Supporting Information

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SI Experimental Procedures

Experiment 1. ***Subjects.*** A precondition for participation in the study was that the dogs had to know the command "to give the paw." Before the experiment started, the dogs would be asked to give the paw to the experimenter in a relaxed situation. Four dogs that refused to obey were excluded from the study. Furthermore, an assessment session was used to verify that, in general, the subjects would give the paw to the experimenter 30 times in a row. Two subjects refused to cooperate with the experimenter to give the paw 30 times in the assessment session and thus were excluded from the study. Another pair of dogs was excluded because one of them (a border collie) tried to herd the partner dog instead of concentrating on the task. Another dog had to be excluded because the owner decided to stop the experiment after her first dog was tested and another one died because of old age before the assessment session could be conducted. Thus, we had a total sample size of 29 dogs. Participation in the tests was voluntary. Only dogs older than 6 months were tested, and various breeds were included (Table S1).

Experimental setup. Experiments were carried out between October 7 and April 8 in Vienna either in the Clever Dog Laboratory or at the owner's home. Two familiar dogs that showed no aggression over food were seated 30 cm apart from each other with their backs toward a wall. Both were on same-length leashes fixed to the wall to prevent the dogs from running around. We laid a wooden block (length, width, height: 60 × 10 × 10 cm) between the 2 dogs to indicate a physical boundary. However, this boundary prevented the dogs only from moving over and displacing the other dog; it did not prevent any body contact between the 2 animals or seeing exactly what the partner did or received (see Fig. 1). The experimenter was sitting in front of the 2 dogs within arm's reach and facing them. A red food bowl (30-cm diameter) was placed between the 2 dogs and the experimenter. It was divided into 2 parts by a paper partition: In the part closer to the experimenter, 30–60 small pieces of sausage were placed, whereas in the part closer to the dogs, 30–60 pieces of black bread were placed. The food bowl and its content were clearly visible to both dogs. The owner of the dogs was standing 1 m behind the dogs at the wall and had no physical contact either with the dogs or the leashes. A camera was mounted behind the experimenter to video tape the experiments.

Session tasks. Each test session consisted of a series of 60 trials, with trials alternating between the partner and the subject such that each individual received 30 trials per session (or until the subject refused to work), and the partner always performed immediately before the subject. A session was started by giving 1 piece of sausage to each animal to focus the attention of the animals on the task.

The task for a dog was to give its paw to the experimenter on command, e.g., the hand of the experimenter was held out to the dog, and the command "paw" was spoken. The experimenter only "asked" for the paw if the dog was in a sitting position. If the dog was lying or standing, it was asked to "sit" by using a spoken command before being prompted to give the paw. Depending on the experimental condition (see below), the subject either received a high-value reward (a piece of sausage of size 5 × 5 mm), an equally sized low-value reward (black bread), or no reward for giving the paw. After successfully giving the paw, the reward was picked up from the bowl in front of the experimenter, held up in the middle between the 2 dogs for them to see, and then given to the dog that had just performed. If the subject refused to give the paw, the command "paw" was repeated 5 times, then the subject was once addressed by name and asked again for a maximum of 5 times to give the paw. If the subject did not resume working, the session was terminated. If the subject was lying or standing at the beginning of a trial or laid down or stood up after being asked for the paw, it would be asked by the experimenter to sit. The command was repeated 5 times; then the animal was addressed by name and asked again a maximum of 5 times to sit up. If the dog still refused to sit, it was ignored for 5 trials during which the partner was asked for the paw and rewarded. Afterward, the experimenter turned once more to the subject and asked it to sit and then to give the paw or if the subject was already sitting only to give the paw. If, however, the subject continued to refuse to sit, the session was terminated after 10 additional repetitions of the command. During the experimental sessions, the experimenter avoided any eye contact with the dogs and kept looking at the wall behind the dogs. The owner was told not to interfere or address the dogs at any point during the experiment except if the partner left its place, then the owner was told to put it back into its position. In each experimental session except the control, both animals were addressed alternately by the experimenter.

Each dog served as partner and subject in their respective dyad. The 1st subject was tested in all conditions before the roles were reversed. We carried out 2 test sessions per day with a 15-min break between them. The order of the 4 social conditions was randomized across subjects but never started with the Reward Inequity test. This latter restriction was administered to avoid complete frustration of the subject when put into a completely novel situation, commanded by an unfamiliar person and then not even rewarded for the commanded action. Thus, we first established the testing situation with conditions where both animals were rewarded before testing the No-Reward condition (see Table S1 for the exact sequences). The asocial control was conducted for half of the dogs before and for half of the dogs after the social conditions. The assessment and the control sessions were either carried out before or after the test sessions in the same sequence (Table S1).

Data analysis. To analyze also the behavior of the partner in the various conditions, the following parameters were coded. We first coded the number of trials the dog gave the paw to the experimenter on command (defined as putting the paw on the experimenter's hand) to see whether the animal refused to cooperate differentially in the various conditions. Furthermore, we coded the number of times the experimenter had to prompt the dog to give the paw (defined as the number of times the experimenter said the command "paw" to the dog before the dog obeyed) to examine whether they showed differential cooperative behavior in the sense that to give the paw they had to be asked more often. In addition to this, we coded how often the subject looked at (defined as turning the nose toward the other dog) or initiated physical contact with the partner (defined as touching the partner with the nose; merely touching it because the subject moved around did not qualify) and how often the dogs turned their head completely around to gaze at the owner who was standing behind them. Finally, we coded behaviors indicative of stress, such as licking (moving the tongue out of the mouth and licking over the nose), scratching, vocalizing (barking, whining), leaving the place (moved away from the place it was sitting before within the range of the leash), and avoiding gaze (looking away and not directly at the experimenter when asked for the paw).

For each parameter we calculated the average number per trial to correct for shorter sessions because of refusal of the subject. All videos were analyzed by hand using Player (VirtualDub 1.5.10) by L. Horn.

Additional analysis to test for ordering effects. When testing statistically, whether animals differed in how fast they would refuse giving the paw or how often they needed to be prompted to give the paw dependent on the position when the condition was tested e.g., in the 1st, 2nd, 3rd, or 4th social session, no significant difference was found [Kruskal–Wallis Test: paw refusal: ET, df = 3, $P = 0.144$; QI, df = 3, $P = 0.375$; EC, df = 3, $P = 0.626$; RI (only 2nd, 3rd, or 4th position): df = 2, $P = 0.983$; paw prompts: ET, df = 3, $P = 0.152$; QI, df = 3, $P = 0.581$; EC, df = 3, $P = 0.530$; df = 2 RI (only 2nd, 3rd, or 4th position): df = 2, $P = 0.183$]. Furthermore, no statistical difference was found according to the relative positions of the equity and the reward inequity condition (Mann–Whitney U: refusal to give paw, $z = -0.244$, $P = 0.813$; paw prompts, $z = -0.458$, $P = 0.655$).

Experiment 2. ***Subjects.*** In this 2nd experiment, we tested additional 14 well-trained dogs that knew the command to give the paw. Only dogs older than 6 months were tested, and various breeds were included (Table S2).

Experimental setup. Experiments were carried out between August and September 8 in Vienna in the Clever Dog Laboratory. The experimental setup was identical to the 1st experiment.

Session tasks. Each of the 2 test sessions consisted of a series of 20 warmup trials (both subjects received the low-value reward for giving the paw on command) and 60 experimental trials, with trials alternating between the partner and the subject such that each individual received 40 trials per session (or until the subject refused to work), and the partner always performed immediately before the subject. A session was started by giving 1 piece of sausage to each animal to focus the attention of the animals on the task. The further procedure was identical to the 1st experiment. The order of the 2 sessions was randomized across subjects (Table S2).

Data analysis. The analysis was identical to the 1st experiment.

Table S1. Overview over the sex, breed, and sequence of sessions for each dog in experiment 1

	Sex	Breed	Session 1		Session 2		Session 3	
Ananasz	F	Labrador retriever	AC	NR	EC	QI	ET	RI
Benji	M	Border collie	EC	ET	RI	QI	AC	NR
Bonny	F	Border collie	EC	QI	ET	RI	AC	NR
Bounty	F	Australian shepherd	QI	EC	RI	ET	AC	NR
Borka	F	Labrador—mongrel	EC	ET	RI	QI	AC	NR
Csipzi	F	Dachshund	AC	NR	QI	EC	RI	ET
Daphne	F	Flat-coated retriever	QI	ET	RI	EC	AC	NR
Duke	M	Border collie	AC	NR	EC	RI	ET	QI
Finn	M	Australian shepherd	ET	RI	EC	QI	AC	NR
Guinness	F	Border collie	ET	QI	EC	RI	AC	NR
Happy	F	Border collie	AC	NR	QI	ET	RI	EC
Ikarus	F	Border collie	AC	NR	ET	QI	RI	EC
Ivy	F	Australian shepherd	QI	EC	RI	ET	AC	NR
Jamil	M	Mongrel	AC	NR	QI	ET	RI	EC
Jay	M	Border collie	ET	EC	QI	RI	AC	NR
Josie	F	American staffordshire terrier	ET	QI	EC	RI	AC	NR
Kisha	F	Rottweiler	QI	EC	RI	ET	AC	NR
Lindsy	F	Border collie	AC	NR	EC	RI	ET	QI
Lucky	M	Mongrel	AC	NR	QI	ET	RI	EC
Luke	M	Border collie	ET	QI	EC	RI	AC	NR
Maggi	F	Border collie	AC	NR	ET	RI	QI	EC
Maja	F	Golden retriever	QI	ET	RI	EC	AC	NR
Marty	M	Mongrel	AC	NR	ET	QI	EC	RI
Noa	M	Flat-coated retriever	EC	ET	QI	RI	AC	NR
Oscar	M	Mongrel	AC	NR	EC	QI	ET	RI
Quincy	M	Border collie	AC	NR	QI	ET	RI	EC
Rosie	F	Flat-coated retriever	ET	RI	EC	QI	AC	NR
Tili	F	Welsh terrier	AC	NR	ET	QI	EC	RI
Todor	M	Mongrel	QI	ET	RI	EC	AC	NR

AC, Assessment Condition; NR, No Reward control; ET, Equity Test; QI, Quality Inequity test; RI, Reward Inequity test; EC, Effort Control.

Table S2. Overview over the sex, breed and sequence of sessions for each dog in experiment 2

Dog	Sex	Breed	Session 1	Session 2
Allegro	M	Border collie	RI	SC
Amy	F	Border collie	SC	RI
Bertl	M	Australian shepherd	SC	RI
Brunhilde	F	Golden retriever	SC	RI
Feder	F	Border collie	SC	RI
Jana	F	Mixed	SC	RI
Jola	F	Border collie	RI	SC
Jolly	F	Jack Russell terrier	RI	SC
Lilly	F	Mixed	SC	RI
Lucy	F	Rottweiler	RI	SC
Monty	F	Border collie	RI	SC
Sam	M	Sheltie	SC	RI
Sidney	M	Border collie	RI	SC
Summer	F	Border collie	RI	SC

SC, Social Control condition; RI, Reward Inequity test.