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Conspecific observational learning by adult dogs in a training context

Anna Scandurra[a,b], Paolo Mongillo[b], Lieta Marinelli[b], Massimo Aria[c], Biagio D'Aniello[a,*]

[a] Department of Biology, University of Naples "Federico II", via Cinthia, Naples, Italy
[b] Department of Comparative Biomedicine and Food Science, University of Padua, Legnaro, Padua, Italy
[c] Department of Economics and Statistics, University of Naples "Federico II", via Cinthia, Naples, Italy

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A B S T R A C T

The role of observational learning in dogs has drawn great interest from the scientific community. However, only a few studies explored its potential use for training purposes. The aim of the present study was to assess the potential benefit of conspecific observational learning in a dog training context. Fifty adult Labrador retrievers were recruited at the Italian Water Rescue School. Dogs were equally distributed between basic and advanced training level and assigned to demonstration and control groups.

The experimental procedure consisted of two phases: Phase 1, intended to ascertain that dogs could not perform the selected exercise when requested by their handlers; Phase 2, to assess whether they would perform the same exercise after the observation of a conspecific demonstrator. The tests were performed outdoors in a fenced training area and one out of two dynamic exercises were selected for each dog: jumping on a trunk or hop on a slide for children. The outcome of Phase 2 was coded into a binary variable as successful or unsuccessful and a generalized linear model with binary logistic link function was used to analyze outcomes. The model included the dog's age as a covariate and the experimental group, level of experience, sex and all two-ways interactions as fixed factors. The dogs' probability to replicate the action increased significantly after demonstration by a conspecific compared to a control group and such probability improves with age. This study supports the usefulness of the intraspecific observational learning in adult dogs for training purposes.

1. Introduction

In the last two decades, the role of social processes in inducing behavioral similarity has drawn great interest from the scientific community. Researchers effort on this topic was mainly prompted by the potential of dogs to model specific features of social learning and underlying cognitive mechanisms (for review see Kubinyi et al., 2009).

Social learning in canids has a role in the adaptation to local conditions, providing the opportunity to gain information about appropriate behaviors, hunting skills and food location by observing conspecifics' actions (Nel, 1999). Dogs seem to have extended these skills to include human companions (Pongrácz et al., 2003) and are considered a good model for the study of interspecific social learning. Indeed, studies have shown that dogs can learn how to solve a manipulation (Kubinyi et al., 2003; Kupan et al., 2011; Pongrácz et al., 2012; Topál et al., 2006) or a detour task (Pongrácz et al., 2001, 2003) by observing human demonstrators. Curiously, fewer studies investigated adult dogs' observational learning from conspecific demonstrators. The first study we are aware of proved that adult dogs' performance in detouring behavior improve after conspecific demonstration (Pongrácz et al., 2004). With the same paradigm Pongrácz et al. (2008) showed that adult pet dogs were faster in detouring after a conspecific demonstration and that observer performances depended on their housing condition and social status. Besides performance improvement, dogs' ability to repeat an observed action (or to choose a proper action) from conspecific demonstrations is more controversial. Dogs failed to copy an untrained posture (sphinx-like posture, lateral lying down) and even when the posture were previously trained in the observer dogs, no evidence for copying the action was found (Tennie et al., 2009). However, it was showed that witnessing a conspecific demonstration affects the dog's choice of trained actions (to pull a rod with their paw or their mouth) depending on the situational constraints of the demonstrator, indicating that the dogs are able of inferential selective imitation (Range et al., 2007). Moreover, in their first attempt after observing demonstration by a conspecific, 92% of dogs pushed a screen in the same direction of the demonstrator (Miller et al., 2009). Other studies

* Corresponding author at: Department of Biology, University of Naples "Federico II", via Cinthia, 80126 Naples, Italy.
E-mail address: biagio.daniello@unina.it (B. D'Aniello).

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with dogs' witnessing a skillful dog demonstrator gave inconsistent results for the ability to copy object-related actions to solve an instrumental problem (Mersmann et al., 2011; Range et al., 2009; Range and Virányi, 2014). These uncertainties may have deterred the researchers in evaluating the potential use of observational learning from conspecifics for training purposes. Thus, only one study explored this possibility showing that the puppies that have observed their mother at work benefited in becoming explosive detection dogs (Slabbert and Rasa, 1997).

The potential advantages of introducing observational learning in adult dogs' training have been proved with humans as demonstrators (Fugazza and Miklósi, 2014; McKinley and Young, 2003). To the best of our knowledge, no studies explored the benefits and limitations of conspecific observational learning in the training of adult dogs. For instance, a potential disadvantage of using dogs instead of human demonstrators is the impossibility to rely on ostensive cues to drive the observer dog's attention to the demonstrator, which is crucial for the efficacy of the process (Pongrácz et al., 2004); this would make conspecific observational learning effective only when actions are inherently interesting for the observer. On the other hand, a dog demonstrator would be the best model for an observer dog since the matching degree of the demonstrator's and the observer's performance can be maximized at any organizational levels, whereas performance's matching degree between humans demonstrator and observer dog can be complete only at functional level due to the species-specific features (Topál et al., 2006).

Training of dogs through the traditional handler-guided, operant conditioning techniques implies various issues and often requires long time to be accomplished, particularly with the high standard of performance required in specialized dog working activities. For instance, some behaviors may be difficult to train because they are unnatural actions that need to be gradually obtained through shaping; moreover, handlers must acquire considerable control over their postural and verbal communication with the dogs for an effective training, which is otherwise bound to fail (Mills, 2005). Such problems could be overcome by using a conspecific observational learning which may shorten training time requirement and reduce the impact of handler's skills on the outcomes.

To claim the usefulness of observational learning in real training contexts, the demonstrated/observed actions need to be unknown by/untrained for the observers and relevant for the dog's work requirements. Unfortunately, previous studies on dog's conspecific observational learning were mostly conducted with complex object-related actions, unlikely to be required in working dogs. Pongrácz et al. (2004) reported a positive effect of witnessing a conspecific performing an action not directly related to an object (i.e. detour a fence) in adult dogs. However, this study focused on performance improvement (i.e. reduction in latency to detour), rather than on the learning of a previously unknown action. On the other hand, dogs were unable to copy trained and untrained static postures (Tennie et al., 2009) suggesting that action's dynamics may be important in conspecific observational learning due to the positive link between the arousal and the performance in social learning (see Zentall, 2006).

It is easy to foresee the advantage of using a conspecific demonstrator in various training context: for instance, it could help to communicate training purposes when the trainer is distant from the dog-handler dyad or when the actions to be trained are complex or unusual and would require longer time to induce or shape. Observational learning could also be useful to train more dogs simultaneously in a class with a single demonstration or to avoid lengthening of time for the training of the handlers.

In view of the potential benefits of the method and of the limitations of previous research in this field, the present study aimed at examining the efficacy of conspecific observational learning for the purposes of dog training. We decided to assess the ability of dogs to replicate an action after observing a conspecific demonstration, in a training context with naïve handlers (i.e. not professional trainers); the actions selected in this study were relevant for dog's work and were more dynamic, as an attempt to elicit a stronger motivation in our dogs, compared to Tennie et al. (2009). Our hypothesis was that observing a conspecific demonstration would increase the probability of an observer dog to learn the task, compared to control dogs who did not have such demonstration.

Dogs were assigned to the experimental groups only after having ascertained their inability to perform the requested action and the performance of observer dogs was compared to that of a control group that did not observe the demonstration.

For this study dogs were recruited from the Italian School of Water Rescue Dogs (SICS), because it was able to provide an adequate number of samples, homogeneous for breed, lifestyle and training. Water rescue training involves the formation of qualified dog-human dyads, specialized in rescuing drowning people. The entire training consist of two consecutive stages: the first stage lasts approximately one year and includes obedience training on land, involving positive reinforcement; the second stage consists of water rescue simulations and specific water exercises. Dogs involved in this study were tested during the first phase of their training.

2. Materials and methods

2.1. Experimental subjects

Fifty adult Labrador retrievers, of which 33 males (mean age ± SD = 21.8 ± 6.4 months) and 17 females (39.2 ± 25.3 months), which were under training as water rescue dogs at SICS, were recruited. For more details on SICS training see Merola et al. (2013) and D'Aniello et al. (2015). None of dogs involved in the test had any previous experience of training. Dogs were equally distributed between basic and advanced training level. Dogs in basic level are able to perform on command easy obedience exercises (sit, lay down, stay and come). Advanced level requires performing the same exercises for more time and in condition of disturbance (presence of other dogs, noises, toys), to walk perfectly on leash and respond to the obedience commands through a net. All the dogs lived as pets in a human family, with no other dogs, in an apartment and, as recommended by SICS trainers, each day they spent at least one hour with their handler walking, playing or practicing training purposes. The owners/handlers were volunteers with no special skills in dog training.

2.2. Experimental procedure

The tests were performed outdoors in a fenced training area (about 30 m × 20 m). Before the experimental phases, the dog was allowed to roam freely in the experimental area, so as to become familiar with the environment in which the test would be held and with the items used in the following exercise. The preparatory phase lasted approximately 3-5 min at the end of which the experimental phase began. The procedure consisted of two phases, which were intended to ascertain that dogs did not perform the selected exercise when requested by their handlers (Phase 1) and then to assess whether they would perform the same exercise after the observation of a conspecific demonstrator (Phase 2). In detail the procedure was performed as follows:

Phase 1: Dogs were invited by their handlers to perform one of two possible exercises: jumping on a trunk (about 60 cm high and diameter 60 cm; 'Trunk'; Fig. 1a) and hop on a slide for children (110 cm tall with 4 steps; 'Slide'; Fig. 1b) positioned in two different places inside the fenced area. These exercises were not usual

Fig. 1. Demonstration of the exercises in the experimental setting: jumping on a trunk (a); hop on a slide for children (b). The observer dog and handler pictured here did not take part in the actual experiment.

for dogs and were selected after some preliminary observation to ensure that they were neither easy nor too difficult to achieve. Dogs were assigned one of two possible exercises in a random way, with the only constraint that dogs of different training levels should be equally distributed between the two exercises. No indication had been given to the handlers on how to induce dogs to perform the requested exercise. If the handlers asked for instructions, they were told to use the method they considered most congenial and were allowed to use food for their aim. Dogs had 15 s to perform the action; if they succeeded they were excluded from the subsequent phase, otherwise they were randomly assigned to either the demonstration group, who witnessed a trained dog performing the same exercise that they had tried to do before Phase 2, or to the control group, who proceeded to Phase 2 without observing any demonstration.

Demonstration: The demonstrator dog was a seven years old female Labrador retriever named Flash. She was an expert water rescue dog and had been trained to perform the 'Slide' or 'Trunk' action only when the experimenter approached the object used for that exercise and stopped beside it, without giving any type of gestural signals. This was intended to avoid any gestural or verbal indication, which could enhance/alter the handler communication during the following experimental phase, representing a potential confound on the effect of observation. During the demonstration, tested subjects were positioned at a distance of approximately 3 m from the spot where the exercise was demonstrated and kept on leash by their handlers. The experimenter and the demonstrator dog were positioned at the same distance from the object and from the same side of the observer dog. When the tested dog was in position, the experimenter recalled the attention of the observer dog, and moved from the starting position toward the object used for the exercise. As soon as the demonstrator dog performed the exercise, she was rewarded with both food and praising. The demonstration was then repeated once again.

Table 1
Mean ± SD age (months) and frequency of sexes and training level of dogs in the demonstration and in the control group.

		Demonstration	Control
Age (mean ± SD)		33.2 ± 19.8 mo	29.8 ± 17.7 mo
Sex (N)	Male	10	11
	Female	6	6
Experience level (N)	Basic	8	7
	Advanced	8	10

Dogs of the control group were kept on a leash in the same place and for the same amount of time (approximately 30 s) as dogs of the demonstration group, before moving to Phase 2.

Phase 2: Immediately after the demonstration (or after 30 s for control dogs), the tested subject was again asked by its handler to perform the exercise. Handlers were requested to behave in the same way as they did in Phase 1. In this phase dogs were given only one attempt to perform the requested exercise within 15 s.

2.3. Data analysis

The entire course of the test was recorded by a Sony Handycam HDR-CX115 to allow the subsequent data collection. An experimenter blind to the group assignment of the tested dog coded the outcome of the Phase 2. The outcome of Phase 2 was coded into a binary variable as successful or unsuccessful and a generalized linear model with binary logistic link function was used to analyze outcomes. The model included the dog's age as a covariate and the dog's group (demonstration, control), level of experience (basic, advanced), sex (male, female) and all two-ways interactions as fixed factors. The final model was obtained by sequentially dropping any non-significant interactive term from the initial full model. Student *t*-test were used to assess age differences between groups (observation vs. control and successful vs. unsuccessful performers). Statistical analyses were performed with SPSS ver. 20 (SPSS®, IBM, Armonk, USA) and the level of statistical significance was set at the standard 0.05.

3. Results

Of the 50 dogs that participated in the study, 17 (34%; mean age ± SD = 20.5 ± 12.7 months) were able to accomplish the requested exercise in the Phase 1 and were excluded from further testing. Of the remaining 33 dogs, 16 were assigned to the demonstration group; the other 17 dogs were assigned to the control group. Descriptive characteristics of the dogs' age, sex and experience level of dogs in the two experimental groups are reported in Table 1.

Results of the generalized linear model are reported in Table 2. A significant effect was found for the dog's group, since dogs that witnessed the action performed by the conspecific demonstrator were more likely to accomplish the requested exercise (*N* of dogs who performed the exercise = 10 of 16, 62.5%) than those who did not observe the demonstration (*N* = 4 of 17, 23.5%). The dog's sex and level of experience and the interaction between age and training level had no effect on the likeliness of performing the exercise in the Phase 2. The effect of the dog's age was close to statistical significance. A subsequent student t test indicated that dogs in the demonstration group who performed the exercise at Phase 2 were older than those who could not perform the exercise (mean age ± SD (min–max) = 40.5 ± 22.0 (14-24) months vs. 21.0 ± 4.7 (15-72) months, $t = 2.72$, $P = 0.022$); no difference was

Table 2
Factors affecting the probability of performing the requested exercise in Phase 2 of the procedure. Generalized linear model, binary logistic link function.

Model term	Wald chi-square	df	Sig.
Demonstration	4.816	1	0.028
Sex	0.397	1	0.528
Age	3.688	1	0.055
Experience level	1.175	1	0.278
Experience level × age	1.763	1	0.184
Age × demonstration	0.893	1	0.345
Sex × demonstration	0.523	1	0.469
Sex × age	0.108	1	0.742
Experience level × demonstration	0.000	1	0.991
Experience level × sex	0.000	1	1.000

found in the control group between dogs who performed the exercise at Phase 2 (39.2 ± 22.8 (13-66) months) and those who did not (26.8 ± 15.8 (14-72) months, t = 1.03, P = 0.37). There was no difference in age between dogs belonging to the demonstration or to the control group (t = 0.52, P = 0.60).

4. Discussion

This study aimed to demonstrate the usefulness of conspecific observational learning by adult dogs in a training context. Our results show that dogs who observed a conspecific demonstration were more likely to replicate the target action than dogs in the control group, pointing out the effectiveness of observational learning in this context. It is hard to say if this effect is part of a mechanism of true social learning. Social learning can be attained through mechanisms implying different levels of cognitive skills, from sophisticated imitation (see Zentall, 2006; Galef, 2013 for reviews), to the simpler mechanisms of local or stimulus enhancement, provided by the mere presence of a conspecific acting on an object (see Levine and Zentall, 1974). The latter may be sufficient (though not necessarily correct) to explain our results. For this reason, we cautiously refer to observational learning, rather than social learning, and we are not able to speculate about the cognitive level involved in the repetition of the observed actions by our dogs.

The literature on canine observational learning is very varied in terms of methodological approaches and, to the best of our knowledge, only the study of Tennie et al. (2009) investigated the efficacy of observational learning of an untrained action by adult dogs. The authors report dogs' failure to replicate an untrained action, i.e. lateral recumbency, as well as of other previously trained postures. One factor that could justify the success of our dogs in comparison with the study of Tennie et al. (2009) is the latter use of non object-related actions. It is possible that dogs' conspecific observational learning of novel actions only applies to behaviors involving interactions with objects or salient physical features of the environment, such as those requested to our dogs. A similar idea was earlier proposed by Range et al. (2009) and discussed by Huber et al. (2009). As these authors' arguments are mainly based on tasks requiring the precise manipulation of objects, our results would extend this explanation also to less specific body-object interactions. On the other hand, this may not generalize to all forms of observational learning. For instance, dogs are in principle able to imitate human postural actions (Topál et al., 2006); performance improvement after conspecific demonstration in detour experiments (Pongrácz et al., 2004, 2008) also lacked object manipulation in its classical form. However, another reason that could explain the difference between our results and those reported by Tennie et al. (2009) lies in the static nature of the action required by their procedure. An increase in general arousal seems to mediate observational learning (Zentall, 2006), and static postures may not be sufficiently engaging for the dogs. It is likely that a stronger motivational effect in our method compared to Tennie et al. (2009), may have greatly contributed to our success.

In this study, older dogs were more likely to replicate the observed action than younger ones. One could argue that age increased the dogs' probability to express the requested behavior, regardless of having witnessed a demonstration. However, the difference in age between successful and unsuccessful performers was only found in dogs who witnessed the demonstration and not in the control group. Age seems therefore to increase the adult dogs' ability to replicate an action after observation of a conspecific. While the effect of age on observational learning abilities has not been previously investigated in dogs, an opposite relationship between age and conspecific observational learning is generally reported in studies conducted in other species, including chickens (Nicol, 2004), horses (Krueger et al., 2014) and humans (Law and Hall, 2009). It is thought that younger individuals benefit more from observing other subjects, whereas the consequences of individual learning become more important as one gets older. However, learning from unrelated individuals may require longer development than learning from relatives (Nicol, 2006) and may not be fully effective until social maturity is attained. Notably, all the dogs that failed to replicate the action in the present study were younger than two years. Also, conspecific observational learning may need extensive experience of observing other dogs, especially for actions that are uncommon or have no immediate and overt goals, as was the case of actions demonstrated in the present study. As our dogs were all living in single-dogs households and were separate from conspecifics when they were puppies, their ability to learn through observational of conspecifics could have required longer to fully develop. Such experience needs not, however, be specific to the training context, since training level did not have an effect on our dogs' ability to replicate the demonstrated action. Finally, dominance relationships have been attributed a role in the animals' recourse to observational learning (Krueger et al., 2014; Pongrácz et al., 2008). In our case, however, the demonstrator dog was unfamiliar to the observers and no established social relationship could explain our results; nor the dominance status of the observer could be defined as by Pongrácz et al. (2008), since, as already pointed out, none of our dogs lived with other dogs in the same household.

5. Conclusion

While the usefulness of interspecific observational learning in dog training was recently demonstrated (Fugazza and Miklósi, 2014), this study, consistently with other previous findings (Slabbert and Rasa, 1997) supports also the usefulness of the introduction of conspecific observational learning in dog training, opening the possibility for a "Do as he/she does" project.

Although we cannot provide a direct comparison with proper training techniques, our results suggest that observational learning may be advantageous over attempts to teach by a non-experienced trainer.

In conclusion our results suggest that the observational learning could be a useful tool in dog training. For a better understanding of the type of training context in which the method could be more beneficial, it would be important to assess the relative contribution of characteristics of the actions, including its dynamics and the interaction with objects, to the usefulness of the method in each specific context. Moreover, to further characterize the role of age in adult dogs' ability to learn through observation of conspecific would be of great importance not only for training purposes, but also for a better understanding of this phenomenon in family dogs.

Conflict of interest

The authors declare that there is any actual or potential conflict of interest.

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