Chimpanzees, bonobos and children successfully coordinate in conflict situations.

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Electronic Supplementary Material

Table 1. Subjects' information for studies 1a and 2.

Name	**Species and sex**	**Age (years)***	**Study 1a paired with (phase 1)**	**St. 1a paired with (phase 2)**	**Study 2 paired with (phase 1)**	**St. 2 paired with (phase 2))**	**St. 2 paired with (phase 2)**	**Participation in Sánchez-Amaro et al., (2016)**
Fimi	Bonobo/F	7	Yasa (mother)	Kuno	Yasa (mother)	Gemena	Kuno	No
Gemena	Bonobo/F	10	Luiza	Yasa	Kuno	Fimi	Yasa	No
Kuno	Bonobo/M	19	Lexi	Fimi	Gemena	Fimi	Yasa	No
Lexi	Bonobo/F	16	Kuno	Luiza	-	-	-	No
Luiza	Bonobo/F	10	Gemena	Lexi	-	-	-	No
Yasa	Bonobo/F	18	Fimi (daughter)	Gemena	Fimi (daughter)	Kuno	Gemena	No
Frodo	Chimpanzee /M	21	Lome	Riet	Bangolo	Taï	Sandra	Yes
Kara	Chimpanzee /F	9	Lobo	Sandra	Lome	Lobo	Kofi	Yes
Kofi	Chimpanzee /M	9	Natascha	Lobo	Lobo	Lome	Kara	Yes
Lobo	Chimpanzee /M	10	Kara	Kofi	Kofi	Kara	Bangolo	Yes
Lome	Chimpanzee /M	13	Frodo	Robert (father)	Kara	Kofi	Taï	Yes
Natascha	Chimpanzee /F	34	Kofi	Taï	-	-	-	No

Riet	Chimpanzee /F	37	Robert	Frodo	-	-	-	Yes
Robert	Chimpanzee /M	39	Riet	Lome (son)	-	-	-	Yes
Sandra	Chimpanzee /F	21	Taï (sister)	Kara	Taï (sister)	Bangolo	Frodo	Yes
Taï	Chimpanzee /F	12	Sandra (sister)	Natascha	Sandra (sister)	Frodo	Lome	Yes
Bangolo	Chimpanzee /M	6	-	-	Frodo	Sandra	Lobo	No

* ages of participants from the start of Study 1a except Bangolo who only participated in Study 2.

Study 1a: chimpanzees and bonobos

Details training phases

Phase 1: Individual training

Within each session subjects completed two trials in each condition from each side of the apparatus for a total of four SD trials and four COM trials, in a predetermined random order. Each subject performed two sessions on separate days. In this training, only one rope was attached to the blade at a time.

Phase 2 Dyadic training. Close-doors condition

In this training phase individuals experienced all four possible outcomes: obtain the high or the low reward by pulling (SD and COM conditions respectively); or obtain the high or the low reward by waiting (COM and SD conditions respectively). Subjects were trained in the pairs that they would be in during the first phase of the test sessions. Subjects were in adjacent rooms and the door between them was closed. A trial started after an experimenter checked that subjects were looking when the food was placed on the blade. If subjects were not looking they were called by the experimenter. After placing the rewards, the experimenters opened the windows. Each dyad had two sessions (on separate days) of eight trials each. Subjects experienced all possible combinations from both sides of the apparatus (swapping their position between sessions). As in the individual training, only one rope was attached to the blade during a trial.

Reliability codes

Inter-observer reliability measures Study 1a

The inter-observer reliability was excellent based on the 20% of the data (Time of pulling: Pearson's r = 0.99 for both species; 1.1 % of data mismatch between observers in bonobos and 2.5 % in chimpanzees).

Coding

Communication

We aimed to study the relationship between subjects' strategies and their communication during test trials. For this purpose, we coded vocal and gestural communication. Vocal communication was defined as any vocalization directed towards the partner or the partners' actions. As gestural communication we coded attentional getters directed to the partner.

Communication codes

Screams: loud, high-pitched sounds that apes directed towards the partner or the partners' actions.

Whimpers: low, feeble sounds expressing fear (moans) directed towards the partner or the partners' actions.

Claps: sounds resulting of the repeated strike of individuals' hand palms.

Degree of flexibility

We investigated whether apes changed their behavioural strategies between partners. To do that, we compared the subject's frequencies of pulls per condition with each partner.

Results

Model analyses

Linear mixed models (LMM) and generalized linear mixed models (GLMM) [1] and were run using R statistics (3.1.1) and lme4 package [2]. To obtain the P values for the individual fixed effects we conducted likelihood-ratio tests [3]. For every model we assessed model stability by comparing the estimates derived by a model based on all data with those obtained from models with the levels of the random effects excluded one at a time. All models were stable. Moreover, to rule out collinearity we checked variance inflation factors (VIF) [4]. All VIF values were closer to 1. Missing *p-values* are not indicated because of having a very limited interpretation.

Model 1. Waiting time before pulling (LMM)

Model 1 investigated how long the first individual waited to pull. In this model we included the trials were at least one subject pulled one rope (N = 1019). The response was the time (in seconds) that a subject

waited before start pulling. We expected subjects to maximize their rewards by waiting longer to pull in SD condition and pull faster in the COM condition. We also expected them to wait longer to pull in SD condition across trials and or sessions. We included phase as a test predictor to see whether subjects would wait more in phase 2 due to their previous experience in the task (during phase 1). The full model included the test variables condition, session, trial, phase and species as well as the interactions condition and session, and condition and trial. The control variables were sex of the dyad as fixed effect; subject on the right, subject on the left and dyad as random effects and the random slopes. The comparison between the full and the null model was significant (LMM: χ^2_7= 16.588, P = 0.02, N = 1019). We dropped the two non-significant two-way interactions condition*session (LMM, χ^2_1 = 1.135, P = 0.29, N= 1019), and condition and trial (LMM, χ^2_1 = 1.452, P = 0.23, N= 1019). We found a main effect of condition and trial (see Table Model 1 and Figure 1). Chimpanzees and bonobos waited less across trials within sessions.

Table Model 1

Term	Estimate	Standard Error	Chi-square	Degrees of freedom	p-value	CI (95%) of the reduced model
Intercept	0.355	0.125	-	-	-	0.029/0.697
Phase	0.01	0.07	0.02	1	0.886	-0.184/0.212
Sex of dyad	-	-	4.37	2	0.112	-
Session	0.02	0.028	0.477	1	0.489	-0.59/0.0987
Trial	-0.039	0.016	4.866	1	0.027	-0.082/0.007
Species	0.037	0.158	0.055	1	0.815	-0.386/0.488
Condition	0.266	0.077	9.181	1	**0.002**	0.057/0.483

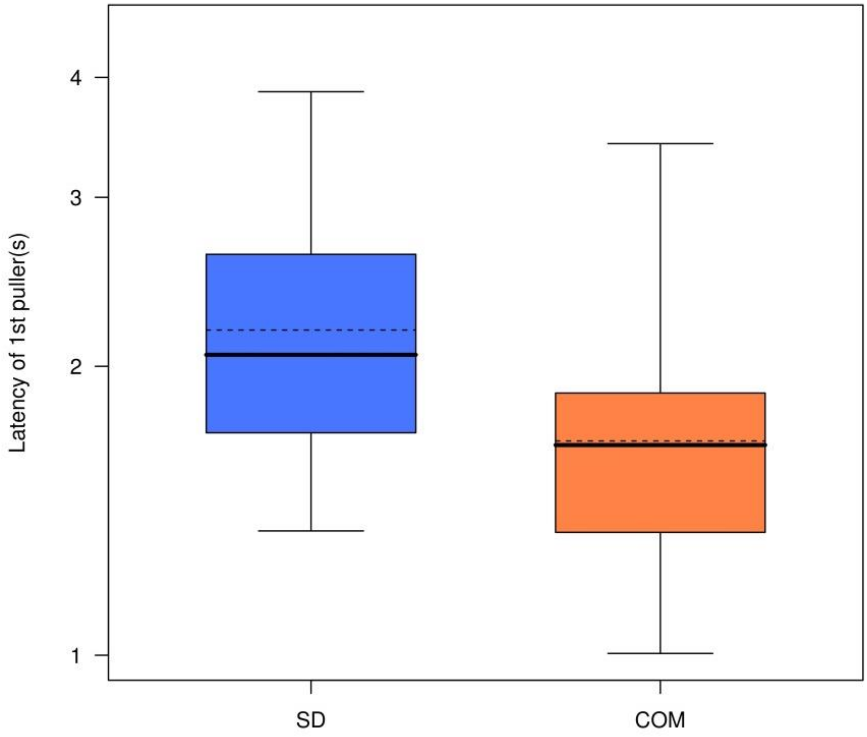


Figure 1. Latency of the 1st puller to pull the rope in SD and COM trials. The dotted lines represent the fitted model. Latencies in seconds are presented in a logarithmic scale.

Percentages of success

Table 2. Percentage of times in which each subject obtained 4 rewards.

Subject	Species	Sex	% of trials in which a subject obtains 4 rewards in total (COM/SD)
Lobo	Chimpanzee	Male	65 (75/55)
Gemena	Bonobo	Female	59 (29/89)
Lome	Chimpanzee	Male	54 (87.5/20)
Riet	Chimpanzee	Female	54 (16/92)
Kara	Chimpanzee	Female	52 (62.5/41)
Lexi	Bonobo	Female	52 (51.5/51.5)
Sandra	Chimpanzee	Female	52 (34/69)
Fimi	Bonobo	Female	50 (51/49)
Natasha	Chimpanzee	Female	49 6 (95/3)
Kuno	Chimpanzee	Male	49 (13/85)
Frodo	Chimpanzee	Male	48 (61/34)
Tai	Chimpanzee	Female	46 (25/67)
Luisa	Bonobo	Female	46 (83/10)
Robert	Chimpanzee	Male	42 (36/48)
Yasa	Bonobo	Female	40 (66/14)
Kofi	Chimpanzee	Male	34 (5/64)

Model 2. Distribution of conflict trials (GLMM)

Model 2 investigated the predictors of conflict trial occurrences (trials in which both subjects pulled). In this model we included all trials except the first trials of each session (N = 895). We transformed our response into a binomial response where 1 meant that both subjects pulled and 0 meant that only one subject pulled. We expected that previous conflict trials would decrease the likelihood of a subsequent conflict trial. We also expected more conflict trials in the COM condition compared to the SD condition. Finally, we also expected that conflict trials would decrease across trials, session and phase. The full model included the test variables condition, trial, session, phase, previous conflict trial and species. The control variables were sex of the dyad as fixed effect; subject on the right, subject on the left and dyad as random effects and the random slopes. The comparison between the full and the null model was marginally significant (GLMM: χ^2_6 = 11.49, P = 0.074, N = 895). Therefore, due to the observed trend, we inspected how the test variables contributed to the response although we did not calculate the CI for the estimates. We found that condition was significant suggesting that there were more conflict trials in the COM condition (see Table Model 2).

Table Model 2

Term	Estimate	Standard Error	Chi-square	Degrees of freedom	p-value
Intercept	-1.437	0.704	-	-	-
Phase	-0.187	0.385	-0.062	1	1
Sex of dyad	-	-	5.286	2	0.071
Session	-0.429	0.341	1.452	1	0.228
Trial	-0.131	0.166	0.461	1	0.497
Condition	-2.186	0.857	6.607	1	**0.01**
Prev. Conf. Trial	-0.654	0.409	1.636	1	0.2
Species	0.553	0.88	0.126	1	0.723

Degree of flexibility

Subject's behavior was not constant and they changed their strategy when paired with different partners (Figure 2).

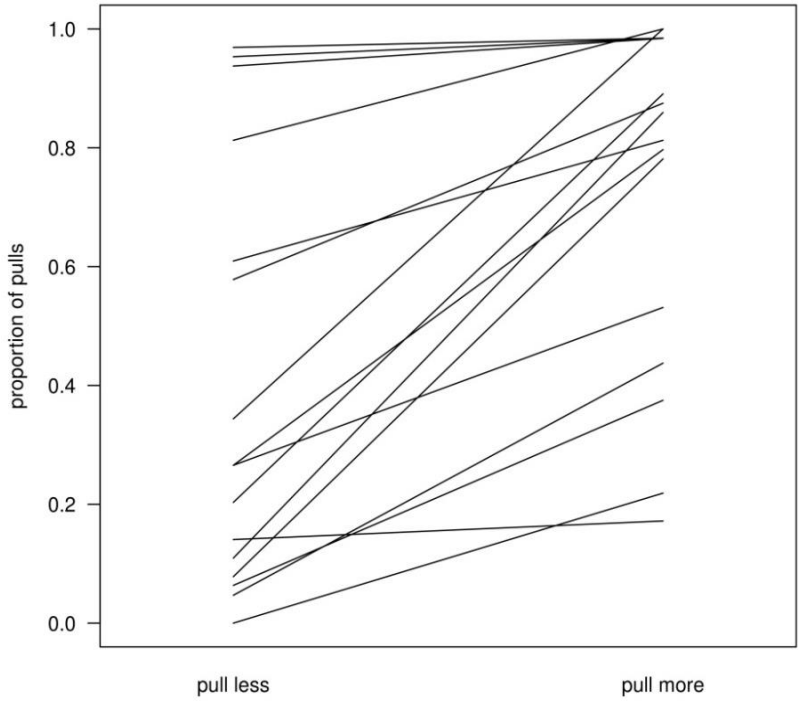


Figure 2. Graph showing the proportion of trials pulled when paired with each of the two partners. Each line end represents the proportion of pulls by a subject when paired with the partner with whom the subject pulled less (left side) and with whom the subject pulled more (right side), if pulling rate had been equal across partners we would have expected to see flat lines for each subject.

Study 1b: children

Differences between Study 1a and Study 1b

The wooden box was placed on the ground between both children. Access to the ropes was blocked by two sliding doors. Only Experimenter 1 could open them to allow access at the start of the trial.

In contrast to Study 1a, the rewards were not collected from the rotating blade but fell through a hole to the ground, in front of each child. This change was due to security reasons (i.e., to prevent children to catch their fingers with the rotating blade)

Finally, in the children´s version of the apparatus we added a small peg under the rotating blade to prevent it spinning 360°. This change was due to security reasons.

The marbles used as rewards in the test sessions were four different colours (red, yellow, green and blue) to keep the children motivated to collect more. Each colour was presented twice per session, once per condition.

Design and procedure

Differences between Study 1a and Study 1b

Apes could consume their rewards immediately after retrieving them (and they did so in 100% of trials) whereas children collected their rewards. Thus, they could always monitor their own and their partner's quantities.

In study 1b we did not conduct individual training in order to reduce the testing time per dyad. However, during the first half of the dyadic training session we emphasized the rewards distribution with the aim of highlighting all possible outcomes that children could encounter during the test.

Dyadic training

The dyadic training was essentially the same as in Study 1a except that children only performed one session of eight trials. Therefore, children swapped sides halfway through the session (between trials four and five). During the training children collected rewards (wooden blocks) they could insert into a blink box that produced music.

Prior to the dyadic session, Experimenter 2 (E2) explained to the children that they would play a game that consisted of collecting "jewels" (the marbles) from a magic box (E2 told the children specifically that they were "diamond collectors"). E2 told this information to the children before they entered in the test room.

E2 entered the test room with the children and showed them the apparatus and introduced them to Experimenter 1 (E1). Each child took their position in front of the openings on the sides of the box. E2 sat between the children, on the other side of the apparatus from E1. Before E1 operated the apparatus,

E2 told the children that, in order to collect the “jewels”, they were first required to remove the “stones” (wooden blocks) and put them in a blink box.

E1 baited the apparatus in full view of the children. E1 always baited first the interior side of the apparatus. E2 told the first child to pull from the accessible rope. E2 then told the children to insert the wooden blocks into the blink box. During the training and the test sessions, Experimenter 1 relocated the ropes and baited the rewards between every trial. In the second trial E2 told the other child to pull and to insert the wooden blocks into the blink box. To facilitate the insertion of the wooden blocks into the blink box and avoid sharing, at the end of each trial E2 pointed the opening of the blink box towards each child. E1 only instructed the children to swap sides between trials four and five of the training and the test sessions.

After this two trials, two more explanatory trials were repeated before children swapped sides between trials 4 and 5 of the training session. In the last 4 trials of the session, children performed the same actions but E2 did not instruct them.

Details of the test sessions

After the dyadic training, E2 presented the children with Plexiglas tubes. He told them that now they were going to collect “jewels” and instructed them to collect as many as possible and to put them inside their own tube. After the instructions, E2 presented the apparatus again (which was already baited with the first set of marbles) and left the test room. At the end of session 1 they were told to write their names on the tubes and to leave the tubes in the room for the next day.

In the second test day and prior to session 2, E2 briefly instructed the children again to collect “jewels” and give them their Plexiglas tubes. Between sessions 2 and 3, the children left the test room and waited for approximately 7 minutes with E2 while E1 reset the apparatus before children entered the test room again.

At the end of the third session, every child chose 4 marbles to take home.

Communication coding details

For every trial, we coded whether dyads communicated (by either one or both children). In every trial, we gave a measure of 1 or 0 if communication occurred or not. In addition, we coded whether each of the five categories of communication (*imperative*, *protests*, *informative*, *turn-taking* and *deception*) was present within a dyad (uttered by either one or both children).

Reliability codes

The inter-observer agreement for the timing of decisions based on the 20% of the data was excellent (pulling actions from child on the left side: Pearson’s r = 0.93, 1.5 % of data mismatches between

observers; pulling actions from child on the right side: Pearson's r = 0.99, 4% of data mismatches between observers).

The inter-observer reliability for communication based on the 20% of the data was also excellent (Cohen's Kappa = 0.94).

Results

Model 3. Waiting time before pulling (LMM)

Model 3 investigated how long the first child waited to pull. We only included the trials in which at least one subject pulled the rope (N = 478). The response was the time (in seconds) that a subject waited before starting to pull after the onset of the trial. We also expected that they would wait longer to pull in SD condition across trials and or sessions. The full model included the test variables condition, session, trial as well as the interactions condition and session, and condition and trial. The control variables were sex of the dyad as fixed effect; subject on the right, subject on the left and dyad as random effects and the random slopes. The comparison between the full and the null model was significant (LMM: χ^2_5 = 18.117, P = 0.002, N = 478). We dropped the non-significant two-way interaction condition and trial (LMM, χ^2_1 = 0.019, P = 0.89, N= 478). We found a significant two-way interaction between condition and session suggesting that children got slightly slower across sessions in the SD condition and slightly faster in the COM conditional (see Table 3). We also found a significant effect of trial; they tended to wait slightly less by the end of the sessions (see Table Model 3).

Table Model 3

Term	Estimate	Standard Error	Chi-square	Degrees of freedom	p-value	CI (95%) of the reduced model
Intercept	0.347	0.052	-	-	-	0.214/0.498
Sex of dyad	-	-	0.523	1	0.469	-0.27/0.152
Trial	-0.037	0.018	3.905	1	0.048	-0.083/0.011
Condition *session	0.105	0.046	4.913	1	**0.027**	-0.023/0.223

Comparison between children-apes strategies

The most strategic individuals were children. This is evident from Figure 3, which shows the proportion of strategic choices in COM and SD trials. The upper right quadrant (above 50% strategic choices in both conditions) is clearly dominated by children. However, it is important to note that due to the reduced statistical power of the children's data (children performed three sessions while great apes did sixteen)

not all individuals in this quadrant performed significantly above chance, even though they made strategic choices more often than the apes categorized as “strategisers”.

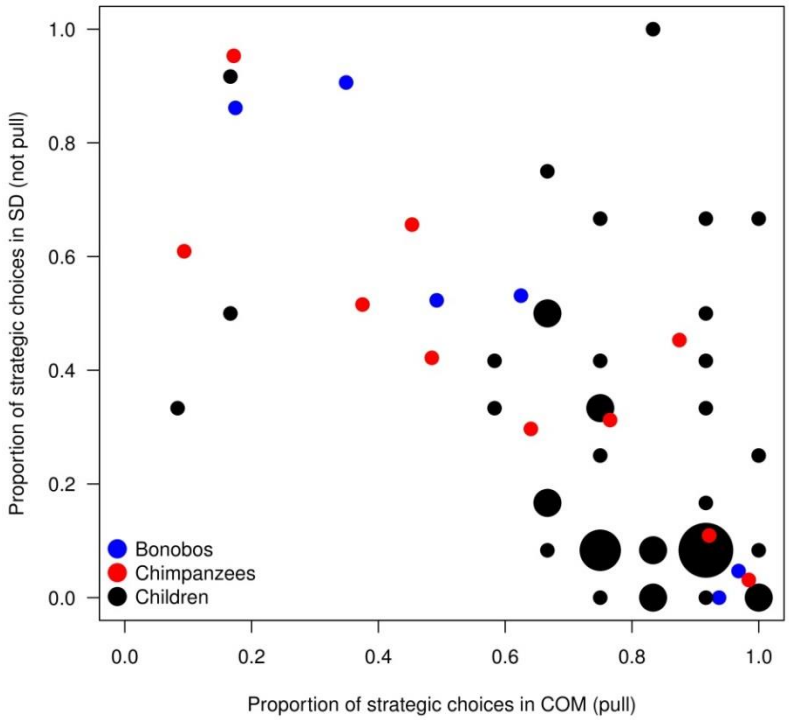


Figure 3. Proportion of strategic choices in both SD and COM trials for all subjects of the three species. The most strategic individuals in both conditions are in the top-right corner of the plot. The size of the dots represents frequencies of subjects for different scores.

Model 4. Distribution of conflict trials (GLMM)

Model 4 investigated what predicted the appearance of a conflict trial. In this model we included all trials except the first trial of each session (N = 420). We transformed our response into a binomial response where 1 meant that both children pulled and 0 meant that only one child pulled. We expected that previous conflict trials would decrease the likelihood of a subsequent conflict trial. We also expected more conflict trials in the COM condition compared to the SD condition. Finally, we also expected that conflict trials could decrease across trials and sessions. The full model included the test variables condition, trial, session and previous conflict trial. The control variables were sex of the dyad as fixed effect; subject on the right, subject on the left and dyad as random effects and the random slopes. The comparison between the full and the null model was non-significant (GLMM: χ^2_4 = 5.305, P = 0.257, N = 420).

Model 5. Communication (GLMM)

Model 5 investigated the occurrence of communication. In this model we included all trials (N = 480). We transformed our response into a binomial response where 1 meant the presence of any communicative act within the members of the dyad in a given trial and 0 meant no presence of communicative acts within the members of the dyad in a given trial. We expected children to communicate more in the SD condition. We also expected children to communicate more across trials or sessions. The full model included the test variables condition, trial and session. The control variables were sex of the dyad as fixed effect; subject on the right, subject on the left and dyad as random effects and the random slopes. The comparison between the full and the null model was significant (GLMM: χ^2_3 = 8.165, P = 0.043, N = 480). We found a significant effect of condition suggesting that children communicated more during SD trials (see Table Model 5 and Figure 4).

Table Model 5

Term	Estimate	Standard Error	Chi-square	Degrees of freedom	p-value	CI (95%) of the reduced model
Intercept	-2.276	0.769	-	-	-	-5.617/-0.138
Sex of dyad	-1.805	1.186	2.232	1	0.135	-5.741/1.506
Trial	0.079	0.150	0.253	1	0.615	-0.359/0.557
Condition	1.087	0.444	4.719	1	**0.03**	-0.219/2.464
Session	0.447	0.228	3.093	1	0.079	-0.274/1.21

<u>Communication types</u>

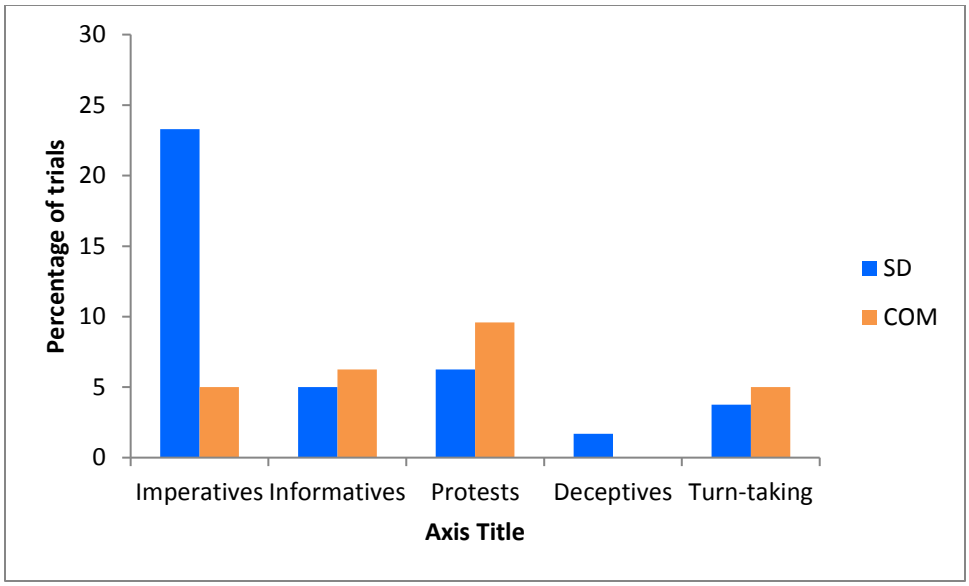


Figure 4. Percentage of trials in which every type of vocal communication occurred at least once within a trial.

<u>Study 2: chimpanzees and bonobos</u>

<u>Details of the materials</u>

A pin was inserted in the door to prevent subjects from sliding it open before the start of the trial. The experimenter could remove the pin before the trial started.

<u>Training phases</u>

Prior to the test phase all subjects completed four training phases.

Phase 1: Individual training 1

This training phase served to show the subjects how to access the rewards.

Subjects were required to access the baited option and retrieve the reward. Within a session a subject faced eight trials presented in a randomised order: four trials in which only the rope end was baited and four trials in which only the alternative platform was baited with one piece of food (Figure 5, phase 1). The presentation side was counterbalanced between sessions.

Subjects had to choose correctly in at least 80% of the trials during two consecutive sessions to continue with the next phase. We used the same criteria for the rest of training phases.

Phase 2: Individual training 2

This training served to demonstrate that subjects could either get a high or a low reward that could be placed on either the blade or the alternative platform.

Subjects were required to choose the option with more food and then retrieve the reward. Within a session a subject faced eight trials in a randomised order: four trials in which the rope end of the blade was baited with five pieces of food and the alternative platform with one, and four trials in which the alternative platform contained five pieces while the ropes' end was baited with one (Figure 5, phase 2). Subjects experienced all possible combinations from both sides of the apparatus (swapping their positions between sessions).

Phase 3: Individual training 3. Open doors condition

The purpose of this training phase was to ensure that the apes took into account all the quantities involved in a given trial. In this training phase the door that separated both sides of the apparatus was open to allow subjects access to both sides of the apparatus.

Within a session we presented the subjects with two conditions, the ropes and the alternative condition (Figure 5, phase 3). Each subject was presented four trials of each condition in a randomised order. In the alternative condition both ends of the blade were baited with one reward each and the alternative platform with four. In the ropes condition each end of the blade as well as the platform were baited with two rewards. Thus, in the alternative condition a subject had to choose the alternative platform while in the ropes condition a subject had to forego the food present on the alternative platform (which was closer) and access the ropes, obtain the two rewards from the ropes' end and move to the other side of the room to retrieve the other two rewards from the free end. Subjects experienced all possible combinations from both sides of the apparatus (swapping their positions between sessions despite the doors were open).

The baiting order differed between conditions. In the non-social condition we first baited the rewards on the alternative platform and then in the blade, always starting from the rope's end. We always baited the blade after the alternative platform to draw subjects' attention to it and to be sure that they paid attention to all the rewards.

In the social condition we first baited the platform on half of the trials and first the blade on the other half. We did this to control for possible attentional biases towards the last baited place.

Phase 4 Dyadic training. Close-doors condition

This training was the same as the dyadic training we conducted in Study 1a (phase 2).

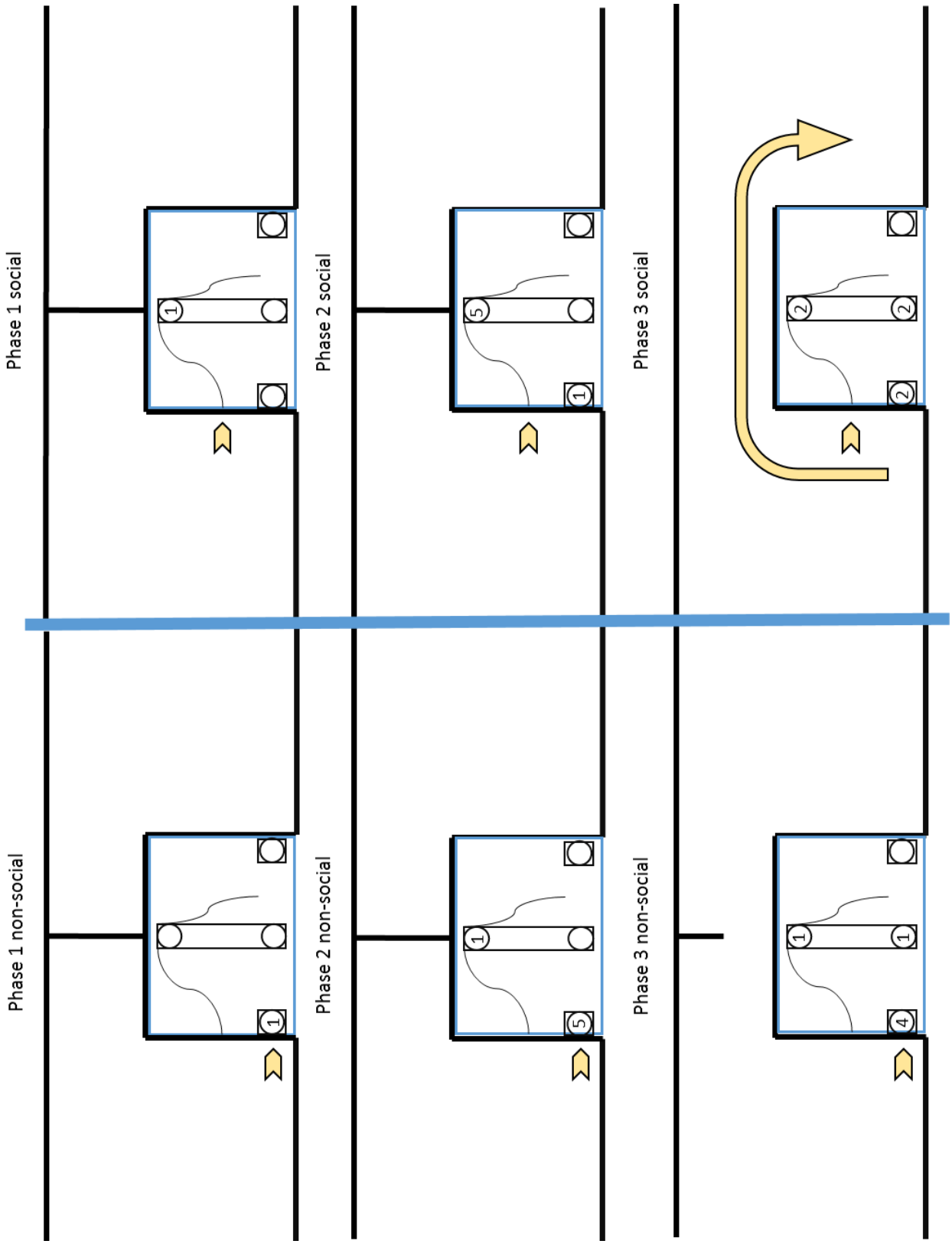


Figure 5. Training phases.

Reliability coding

The inter-observer agreement for the timing of decisions by chimpanzees, based on the 20% of the data, was excellent (time to access the non-social option: Pearson's r = 0.98, 0.8% of data mismatches between observers; time to access the social option: Pearson's r = 0.98, 1.4% of data mismatches between observers; time to access the ropes: Pearson's r = 0.99, 3% of data mismatches between observers) and for bonobos (time to access the non-social option: Pearson's r = 0.96, 1.3% of data mismatches between observers; time to access the social option: Pearson's r = 0.97, 1.2% of data mismatches between observers; time to access the ropes: Pearson's r = 0.95, 3.5% of data mismatches between observers).

Results

Model 6. Choices (GLMM)

Model 6 investigated whether apes adjusted their choices according to the number of food rewards in the social and the non-social options. In this model we included all trials in which a subject accessed either the social or the non-social option and we removed the trials where they did not access any option (in total: N = 2218). We transformed our response into a binomial response where 1 meant that the subject chose the social option and 0 meant that the subject chose the non-social option. We expected apes to choose the social option more often when there was food only present in the tray and the non-social option, more often that when there were five items present in the alternative platform. We also expected that they will switch from the social to the non-social option more abruptly in the SD condition compared to the COM condition. We also investigated whether species differed in their choices. The full model included the test variables social condition, level of non-social condition and species as well as the three-way interaction between social condition, non-social condition and species. The control variables were sex of the dyad, session, trial and phase as fixed effects; subject, partner, dyad and trial id effects and the random slopes. The comparison between the full and the null model was significant (GLMM: χ^2_7 =74.184, P <0.001, N = 2218). We dropped the non-significant three-way interaction between social condition, non-social condition and species (GLMM, χ^2_1 = 1.029, P = 0.31, N= 2218). We found a significant two-way interaction between social condition and non-social condition (see Table Model 6).

Table Model 6

Term	Estimate	Standard Error	Chi-square	Degrees of freedom	p-value	CI (95%) of the reduced model
Intercept	0.238	0.847	-	-	-	-2.165/2.828
Sex	-	-	2.143	2	0.342	-
Trial	0.181	0.078	5.418	1	0.019	-0.046/0.409
Session	-0.202	0.107	3.256	1	0.071	-0.519/0.103
Phase	-0.367	0.191	3.347	1	0.067	-0.914/0.188
Species	-0.971	1.031	0.85	1	0.356	-3.814/2.086
Social condition*non-social condition	1.213	0.346	9.572	1	**0.002**	0.284/2.258

Model 7. Latencies to open the door (LMM)

Model 7 investigated the length of time from the start of the trial (when the experimenters released the security pegs) until the moment the subjects open the door to access either the social or the non-social option. In this model we included the trials in which an opening action occurred (N = 2216). The response was the time (in seconds) that a subject took to open one of the doors. We expected subjects to open the door faster in COM trials compared to SD trials and we also expected a decrease in their latencies in relation to an increase in the number of items presented in the non-social option. Moreover, we expected the decrease in latency to follow a quadratic shape. In other words, we expected a larger decrease in latency between levels 0 and 1 of the non-social option compared to a decrease between the subsequent levels. For this reason, we included a squared term for the non-social. We also investigated whether chimpanzees and bonobos would differ in their latencies to open the door. The full model included the test variables social condition, level of non-social condition and species as well as the three-way interaction between social condition, non-social condition, and species. The control variables were sex of the dyad, session, trial, phase and choices as fixed effects; subject, partner, dyad and trial id as random effects and the random slopes. The comparison between the full and the null model was significant (GLMM: χ^2_{12} = 52.856, P <0.001, N = 2216). We dropped the non-significant three-way interaction between social condition, non-social condition and species (GLMM, χ^2_1 = 1.31, P = 0.31, N= 2216). We found a significant two-way interaction between social condition and non-social condition and also a main effect of species; overall, chimpanzees opened the door faster than bonobos (see Table Model 7 and Figures 6 and 7).

Table Model 7

Term	Estimate	Standard Error	Chi-square	Degrees of freedom	p-value	CI (95%) of the reduced model
Intercept	0.368	0.137	-	-	-	-0.004/0.717
Sex	-	-	6.711	2	0.0348	-
Trial	-0.027	0.035	0.6	1	0.438	-0.12/0.069
Session	-0.032	0.043	0.546	1	0.459	-0.144/0.09
Phase	-0.094	0.037	4.884	1	0.027	-0.203/0.008
Species	-0.567	0.171	8.06	1	**0.004**	-1.061/-0.099
Choice	-0.637	0.134	14.47	1	0.0001	-1.029/-0.264
Squared non-social condition	0.148	0.034	11.697	1	0.0006	-0.053/0.243
Social condition*non-social condition	0.156	0.051	6.62	1	**0.01**	-0.007/0.295

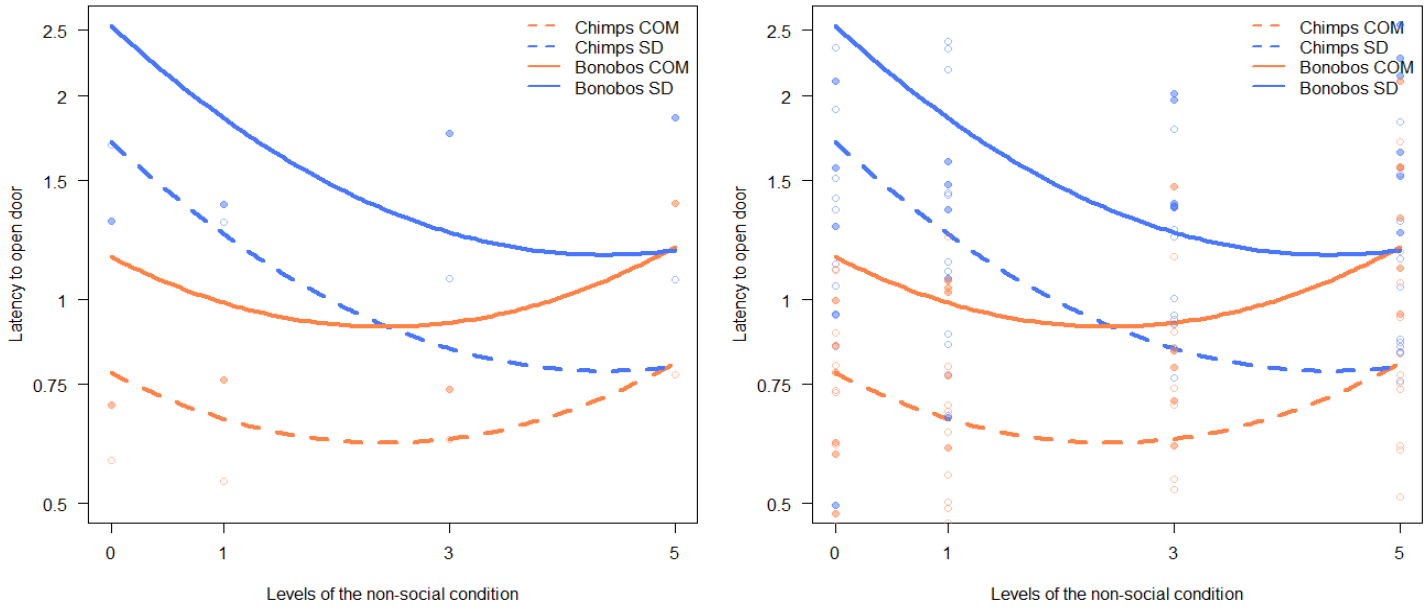
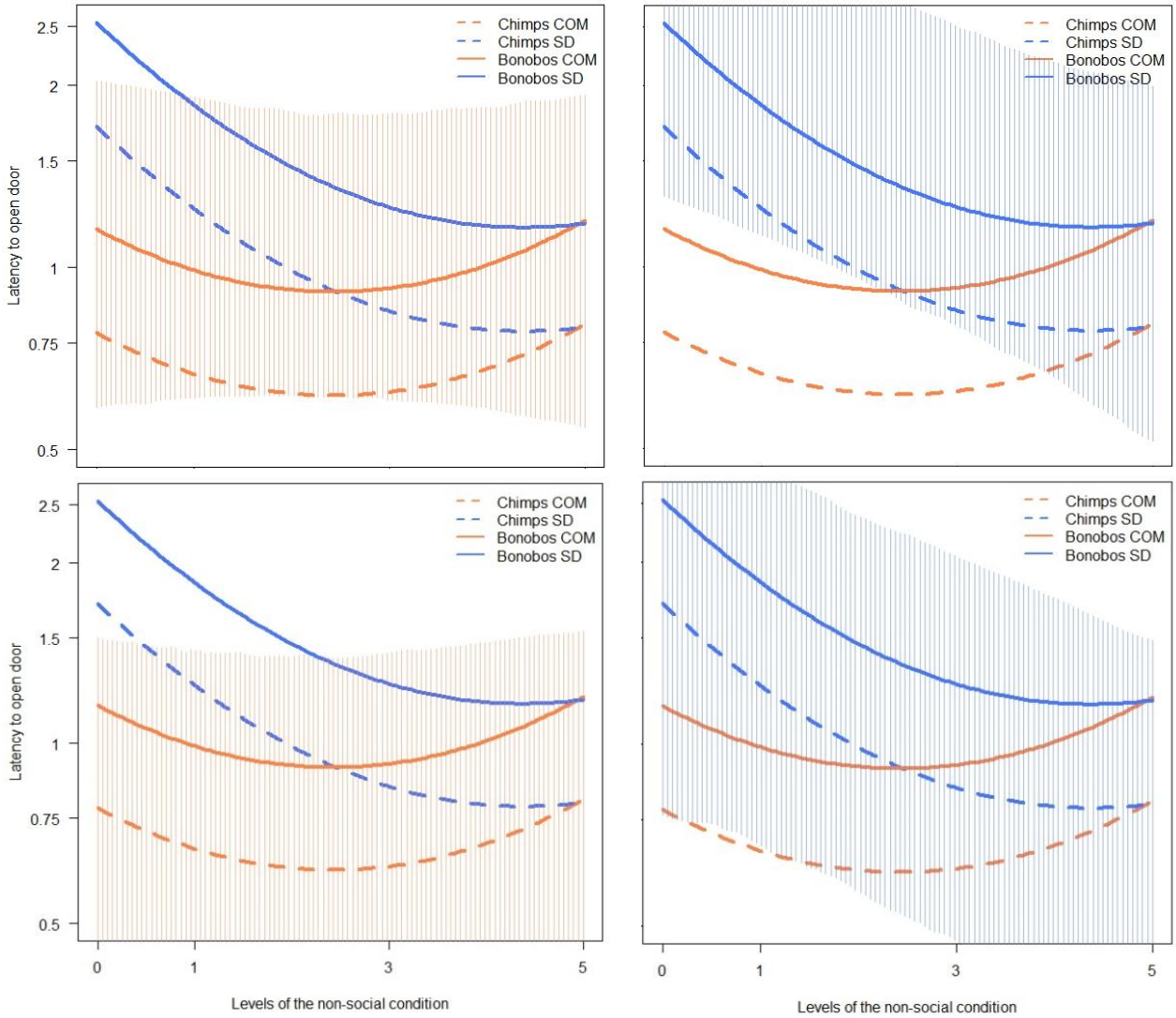


Figure 6. Latency of chimpanzees and bonobos to open the door as a function of the number of food pieces in the non-social option and the social option (SD and COM trials) with the mean values for every



combination of social and non-social options (left side). The second plot (right side) depicts the mean values per dyad. For both plots the filled dots represent COM trials and empty dots represent SD trials.

Figure 7. Latency of chimpanzees and bonobos to open the door as a function of the number of food pieces in the non-social option and the social option (SD and COM trials).Each figure depicts a CI. Top left Bonobos COM, top right Bonobos SD, bottom left Chimps COM, bottom right Chimps SD. Latencies in seconds are presented in a logarithmic scale.

<u>Model 8. Latencies to pull the ropes (LMM)</u>

Model 8 investigated the length of time from the moment a subject opens the door to the social option only until they start pulling on the rope. In this model we included the trials in which pulling occurred (N

= 773). The response was the time (in seconds) that a subject took to pull the rope. We expected subjects to pull faster in COM trials compared to SD trials. We also wanted to investigate whether the presence of food in the non-social option (although not available anymore for the subject) had an effect on the latency to pull the rope. We also investigated whether chimpanzees and bonobos would differ in their latencies to pull. The full model included the test variables social condition, level of non-social condition and species as well as the three-way interaction between social condition, non-social condition and species. The control variables were sex of the dyad, session, trial and phase; subject, partner, dyad and trial id as random effects and the random slopes. The comparison between the full and the null model was significant (LMM: χ^2_8 = 31.236, P <0.001, N = 773). We found a significant three-way interaction between social condition, non-social condition and species (see Table Model 8 and Figures 8 and 9). In this model we had to make a correction *a posteriori*. We removed three outliers we did not detect in an earlier analysis. The three way interaction and the full-null model comparison remained significant after the correction.

Table Model 8

Term	Estimate	Standard Error	Chi-square	Degrees of freedom	p-value	CI (95%) of the reduced model
Intercept	0.848	0.067	-	-	-	0.663/1.044
Sex	-	-	0.896	2	0.638	-
Trial	-0.048	0.024	3.448	1	0.063	-0.116/0.014
Session	0.055	0.046	1.363	1	0.243	-0.069/0.181
Phase	-0.025	0.042	0.342	1	0.558	-0.145/0.084
Social condition*non-social condition*species	0.152		3.888	1	**0.048**	-0.044/0.37

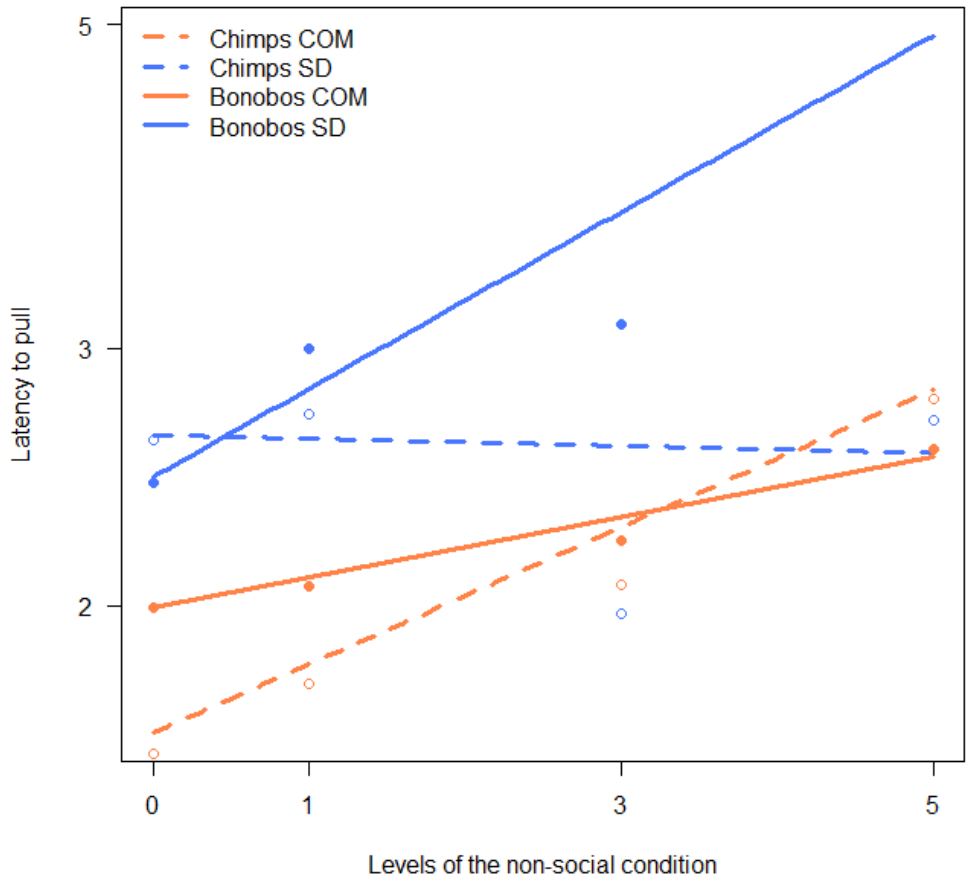


Figure 8. Latency of chimpanzees and bonobos to pull the rope as a function of the levels in the non-social option and the social option (SD and COM trials) with the mean values for every combination of social and non-social options.

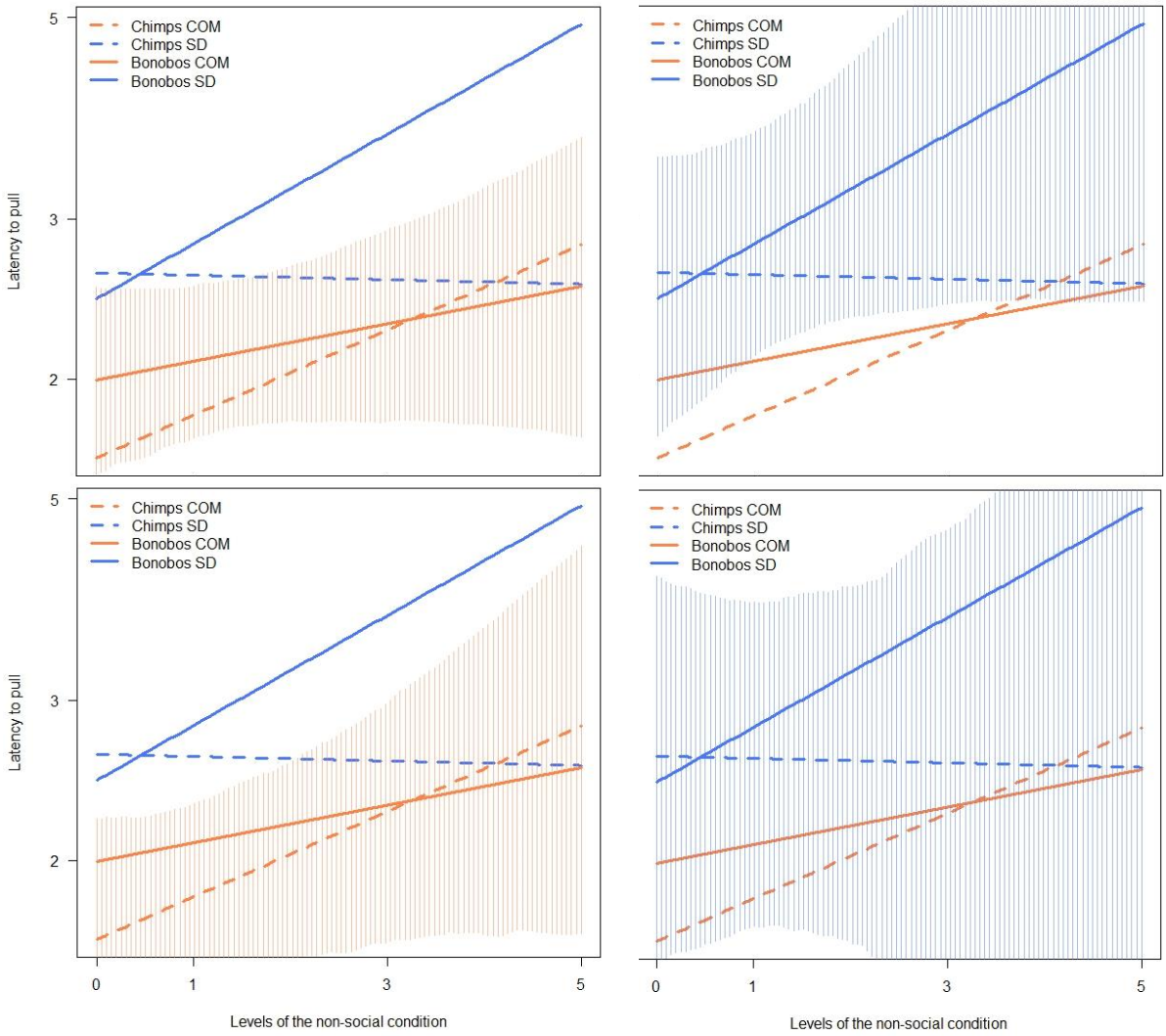


Figure 9. Latency of chimpanzees and bonobos to pull the rope as a function of the levels in the non-social option and the social option (SD and COM trials). Each figure depicts a CI. Top left Bonobos COM, top right Bonobos SD, bottom left Chimps COM, bottom right Chimps SD. Latencies in seconds are presented in a logarithmic scale.

<u>Model 9. Strategic choices of 2nd actors based on 1st actors actions</u>

Model 9 investigated whether 2nd actors would make strategic choices based on the previous choices of the 1st actors. In this model we included the trials where both the 1st and 2nd actors opened the sliding door (N = 925). We removed the trials in which both members opened their doors at the same time. To investigate the 2nd actors' strategic choices, we created a binomial variable establishing whether the

choice of the 2nd actor was strategic or not based on the 1st actor decision for every combination of social and nonsocial conditions (see details Table 1 in the main manuscript). We used this variable as the response variable in our model. We expected that both social and nonsocial conditions would influence in the 2nd actors decisions. Moreover, we conducted pair-wise comparisons to analyze whether 2nd actors made strategic choices contingent upon the 1st actor's decision for each combination of social and non-social conditions (8 levels in total). The full model included the test variables social condition and non-social condition as well as the two-way interaction between them. The control variables were the sex of the first puller, the sex of the second puller, session, trial, phase and species as fixed effects; first actor, second actor and dyad as random effects and the random slopes. The comparison between the full and the null model was significant (GLMM: χ^2_7 = 43.413, P <0.001, N = 925). We found a significant two-way interaction between social condition, and non-social condition (see Table Model 9). The pair-wise comparisons revealed that 2nd actors were making strategic choices in 4 of 8 combinations: : Non-social option 0-SD: p = 0.008; Non-social option 0-COM: p = 0.003; Non-social option 1-SD: p = 0.967; Non-social option 1-COM: p = 0.257; Non-social option 3-SD: p = 0.224; Non-social option 3-COM: p = 0.182; Non-social option 5-SD: p = 0.002; Non-social option 5-COM: p =0.02 (see Figure 10).

Table Model 9

Term	Estimate	Standard Error	Chi-square	Degrees of freedom	p-value	CI (95%) of the reduced model
Intercept (level 5 non-social, COM condition)	2.563	0.733	-	-	-	0.531/22.301
Level 0	2.842	1.266	-	-	-	-0.811/22.118
Level 1	-0.278	0.885	-	-	-	-18.633/2.596
Level 3	-2.416	0.881	-	-	-	-20.995/-0.126
Condition SD	2.567	1.263	-	-	-	-1.328/21.362
Phase	0.031	0.198	0.025	1	0.875	-0.548/0.696
Session	-0.015	0.156	0.009	1	0.926	-0.548/0.499
Trial	0.047	0.127	0.14	1	0.708	-0.0367/0.444
Species	0.332	0.484	0.446	1	0.504	-1.107/1.902
Social condition*non-social condition	-	-	18.54	3	**<0.001**	-

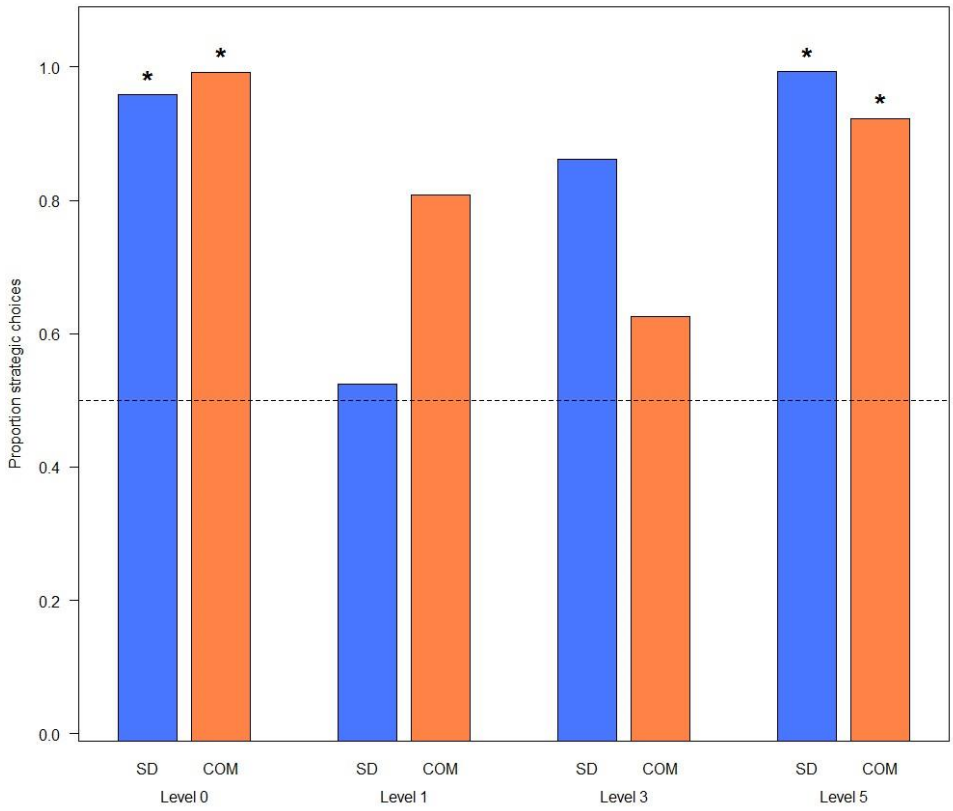


Figure 10. Proportion of strategic choices of 2nd actors across the 8 combinations of social and non-social options. Data from chimpanzees and bonobos in study 2.

Model 10. Second actors' choices based on 1st actors' choices.

Model 10 investigated whether 2nd actors' decisions were influenced by the previous choices of the 1st actors. In this model we only considered the combinations of social and non-social conditions in which 1st actors showed variability in their decisions (*N* = 396. Those combinations were social condition SD and non-social level 1; social condition COM and non-social level 3 and social condition COM and non-social level 5. As in Model 9, we removed the trials in which both members opened their doors at the same time. The response variable of the model was the 2nd actors' decision (social or non-social). The full model included the interaction between the test variables condition (the combinations mentioned above) and 1st puller decision (social or non-social). The control variables were the sex of the dyad, session, trial, phase and species as fixed effects; first actor, second actor and dyad as random effects and the random slopes. The comparison between the full and the null model was significant (GLMM: χ^2_3 = 12.58, P = 0.006, N = 396) and there was also a significant interaction between the 1st actor's choice and condition (GLMM: χ^2_2 = 12.52, P = 0.002, N = 396). Inspection of model results and results of additional models fitted after re-levelling condition, revealed that the probability of 2nd actors to choose the social option increased when 1st actors chose social in SD-level 1 (P = 0.02) but the choice was not significantly affected in the other two conditions (COM-level 3: P = 0.22; COM-level 5: P = 0.4). See Table 10 for information about the model and Table 11 for differences between conditions in 2nd actors choices.

542 Table Model 10

Term	Estimate	Standard Error	Chi-square	Degrees of freedom	p-value
Intercept (level 3 non-social, COM condition)	0.607	0.98	-	-	-
Sex male	0.63	0.77	3.19	2	0.2*
Sex mix	-0.51	0.49	3.19		0.2
Trial	0.27	0.15	3.06	1	0.08
Session	-0.62	0.2	6.39	1	0.01
Phase 2	-0.08	0.38	1.82	2	0.4*
Phase 3	-0.56	0.41	1.82	2	0.4
Species (chimpanzees)	-0.03	0.89	0.001	1	0.97
1st actor choice (social)	-1.03	0.83	-	-	-
Condition (COM 5)	-1.66	0.83	-	-	-
Condition (SD 1)	-1.67	0.72	-	-	-
1st actor choice * COM-level 5	-0.32	0.98	12.53	2	**0.002***
1st actor choice* SD-level 1	2.49	0.84	12.53	2	**0.002***

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544 * The tests refers to the overall effect of the interaction between 1st actor choice and condition.

545 Table 11: Probability of the 2nd actors to choose the social option depending on the 1st actors' previous
546 choices.

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1st puller choice	Probability of 2nd actors to choose social in COM 3	Probability of 2nd actors to choose social in COM 5	Probability of 2nd actors to choose social in SD 1
Non-social	30%	30%	26%
Social	30%	8%	52%

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