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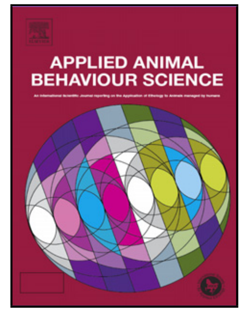

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Should old dog trainers learn new tricks? The efficiency of the Do as I do method and shaping / clicker training method to train dogs

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ABSTRACT

Despite evidence that dogs are skilful in acquiring information socially from humans and are able to copy the actions of a human demonstrator, formal dog-training methods have traditionally relied only on individual learning (operant and classical conditioning). We compared the efficiency of the 'Do as I do' method (Topál et al. 2006), which relies on social learning, with that of a training method that relies on individual learning (shaping/clicker training - Skinner 1951) to teach dogs three different kinds of object-related actions. In order to control for the comparability of the previous training experiences of our subjects, we tested experienced dog-owner dyads that had previously achieved a certificate for either type of training (Do as I do and shaping/clicker training). They were tested upon training three different novel actions: simple, complex and sequences of two actions, in three separate sessions, using the training method they were certified for. In each case the owners had 15 minutes for accomplishing the task of training the dogs to perform the predetermined action. We used the latency of first occurrence and the number of dyads that were successful within 15 minutes as measures of training success. While we did not find a significant difference between the two training methods with regard to simple actions, we found that subjects using the Do as I do method outperformed those using shaping/clicker training in the case of complex actions and sequences of two actions. This study is the first to formalize a method based on the Do as I do protocol for training dogs and to assess its efficiency by comparing it with shaping/clicker training. We acknowledge that many factors can influence the success of different training paradigms, however, these results provide new insights for the applied dog training techniques by suggesting the usefulness of social learning in addition to the widely used methods that rely on individual associative learning.

KEYWORDS
Dog, Social learning, Training method, Training efficiency, Do as I do

1. Introduction

Despite a huge popular literature on the practical application of dog training methods (e.g. Lindsay 2000), this field has received very little attention from researchers and most of the training methods have not been formally validated by a scientific approach. Thus there is little scientific knowledge on whether one method would be superior to others with regard to a given behavioural situation or goal to be achieved (Miklósi 2007). Mills (2005) categorized the dog training approaches according to the two main behavioural models used in behavioural sciences: the associative approach, as typified by the behaviourists (Watson 1913) and the cognitive one, as theorized by the psychologists (Tolman 1948). Accordingly, associative training approaches focus on exposing the dog to the relation between two events (unconditioned and conditioned stimuli) and/or on the association between a discriminative stimulus and an operant behaviour, while cognitive oriented approaches take into account the role of attention and the knowledge of the learner. However, most dog training appears to rely mainly - if not only - on individual associative learning and the relatively straightforward operant conditioning rules of association (Mills 2005).

One of the most popular training techniques is shaping (SHA) (E.g. Pryor 1999). With this training method the animal's spontaneous behaviour is gradually adjusted by means of strategically timed reinforcements as typically prescribed by operant conditioning rules (Skinner 1951). Shaping involves breaking down the training objective or target behaviour into more manageable and easily learned parts so that otherwise complex actions can be trained by carefully arranging these component parts of the target behaviour according to a plan or program of instrumental contingencies (Lindsay 2000). In functional terms a clicker is typically used as (1) a secondary reinforcer (2) a marker ('clicker training'), which serves to distinguish for the animal a particular behaviour as the event that has earned the primary reinforcer and/or (3) as a bridging stimulus which fills the temporal gap between the behaviour and the primary reinforcer by signalling that the latter is coming (Pryor 1999, 2005, Williams 1994). Effective Pavlovian conditioning of the bridging stimulus is considered crucial to the shaping process. Lindsay (2000) reports that, before shaping can be effective, the dog must learn that the bridging stimulus: (1) is linked with a remote but forthcoming reinforcer and (2) is contingent on the emission of a particular behaviour. In shaping procedures, once the clicker has been properly associated with the primary reinforcement, it is activated by the trainer with a strategic timing so that it produces the 'click' noise precisely when the spontaneous behaviour of the dog approximates to the action to be trained and, by rewarding successive approximations, the spontaneous behaviour of the dog is gradually modelled to obtain the final desired response. The crucial role of the trainer is thus to deliver the secondary reinforcement (‘click’) and primary reinforcement (‘food’) at the right moment, while the dog gradually learns individually by trial and error what actions are rewarded and what are not.

Despite scarce consideration in formal dog training, recent studies have provided robust evidence that dogs are adept to learn socially both from con- and heterospecifics (Kubinyi et al. 2009 for review). Dogs readily learn to master a detour task by observing human demonstrators (Pongrácz et al. 2001, 2003), they are able to learn socially how to solve manipulative tasks (Pongrácz et al. 2012; Kubinyi et al. 2003) and are easily influenced by humans in observational learning situations (Kupán et al. 2010). Following a specific training, dogs are also able to match their behaviour to actions demonstrated by a human experimenter (Topál et al. 2006, Huber at al. 2009), even if a delay is interposed between the demonstration and the command to imitate (Fugazza and Miklósi 2013). Thus it is unexpected that only very few studies (Slabbert and Rasa 1997; McKinley and Young 2003) focused on the use of social learning in the applied field of dog training. Slabbert & Rasa (1997) concentrated on the training for detection of narcotics. They found that pups that were allowed to observe their mother during the training between the age of six and 12 weeks outperformed the non-exposed pups, when tested at the age of six months on the same task. McKinley and Young (2003) utilised the ‘model-rival’ technique (Todt 1975; Pepperberg 1994, 1999) to train dogs for a retrieval selection task. This method relies on social processes (stimulus enhancement) to direct the dogs’ attention to the specific object to be retrieved (Cracknell et al. 2008). Dogs trained with this method can perform as well as dogs trained with traditional associative training techniques to retrieve a named object.

The first study relying on training to copy human demonstrated actions (Do as I do) involved a home raised chimpanzee (Hayes and Hayes 1952). This paradigm (Custance et al. 1995) was then also used to test dogs’ imitative abilities (Topál et al. 2006) and later a training method that relies on it was introduced in the applied field of dog training practice: Do as I do method (DAID) (Fugazza 2011). With this method the dog is first trained by operant conditioning techniques to match his behaviour to a small set of familiar actions demonstrated by a human, typically the owner, on command ‘Do it!’ and is then able to use this rule to learn novel tasks (see 2.3 for a description of the training protocol). Three independent studies showed that dogs are able to generalize this copying rule to several kinds of tasks and situations, such as copying novel actions, action sequences (Topál et al.

2006; Huber et al. 2009) and also imitating after a delay (Fugazza and Miklósi 2013). However the efficiency of this method in dog training situations has not been tested in the previous investigations.

In the present study we compared the efficiency of the DAID with that of the SHA method to teach experienced dogs novel object-related actions. We chose to use object-related actions for three different reasons: (1) object-related actions (e.g. 'open a drawer', 'close a door' or 'pick up an item and put it in a basket') are complex behaviours that are not in the typical spontaneous behaviour repertoire of a pet dog and some authors (Thorpe 1963) claim that, for imitation to occur, *non*-typical actions should be involved. Despite being far from dogs' spontaneous behaviour repertoire, these kinds of actions are usually required in training dogs that assist disabled owners, therefore it is important to assess how they can be efficiently trained; (2) this kind of actions can be systematically varied in terms of complexity; (3) dogs have difficulty of replicating body-oriented actions compared with object-related ones (e.g. Huber et al. 2009).

We compared the efficiency of the DAID with the efficiency of SHA when teaching dogs actions of different degrees of difficulty because in the theoretical framework of cultural evolution it is predicted that individuals tend to rely on social learning with increased difficulty of the task (Laland and Brown 2011), as experimentally confirmed with regard to humans by McElreath et al. (2005). Consistently, we expected that, in particular, difficult actions would be more easily learned by dogs socially than individually and that, especially when difficult tasks are involved, dog training could benefit from the use of social learning with the DAID. We therefore hypothesised that complex actions would be more efficiently trained with the DAID method, compared to SHA, whereas such difference would be less evident when the subjects are tested on simple actions.

Several factors may influence the success of different training paradigms that may go beyond the aim of this study. Thus we do not aim for claiming an absolute superiority of one training method over the other, but aim to provide useful insights on the use of social learning in addition to the traditional training methods that rely on individual learning, when dogs are trained to learn object-related tasks.

2. Methods

2.1 Subjects

A total of 30 dog-owner dyads were recruited for this study. All the owners had experience with training and had passed a dog-training exam with their dog, either for shaping / clicker training (SHA Group N=15) or for Do as I do (DAID Group N=15) as described in detail in section 2.2. As all subjects passed an advanced level training exam, it is possible to consider all the dyads as experienced in training. Owners were informed about the aim of the study.
Dogs belonged to various breeds and the two groups were balanced for breed-groups and age as much as possible: in the SHA Group there were a Irish Terrier, four Hungarian Vizslas, a Golden Retriever, five Border Collies, a Flat Coated Retriever, a Border Terrier, a Labrador and a Terrier cross breed. In the DAID Group there were: a Yorkshire Terrier, a Cavalier King Charles Spaniel, six Border Collies, a Beagle, a Poodle, a Shetland Shepherd, two mixed breeds, a Czechoslovakian Wolf-dog and a Jack Russell Terrier. The age of the dogs in the SHA Group ranged from 2 to 11 years (mean age 5.9 years; SD±2.82) and in the DAID Group it ranged from 2 to 11 years (mean age 5.6 years; SD±2.98). All dogs practiced some sports and training activities with their owners.

2.2 Training exams

The exam for shaping / clicker training is the so-called CAP and is divided into four levels (Kay Lawrence http://www.learningaboutdogs.com/html/cap_assessment_.html). Only dog-owners dyads that passed at least level 2 or 3 were recruited for this study because we thought these advanced levels are comparable with the Do as I do exam (see below). CAP level 2 is assessing the trainer's ability to secure a solid foundation in achieving a consistent quality and reliability to cue and develop more complex behaviours in free shaping. In the CAP level 3, the assessor looks for different collections of compound behaviours, advanced shaping and evidence of data collection and analysis (http://www.learningaboutdogs.com/html/cap_criteria.html).
One of us (C.F.) has recently developed an exam in order to assess the level of training in dogs that are trained to copy human actions on command (see Topál et al. 2006 for details of the method). To pass the exam for Do as I do, the owner is required to demonstrate that her/his dog can display at least six familiar actions (i.e. actions already trained with other techniques) on the 'Do it!' command with a novel demonstrator. The preliminary training protocol necessary to pass the exam requires that dogs learn through operant conditioning techniques to match their behaviour to three demonstrated familiar actions on command 'Do it!' and then generalize this command to other three familiar actions, before the 'Do it!' command can be used as a training rule, following the demonstration of novel tasks to be

learned (see Topál et al. 2006 and Fugazza and Miklósi 2013 for details on the training protocol). The definition of behavioural correspondence is based on Topál et al. 2006: the first action that the dog performs after the 'Do it!' command is considered as functionally matching the demonstration if it entails the same goal and, given the species-specific differences in the behaviour repertoire of the two species, is executed in a similar way.

2.3 Experimental protocol

Each dog-owner dyad was tested in three subsequent tests in which the owner was instructed to teach his dog three new object-related actions (one per test) using only the training method s/he was certified for (i.e. clicker training / shaping in the SHA Group and Do as I do in the DAID Group).

An inter-test interval of at least 30 minutes occurred between two subsequent tests for each subject. The maximum inter-test interval was 1 day.

The timeline for a test was 15 minutes. If the owner did not reach the predetermined goal within this time (i.e. the dog did not perform the predetermined action), the test ended and the result was considered as a failure (i.e., the owner did not manage to teach the particular action within 15 minutes).

During the tests, owners in the SHA Group sat on a chair, 1 m from the target object and used food as a reward for their dogs. The spontaneous behaviour of the dog was shaped by the means of strategically timed reinforcements with a clicker as a marker, followed by a treat, until the first occurrence of the predetermined action by the dog. Owners were instructed not to lure the dog's behaviour. After the 'click', the dog could take the treat from the owner's hand or the owner could toss it to a strategic location that could increase the probability that the subject interacted again with the target object (e.g. the owner could toss the treat over the target object, so that the dog, after having eaten the food, had the object between himself and the owner).

In the DAID Group owners were not allowed to give food to their dogs during the tests but could give it after the test was finished, in order to keep the dog motivated in the next testing session. During the tests owners asked their dogs to stay and pay attention, then they demonstrated the action they wanted the dog to perform and gave the 'Do it!' command. If the dog did not perform the correct action after the first demonstration, owners demonstrated the behaviour again and gave the 'Do it!' command again, until they reached the predetermined result. If the action provoked a modification in the object (e.g., the drawer was opened), the experimenter repositioned the object in the original situation (e.g., closed the drawer) after the owner's demonstration but before the 'Do it!' command.

In both groups the owners could decide to take as many breaks as they thought were necessary for a successful training. When taking a break, owners in the SHA Group went away from the testing area with their dogs and did not give them treats for the whole duration of the break. Owners in the DAID Group stopped and behaved with them as they usually did at the end of a training session. The break could last form 5 minutes to 4 hours, according to the owner's decision and availability for the tests. Owners were informed that, for the analysis of results on learning latencies, the time of the breaks was not considered as part of the test.

For both groups all tests were run in the presence of an experienced dog trainer who could give suggestions to the owners regarding the training strategy. They were two experts respectively in shaping / clicker training or Do as I do and also assessors for the training exams and gave suggestions only to the owners of the group using the method they were expert on. The suggestions that were given regarded the training strategy (e.g., where to toss the food in the SHA Group, how to demonstrate the action in the DAID group and when to take a break in both groups).

2.4 Actions for the testing

The actions were selected randomly from a predetermined list of 12 actions (see Table 1 for details), discarding only those that were eventually already familiar for a particular dog (Before the testing, each owner had filled a complete list of the actions already taught to his dog, so that those actions were not used in the tests).

All the actions chosen for this study were object-related actions - which are particularly useful, for example, for assistance dogs helping humans with disability. They differed in difficulty: simple actions, complex actions and action sequences. The simple actions involved getting in contact or interaction (e.g., touch) with specific objects (e.g., knock over a bottle, ring a bell); the complex actions necessitated more elaborate manipulation of objects and consisted of tasks which are usually required for an assistance dog (e.g., open a drawer, close a locker etc.) and deviate from the natural behavioural tendencies of dogs; action sequences consisted of two actions (e.g., climb on a chair and ring a bell). The required actions, as well as the number of subjects tested on each single action, are described in detail in Table 1.

Each dog-owner dyad was tested only with one action in all conditions representing different levels of difficulty, thus each owner was required to train his dog on a simple action, on a complex one and on a sequence during three different testing sessions. In order to control for the eventual difference in the difficulty of the tasks within a category, each subject in the SHA Group was matched with a subject in the DAID Group with regard to the three actions they were required to train during the tests.

Two subjects (one from the SHA Group and one from the DAID Group) were tested on two simple actions and one sequence (another simple action instead of the complex one) because all the complex actions of our list were already familiar for them.

The order of the tests (simple action, complex action and action sequence) was randomized for each matched pair of dogs learning the same actions, with the order being the same for the subjects of the same pair.

The testing sessions were recorded by two video cameras placed in two different positions in order to always have a view of the dog and the owner.

2.5 Data collection and analysis

From the videos obtained we determined:

1. The number of dyads who completed the predetermined task within 15 minutes in the two groups;
2. The time from the beginning of the training session to the first correct occurrence of the selected action (latency). In the case of SHA Group the beginning of the session was either marked by the first 'click' or by the owner tossing a treat on the floor as these were the routines typically used by the owners to start the training. In the case of DAID Group, the training session started when the owner made the dog stay and pay attention to the demonstration;
3. We also calculated the number of owners that took breaks for their dogs in each group and the number of breaks.

The difference between SHA and DAID groups in the test outcome (i.e., the number of dogs that succeeded or failed within 15 minutes in the two groups) was statistically analysed by using Fisher's exact test.

In a conservative statistical analysis of the learning latencies we considered the data only from those dogs that actually completed the task within 15 minutes. Normality of the data on the latencies of those dyads that completed the task before the timeline was checked with the Anderson-Darling Normality test and latency values were compared between DAID and SHA dogs by unpaired t-tests if they followed the normal distribution, and by Mann-Whitney U test if they did not follow the normal distribution.

In order to assess if the relative difference between the efficiency of the two training methods increases with increased complexity of the tasks, we compared the relative difference of the learning latencies when training complex and simple actions with the two methods by unpaired t-test.

The number of owners who took breaks for their dogs during the tests was compared between the two groups in each condition by Fisher's exact test P=0.018 and the number of breaks in each condition was compared between the two groups by Mann-Whitney U test.

We used GraphPad software for the statistical analysis of the results.

3 Results

3.1 Simple actions

When tested on simple actions all dogs in both groups where able to perform the predetermined action within 15 minutes (Table 2). We did not find a significant difference in learning latency between the two groups (t=1.47; df=29; P=0.152) (Fig. 1).

When training the simple actions no trainer decided to take a break for his/her dog during the tests.

3.2 Complex actions

All 14 dogs tested in the DAID Group succeeded with the complex actions and in the SHA Group 11 dogs out of 14 succeeded within 15 minutes. Accordingly, both training methods seemed to be equally successful (Fisher's exact test P=0.22).

However, subjects in the DAID Group outperformed those in the SHA Group by obtaining significantly shorter latencies to display the target complex action (t test: t=3.62; df=22; P=0.0015).

Significantly more owners (9 out of 14) in the SHA Group had breaks for their dogs during the training of complex actions than owner in the DAID Group (2 out of 14) (Fisher's exact test P=0.018) and the number of breaks in the DAID Group was significantly smaller than the number of breaks in the SHA Group (Mann-Whitney U test: U=44; df=27; P=0.013)

3.3 Action sequences

In this test, 13 dogs out of 15 in the DAID group and only 7 dogs out of 15 in the SHA group succeeded within 15 minutes. Thus the training method affected the success of dogs, that is, significantly more dogs were successful in the DAID group (Fisher's exact test P=0.05).

In the conservative statistical analysis on learning latencies (see above) we did not find a significant difference between the two groups (Mann-Whitney U test: U=24; df=19; P=0.09). Upon training action sequences significantly more owners (13 out of 15) in the SHA Group took breaks for their dogs during the tests, than owners in the DAID Group (5 out of 15) (Fisher's exact test P=0.0078) and the number of breaks in the DAID Group was significantly smaller than the number of breaks in the SHA Group (Mann-Whitney U test: U=49.5; df=29; P=0.009).

In the tests on action sequences all owners in the SHA Group used the so-called 'back-chaining' strategy, that is they trained the last action of the sequence first and then the first action, before training the dog to perform the whole sequence in the proper order. Owners in the DAID Group trained the sequence in the given order since the first trial, demonstrating the first action followed by the second one since the very first demonstration of the training session.

3.4 Relative difference in learning latencies

The relative difference of the learning latencies when training complex and simple actions with the SHA method is significantly larger compared to the difference of the learning latencies when training complex and simple actions with the DAID method (t test: t=3.43; df=21; P=0.0025). Thus dogs in the DAID group show a smaller increase in the latency if they have to perform a complex action.

4. Discussion

This study is the first to demonstrate the efficiency of the Do as I do (DAID) method in dog training. In particular our results show that sequences and complex object-related actions, such as those typically required from an assistance dog, are more efficiently trained with the DAID method compared to the SHA method. We divided the behaviours to be taught during the tests into simple actions, complex ones and sequences and we expected that, consistently with the social learning strategy theory (Laland & Brown 2011) the efficiency of the DAID method would be more evident with complex actions and sequences. As predicted by the theory, the relative difference in the learning latencies between the two methods increased with increased complexity of the actions to be taught.

With regard to the simple object-related actions, we did not find any significant difference between the two methods, neither concerning the number of dogs that succeeded within 15 minutes, nor with regard to the time needed by the trainer to obtain the first correct occurrence of the behaviour. Nevertheless, coherently with our expectation, the Do as I do method proved more efficient than the shaping method for teaching complex actions and sequences, respectively considering the learning latency and the number of dogs succeeding within 15 minutes. In fact, when the dog-owner dyads were tested on complex behaviours, the time needed to obtain the first correct performance was dramatically shorter in the Do as I do Group compared to the Shaping Group. With the action sequences, the difference is significant with regard to the number of dyads that succeeded within 15 minutes (more dyads succeeded in the DAID Group compared to the SHA Group) although it is not significant when we compare the time needed by the owners to obtain the first correct performance of the behaviour. For the conservative analysis of latency of the first performance we only compared the time needed by those dogs that succeeded within 15 minutes because after this arbitrary deadline we stopped the tests. Therefore, for the sequences, in the SHA Group only 7 dogs completed the testing before the cut off time in comparison with 13 dogs from the DAID Group. Thus the low sample size explains the absence of significant difference. Owners in the SHA Group decided to take more breaks compared to the owners in the DAID Group. This could be due to the increased length of the training sessions and/or to the expectations that the owners form about the duration of the training session: owners using a training method with which the complex actions are usually obtained in longer times may have expected long testing sessions since the beginning and therefore would have been more likely to take breaks, splitting the expectedly long training session in shorter bouts in order to prevent the dog from being tired or stressed later in the training session.

Dog training often requires that a sequence of arbitrary behaviours be structured so that they occur in a specific order (Lindsay 2000). This order of occurrence is based on a predetermined continuity in which one action must always precede the next in a set sequence. Regarding the training strategy for training sequences in our experiment, in the SHA Group all owners used the so-called backward chaining, an operant technique described by Lindsay (2000) as ‘connecting the final response with the terminal reinforcer and then adding on successive behaviours up to the origin of the chain’. On the contrary, in the DAID Group, owners demonstrated the predetermined sequence beginning with the first action and demonstrating the second action next, so that the whole sequence was immediately shown in the correct order. Huber et al. (2009) tested a dog trained with the Do as I do protocol on her ability to reproduce sequences and found a recency effect, whereas in the present experiment this effect did not arise. This difference could be explained by the dissimilar kind of tasks used for the tests: our sequences were less arbitrary than those used by Huber et al. (2009), in the sense that the first action of the sequence was always necessary to reach the final goal and/or to enable the second action to be performed (e.g., open a locker and pick up an object that is placed inside of it or pick up an object from the floor and put it in a basket). Thus dogs could not perform the last action without having previously performed the first one. This piece of information could hardly be learned within a few trials if dogs were to do it individually by trial and error, as it is the case with shaping. Thus it is possible that the owner's demonstration of the goal to be reached, together with the demonstration of the correct sequence of actions that were required to reach it, might have helped the dogs to acquire the proper sequence either by goal emulation, that is learning about the outcome of the demonstrator's action but not about the action itself (Wood 1989; Tomasello 1990) or by functional imitation, where also some aspects of the action are socially acquired (Topál et al. 2006) or also by imitation of the sequential organization (Whiten 1998).

Other species are known to utilise flexibly social learning, that is, the information gained may depend on the particular situation or task to be learned. Horner and Whiten (2005) found that the chimpanzees' tendency to use emulation or imitation to solve a tool-using task depended on the availability of causal information during demonstration and the authors suggest that they are able to flexibly use the learning process that is more efficient, given the environmental constrains of the situation. The plasticity of dogs' social skills with humans has been revealed by several studies (e.g., Miller et al. 2009, Kubinyi et al. 2009, Huber at al. 2009). Fugazza and Miklósi (2013) showed that dogs are able to match not only the goal of the human demonstrated action, as could be explained by goal emulation, but also the action, even if no goal is present, as it is the case with functional imitation. Furthermore, in social learning situations where two actions are conceivable to solve the task, dogs are able to select the action that is more efficient given the constrains of the demonstrator's state (Range et al. 2007), showing a plasticity which is similar to that of preverbal human infants (Gergely et al. 2002) and hence possibly engaging flexibly in emulation or imitation. It is therefore highly probable that, when trained with the DAID method, dogs learn about the tasks by flexibly relying on different types of social learning processes, such as emulation, functional imitation, local and stimulus enhancement.

Although in this study we enrolled only dog-owner dyads that achieved a training certificate for the training method they were tested on, some differences in their skilfulness cannot be completely excluded and could have slightly affected the results. Furthermore, some preliminary training is necessary for the successful use of the shaping / clicker training method both in order to establish the association between the 'click' and the primary reinforcement (Murphree 1974; Lindsay 2000) and also for the dog to become skilled with this form of trial and error learning so that he will be more confident in spontaneously showing different behaviours that the trainer can chose to reward in the training process (Pryor 2009). Likewise, in order to use the DAID method to teach novel actions, a preliminary training is necessary for the dog to learn the imitation rule (see Topál et al. 2006). The amount of time needed for this preliminary training with the two methods was not considered in the present study (i.e., only already experienced subjects were tested) and it is possible that it varies between the two techniques, therefore making one technique more laborious than the other for the trainers and owners.

The comparison of learning rates is a very difficult issue because several factors, such as individual experience of each subject, may influence the results. Importantly, the results of this study do not claim for an absolute superiority of one training method over the other. Instead, we suggest the usefulness of the DAID method in addition to the already widespread techniques that rely on individual associative learning, such as shaping / clicker training, particularly to teach dogs complex object-related tasks. This is the first study on the practical application of the DAID method and we only assessed its efficiency with regard to object-related actions to be trained. It is probable that different kinds of actions are more easily taught with shaping or other traditional methods that rely on individual associative learning.

The studies on the imitative abilities with the DAID paradigm generally highlight a higher difficulty in copying body movements, compared to object-related actions in several species: chimpanzees (Myowa-Yamakoshi and Matsuzwa 1999), orang-utans (Call 2001) and in dogs too (Huber et al. 2009). Therefore, the results of the present study should not be automatically extended to tasks that differ from those actually tested and, in particular, should not be extended to the training of body movements. Furthermore, we only measured the success of the training methods with regard to the first correct performance of the action and we acknowledge that it might, in certain cases, also occur by chance, particularly with shaping, where the dog learns by trial and error. Further studies should thus investigate on the consistency of the dog's behaviour after the first occurrence and on its resistance to extinction.

5. Conclusion

Consistently with the social learning strategy theory, the DAID method, which is based on social learning, is particularly useful for teaching difficult object-related actions. From a cognitive perspective, the efficiency of the DAID method relies on dogs' ability to flexibly use various sources of social information such as local enhancement, goal emulation and functional imitation.

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Table 1. List and description of the actions the subjects were required to accomplish during the tests, number of subjects tested on each single action per group and number of dyads that failed to complete the task within 15 minutes

Table 2. Number of subjects that succeeded to accomplish the task within 15 minutes in the various conditions, mean latency and SD to the first occurrence of the predetermined action

Fig. 1. Mean latency (+ SD) of the first occurrence of the predetermined action in the two groups (** indicate statistically significant difference; unpaired t test, P=0.05)

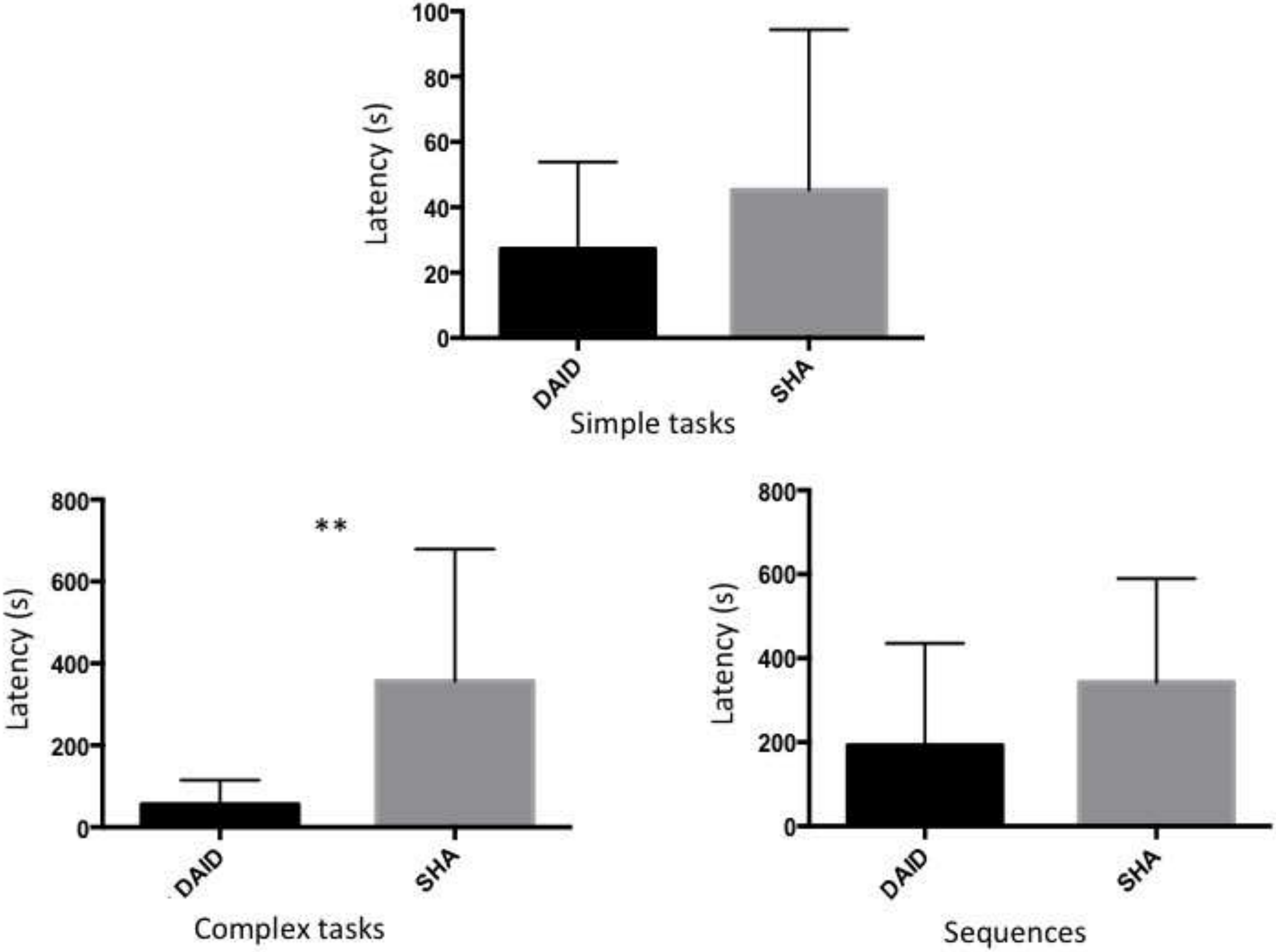
Table 1.

Action (Subjects tested per group)	**Description of the action**	**N. of failures within 15 min. in the SHA Group**	**N. of failures within 15 min. in the DAID Group**
	SIMPLE ACTIONS		
Ring a doorbell (N=4)	A doorbell with a button on top is placed on the ground. If the button is pushed the doorbell rings. The dog is required to ring the doorbell so that a sound is emitted	0	0
Ring bell (N=2)	A metallic bell hangs from a hurdle at ca. the same height as the dog's withers. The dog is required to ring the bell by touching it with any part of his body. A sound has to be emitted from the bell when the dog touches it	0	0
Paws in hoop (N=4)	A plastic hoop is placed on the ground. The dog is required to enter the hoop with all fours	0	0
Knock over bottle (N=6)	A plastic bottle is placed vertically on the ground. The dog is required to knock it over	0	0
	COMPLEX ACTIONS		
Open drawer (N=1)	A string is attached to the handle of the drawer of a small cabinet with a drawer and a locker. The dog is required to open the drawer for at least 10 cm	0	0
Close drawer (N=4)	The drawer of a small cabinet with a drawer and a locker is opened (15 cm). The dog is required to close the drawer	1	0
Open locker (N=2)	A string is attached to the handle of the locker of a small cabinet with a drawer and a locker. The dog is required to open the locker for at least 10 cm	2	0
Close locker (N=7)	The locker of a small cabinet with a drawer and a locker is opened (30 cm). The dog is required to close the locker	0	0
	SEQUENCES		
Object in basket (N=5)	A basket (ca. 40 x 30 x 8 cm) is placed on the ground. A small purse is placed 50 cm from the basket. The dog is required to pick up the purse and put it in the basket	2	1
On chair ring bell (N=1)	A metallic bell is hanging in a high position over a chair. The dog can reach the bell only if it climbs on the chair. The dog is required to climb on the chair and ring the bell. A sound has to be emitted from the bell when the dog touches it	1	0
On chair ring doorbell	A doorbell is placed on a cabinet. The dog can reach the doorbell only if it climbs on the chair that is adjacent to the cabinet. The dog	2	1

(N=6)	is required to climb on the chair and ring the doorbell. A sound has to be emitted from the doorbell when the dog touches it		
Open locker pick up object (N=3)	A small purse is placed in the locker. The dog is required to open the locker and take the purse out of it	3	0

SIMPLE TASKS		
	DO AS I DO (N=15)	*SHAPING (N=15)*
Subjects that succeeded within 15 min	15	15
Mean latency	27.18	45.25
SD	26.72	49.11
COMPLEX TASKS		
	DO AS I DO (N=14)	*SHAPING (N=14)*
Subjects that succeeded within 15 min	14	11
Mean latency	55.71	356.18
SD	59.23	322.66
SEQUENCES		
	DO AS I DO (N=15)	*SHAPING (N=15)*
Subjects that succeeded within 15 min	13	7
Mean latency	192.07	318.14
SD	243.45	234.29

Figure



100
80
60
40
20
0
Latency (s)
DAID
SHA
Simple tasks
800
600
400
200
0
Latency (s)
**
DAID
SHA
Complex tasks
800
600
400
200
0
Latency (s)
DAID
SHA
Sequences