogs had actually paid attention towards the exact opening of the box, we found no significant difference across the four groups (Kruskal–Wallis test: KW = 0.307; df = 3; $p = 0.959$).

Thus another factor that may influence how much information an animal can extract from a demonstration is its emotional state during observation, which may be reflected in other behaviours than the animals' attentiveness. In this experiment, the dogs showed high variability in their activity during the demonstration; they pulled on the leash and/or moved around during the demonstration or were sitting or lying quietly next to their owner. This behaviour may easily depend on the communication during the demonstration or the training level of the dog. When we compared activity during demonstrations, we found an overall significant difference between the four experimental groups (Kruskal–Wallis Test: KW = 24.981, df = 3, $p < 0.0001$). Post hoc comparisons revealed that dogs were significantly more often active during demonstrations if they watched an ostensive dog demonstration (median [1. quartile, 3. quartile] = 3 [1, 4.5]) compared to a non-ostensive dog demonstration (median [1. quartile, 3. quartile] = 0 [0, 1]) (Dunn's multiple Comparison Test: $p < 0.01$), and if they watched an ostensive human demonstration (median [1. quartile, 3. quartile] = 3 [1,6]) compared to a non-ostensive human demonstration (median [1. quartile, 3. quartile] = 0 [0, 1]) (Dunn's multiple Comparison Test: $p < 0.001$). Contrary to what one might expect, training level did not influence whether or not the dogs were active (Mann–Whitney-U: $N_{no\ training} = 42$, $N_{well\text{-}trained} = 23$, $z = -1.338$, $p = 0.181$). These results might suggest that the dogs were in a more aroused emotional state in the ostensive groups compared to the non-ostensive groups independently of the training history and demonstrator and thus could not extract as much information from witnessing the box opening than the dogs in the non-ostensive conditions.

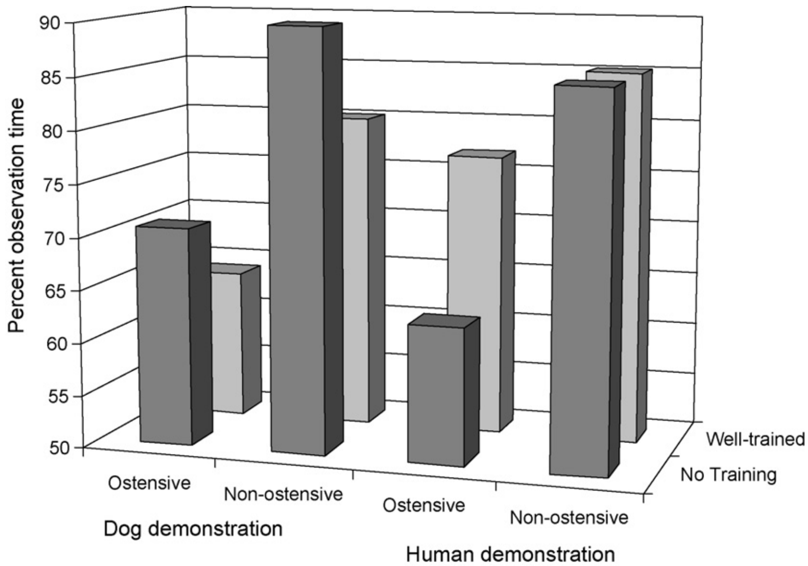

Fig. 4. The percent (mean) observation time during the demonstration in the non-ostensive and ostensive dog and human demonstrations separated for training level (not trained, well trained). In the ostensive demonstrations, a by standing experimenter was directing the dogs' attention to the demonstrator.

4. Discussion

To our knowledge, this is the first study suggesting that ostensive cues may hinder aspects of social learning in dogs instead of facilitating social learning. We found that dogs, after having watched non-ostensive demonstrations provided either by a dog or human model, spent significantly more time in contact with the box than dogs that watched ostensive demonstrations. Additionally we found that trained dogs were overall more successful than untrained dogs. We also found that subjects paid significantly more attention towards demonstrators in the non-ostensive than in the ostensive situation and that, depending on the demonstrator species, training level also influenced attentiveness of the observers, with trained dogs watching a human demonstrator more than a dog model. However, all groups saw the opening of the box equally often. Further analyses revealed that dogs in the ostensive demonstrations were significantly more active during the demonstrations than dogs in the non-ostensive situations independently of training, suggesting that dogs were more excited and might not have been able to focus as much on the demonstrations.

4.1. The influence of communicative cues

What an animal attends to during a task is of central importance in determining the information available for effective task performance (Miklosi, 1999; Range and Huber, 2007). In our experiment, analyses of attention suggested that the dogs in the non-ostensive demonstrations paid closer attention to the demonstration than dogs that watched the ostensive dog and human demonstrations. The fact that the groups which attended less to the demonstrator also showed poorer performance suggests that they might have been distracted by the talking experimenter. These results are in line with studies on cottontop tamarins (*Saguinus oedipus*), in which the more attentive animals were also more successful when solving the problem than less attentive animals (Moscovice and Snowdon, 2006). Several other studies also showed that distracted animals (e.g. through a threatening or challenging stimulus) shift attention away from the task at hand to search for the source of the stimulus (Metcalfe et al., 1987; Lima and Dill, 1990; Berglund, 1993).

Further analyses of our data revealed, however, that all subjects in our experimental groups had watched the actual opening equally often, suggesting that attention (in the sense of watching) alone might not be the entire explanation for the poor performance of the dogs in the ostensive groups compared to the non-ostensive groups. Addressing the dogs by calling their names and pointing towards the box might also have invoked a more excited or active state in the dogs, affecting their attention at the cognitive level (Virányi et al., 2009). It has been reported that in children exposed to contingency games, the arousal state and the attention directed towards the reward increased, which in turn influenced performance (Watson, 1966). The combination of communication and rewarded demonstrations might have triggered a higher arousal state in our dog subjects as well, when compared to the dogs that solely received the reward. Indeed, our analyses showed that dogs in the ostensive groups were more active, pulling more on the leash than dogs in the non-ostensive demonstrations.

Whether the directed attention and arousal invoked by third party communication has a positive or negative effect on learning from a demonstration is likely to be strongly influenced by the timing and synchronization of the communication and demonstration. In children, attention getting behaviours are often used to engage the children's attention (Zukow-Goldring and Arbib, 2007). Once children show evidence of attending towards adults, however, the adults usually stop using summons to engage the children's attention and start talking about the relevant task (Estigarribia and Clark, 2007). In our dog study, we used attention-getting behaviours throughout the demonstration and thus might have distracted the dogs from paying attention to the relevant actions. Further experiments should examine whether attention-getting behaviour before a demonstration, but utter silence during the demonstration would enhance the dogs' performance in manipulative tasks.

4.2. Influence of the demonstrator

In many studies investigating social learning in dogs, humans have been used as demonstrators (Pongrácz et al., 2005), whereas others engaged dog demonstrators (Pongracz et al., 2004; Lupfer-Johnson and Ross, 2007; Range et al., 2007). Although humans are usually easier to instruct and perform an action reliably, dogs might be the better demonstrators for other dogs due to the same body schema. Conspecifics have the same morphology and communicative behaviour as well as usually a higher social impact on a subject, thus increasing the likelihood that the subject shows a certain interest in the actions of the demonstrator and thus a higher learning rate. Physical and movement similarities might be especially important if the imitative abilities of dogs are investigated. While Pongracz et al. (2004) showed that a dog demonstration can be equally effective than an ostensive human demonstration in a detour task, the ability of dogs to imitate was shown using a dog demonstrator (Range et al., 2007).

The present study confirms that dogs did not differ in their performance in relation to having watched a dog or a human demonstration. This suggests that, for pet dogs, it does not matter whether a human or a dog is used in social learning experiments in terms of their general performance. However, when the exact action should be copied, it might still prove advantageous to use dogs as demonstrators. Due to the so-called correspondence problem (Heyes, 2001; Byrne, 2003; Brass and Heyes, 2005), it is important to distinguish between the use of body-oriented actions and object-oriented actions in imitation tasks. A specially trained service dog has proved to be able to duplicate object-oriented actions and action sequences in a so-called "Do as I do" experiment (Hayes and Hayes, 1952), but at the same time showed poorer matching performance when required to copy visually opaque, body-oriented actions (Topal et al., 2006, Huber et al. in preparation).

4.3. Training effects

Not surprisingly, well-trained dogs were more successful and spent more time with the box than untrained dogs. A recent study by Marshall-Pescini et al., 2008 has found the same effect on performance in a manipulation task using the same distinction in regard to trained vs. untrained dogs, suggesting that training, at the very least, alters how animals approach novel problems. Interestingly, it also influenced how attentive the dogs were towards demonstrators with well-trained dogs being more attentive towards human than dog demonstrators. Since during training the dogs are usually instructed exclusively by humans, they can easily learn to pay more attention to people.

4.4. General learning effects

Our data suggests that the dogs had primarily learned that they should do something with the box (e.g. they were more persistent), but not that they should specifically manipulate the front part of the box. In contrast to our results, Kubinyi et al. (2003b) found that dogs did learn which part of a box to manipulate in order to get a reward after watching demonstrations by their owner. One possibility is that the difference in the two studies arises from the fact that the owner demonstrated the actions, whereas in our study an unfamiliar person or dog demonstrated the actions. Moreover, our task seemed to have been more difficult indicated by the overall low success rate. Due to the wire mesh on the sides of the box, the box offered not only one but three (the handle and the two sides) salient attractions for the dogs to manipulate. Since the food could be smelled through the wire mesh, this task is probably rather difficult for dogs to solve, since they have to inhibit their motivation to manipulate at the place closest to the food (see also Osthaus et al., 2005). Other differences included the number of demonstrations in the two studies as well as the reward used (food vs. toy). Thus, it is difficult to assess which of these differences led to the different results.

5. Conclusions

In conclusion, our experiment suggests that whether ostensive cues enhance learning abilities in dogs or not might depend a lot on the task at hand as well as the way ostensive communication is utilized. If the demonstration is to highlight a certain location or a route, continuous attention-calling and directing might enhance learning, whereas in sophisticated manipulative tasks it probably has distracting effects. In such cases, attention-calling is probably needed to be regularly interrupted in a way that is properly synchronized with the crucial elements of the demonstration. Moreover, training per se influences how dogs perform in problem solving tasks and thus training level should be controlled for when investigating social and individual learning skills. Finally, the level of training might be a factor that influences how much attention a dog pays to a human vs. a dog demonstrator.

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