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Social learning in dog training: The effectiveness of the Do as I do method compared to shaping/clicker training

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ABSTRACT

Dog training methods traditionally rely on individual learning (mainly operant conditioning). Yet dogs are adept in acquiring information socially and are able to imitate humans. Dogs' predisposition to learn socially has been recently introduced in dog training with the Do as I do method. With this method dogs first learn to match their behaviour to a small set of actions displayed by a human demonstrator on command 'Do it!' and later are able to generalise this rule to use it to learn novel actions. In the present study, we compare the effectiveness of the Do as I do method with that of shaping/clicker training, a method that relies on individual learning, for teaching dogs two different kinds of actions: a body movement and an object-related action. As measures of effectiveness, we use the number of dog-trainer pairs experienced with either method, that succeed in obtaining five performances in a row of the predetermined action within 30 min and the latency to the fifth performance. Additionally, we assess the effect of these training methods on dogs' memory of the trained action and its verbal cue in different contexts. Our results show that the Do as I do method is more effective than shaping/clicker training to teach dogs object-related actions within a relatively short time and suggest that this method might be also applied for training body-movements. Importantly, the use of social learning enhances dogs' memory and generalisation of the learned action and its verbal cue.

1. Introduction

Until very recently little use of social learning mechanisms has been made in formal dog training, as training methods relied mainly on non-social forms of associative learning (Mills, 2005). Among the various training methods that follow operant conditioning rules (Skinner, 1951), shaping/clicker training is a technique in which the spontaneous behaviour of the animal is gradually shaped by means of strategically timed reinforcements, using the sound of a clicker as a conditioned reinforcement and food as a primary reinforcement (e.g., Veeder et al., 2009). Thus, the animal learns gradually and individually, by trial and errors, what actions are followed by a reward. In shaping procedures, complex actions are simplified by training simpler steps towards the final goal, according to a plan or programme of instrumental contingencies (Lindsay, 2000). The main role of the trainer during the training procedure is that of delivering the secondary reinforcement with proper timing, followed by the food reward. With regard to laboratory animals, for which the interactions with the experimenters may be a stressful situation, this training method has proven useful to reduce stress during manipulations and other laboratory activities (e.g., Coleman and Maier, 2010; Lambeth et al., 2006; Bassett et al., 2003). This training method is also very popular among dog trainers (e.g. Pryor, 1999, 2005).

Several studies have provided robust evidence that dogs are skilful in learning socially from both con- and heterospecifics (Kubinyi et al., 2009 for review). Dogs trained by the Do as I do procedure (Topál et al., 2006) were able to functionally imitate actions shown by a human experimenter (see also Huber et al., 2009; Fugazza and Miklósi, 2014a). With this method, dogs first learn by operant conditioning rules to match their behaviour to actions shown by a human demonstrator on command 'Do it!' (the trainer shows demonstrations of familiar actions and rewards the dog for performing actions that functionally match the demonstrated ones). Later dogs are able to generalise this 'imitation rule' to novel actions and different demonstrators (see Topál et al., 2006; Fugazza and Miklósi, 2014a for details on the training procedure). It is surprising that, despite the wide scientific literature providing evidence of dogs' predisposition to learn socially from humans, only very

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few studies (Slabbert and Rasa, 1997; McKinley and Young, 2003) focused on the use of social learning in the applied field of dog training. A training method relying on learning socially from humans – the Do as I do method – was recently introduced in the dog training practice (Fugazza, 2011). In a previous study, we assessed its efficiency for training object-related tasks (Fugazza and Miklósi, 2014b). We found that this method is more efficient than shaping/clicker training for teaching dogs complex object-related tasks and goal-directed sequences of actions. We defined efficiency as the time needed to obtain the first occurrence of the behaviour and, as measures of efficiency, we used the number of dog-owner pairs succeeding to accomplish the task within a time limit of 15 min and the latency to the first occurrence of the predetermined behaviour.

Trainers and owners usually require dogs to perform the trained actions reliably – not only once, during the training procedure. Furthermore they require that dogs perform the trained actions on cue, rather than imitating a demonstrator, and also in different contexts (Mills, 2005). We define a training method effective if it allows reaching these objectives in a relatively short time.

Thus in the present study, we compared the Do as I do method and shaping/clicker training with regard to two objectives: (1) behavioural consistency during training – i.e. performing the required action repeatedly and (2) memorisation and generalisation to different contexts of the trained action and its verbal cue – i.e., performing the trained action after a delay, when verbally required by the owner, in different contexts.

To assess the effect of the two methods with regard to behavioural consistency we measured the number of dogs succeeding to perform five times in a row the action to be trained within a 30 min time limit and the latency to the fifth performance. To assess the memorisation and ability to generalise the trained action we used the number of dogs that performed the trained actions on cue in the same context where the training took place, and also in a different context.

We aimed also at providing information on the effectiveness of the training methods with regard to different behavioural goals to be achieved, e.g., train object-related actions and body movements, because previous studies did not include body movements. Consistent with our previous results, we expected the Do as I do method to be quicker for training object-related actions (Fugazza and Miklósi, 2014b), not only with regard to the first occurrence of the predetermined action but also with regard to more performances of it in a row.

Regarding the body movements, it is suggested that their imitation is more difficult than the imitation of object-related actions for all the species in which this has been tested (see Huber et al., 2009). Thus, we expected dogs to show difficulties in learning body movements with the Do as I do method.

With regard to dogs' memory and generalisation of the trained action and its cue, it is known that dogs are able to imitate observed human actions after delays ranging from 40 s to 10 min, even without motor practice (deferred imitation – Fugazza and Miklósi, 2014a). Thus, we expected that the demonstration performed by the owner might enhance dogs' memory of the trained action and their ability to generalise it across contexts in training situations. In humans observing someone performing an action can result in a memory benefit comparable to the benefit associated with producing the action (Cohen, 1981, 1983; Mulligan and Hornstein, 2003). We hypothesised that the use of the Do as I Do method, in which dogs observe and also produce the action, would boost dogs' memory and generalisation of the trained actions, compared to a training method that relies only on individual learning (i.e., only producing the action).

2. Methods

2.1. Subjects

A total of 38 dog-owner pairs were recruited for this study. All the pairs had experience with training. Subjects were divided in two groups (DAID group $N = 20$ and SHA group $N = 18$) according to their skills and experience with specific training methods: in the DAID group we recruited owners who had previously passed a dog-training exam with their dogs for the Do as I do method (see Fugazza and Miklósi (2014b) for details about the exam). In the SHA group, we recruited professional dog-trainers who had studied shaping/clicker training during their education for becoming dog-trainers and used this method in their practice. This way we ensured that all the pairs were skilled and experienced with the specific training method they were required to use during the tests. The participants were informed about the aim of the study. Dogs were adult, from 1 to 11 years (SHA group: mean age 5.9 years, SD $\pm$ 3.5; DAID group: mean age: 5.4 $\pm$ 2.6 years) and belonged to various breeds. The two groups were balanced for breed-group and age as much as possible. All the dog-owner pairs were living together since at least 9 months, all dogs practiced some sports and training activities with their owners and had extensive experience with training. All the subjects lived in urbanised areas in northern Italy or in the Barcelona area (Spain).

2.2. Experiment 1

The tests were carried out in different dog schools in Italy and Spain (Italian dog schools: Happy Dog School, Freedog, Good Boy, Allevamento dei Grigi Audaci; Spanish dog school: Ludocan), indoor or outdoor in fenced areas, according to the spaces available in the facilities. All dogs were familiar to the places where they were tested.

Each dog-owner pair was tested during two separate training sessions in which the owner was instructed to teach his/her dog two novel actions: a body movement and an object-related action, one per test/training session, and to make the dog perform this action five times in a row. We chose the actions to use in the tests according to lists of already trained actions previously reported by the dog owners. This enabled us to find actions that were novel (i.e., never trained before) for all the dogs in our sample.

As *object-related action* we chose 'open a sliding door': the door of a white cabinet ($95 \times 81 \times 30\,cm^3$) was positioned 5 cm already opened so that the dog could insert its muzzle or paw to push it open. An experimenter positioned the cabinet's door back in the starting position after the dog's performance (and also after the owner's demonstration in the Do as I do tests).

As *body movement*, we chose the action 'jump in the air': the dog was required to raise at least the front paws from a standing position. This was the only possible body movement that we found to be novel for the dogs in our sample.

The order of administration of the two tasks (i.e., teach body movement first or teach object-related action first) was randomised. An inter-test interval of at least 20 min elapsed between the two subsequent training sessions. The timeline for a training session was 30 min: if the owner did not reach the predetermined goal (i.e., five performances in a row of the predetermined action) within this time limit, the test ended and the result was considered as a failure. Owners were informed that they could decide to stop the test earlier if they thought their dog was tired or stressed. Owners were instructed to stay at 1.40 m from the cabinet when they trained the object related action and at least 3.50 m from the cabinet when they trained the body movement.

DAID group: Owners were instructed to use only the Do as I do method. They were required to ask their dogs to stay and pay

attention, then they demonstrated the action to be trained and gave the 'Do it!' command. If the dog did not perform the correct action after the first demonstration, the owners demonstrated it again and gave the 'Do it!' command again. They were required to demonstrate the predetermined action and to give the 'Do it!' command as many times as necessary to obtain five performances in a row of the predetermined action, as counted by the experimenter. They were allowed to use praise, petting and food as rewards.

SHA group: Owners were instructed to use only shaping/clicker training. During the experiment they either sat on a chair or stood (according to what position they used when normally training their dogs). They were required to shape the spontaneous behaviour of the dog by the means of strategically timed reinforcements using a clicker as a marker, followed by food reward. Owners were instructed not to lure the dog's behaviour and not to give cues with their body or voice. After the clicker sound, they could deliver the treat from their hands or toss it on the floor.

The use of food was allowed in both groups in order to keep the dogs motivated throughout quite long (30 min) training sessions. In both groups, the sessions lasted until the experimenter counted five performances in a row of the predetermined action by the dog or until the 30 min timeline was over.

The training sessions were video recorded for later analysis. From the videos we determined (1) the number of dogs who performed the predetermined action five times in a row within 30 min in the two groups; (2) the time from the beginning of the training session to the fifth performance in a row of the predetermined action (latency) for each individual dog. In the case of SHA group, the beginning of the session was marked by the first 'click'. In the case of DAID group, the training session started when the owner made the dog stay and pay attention to the first demonstration.

2.3. Experiment 2

After successfully obtaining five performances in a row of the action trained in the second session, the successful owners were required to choose a new word (i.e., a word never used before in a training context) as a verbal cue for the trained behaviour and to put this action under verbal cue, so that the dog would perform the desired action upon utterance of the verbal cue. Owners had 10 min to accomplish this task, using either Do as I do or shaping/clicker training, according to the group they belonged to.

In the SHA group, owners first pronounced the verbal cue while the dog was performing the predetermined action and later they pronounced it after rewarding the dog with 'click' and food, but before he started to perform the action again.

In the DAID group, owners first demonstrated the action and then pronounced the verbal cue, eventually followed by the 'Do it!' command (in case the dog did not move after the verbal cue). Later the owners did not demonstrate the action any more and only uttered the verbal cue. The dogs were rewarded with praise and food if they performed the predetermined action.

In both groups, owners were suggested to vary their position and the position of the dog in the training area, when pronouncing the verbal cue, in order to achieve a better generalisation of the trained action on verbal cue. After 10 min of training owners were instructed to stop and take their dogs home for a 24 h retention interval. During this delay, owners and dogs were allowed to engage in their habitual activities, but no training was allowed.

The dogs were tested on their memory of the trained action on verbal cue after a retention interval of 24 h, first in a different context from that where the training took place (e.g. dogs trained inside were tested outside or in a different room, according to the areas available in the facilities where the testing took place. We balanced the dogs that were tested inside in a different room as much as possible – $N = 6$ in the DAID group and $N = 6$ in the SHA group). Subsequently, they were tested in the same area where they had been trained the previous day. For the test, the owners where asked to position themself next to the cabinet, at a distance of 2 m from it, to lead and position their dog in front of them using cues known by the dog (e.g. calling its name and using gestures to position the dog in front of them). Next, the owners were required to utter the trained verbal cue while standing still, orienting themselves straight forward and keeping their eyes closed, in order to prevent involuntary cues. The dog was free to perform any action. This test was performed first once in the different context and then once in the same context where the training took place.

2.4. Data collection and analysis

The difference between the two groups in the number of pairs that succeeded or failed to obtain 5 performances in a row of the predetermined action within 30 min was statistically analysed by using Fisher's exact test.

Normality of data on latencies of those pairs that completed the task before the timeline was checked with the Anderson–Darling Normality test and latency values were compared between DAID and SHA group by unpaired *t*-tests, as they followed the normal distribution (Anderson–Darling Normality test results: object-related action: DAID group $P = 0.55$; SHA group $P = 0.54$; body movement: DAID group $P = 2.13$; SHA group $P = 0.29$).

We also counted the number of dogs that performed the required action upon hearing the verbal cue in the two groups, in the different context and in the same context where the training session took place. The number of dogs that performed the required action on verbal cue after 24 h was compared between the two groups using Fisher's exact test. As only few subjects, especially in the SHA group, succeeded in obtaining the body movement and putting it on verbal cue (see Table 1), due to reduced sample size, we pooled the results of object-related action and body movement together for the statistical analysis.

3. Results

3.1. Experiment 1

When teaching the object-related action, more pairs in the DAID group succeeded to accomplish the task within 30 min than pairs in the SHA group (see Table 1) (Fisher's exact test $P = 0.038$). Regarding the body movement, only a few pairs succeeded in the SHA group (Table 1) but we did not find a significant difference between the number of successful pairs in the two groups (Fisher's exact test $P = 0.1014$).

The analysis of the latencies to the fifth performance was conservatively calculated considering only the successful pairs. The latency to the fifth performance was significantly shorter in the DAID group, compared to the SHA group for both the object-related action (open a sliding door; $P = 0.0009$; $t = 3.7060$; $df = 28$) and for the body movement (jump in the air; $P = 0.0038$; $t = 3.3197$; $df = 18$) (Fig. 1).

3.2. Experiment 2

The pairs that were successful in obtaining five performances in a row of the second action trained in experiment 1 (for the object-related action $N = 9$ in the DAID group and $N = 8$ in the SHA group; For the body movement $N = 7$ in the DAID group and $N = 3$ in the SHA group) were tested in experiment 2. In the DAID group, the owners of two dogs out of seven did not succeed in putting the 'Jump' behaviour on verbal cue within the 10 min time limit. All the other owners in both groups succeeded in making the dog perform the action on verbal cue.

Table 1
Experiment 1: number of pairs in the Do as I do group (DAID) and shaping group (SHA) that succeeded in obtaining 5 performances in a row of the predetermined actions within 30 min; experiment 2: number of dogs in the two groups that performed the requested actions on cue in a different context and in the same context where the training took place.

	Experiment 1: no. of pairs that succeeded within 30 min			
	Object-related action		Body movement	
	DAID ($N = 20$)	SHA ($N = 18$)	DAID ($N = 20$)	SHA ($N = 18$)
	19	12	14	7
	Experiment 2: no. of dogs that performed the requested action on cue			
	Object-related action		Body movement	
	DAID ($N = 9$)	SHA ($N = 8$)	DAID ($N = 5$)	SHA ($N = 3$)
Different context	6	1	5	0
Same context	9	6	5	2

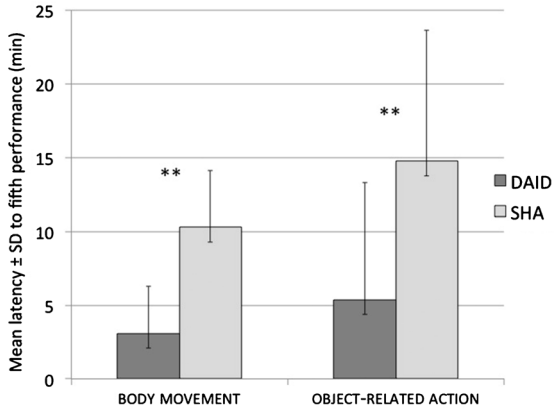

Fig. 1. Mean latency ± SD to the fifth performance in a row of the predetermined action in the Do as I do group (DAID) and in the shaping/clicker training group (SHA). ** Indicate statistical significant difference (*t*-test: body movement: $P = 0.0038$; object-related action: $P = 0.0009$).

The analysis of dogs' performance showed that more dogs in the DAID group than dogs in the SHA group recalled the actions upon hearing the verbal cue after 24 h in a different context (Fisher's exact test $P = 0.001$). When dogs were tested in the same context where the training took place we did not find a difference between the two groups in the number of successful dogs (Fisher's exact test $P = 0.0717$) (see Fig. 2 and Table 1).

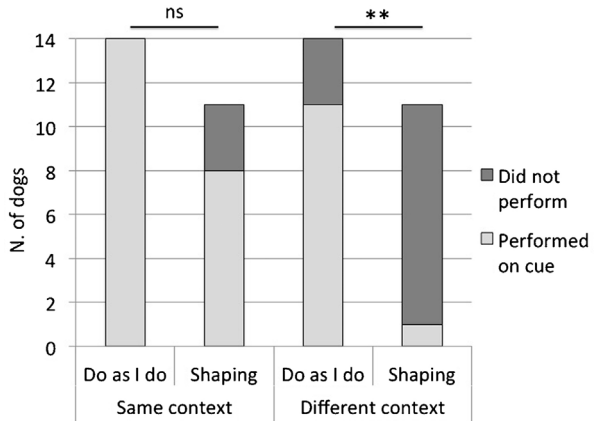

Fig. 2. Number of dogs in the two groups that performed and did not perform the required action on verbal cue in a different context and in the same context where the training took place. ** Indicate statistical significant difference (Fisher's exact test: $P = 0.001$).

4. Discussion

This study shows that the Do as I do method, which relies on social learning, is more effective than shaping/clicker training, which relies on individual learning, for training dogs on the complex object-related action 'open a sliding door' within a relatively short time. Our results additionally suggest that the Do as I do method may be used to train also different actions, such as a body movement (i.e., jump in the air), at least in some cases. Importantly, this study clearly demonstrates that the use of social learning with the Do as I do method enhances dogs' memory of the trained actions and their verbal cues, when dogs are required to perform in a context that is different from that where the training took place, thus it enhances generalisation.

More owners in the DAID group than owners in the SHA group were able to obtain five performances in a row of the predetermined object-related action within our 30 min timeline and the latency to the fifth performance in the DAID group was shorter compared to that of the SHA group. With regard to the body movement, 6 owners out of 20 in the DAID group and 11 out of 18 in the SHA group were not able to obtain the predetermined action from their dog within the time limit, suggesting that this action may be quite difficult to train with either method, although the lack of a significant difference may be due to the small sample size. Nevertheless, considering the successful pairs only, the latency to the fifth performance in a row of the body movement was shorter in the DAID group, compared to the SHA group. With regard to the effect of the training method on dogs' ability to perform the trained actions after a delay on verbal cue, we found that, regardless of the type of action, more pairs in the DAID group than pairs in the SHA group were successful when tested in a different context.

The better performance by dogs in the DAID group, compared to dogs in the SHA group, with regard to the object-related action 'open a sliding door', considering both the number of successful pairs and the latency to the fifth performance, is consistent with the results of our previous study (Fugazza and Miklósi, 2014b) that showed shorter latencies to the first occurrence of the predetermined complex object-related action for dogs trained with the Do as I do method compared to dogs trained with shaping/clicker training. The present results thus integrate those findings by indicating that, after the first occurrence of the behaviour, owners and trainers using the Do as I do method can also make it consistent (i.e., obtaining more repetitions of it) in a shorter time, compared to trainers using shaping/clicker training. Furthermore, our results suggest that this shorter latency applies to the body movement 'jump' as well.

Better performance with these complex actions in the group trained with social learning is also consistent with the findings by McElreath et al. (2005), which predict increased reliance on social

learning with increased task difficulty (McElreath et al., 2005). Dogs may have learned socially, from the owner's demonstration, what was the goal to be achieved through goal emulation (Tomasello, 1990; Wood, 1989) or may have also learned socially the action to achieve it through imitation (Miller et al., 2009; Whiten, 1998).

The interpretation of the results obtained when the body movement was trained is less straightforward than that on the object-related action. First of all, it should be noted that most pairs in the SHA group and also some subjects in the DAID group failed to accomplish the task within the time limit, despite this timespan was twice as long as that allowed in our previous study (see Fugazza and Miklósi, 2014b). This suggests that either this particular action (i.e., jump in the air), or body movements in general, are difficult to train with both training methods. With regard to this particular action, a possible explanation may rely in a previous history of inhibition by the owners for similar actions (e.g., jump on people to greet them). Although this action is different from the one we included in our tests – our 'jump in the air' did not imply physical contact with the owner – we cannot exclude that this possible previous experience may have affected dogs likeness to jump when the owner is in front of them. Further studies including different kinds of body movements could reveal the role of previous inhibition experience of similar actions on dogs' learning success. When we considered the latency to the fifth performance of the body movement for the successful pairs, we found significantly shorter latencies in the DAID group compared to the SHA group. Our results indicate that, those dogs that succeed in replicating this body movement do so in a very short time. It is possible that their success relies in a non-imitative process: if they were already likely to jump because this behaviour was already part of their spontaneous behaviour repertoire (although never trained), seeing the owner jump may have acted as a primer to release a similar motor response defined as a response facilitation (Byrne, 1994). Thus, such priming could be very effective for the actions that are in the spontaneous behaviour repertoire of the subjects. Consistent with this interpretation, two owners out of seven in the DAID group did not succeed in putting the 'jump action' on verbal cue, despite having quickly succeeded in obtaining five performances of this action, indicating that these two dogs were only likely to jump in response to the owner's jump, but would not perform this action in absence of the demonstration. The performance of these two dogs supports this facilitative hypothesis. Alternatively, it is also possible that the imitation of body movements is more likely to occur if dogs are somehow predisposed to learn them. Bjorklund et al. (2002) reported that chimpanzees were more likely to imitate actions of which they already displayed approximations at a baseline condition without demonstration. It is thus possible that dogs that already had a tendency to spontaneously perform some parts of the jump action could quickly be trained to jump through imitation, because this previous experience made the demonstration particularly salient and effective (see also Whiten, 1998).

Importantly, the results of the present study indicate that the human demonstration of the action to be trained enhances dogs' memory of this action and of its verbal cue when they are tested after a delay in a context that differs from that where the training took place. Thus, the use of the Do as I do method enhances the generalisation process. When dogs were tested in the same context where the training took place, most dogs were able to perform the trained action on verbal cue and we did not find a significant difference between the amount of successful dogs in the two groups. However, the difference was strikingly evident when the dogs were tested in a different context, with most dogs in the DAID group, but only one dog in the SHA group, performing the required action. This indicates that the beneficial effect of the human demonstration is evident when the task is more difficult, such as in the case of remembering an action in absence of contextual cues that may facilitate recall. From a cognitive perspective, this result strongly supports that dogs form mental representations of others' actions and store these representations in their memory (Fugazza and Miklósi, 2014a), similarly to 12-month-old human infants (Klein and Meltzoff, 1999). Thus, it is very likely that observing the owner performing the demonstration of the trained action and the mental representation formed through this observation, facilitate dogs' recall in challenging situations, such as when they are required to perform in a different context – which is also a typical requirement of dog training, where dogs are trained in the dog school or at home and are then required to perform the trained actions in other daily situations. The better ability to recall the trained action in the DAID group is also consistent with the benefit in human's memory after the observation of a demonstrator and one's own practice of the actions (Cohen, 1983; Cohen et al., 1987; Mulligan and Hornstein, 2003). In our case the effect may be even more evident because dogs could both observe the demonstration (thus forming a mental representation of it) and produce the action during training (thus motor practicing it) (Hayne et al., 2003).

Shaping procedures have proven effective for training a wide range of species (Langbein et al., 2007; Gillis et al., 2012) and shaping/clicker training is also widely employed in dog training (Pryor, 2005). There is no doubt that this method is effective for training dogs, as dogs can learn individually, through associations, as well as all the other species in which this ability has been tested (Williams, 1994). Nevertheless dogs' predisposition to attend to humans and learn socially from them (e.g., Pongrácz and Miklósi, 2003), in addition to the puppies' early socialisation with humans (Frank, 1980), may make dogs particularly inclined to be trained using methods that rely on social learning, such as the Do as I do method. Thus social learning methods in dog training may be more in line with the natural predispositions of dogs.

The subjects of our study were pet dogs that had received a specific training and passed an exam either on shaping/clicker training or on the Do as I do method. In principle, all well socialised pet dogs can be trained, thus these results are relevant to all well socialised pet dogs, provided they are properly trained with either method. We acknowledge that many factors, such as previous experience, rearing history etc. may influence the training success. For example different experiences with humans (e.g. laboratory dogs) provide a substantially different ontogenetic background that may affect the success of specific training methods relying on social interactions between humans and dogs (Lazarowski and Dorman, 2015). Moreover specific types of training may have an effect on related factors such as responsiveness to social contexts (e.g. Merola et al., 2013), thus we advice cautiousness in automatically extending the results of the present study to dogs with different experiences. However, we believe that this study represents a step forward towards a wider knowledge of the benefits of the use of social learning in the applied field of dog training.

5. Conclusion

This study shows that the Do as I do method, which relies on social learning is more effective than shaping/clicker training, which relies on individual learning, to train dogs to perform consistently object-related actions in a relatively short time. Our results also suggest that similar outcomes may be also obtained regarding a body movement (jump), although this action was difficult for many dogs trained with either method. Interestingly, the use of social learning with the Do as I do method enhances dogs' memory of the trained actions and of their verbal cues, when dogs are required to perform in different contexts, thus it enhances generalisation. This

suggests that the mental representation of the trained action that emerges as a result of the two methods is rather different.

Conflict of interest

None.

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