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Assessing dogs' performance in a social and non-social reversal learning task

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Abstract: Reversal Learning could be an essential tool for dogs to accomplish a favorable adaptation to the human environment. Some dimensions of the social context, such as the presence of humans as choice stimuli, might influence dogs' achievement in reversal learning tasks. Our goal was to assess the influence of the human presence on dogs' ability to solve these tasks. For that purpose, we compared the performance of the same subjects in a social and non-social condition. Dogs had to choose between two passive humans (social reversal task) and between two apparatuses (non-social reversal task) as the discriminative stimuli. Our results showed no significant differences in the mean number of trials before giving the first correct response and mean number of correct responses comparing the social and non-social reversal conditions. This could indicate that reversal learning is independent of the social nature of the acquired stimulus, and that the human presence might not facilitate dogs' performance. However, in the last block of trials, dogs made significantly more correct responses in the social task than in the non-social task. This result must be considered with caution. Further research is required to compare social and non-social tasks applied to the same subjects and including distinct dimensions of the social context. In addition, future work should address other factors that potentially shape dogs' ability to learn reversals.

Key Words: reversal learning; inhibition; social context; domestic dogs.

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Introduction

Reversal learning tasks have been extensively used in human and non-human animals as a well-established comparative test of behavioral flexibility and inhibitory control (Wallis et al., 2011). They measure how individuals react when a previously valid response is now incorrect (Rosatti, 2017). In a reversal task, at an operational level, the individuals need to inhibit choosing the S+ once the reward contingencies are reversed (Rumbaugh, 1971).

One important issue about reversal learning is related to the influence of different contexts. It is proposed that the social context could pose dissimilar learning challenges for the animal compared to those involved in the physical context (e.g., de Waal, 1991; Miklósi et al., 2004). Within social species, it has been proved that by placing a problem in a social context increases performance compared to when that problem is presented in a non-social context (e.g., humans: Tooby & Cosmides, 1992; chimpanzees: Wobber & Hare, 2009). However, other findings suggest that social contexts might impair reversal abilities (e.g., humans: Topál et al., 2008; dogs: Kis et al., 2012) or might not have significant impact on achievement (e.g., domestic dogs: Topál et al., 2009; Wobber & Hare, 2009; humans: Osborne-Crowley et al., 2016). Thus, more studies are required to improve the knowledge about the relative influence of each domain.

In order to study the influence of social and non-social contexts on reversal learning, domestic

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dogs (*Canis familiaris*) are considered to be excellent candidates. As a social species, they have adapted to live in human society through a process of domestication (Hare & Tomasello, 2005) and they live in close contact with people (for a review see Udell & Wynne, 2010). In fact, dogs show remarkable learning and socio-communicative abilities, including those critical to reversal learning (Laude et al., 2016).

The study of the influences of social contexts in dogs' reversal learning capacities has been focused mainly on the communicative dimension (e.g., Elgier et al., 2009; Wallis et al., 2011; Kis et al., 2012; Gergely et al., 2016). For instance, it has been shown that in the A-not-B task (a standardized reversal task), dogs make more mistakes in communicative contexts (where a human displays ostensive cues) than in non-communicative contexts (social environments where the person is present but does not display cues) (e.g., Topál et al., 2009). Additionally, in the A-not-B task, dogs make more mistakes in communicative conditions than in non-social conditions using non-human stimuli, such as a remote-control toy car (Gergely et al., 2016) or transparent strings (Topál et al., 2009).

Some authors state that it is possible that dogs could perform better in a reversal task using a human as a social stimulus instead of objects as non-social stimuli (e.g., Laude et al., 2016). To our knowledge, two are the studies that directly draw a comparison between these conditions using reversal paradigms. One of them was carried out by Topál et al. (2009), who compared a social (a human was present but did not display cues) to a non-social condition (no human was present) using the A-not-B task but they found no significant differences. Similarly, Wobber & Hare (2009) found no differences when applying a standard reversal task in two conditions: one with two containers and the other with two humans as discriminative stimuli. However, this study has not controlled the presence of a human in the non-social condition, as the experimenter was equidistant from both stimulus containers and he also baited them for each trial.

Pursuant to the above, we are unable to conclude if the interspecific social context may have a facilitating effect on reversal learning in dogs. Therefore, we compared the performance of the same dogs in a social and in a non-social version of a reversal learning task. The presence of differences in the performance while comparing both versions of the task would indicate that the social nature of the context has an influence on reversal learning in dogs. By contrast, if no differences were found, it would suggest that this ability is independent of the acquired stimulus.

The skills involved in reversal learning could be a major tool for dogs to achieve a favorable adaptation to the human environment and, consequently, it might be beneficial for interspecific relationship affecting behaviors like training, obedience, and aggression, to name but a few (Wright et al., 2011).

Method

Subjects

We evaluated 24 healthy adult dogs between 1 and 10 years old, of different breeds. All animals were domestic pets living for at least 1 year with their owners. None of the dogs presented aggressive behavior and/or excessive fearfulness to strangers.

The owners were requested to express written consent for the participation of their pet in this study. Also, they were requested not to feed their pet for 4-6 hours before the experiment so as to keep the animal highly motivated to perform the task.

We excluded a total of four dogs, one female did not meet the learning criterion in any of the reversal tasks (see procedure section), one male showed separation-related behaviors, and two males lacked of food motivation. The definitive sample included 20 subjects (6 mixed-breeds, 2 Lhasa Apso, 2 Bichon Frisé, 1 Poddle Toy, 1 Pitbull, 1 Labrador, 1 Shih Tzu, 2 Cockers, 1 Dobermann, 1 Bichon Maltés, 1 Staffordshire Bull-terrier, 1 Golden Retriever), 7 males (35%, 2 neutered) and 13 females (65%, 6 neutered), 1 to 10 years old, mean age 4.67 ± 2.88 ($M \pm SD$). All of them had previous experience with the cylinder task (a widely used approach different from the reversal paradigm; subjects need to inhibit the impulse to reach a visible food reward).

Materials and experimental setting

The study was conducted at the location where the dogs lived, in a room at the owners' houses. The owners were not present during the testing. The reward used was cooked liver and dogs had free access to water during the trials. The experimenters (Es) and the handler (H) were always unknown women to the animals.

Sessions were filmed with a Motorola G4p16MP camera on a tripod.

For the social reversal task, two transparent acrylic trays of 21 x 15 cm were used. The subjects observed two Es seated on the ground. Each E had a transparent tray in front of her, which was set on the ground, and wore a belt pouch with food. The Es were separated from each other by 1.50 m. At 1.50 m was the starting point where the dog and the H (who was holding the dog on a leash) were waiting, forming a triangle. One of the Es had the tray previously baited with a piece of cooked liver, visible to the dog, and the other E had the tray empty. A 50 x 50 cm quadrant was marked around each E to determine the choice response (Figure 1a).

For the non-social reversal task, two dispensing devices MannersMinder® (Treat & Train® Dog Training System) of 25.4 x 40.6 x 25.4 cm were used. They were supported on the ground and dispensed food inside the transparent trays by remote control. As in the previous task, only one of the trays was baited (Figure 1b).

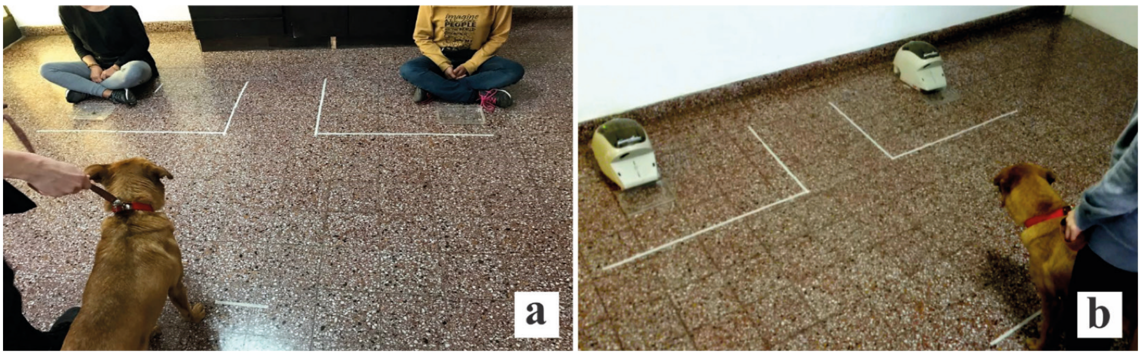

Figure 1. Experimental set of (a) the social reversal task and the (b) non-social reversal task.

Procedure

All subjects were tested in two reversal learning tasks: a social and a non-social task.

As in any standard reversal learning protocol, the procedure of these two tasks comprises two phases: in the initial phase, named Discriminative Learning Phase, the individuals need to learn an association between a specific stimulus and a food reward (S+), while the other stimulus is never paired with the reward (S-) (Rumbaugh, 1971). After reaching a learning criterion for accuracy on this discrimination problem (i.e., successfully choosing S+), the second stage, called Reversal Test is implemented and the reward contingencies are reversed (Izquierdo & Jentsch, 2012). Specifically, the S+ is no longer rewarded while the S- is rewarded (e.g., press the right but not the left lever).

We incorporated a visible food component to the stimulus paired with food reward during the discrimination phase (S+) since not everyone agrees that reversal learning tasks properly measure motor response inhibition (Bari & Robbins, 2013; Diamond, 2013). This adds a new experimental element to the study of flexibility and inhibitory control using the traditional paradigm (e.g. Tapp et al., 2003) since it demands motor inhibition to a greater extent. Moreover, the evidence shows that performance in other behavioral tasks decrease when food is in sight of the subject (e.g., Addessi et al., 2013; Paglieri et al., 2013). For this reason, adding visible food to our protocol may increase the difficulty during reversal. By doing so, we also increase the probabilities to observe differences between the conditions.

The two tasks were administered separately with a 4-6 weeks interval, and applied in a counterbalanced order across dogs. Additionally, the location (right-left) of the positive stimulus (S+) and the negative stimulus (S-) was counterbalanced between and within subjects. Namely, in each task half of the dogs experienced the right object/human as the S+ and the other half of dogs had the left as positive. Also, a dog that experienced the right side as positive in one task, experienced the left side as positive in the other task (but the positions of the two reward locations were kept constant throughout each subject across all types of trials within a task).

All dogs completed a training phase comprising 8 discriminative learning trials with the initial reward-object/human association. If a dog made at least 6 correct responses, it proceeded directly to the reversal phase, where the reward was switched to the location that had previously been unrewarded. Dogs received 15 reversal test trials.

Furthermore, immediately after finishing the task, all dogs were praised and fed with 5-8 pieces of cooked liver. This practice allows us to evaluate food motivation and satiation effects.

Social reversal task

The subjects chose between two passive Es that were seated 1.5 m apart. In the training phase, the reward was delivered by the E1, who had the tray previously baited with food visible to the dog (S+). In the reversal phase, the reward delivery was switched to the side of the E2, who had the food hidden in her belt pouch (S-).

In the training phase, the subjects learned to discriminate between two choice stimuli. Two Es were seated forming a triangle with the dog and the H, looking at a distant point in the room without making eye contact with the dog. The H took the dog to the starting line, oriented the animal body towards the Es and waited for it to observe the situation. In the first trial, the dog was given 5 s to observe the situation, but then in the rest of the trials, the time was reduced to 1 s. After that, the H said "go", and at the same time dropped the leash and advanced two short steps towards the center of both trays, so as to allow the dog to choose freely. If the dog entered the E's quadrant that had visible food (E1's quadrant), she remained passive, the dog could eat from the tray, and the H said "very good" with positive intonation. After the dog ate, the H conducted it back to the starting point. Conversely, if the dog entered the E2's quadrant, she remained passive, and the H said "no" while preventing the animal from moving forward (holding it with the leash as soon as it entered the choice quadrant, avoiding physical contact with the E2 or the tray).

Each time the H led the dog back to the starting line, it was guaranteed that the dog did not look back at the Es, which enabled the E1 to replenish the reward. In the baiting procedure, the E1 grabbed another piece of liver from the belt pouch and deposited it gently into the tray. This phase comprised 8 trials, and the subject was required to retrieve the reward (S+) in at least 6 trials. The inter-trial intervals were 20 s. A choice was coded as correct if the dog entered (with the snout, head or paws) into the E1's quadrant (i.e., if the dog chose the S+). A choice was coded as incorrect if it entered into the E2's quadrant (i.e., if the dog chose the S-). The reversal phase started after 20 s of completed the eighth trial.

In the reversal test phase, the procedure was identical to the training, except that a change in the contingency of the stimuli was conducted. That is, the choice of the E2 (S-) was the one that led to the reward, while the choice of the E1 (S+) no longer did. Accordingly, if the dog approached the tray with food (E1's quadrant), the H prevented it from moving forward, holding it with the leash. The H made this restriction when the dog crossed the 50 cm choice line that surrounded the E1, thus preventing it from eating; she said "no" and led the dog back to the starting point. If the dog went towards the E2's quadrant, she immediately took a piece of liver from the belt pouch and deposited it into the tray so that the dog could eat. When entering the E2's quadrant, the H said: "very good" and took the dog back to the starting point. Fifteen trials were performed. A choice was coded as correct if the dog entered into the E2's quadrant (i.e., if the dog chose the S-). A choice was coded as incorrect if the dog approached the visible food entering the E1´quadrant (i.e., if the dog chose the S+). The inter-trial intervals were also 20 s. In both phases, a response was coded as non-choice if the dog did not move forward after 15 s since the H performed the "go" command. The non-choice responses were coded as incorrect. If the dog made 5 consecutive non-choices in the reversal phase, the task was finished (extinction criterion).

After concluding the task, 100% of the dogs ate all the food that was given to them by the experimenters.

Non-social reversal task

The procedure was the same as the social version, except that the E1 and the E2 were replaced by the dispensers one (D1) and two (D2).

During the training trials, the two dispensers were located forming a triangle with the dog and the H. An E stood far behind in the room and operated the remote control of the devices. If the dog entered the D1's quadrant, it could consume the piece of liver from the tray. Out of the dog sight, the E pressed the remote control so that the D1 replenished the liver into the tray. If the dog approached the D2's quadrant, the H said "no" while preventing the animal from moving forward, and returned it to the starting point. During the 20 s interval between the training and the test, the E turned off the D1 and turned on the D2, while the H held the dog at the starting point, obstructing the animal vision of the devices and the E. During the reversal phase, each time the dog moved towards the D2's quadrant, the E pressed the remote control in order to deliver the reward. The coding of the choice responses was carried out in the same way as in the social version.

After concluding the task, 100% of the dogs ate all the food that was given to them by the experimenters.

Measures

In each behavioral task, we considered the following dependent measures: a) number of correct training trials, b) number of trials before the first correct response in the reversal phase, and c) number of correct responses in the reversal phase.

Analysis

Trials were coded live by one of the Es and the H, with a total agreement between them.

Since all the variables did not show a normal distribution (Shapiro-Wilk test, Ps < 0.005, N = 20), we calculated nonparametric statistics. All the analyses were performed with SPSS 17.0 and all tests were two-tailed with an alpha of 0.05.

We used the Mann-Whitney U test to analyze possible order effects, comparing all training and test measures between the group which was first evaluated in the social task (n = 12) and the group first evaluated in the non-social task (n = 8).

We used the Wilcoxon test for two related samples to analyze possible differences between the mean number of correct responses of the training and the reversal phase. Given that the length of the trials varies between the training and the reversal stages we calculated the proportions (ratios) of the mean number of correct responses.

We used the same test to evaluate learning effects in each behavioral task, we divided the performance into three blocks (the first, the second and the third 5 trials) and compared the mean number of correct responses across the 15 reversal trials.

We also used the Wilcoxon test to compare the performance between the social and the non-social tasks, regarding: a) the mean number of correct responses during the training, b) the mean number of trials before the first correct response in the test, c) the mean number of correct responses in the test, d) the proportion of dogs that did not managed to revert at least in one trial, e) the mean number of correct responses and non-choices in the last block of trials.

Finally, we considered possible effects of age (Spearman's Rho) and sex (Mann-Whitney U test) in all dependent variables, and we found no significant influence in any of them (all P values > 0.05), so we did not include them in the remaining analysis.

Results

We found no order effects in performance since no significant differences were observed between the group first evaluated in the social task and the group first evaluated in the non-social task (Mann-Whitney, N = 20, all P values > 0.05).

Taking the 8 training trials, dogs made on average 7.10 ± 9.12 (88.75%) correct responses in the social task and 7.50 ± 0.76 (93.75%) in the non-social task. We found no significant differences in the number of correct responses between the social and the non-social training phases (Wilcoxon, Z = -1.517, N = 20, P = 0.129).

In respect of the reversal test phase, dogs made on average 6.75 ± 4.45 (range: 2-15, 45%) trials until giving the first correct response in the social task and 8.60 ± 5.92 (range: 1-15, 57%) in the non-social task. We found no significant differences in the number of trials before the first correct response between the social and the non-social reversal tasks (Wilcoxon, Z = -1.252, N = 20, P = 0.211). Additionally, 15% (n = 3) of the dogs in the social task and 40% (n = 8) in the non-social task never succeeded in reversing their response, and there was no significant difference between both proportions (Wilcoxon, Z = -1.335, N = 20, P = 0.182).

Furthermore, in the reversal test phase, dogs made on average 6.55 ± 3.97 (43.67%) correct responses in the social task and 4.75 ± 4.92 (31.67%) in the non-social task. We found no significant differences in the number of correct responses between the social and non-social reversal tasks (Wilcoxon, Z = -1.151, N = 20, P = 0.250). Taking the total of incorrect responses (incorrect per se plus non-choice responses), 16.97% in the social task and 22.39% in the non-social task were due to non-choices. In addition, one dog in the social task and two dogs in the non-social task did not manage to complete the 15 trials of the reversal phase, since they made five consecutive non-choices during the same (see extinction criterion in the procedure section). Also, in this case, we found no significant differences in the number of incorrect and non-choice responses between the social and the non-social reversal tasks (Wilcoxon, N = 20, all P values > 0.05).

We analyzed possible differences between the training and the reversal phase. Dogs were significantly less successful in the reversal phase compared to the training phase in both social (Wilcoxon, Z = -3.698, N = 20, P = 0.0001) and non-social tasks (Wilcoxon, Z = -3.821, N = 20, P = 0.0001).

We compared the three blocks of reversal trials in order to evaluate learning effects, and we found significant differences between the three blocks in the social task (Friedman, X^2 = 27.672, N = 20, P = 0.0001, Block 1: 17%, Block 2: 45%, Block 3: 70% correct responses), and in the non-social task as well (Friedman, X^2 = 14.205, N = 20, P = 0.001, Block 1: 15%, Block 2: 38%, Block 3: 39% correct responses; Figure 2). All post-hoc comparisons were significant (Wilcoxon, N = 20, all P values < 0.004) except for block 2 vs. block 3 in the non-social task (Wilcoxon, Z = - 0.776, N = 20, P = 0.438).

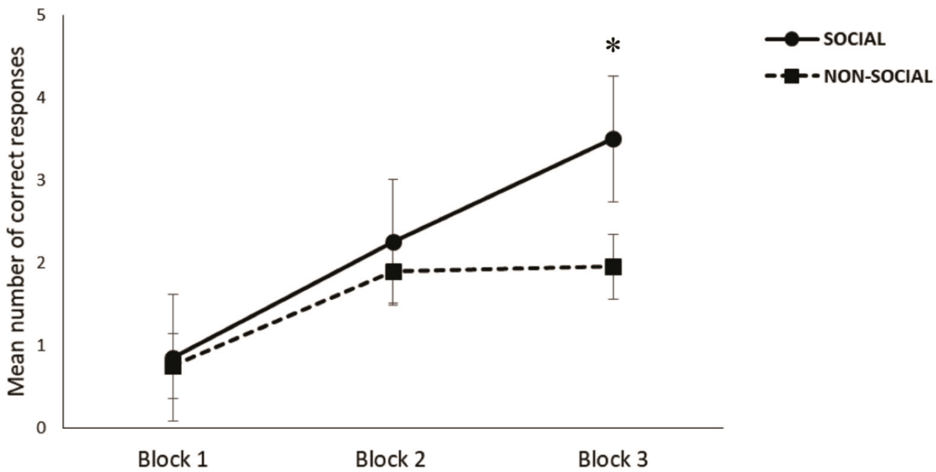

Figure 2. Mean performance across the 15 trials of the social and non-social reversal tasks. Reversal trials were divided into three blocks: the first, the second and the third (last) 5 trials. The *y*-axis denotes on average how many subjects choose correctly out of these 5 trials in the social and non-social tasks. Error bars represent ± 1 SEM. Two-tailed tests (*P* < 0.05).

Furthermore, since dogs reached their best achievement in the last block of trials, we analyzed the number of correct responses and non-choices in the last block of the social task compared to the last block of the non-social task. We found significant differences in the number of correct responses between the two tasks (Wilcoxon, Z = -2.029, N = 20, P = 0.042), showing that dogs performed better in the social task than in the non-social task. Moreover, we found significant differences in the number of non-choices between the two tasks (Wilcoxon, Z = -2.516, N = 20, P = 0.012), with dogs showing more non-choices in the non-social task than in the social task (social: 0.30 ± 0.733, 6%; non-social: 1.37 ± 1.739, 27.4%).

Discussion

For the purpose of exploring the influence of social context on reversal learning, we compared the performance of the same subjects in a social and in a non-social reversal learning condition. We assessed the influence of two humans (non-communicative social context) and two apparatuses (non-social context) as discriminative choice stimuli.

In the last block of trials, we found a significant difference in the number of correct responses between the two tasks, showing that dogs performed better in the social task than in the non-social task. Therefore, it is possible that the presence of humans could facilitate dogs' reversal learning abilities. However, this result is limited and must be considered with caution. Although subjects' overall performance was slightly worse in the non-social task, there were no considerable differences between the social and non-social conditions considering all reversal trials. This would suggest that the reversal ability (at least in these protocols) is independent of the social nature of the acquired stimulus, and that the human presence would not facilitate dogs' performance. This is contrary to some proofs found in humans, which indicate that social contexts may increase achievement (e.g., Tooby & Cosmides, 1992). In addition, our results are in line with other findings which demonstrate that there may be no differences between social and non-social reversal learning conditions, both in humans (e.g., Osborne-Crowley et al., 2016) and dogs (e.g., Topál et al., 2009; Wobber & Hare, 2009).

Furthermore, in the last block of trials we found a significant difference in the number of non-choices between the two tasks, showing that dogs made on average more non-choices in the non-social reversal trials. According to this result, a fatigue effect might have happened due to the extension of the task, suggesting that learning reversal with apparatuses could be more complex than doing so with humans. Additionally, animals might have experienced frustration resulting from the difficulty of the test. Another explanation is related to the presence of biological satiation effects, but this is improbable since all dogs continued eating the reward after finishing the tasks.

Our overall results are similar to Wobber & Hare's (2009) who compared dogs' performance in two reversal conditions. One of them was social, where two persons were used as discriminative stimuli. The other was a non-social condition, where two containers were employed and where there was a person who baited them. There was a close resemblance between the aforementioned investigation and the one we carried out as no differences were found neither in the average of correct trials nor in the number of trials until giving the first correct response. Notwithstanding this, a limitation in Wobber & Hare's work is that the human presence was not controlled in the non-social condition. In light of the above, in our protocol we made sure that the human presence *vs.* its absence was compared. Since the apparatuses used for the non-human condition dispensed food by remote control, the dogs were able to go directly towards the two stimuli without a person manipulating the rewards during their choice.

In our protocol, the lack of differences between the conditions would not necessarily mean that reversal learning is a stable ability across social and non-social contexts. There might be two possible explanations. To start with, there is a possibility that the mere presence of a person as a discriminatory stimulus proves to be irrelevant for the dogs and does not provide enough social information to use. In other words, subjects were not required to interpret a communicative cue displayed by the humans but simply build up an association between a person and a reward (Wobber & Hare, 2009). Also, due to the fact that a passive human, who does not provide communicative cues, was employed as a stimulus may be considered a less natural situation than an interacting human (Szetei et al., 2003). Therefore, dogs could have interpreted both situations similarly as a food-finding problem (Wobber & Hare, 2009). Furthermore, studies using interacting humans suggest that the type of cue used might have an effect on reversal learning performance in communicative tasks. For instance, Wallis et al. (2011) compared two groups of dogs in two different conditions: in one of them, a person was pointing the target stimulus. In the other, the person was touching it. It was noted that the animals had more difficulty to reverse their response with the cue of touching the stimulus, which is considered stronger and had more local enhancement than the pointing cue.

There is another possible explanation for the absence of differences between the reversal conditions. It is related to the large individual variability in the performance between the tasks. While some dogs showed better performance in the social condition (14 out of 20 subjects), other dogs outperformed in the non-social condition (6 out of 20 subjects). In this sense, we might consider the influence of individual differences on reversal learning, like motivational and personality factors, as it has been shown in humans (e.g. Murdock et al., 2013). These aspects might be modulating the impact of the social context upon each individual.

Doubtless, further research into this area is required so as to compare the social and non-social tasks applied to the same subjects and the different conditions of the social domain should be also included. To this end, the design of protocols should be as homogeneous as possible in relation to other cognitive demands that might interfere. In addition, future work should address the influence of temperament, motivation, age, breed, gender and other possible factors that might be shaping dogs' ability to learn reversals.

Another relevant aspect of our protocol is that we made a modification to the reversal paradigm commonly used (e.g., Tapp et al., 2003). We wanted to increase the probabilities to observe the differences between the conditions. Also, we considered the assumption that reversal tasks do not precisely measure motor inhibition (e.g., Diamond, 2013), but a highly narrow aspect of inhibitory control which is not displayed by subjects during typical response inhibition tasks (Bari & Robbins, 2013), like the cylinder task or go/no-go tasks (e.g., Rubia et al., 2001; Bray et al., 2014). While the aspect that needs to be inhibited in response inhibition tasks is a motor response, in reversal tasks it is a habitual stimulus-response association (Bari & Robbins, 2013). Therefore, in our protocol, during the training, the positive stimulus (S+) was paired with a visible food reward, while in the reversal phase it was not paired with a reward but the food remained visible. This way, the individuals had to inhibit not only a habitual stimulus-response association but also the prepotent response of heading to the visible food. When visible food is added, the subject's level of motivation might increase towards food rewards and, thus, the capacity to inhibit food-seeking behaviors could be potentially affected in a negative way (Brucks et al., 2017). Accordingly, our results showed a low percentage of correct responses in both reversal conditions (social: 43.67%; non-social: 31.67%), which might indicate that the reward visibility have acted by increasing the tasks' difficulty, demanding motor inhibition to a greater extent.

Furthermore, we found a learning effect in both social and non-social tasks, indicating that, in such cases, the number of correct responses in the last block of trials was significantly greater than the number of correct responses in the first block. This suggests that the two tasks were valid measures of learning ability and that dogs were motivated to solve the problem (Wobber & Hare, 2009). What is more, dogs were significantly less successful in the reversal phase than in the training phase in both tasks. The fact that dogs' performance declined when the stimuli were reversed could indicate that these tasks were indeed measuring the dogs' abilities to inhibit choosing the previously rewarded stimuli and to adapt to new stimuli contingencies (Brucks et al., 2017).

Conclusion

Our results are in line with previous evidence that suggest that the presence of human stimuli might not have a substantial impact on reversal learning (e.g., Topál et al., 2009; Wobber & Hare, 2009; Osborne-Crowley et al., 2016). The effects of the separate dimensions of the social context and the relative influence of individual differences need to be addressed.

Reversal learning in dogs could be an essential tool for achieving a successful adaptation to the human environment. At the same time, flexibility and inhibitory control abilities involved in learning reversals may have a relevant impact on behaviors like training, obedience, and aggression (Wright et al., 2011). Hence, the study of reversal learning in pet dogs has potential applications for the assessment in areas where these behaviors are crucial, for instance, drug detection, rescue operations and assistance to humans with disabilities. In addition, it has implications for the welfare of owners and dogs in their valuable role as pets.

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Valutazione della performance del cane in prove di "social and non-social reversal learning"

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Sintesi

Il "Reversal Learning" potrebbe essere uno strumento essenziale per i cani per realizzare un adattamento favorevole all'ambiente umano. Alcune dimensioni del contesto sociale, come la presenza degli esseri umani come stimoli di scelta, potrebbero influenzare i risultati dei cani nei compiti di "reversal learning". Il nostro obiettivo era valutare l'influenza della presenza umana sulla capacità dei cani di risolvere questi compiti. A tal fine, abbiamo confrontato le prestazioni degli stessi soggetti in una condizione sociale e non sociale. I cani dovevano scegliere tra due esseri umani passivi (compito di inversione sociale) e tra due apparati (compito di inversione non sociale) come stimoli discriminanti. I nostri risultati non hanno mostrato differenze significative nel numero medio di prove prima di fornire la prima risposta corretta e il numero medio di risposte corrette confrontando le condizioni di inversione sociale e non sociale. Ciò potrebbe indicare che il "reversal learning" è indipendente dalla natura sociale dello stimolo acquisito e che la presenza umana potrebbe non facilitare le prestazioni dei cani. Tuttavia, nell'ultimo blocco di prove, i cani hanno dato risposte significativamente più corrette nel compito sociale che nel compito non sociale. Questo risultato deve essere considerato con cautela. Sono necessarie ulteriori ricerche per confrontare compiti sociali e non sociali applicati agli stessi soggetti e includendo dimensioni distinte del contesto sociale. Inoltre, il lavoro futuro dovrebbe affrontare altri fattori che potenzialmente modellano la capacità dei cani di apprendere le inversioni.