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ORIGINAL PAPER

How does dominance rank status affect individual and social learning performance in the dog (*Canis familiaris*)?

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Abstract Dogs can learn effectively to detour around a V-shaped fence after observing a demonstration from either an unfamiliar human or dog demonstrator. We found earlier that there is substantial individual variation between the dogs' performance, even when using the same experimental conditions. Here, we investigate if the subjects' relative dominance rank with other dogs had an effect on their social learning performance. On the basis of the owners' answers to a questionnaire, subjects from multi-dog homes were sorted into groups of dominant and subordinate dogs. In Experiment 1, dominant and subordinate dogs were tested without demonstration and we did not find any difference between the groups—they had similarly low detour performances on their own. In Experiment 2 and 3, dogs from single dog and multi-dog households were tested in the detour task with demonstration by an unfamiliar dog, or human, respectively. The results showed that social learning performance of the single dogs fell between the dominant and subordinate multi-dogs with both dog and human demonstration. Subordinate dogs displayed significantly better performance after having observed a dog demonstrator in comparison to dominant dogs. In contrast, the performance of dominant and subordinate dogs was almost similar, when they observed a human demonstrator. These results suggest that perceived dominance rank in its own group has a strong effect on social learning in dogs, but this effect seems to depend also on the demonstrator species. This finding reveals an intricate organization of the social structure in multi-dog households, which can contribute to individual differences existing among dogs.

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Introduction

Within a given species the individual problem solving and social learning performance can depend on many factors, like sex (in orangutans: van Schaik et al. 2003); age (in human children: Whiten et al. 1996); and previous experiences (in chimpanzees: Bjorklund et al. 2002). Social rank can also affect an individual's strategy for being an effective problem solver or a talented observer of another's solutions. In many cases, agonistic interactions between the higher and lower ranked group members determine profoundly the problem solving and learning performance of the individual (in chimpanzees: Chalmeau and Gallo 1993; in brown lemurs Anderson et al. 1992). In domestic chickens, Nicol and Pope (1999) found that higher ranked hens were not only more "salient" demonstrators, but dominant hens also learned better from a demonstrator in an operant task, than the subordinate hens did. Although it is easy to explain the stronger salience of dominant demonstrators with their supposedly larger foraging success, it is not clear why dominant hens learned more effectively from a demonstrator. It is possible, for example, that as the demonstrators and observers knew each other, subordinate hens were too afraid of the dominant demonstrator to show effective social learning. On the other hand, in other species subordinate individuals may show better social learning performance. For them aggressive scrounging cannot be an option, but as good observers they could learn, for example, food obtaining tactics from the others.

The aforementioned studies mostly tested the effect of conspecifics on problem solving and social learning performance within the original group, in which the subjects were familiar with each other. Dogs offer a unique opportunity to investigate the effect of rank on problem solving performance apart from the familiar group members. This scenario is unlikely in any other social species in the wild, because in these animals the survival of the individual depends mostly on the group—as a result individuals usually do not leave the group. But dogs, being the members of unique, dog–human groups, have to deal to a great extent with the plasticity of their social environment. For the dog the companionship of humans is regarded as the natural environment (Miklósi et al. 2003). Among many other important features, it means that the social and cognitive abilities of the dog were shaped through domestication for accepting humans as group members ("attachment", see Gácsi et al. 2001) and for understanding the communicative signals of the humans (see for example Soproni et al. 2002).

It is already known that the individual problem solving performance in dogs is strongly affected by such social factors as dependence on the owner. We refer to "dependence" as the need for human intervention ("reassurance") to solve a task (Topál et al. 1997). Human dependency in dogs can be a general outcome of domestication, which is obvious if we compare the problem solving behaviour of dogs and human raised wolves. Miklósi et al. (2003) found that during an unsolvable problem task, wolves tried to get the reward tenaciously without looking back to their owners, whereas dogs quickly stopped their futile efforts and looked back to the owner, seemingly waiting for help. These results show that dogs regard humans in their environment mostly as dominant group members. At the same time dogs usually live together with other dogs which result in an interesting multi-species group situation, in which dog–dog social relationships can also affect the individual dogs' behaviour, whereas dogs in general seem to be dependent on humans without any actual dominance-related behaviour from the latter (as a consequence of the domestication process), they have to form and maintain their rank relationships with other dogs again and again. According to the aforementioned studies, dogs' dependence on humans can have a general and profound effect on many aspects of an individual's behaviour. In this study we wanted to know if the dogs' social rank among their home dog companions has a general effect on their individual problem solving performance and also if dominance rank affects the dogs' social learning performance from an unfamiliar demonstrator.

We use in our study a detour paradigm, which was proven to be a suitable method for testing various aspects of learning from a demonstrator in dogs. Although dogs had difficulties with detouring a V-shaped, transparent wire mesh fence on their own, they could learn quickly either from an unfamiliar human (Pongrácz et al. 2001, 2003a), or an unfamiliar dog demonstrator (Pongrácz et al. 2003b). Our recent experiments showed that the key factor of human demonstration for dogs in the detour situation was not only the motor action (i.e. the walking around the fence) but also most importantly the verbal attention maintenance between the human demonstrator and the dog during the demonstration (Pongrácz et al. 2004).

These detour experiments did not deal with the dynamic aspect of the social environment and the individuality of the subjects (discussed by Coussi-Korbel and Fragaszy 1995). However, we should note that in our earlier studies (for example Pongrácz et al. 2001) we found considerable differences between dogs' individual problem solving ability, that is, whether they were or were not able to detour the fence without any demonstration. In that study 48% of the subjects achieved average detour latencies without demonstration, 31% detoured very fast, and 21% of the dogs were unable to detour the fence the first time. As breed and age effects can possibly be ruled out (Pongrácz et al. 2005), the aim of this paper is to investigate the effect of social rank in dogs. Dogs, which were reported by their owners as "dominant" or "subordinate" in their interactions with other dogs at home, were presented with the detour situation, with or without help from an unfamiliar dog or human demonstrator. By this way we could rule out the effect of the actions of the familiar group member(s) with a higher or a lower rank. In such situations we expect that the dogs' behaviour will be the result of the actual balance of strength with the other dog, but it can be also affected by the dominant or subordinate "attitude", which the dog obtained in the home environment with the familiar dogs.

We investigated two main questions: (1) is there any difference between the performance of the dominant and subordinate dogs if they are faced with the detour problem without demonstration? (2) Is there any difference between the social learning performance of the dominant and the subordinate dogs observing a demonstrator in the detour task? Additionally we wanted to know if the species of the demonstrator (dog or human) affected the efficiency of rank-related social learning in dogs. According to the studies mentioned earlier, we hypothesized that dominant dogs might be the better problem solvers and social learners. As in our earlier detour studies (Pongrácz et al. 2001, 2003a, b) we found that the familiarity of the demonstrator did not affect social learning performance, our hypothesis was that conspecific or heterospecific demonstrators have the same effect on the performance of dominant and subordinate dogs.

General materials and methods

Subjects

Dogs ($n = 91$) with their owners were collected from various dog training schools and participants of sport competitions with dogs. Owners were instructed how to behave and what to do (and not to do) during the test. Dogs were included in these experiments only if the owner acted in accordance with our instructions. Each dog was tested in one condition only, but owners could participate with more than one dog.

Only dogs older than 1 year were tested (mean = 3.12 years, with the range of 1 to 9 years) and various breeds were included. The overall sex ratio of dogs was balanced (M/F: 45/46), and we also tried to balance the sex ratio of dogs within each experimental group. The majority of dogs had female owners (M/F: 26/54).

The formation of the experimental groups was done according to the dogs' social circumstances (did they come from a single, or a multi-dog household—i.e. at least two dogs were kept in the given home) and their social rank (this latter was decided only in the case of the dogs coming from multi-dog households). Dominance rank (i.e. dominant or subordinate) was only decided after the experiment was finished with the given multi-dog subject. Dogs were categorized as being "dominant" or "subordinate", on the basis of a short questionnaire filled in by the owners. In each question, the answer could be "the present dog", or "some of my other dogs", or "I don't know". The questions were focused on such social behaviours, which one can recognize easily and they do not require such kind of assumptions from the owner, like "this is the more dominant dog". The four questions were the following:

(1) When a stranger comes to the house, which dog starts to bark first (or if they start to bark together, which dog barks more or longer)?
(2) Which dog licks more often the other dog's mouth?
(3) If the dogs get food at the same time and at the same spot, which dog starts to eat first or eats the other dog's food?
(4) If the dogs start to fight, which dog usually wins?

We considered a dog "Dominant" if the owner checked "the present dog" in at least three questions, and additionally if he or she did not check "some of my other dogs" at the fourth question. Similarly, we considered a dog "Subordinate" if the owner checked "some of my other dogs" in at least three questions, and additionally he or she did not check "the present dog" at the fourth question.

Procedure

All tests were performed outdoors at various Hungarian dog training schools and competitions between the autumn of 2002 and the spring of 2004. We used a V-shaped fence 1 m high, with 3 m long sides forming an angle of 80° (Fig. 1). The fence was made of wire mesh, with a hole diameter of 20 mm, set onto a steel frame. The fence was set up by pushing the pegs protruding from the frame into the ground. The frame of the fence prevented the dogs from digging under the fence. To dissipate any scent trails, after setting up the fence and before the first dog's experimental trials, the experimenter made tracks in the grass along both sides of the fence (including the inner side as well) ten times, in each direction. Usually many dogs were tested at the same experimental session; therefore several different scent trails were laid on each other. This prevented the dogs from following the scent mark of the demonstrator or of any given individual subject behind the fence.

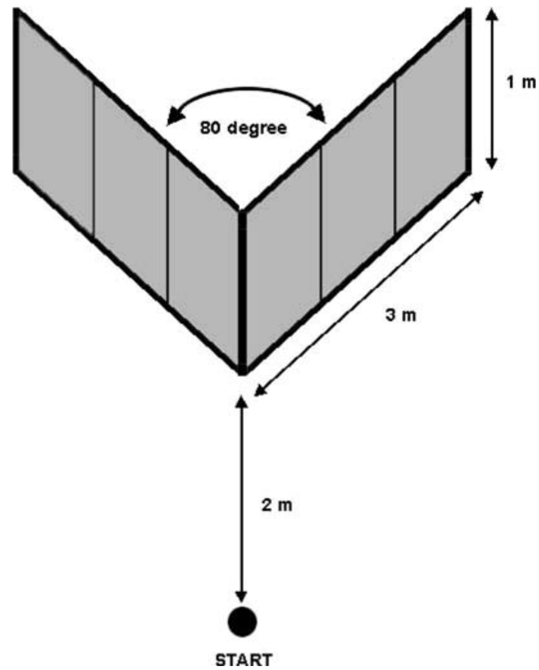

Fig. 1 Perspective drawing of the experimental fence. The frame was covered with transparent wire mesh. The target, which the dog had to obtain by detouring the fence, was placed in the inner corner of the fence

The starting line was set at 2 m from the intersecting angle of the fence where both the dog and the owner stood at the beginning of the trials. The task of the dogs was to get their favourite toy (target object) by detouring along the fence.

The test consisted of three 1 min detour trials that were started one after the other with short (1–2 min long) between trial intervals. Besides the owner, the experimenter and an assistant were present. The assistant videotaped the test from a location behind the experimenter and the owner. The experimenter stood less than 1 m behind the owner. In trials with no detour demonstrations, the experimenter placed the object behind the fence over its upper edge, while the owner covered the dog's eyes with his/her hands. Then the dog was allowed to approach the edge of the fence, and the owner showed the object lying on the opposite side of the fence to the dog, holding the dog by its collar. Finally they returned to the starting point and the owner unleashed the dog. During the trials the owner was asked to encourage the dog to get to the goal object but he/she had to stay on the starting line and was asked not to command the dog to go round verbally or via gestures given by hand or other body parts. We did not inform the owners about the experimental hypotheses and asked them only to encourage the dogs with common commands such as "Where is the ball?" and "Come on, fetch the ball!" The specific conditions of the experimental groups are described below.

"Dominant Dogs Without Demonstration" $N = 10$; M/F = 4/6; (mean age = 2.00 years, with the range 1 to 5 years)
"Subordinate Dogs Without Demonstration" $N = 9$; M/F = 5/4; (mean age = 1.78 years, with the range 1 to 4 years)

As described earlier, in these groups no demonstration was used. The subjects should perform three identical trials. The maximum length of a trial was 1 min, if the dog could not obtain the target during this time, the trial was terminated and after a short (1–2 min) break the next trial was started.

"Single Dogs with Dog Demonstration" $N = 13$; M/F = 7/6; (mean age = 3.45 years, with the range of 2 to 9 years)
"Dominant Multi-Dogs with Dog Demonstration" $N = 11$; M/F = 7/4; (mean age = 2.21 years, with the range 1 to 7 years)
"Subordinate Multi-Dogs with Dog Demonstration" $N = 13$; M/F = 5/8; (mean age = 2.58 years, with the range 2 to 5 years)

For all these groups the same female demonstrator dog was used (she was a Mudi, which is a medium-sized Hungarian herding dog breed, at the start of the experiments she was 1.5 years old). The demonstrator dog was unfamiliar with all the subjects, and we carefully prevented the physical contact between the subjects and the demonstrator dog until the last trial ended. This was important because we did not want the result of the experiment to show the outcome of a somewhat familiar demonstrator–observer pair's performance. Of course, we could not exclude the possible visual cues and signals between the demonstrator and observer dogs, but the short trials and the relatively large distances between the dogs made the impact of these quite unlikely. Table 1 shows the subjects' relative size in comparison to the demonstrator dog, so one can check that in our sample not only "small dogs" were subordinate, but also "big dogs" were dominant. The demonstrator dog executed a detour before all three trials. During this demonstration, the owner and the observer dog stood at the starting point. The experimenter showed the target to the demonstrator dog and after he/she placed the target into the intersecting angle by reaching over the fence. The experimenter unleashed the demonstrator dog, which retrieved the target to the experimenter. The demonstrator dog moved usually along only one side of the fence during the detour (eight times from ten in average), and she preferred the right side for detouring (seven times from ten in average). We found earlier that the direction of the demonstration does not affect its efficiency, only the direction of the observer's later detours (Pongrácz et al. 2001, 2003b). As our goal here was to study how effectively our subjects learn from the demonstrator, we regarded the demonstrator dog's direction being an indifferent factor. After the retrieval, the experimenter put the demonstrator dog back on leash and put the target again behind the fence while the owner again covered the eyes of the observer dog with his/her hands. During the demonstration the owner could encourage the observer dog to watch the action of the demonstrator dog. The same procedure was repeated before trials 2 and 3. The demonstrator dog performed the detour and retrieval with 100% reliability, which means that every subject got three complete demonstrations without hesitation, delay, or incomplete retrieval action.

"Single Dogs with Human Demonstration" $N = 12$; M/F = 7/5; (mean age = 2.60 years, with the range 1 to 8 years)
"Dominant Multi-Dogs with Human Demonstration" $N = 11$; M/F = 5/6; (mean age = 3.80 years, with the range 2 to 7 years)
"Subordinate Multi-Dogs with Human Demonstration" $N = 12$; M/F = 5/7; (mean age = 3.21 years, with the range 1 to 6 years)

For these groups the experimenter played the demonstrator's role. The experimenter was an unfamiliar (female) person for the subjects. The same demonstration procedure was done before all three trials. During this the owner and the observer dog stood at the starting point. The owner covered the eyes of the dog and the experimenter placed the target into the intersecting angle by reaching over the fence. After this the owner encouraged the subject dog to watch the experimenter's action who detoured along the fence's one side (for example, by moving along the left side, turning inside at the end, walking into the intersecting angle), retrieved the target and then walked back out on the aforementioned route. During this the experimenter also encouraged the subject to pay attention to the action. After it the dog's eyes were covered again, while the experimenter put the target back behind the fence. After this the trial started as the owner unleashed the observer dog. The same procedure was repeated during trials 2 and 3, the experimenter used the same side of the fence for demonstrating the detour (however, she randomly varied the demonstrated side between the individual subjects).

Table 1 Breed and relative size of the subjects

		Small	Medium	Large
No demo	Dominant	Pekingese;	BC; Kelpie MB; Mudi	Beauceron; Malinois; MB (2); Tervueren
	Sub-ordinate	Fox Terrier; MB	BC	GSD; Giant Schnauzer; Great Dane; Malinois (2); Old English Sheepdog
Dog demo	Single	Bull Terrier; MB	BC (2); MB (2); Pumi	Bernese MD; Doberman; GSD; Kuvasz; Tervueren; Vizsla
	Dominant	MB	BC; MB (2)	Doberman; GSD (3); Hovawart; Malamute; MB
	Sub-ordinate	Corgi; Yorkshire Terrier	BC; MB (2); Pit Bull Terrier	Airedale Terrier; GSD (2); Kuvasz; Labrador Retriever; MB; Vizsla
Human demo	Single	Beagle; English Bulldog; ECS	Mudi; Welsh Terrier	Boxer; GSD; Golden Retriever; Hovawart; Leonberger; MB; Rottweiler
	Dominant	Dachshund (2); Pekingese; Sheltie	Mudi; Pumi	Bullmastiff; Collie (2); GSD; MB
	Sub-ordinate	Cairn Terrier; Dachshund; ECS; Miniature Pinscher	Pumi	Black Russian Terrier; Doberman; German Wirehaired P; Hovawart; Rottweiler; Tervueren (2)

Relative size was considered on the basis of the height of our demonstrator dog (48 cm)—i.e. the shorter dogs were sorted to the group "small", the taller dogs to the "large", and the approximately same-sized dogs to the "medium" category

BC Border Collie, *ECS* English Cocker Spaniel, *GSD* German Shepherd Dog, *MB* mixed breed

Data collection and analysis

The behaviour of the subjects was analysed via the videotaped sequences of the trials. We analysed the latency(s) of getting to the object, (the time elapsed between the releasing of the dog and the first touch on the target) by mixed ANOVA for repeated measures, ANOVA for repeated measures and one-way ANOVA, after we found that the data did not differ from the Gaussian distribution (Kolmogorov–Smirnov test for normality). Between group differences were analysed with Student–Newman–Keuls post hoc tests. If the dog did not succeed within 60 s, the trial was terminated and the latency of 60 s was assigned.

Experiment 1: the effect of reported dominance rank status on individual problem solving (without any demonstration)

Results and discussion

A mixed design ANOVA with the trials as a within-group factor, and the dominance/social status as a between-group factor (Fig. 2) showed that there was no significant effect of dominance status on the detour latencies of the dogs ($F_{1,17} = 0.20$; $P = 0.66$). Trials also had no significant effect ($F_{1,17} = 0.89$; $P = 0.36$), and the interaction between trials and dominance status was not significant either ($F_{1,17} = 0.49$; $P = 0.50$).

These results show that without the benefit of demonstration, dominant and subordinate dogs detour the fence with the same speed and they do not improve significantly in their performance after three repetitions.

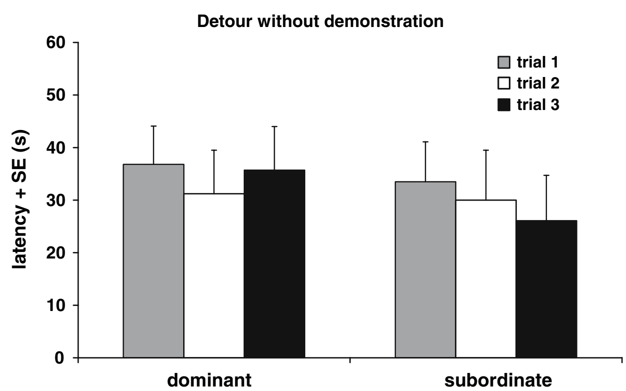

Fig. 2 Latencies of detour (mean + SE) without demonstration. There were no significant differences between the trials within groups, or between the same trials of the two groups

Experiment 2: the effect of reported dominance rank status on social learning from a dog demonstrator

Results and discussion

A mixed design two-way ANOVA with the trials as a within-group factor and the dominance/social status as a between-group factor (Fig. 3) showed that there was a significant effect of dominance status on the detour latencies of the dogs ($F_{2,34} = 7.80$; $P < 0.01$). SNK post hoc test showed that latencies in the dominant group were significantly longer than in the other two groups. Trials had no significant effect ($F_{1,34} = 2.86$; $P = 0.10$), and the interaction between trials and dominance status was not significant either ($F_{2,34} = 1.52$; $P = 0.23$).

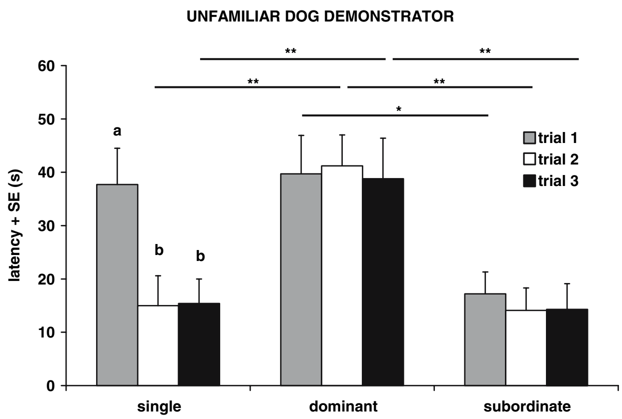

Fig. 3 Latencies of detour (mean + SE) with an unfamiliar dog's demonstration before every trial. Significant differences between the trials of the same group are marked with *different letters* above the bars. Significant differences among the different groups' corresponding trials are marked with *asterisks*

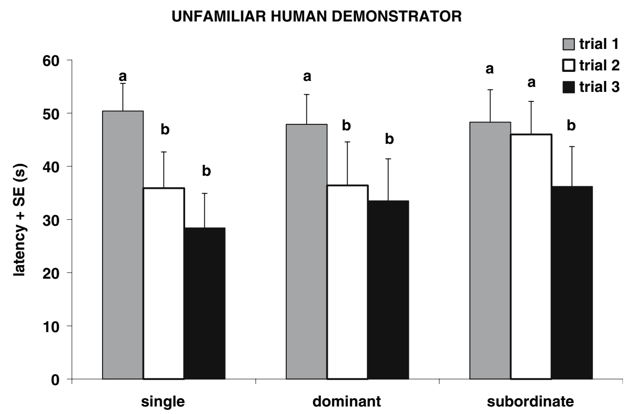

Fig. 4 Latencies of detour (mean + SE) with an unfamiliar human demonstration before every trial. Significant differences between the trials of the same group are marked with *different letters* above the bars. There were no significant differences among the different groups' corresponding trials

We compared the latencies of the same trials among the groups with one-way ANOVA. We found significant differences in all three cases: trial 1: ($F_{2,34} = 3.77$; $P < 0.05$), the latencies in the Dominant Dog group were significantly longer than in the Subordinate Dog group; trial 2: ($F_{2,34} = 8.21$; $P < 0.01$), the latencies in the Dominant Dog group were significantly longer than in the Single and in the Subordinate Dog groups; trial 3: ($F_{2,34} = 5.76$; $P < 0.01$) the latencies in the Dominant Dog group were significantly longer than in the Single and in the Subordinate Dog groups.

The results of this experiment showed that social rank seems to influence the performance after observing an unfamiliar dog demonstrator. Only the dominant dogs were seemingly unable to improve their detour latencies during the three trials, and dogs in the Single and in the Subordinate Dog groups were faster than the dominant dogs. There is a difference however, between the two latter groups. Latencies became shorter somewhat gradually in the Single Dog group, whereas the latencies in the Subordinate Dog group were evenly short, right after the first demonstration. It indicates that subordinate dogs can learn after only one demonstration from another dog.

Experiment 3: the effect of reported dominance rank status on social learning from a human demonstrator

Results and discussion

A mixed design two-way ANOVA with the trials as a within-group factor, and the dominance/social status as a between-group factor (Fig. 4) revealed that dominance status did not have a significant effect on the detour latencies of the dogs ($F_{2,32} = 0.22$; $P = 0.81$). Trials had a significant effect ($F_{1,32} = 25.92$; $P < 0.001$), and the interaction between trials and dominance status was not significant ($F_{2,32} = 0.90$; $P = 0.42$).

Three separate one-way ANOVAs for repeated measures on the individual groups showed a significant effect for all three groups: Single Dog group ($F_{2,22} = 9.64$; $P < 0.01$), in which the latencies of trial 2 and trial 3 were significantly shorter than in trial 1; Dominant Dog group ($F_{2,20} = 4.37$; $P = 0.026$), in which the latencies of trial 2 and trial 3 were significantly shorter than in trial 1; Subordinate Dog group $F_{2,22} = 3.93$; $P = 0.034$), in which the latency of trial 3 was significantly shorter than in trial 1 and trial 2.

The results of this experiment showed that after observing a human demonstrator the dogs in all three experimental groups achieved similar learning performance during the three consecutive trials. A closer look, however, can reveal some difference between the Dominant and the Subordinate Dog group. Demonstration of the detour caused a somewhat faster improvement in the performance of the dominant dogs. Although the latencies of trial 1 did not differ between the two groups, the latency of trial 2 was significantly shorter than the latency of trial 1 in the Dominant Dog group; meanwhile in the Subordinate Dog group only trial 3 had significantly shorter latency than trial 1. Single dogs were more similar to the Dominant dogs with regard to their detour latencies in this experiment.

General discussion

There are plenty of studies in the literature in which animal or human demonstrators were used in experiments for testing the social learning phenomenon (for example, ravens: Bugnyar and Kotrschal 2002; gorillas: Stoinski et al. 2001; geese: Fritz et al. 2000). The same is true for dogs; our research group performed a series of experiments with the detour paradigm, using both human and dog demonstrators (for example Pongrácz et al. 2001, 2004). However, to our knowledge this is the first time when the effect of dominance status was tested on the subjects' social learning performance in a situation, which is out of the range of the subjects' daily routine (like feeding), and also involves unfamiliar demonstrators instead of known group members. Therefore, our results give some interesting details about how dogs' learning performance is affected by their perception of dominance. These results also can be a warning for experiments planned in the future, because we should pay more attention towards the subjects' dominant or subordinate characteristics, which can affect their behaviour in a given test.

The most striking result was that rank-related differences between the dominant and subordinate dogs learning were affected by the demonstrator species. Dominant dogs learned effectively from the human demonstrator and at the same time they did not show any sign of improvement in the presence of the dog demonstrator. The subordinate dogs learned very fast from the dog demonstrator (one demonstration was enough for them), but their performance was not better in any measure than the dominant dogs' one, when the demonstrator was a human. These results also rule out the possibility that a dominant or a subordinate dog would be less or more interested in the task in general, that is, neither dominant nor subordinate dogs showed a "rank-related" unwillingness for social learning.

At the same time there is a possibility that observer dogs develop very quickly a rank assessment in relation with the demonstrator dog, based merely on her visual appearance and the relative size difference between them. For example, if the group of "dominant" dogs would have consisted of only larger dogs than the demonstrator, it would be a reasonable explanation of the results that they did not learn from the demonstrator dog, because they assessed her uniformly as a low-ranked individual because of her smaller size. However, data in Table 1 shows that there is no difference between the size distribution of observer dogs in the subordinate and dominant groups which were tested with the dog demonstrator. Therefore the "in-situ" rank assessment theory becomes rather unlikely, which means that the difference in the observer dogs' performance was most likely the result of their rank which they "carried" from home with themselves.

We think that the rank-related effect of the demonstrators on the dominant and the subordinate dogs could be caused by the different previous social experiences of the subjects. Dogs, like their wolf ancestors, readily form social groups with each other (Bradshaw and Lea 1989) as well with humans (Fox 1975). Although there are significant differences between the organization of a wolf pack and a (strayed) dog pack (there are less agonistic interactions between the dogs, the reproduction of the pack members is not suppressed by the aggression of the leaders, the dominance status of an individual can be different in different situations—Jenks and Ginsburg 1987; Bradshaw and Wickens 1992), dogs are able to form, maintain and communicate dominant–subordinate relationships with other dogs. What is more important is dogs have the ability to communicate subordinance to humans too (this ability is missing from tamed wolves) (Schenkel 1967). We think that a multi-dog household (where the owner has more than one dog) can be considered as a special "pack", which consists of human(s) and dogs. Considering the aforementioned literature, dogs are usually in subordinate position with the humans and at the same time they form their own hierarchy with each other. For a dominant dog it is highly unusual to learn from another dog at the experimental site, because at home he can take whatever he wants from the subordinate individual(s). At the same time dominant dogs usually have "dominant" humans with them—and this human is the focus of the dominant dog's attention. Therefore, dominant dogs will preferentially learn from a human demonstrator and are less likely to learn from another dog. At the same time subordinate dogs are familiar with the situation when they have to pay attention to another dog's actions, because at home they have at least one pack mate who is above them in the "pecking order". They also regard humans as higher ranked individuals but between them and the humans there is usually the dominant dog as an immediate rank neighbour. This might explain why subordinate dogs learn especially quickly from other dogs.

Dog breeds often show striking behavioural differences, but recently there is a strong emphasis on such ethological and genetic (for example Saetre et al. 2006) research, which could give the key to the general evaluation of the individual dog's consistent behavioural patterns, or temperament. Temperament (a term, which is often substituted with 'personality' even in animals—see for example Jones and Gosling, 2005) consists of several behavioural traits, and is being used to describe individual differences, as between dogs here, regardless of the breed they are originating from. Our study concentrated on one (although complex) variable, the dominance status of the individual dog, and we wanted to know if dominance has an effect on the dog's performance in a social learning situation. The uniqueness of this approach was mostly that while the dominance status corresponds to the dog's relations to his/her dog-companions at home, the social learning task was performed with stranger human and canine demonstrators. Our results showed that dominance in dogs can be connected to individual differences of performance in other, seemingly not-related tasks, too. Of course, we do not know yet, whether the dominance status itself affects the behaviour of the dog in other situations, or both factors (dominance and for example, social learning skills) have their roots in other common temperament components.

The dynamic changes in social rank systems and/or its effect on the individuals' learning or problem solving abilities have been shown in several species (swordtail fish—Beaugrand and Goulet 2000; mouse—Barnard and Luo 2002; orangutans—van Schaik et al. 2003). Social learning theory in dogs, however, showed a static picture until now. We knew that young puppies can learn from their trained drug-seeking mother the basics of searching for chemicals (Slabbert and Rasa 1997), and human demonstrators were effective also in teaching dogs to solve detour and manipulative tasks (Kubinyi et al. 2003), either. Our experiments provided evidence that social learning is dependent on the individual dog's social rank and also on the demonstrator species, and these two factors determine jointly the actual efficiency of the learning. We should emphasize once more that during the analysis we relied on the reported social rank of the subjects (i.e. owners reported it to us). We consider reported social ranks as factors, which at least partly influence the dogs' behaviour even when they are without their familiar companions. Such a more or less dominant or subordinant attitude would be highly adaptive for an animal, like the domestic dog, which leaves often the "home pack", and meets regularly with unfamiliar dogs and humans.

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