Supplementary Tables

Table S1: Overview of all experiments

	Question	sample size (n)	Figures/Tables
Experiment 1	Is olfactory information important for cooperative decisions?	23/21	Figure 1 & S1 Table S2,S3 & S7
Experiment 2	Is olfactory information important for cooperation decisions when receiving or when providing help?	23	Figure S2 Table S4
Experiment 3	Does the smell of cooperation suffice to induce cooperative behaviour?	24	Figure S3 Table S5
Experiment 4	Does the performance of cooperation trigger cooperative responses?	24	Figure S4 Table S6

Table S2: Pulling frequency (Experiment 1)

Response	Fixed Effects	ß	SE	z-value	*p*
Direct reciprocity Number of pulls GLMM (Poisson) N = 23	Intercept	-0.328	0.233	-1.405	
	Partner (D)	**-1.135**	**0.271**	**-4.189**	**<0.001**
	Olfactory information (yes)	**0.993**	**0.262**	**3.795**	**<0.001**
	Partner (D) : Olfactory information (yes)	-0.406	0.587	-0.690	0.490
Generalised reciprocity Number of pulls GLMM (Poisson) N = 21	**Intercept**	**1.316**	**0.107**	**12.255**	**<0.001**
	Partner (D)	**-0.657**	**0.134**	**-4.921**	**<0.001**
	Olfactory information (yes)	0.072	0.127	0.571	0.568
	Partner (D) : Olfactory information (yes)	-0.433	0.269	-1.612	0.107

Note that the estimates for the main effects are shown for a model without an interaction term

Table S3a: Latencies to first pull (Experiment 1)

Response	Fixed Effects	Coef	SE(Coef)	SE2	χ^2	DF	*p*
Direct reciprocity Latencies to first pull Cox proportional hazard N=23	Intercept						
	Partner (D)	**-1.120**	**0.502**	**-0.498**	**4.99**	**1**	**0.026**
	Olfactory information (yes)	**2.354**	**0.465**	**0.450**	**25.67**	**1**	**<0.001**
	Partner (D) : Olfactory information (yes)	**-1.476**	**0.675**	**0.666**	**4.79**	**1**	**0.029**
Generalised reciprocity Latencies to first pull Cox proportional hazard N=21	Intercept						
	Partner (D)	-0.450	0.347	0.343	1.68	1	0.19
	Olfactory information (yes)	**1.155**	**0.355**	**0.347**	**10.57**	**1**	**0.001**
	Partner (D) : Olfactory information (yes)	**-1.602**	**0.526**	**0.519**	**9.27**	**1**	**0.002**

Table S3b: Post hoc Tukey comparisons for latency to first pull (Experiment 1)

Response	Fixed Effects	ß	SE	z-value	*p*
Direct reciprocity	**Cooperative– uncooperative smell == 0**	**-2.5963**	**0.464**	**-5.596**	**<0.001**
N = 23	Cooperative– uncooperative no smell ==0	-1.1203	0.502	-2.233	0.113
Generalised reciprocity	**Cooperative– uncooperative smell == 0**	-2.0524	0.400	-5.131	**<0.001**
N = 21	Cooperative– uncooperative no smell ==0	-0.4500	0.347	-1.296	0.564

Direct reciprocity	**Cooperative– uncooperative smell == 0**	**-2.5963**	**0.464**	**-5.596**	**<0.001**

Table S4a: Is olfactory information important when receiving or providing help? (Experiment 2) Model output comparing the number of pulls when pulling for a partner (cooperative and uncooperative partners) whose smell was blocked in the experience phase (CNS; DNS) with when smell was blocked in the test phase (CSN; DSN).

Wilcoxon signed-rank with continuity correction		V	p					
Number of pulls	CNS-CSN	139	0.206					
n= 23	DNS-DSN	65.5	0.916					

Response	Fixed Effects	Coeff	SE(Coeff)	SE2	χ^2	DF	p
Latencies to first pull	CNS-CSN	0.043	0.337	0.337	0.02	**1**	0.9
n=23	DNS-DSN	0.096	0.345	0.336	0.08	**1**	0.78

Table S4b: Comparing the pulling frequency and latency to first pull for cooperative and uncooperative partners from experiment 1 and experiment 2 combined.

Response	Fixed Effects	ß			SE	z-value	p
Combined **GLMM**	Cooperative–uncooperative == 0	-0.657			0.1336	-4.921	**<0.001**

Response	Fixed Effects	Coeff	SE(Coeff)	SE2	χ^2	DF	p
Combined **Latencies to first pull** **Cox prop. hazard**	Partner (uncooperative)	-0.722	0.246	0.243	8.65	1	0.003

Table S5: Does the smell of cooperation suffice to induce reciprocal returns? (Experiment 3): Model output comparing the number of pulls (top) and the latencies to the first pull (bottom) when pulling for a partner after experiencing an uncooperative stooge while being provided with smell of a cooperative partner or an uncooperative partner in the experience phase or in the test phase.

Wilcoxon signed-rank with continuity correction			V	p
	Experience phase	C-D	115	0.197
Number of pulls				
Wilcoxon signed-rank	**Test phase**	**C-D**	**180**	**0.022**

Response	Fixed Effects	Coeff	SE(Coeff)	SE2	χ^2	DF	p
Latencies to first pull	Experience phase	Partner (defector)	**-0.900**	**0.364**	0.352	6.13	1	0.013
	Test phase	Partner (defector)	**-0.682**	**0.359**	0.342	3.62	1	0.057

Table S6: Does individual identity ('cooperative' vs. 'uncooperative') or the performance of cooperation trigger cooperative responses? (Experiment 4): Model output comparing the number of pulls and the latencies to the first pull when pulling for a partner while receiving olfactory information from a conspecific in a different room that either does not help its respective own partner ('neutral') or which helps its partner ('cooperative').

Response	Fixed effects	V	P
	Neutral - cooperative		**0.003**
Number of pulls		**27**	
Wilcoxon signed-rank			

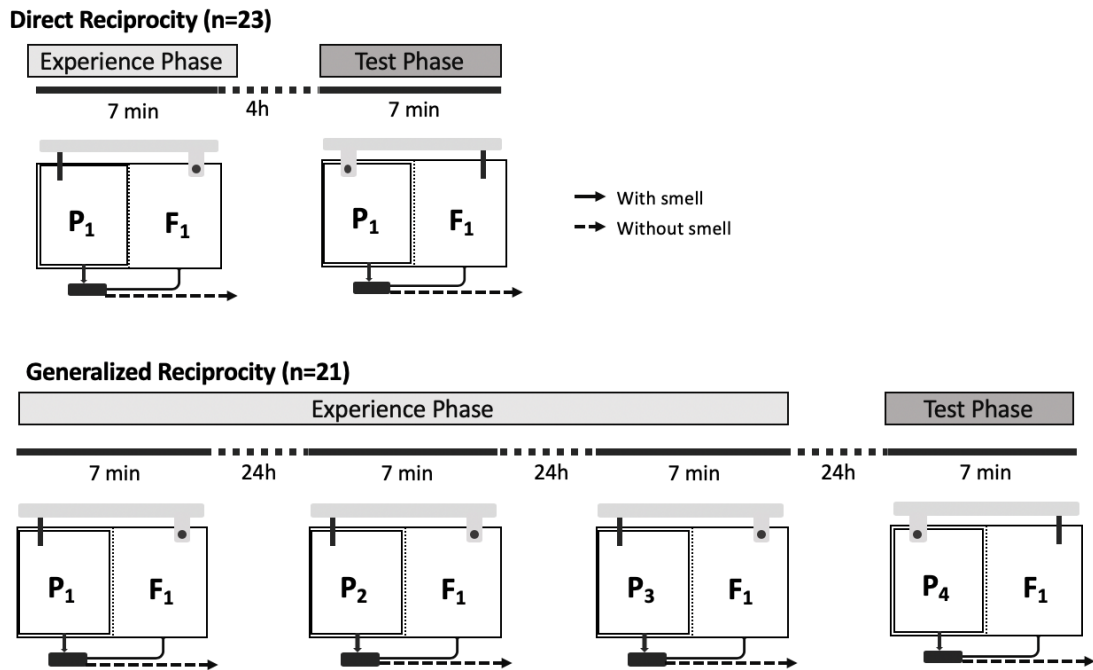| Response	Fixed Effects	Coeff	SE(Coeff)	SE2	χ^2	DF	p
Latencies to first pull	**Neutral - cooperative**	**-0.695**	**0.352**	0.352	3.9	1	0.048

Table S7: Adjusted p values (method =BH) from post hoc comparison using log rank tests for the latency to first pull

	Empty Cage	Cooperator without smell	Cooperator with smell	Non-cooperator without smell
Cooperator without smell	0.0826	-	-	-
Cooperator with smell	**<0.001**	**<0.001**	-	-
Non-cooperator without smell	0.69473	0.0826	**<0.001**	-
Non-cooperator with smell	0.15436	0.69473	**<0.001**	0.15374

Supplementary Figures

Figure S1 Overview of the experimental procedure and set-up (a) and experienced treatments (b) for Experiment 1. All focal individuals experienced the treatments in a generalized (n= 21) and a direct (n= 23) reciprocity paradigm, followed by the respective test phase (see a). The control treatment was however only performed in the direct reciprocity paradigm. The order of each treatment was randomized for every focal individual. The experimental period was always preceded by one minute of acclimatisation time.

a)

b)

Figure S2 Overview of the experimental procedure and set-up (a) as well as the experienced treatments (b) for experiment 2. All focal individuals (n= 23) experienced the treatments in a random order. The experimental period was always preceded by one minute of acclimatisation time.

a)

b)

Figure S3 Experimental treatments for experiment 3. Focal individuals (n= 24) experienced the smell of a cooperative or a non-cooperative individual (P_1) that was pulling for a cage mate (CM_1, represented by a cage mate of P_1) in an adjacent room in a randomized order in either the experience phase (a) or the test phase (b). While experiencing the smell of a conspecific in another room, focal rats always experienced the behaviour of a stooge (S_1). The experimental period was always preceded by one minute of acclimatisation time.
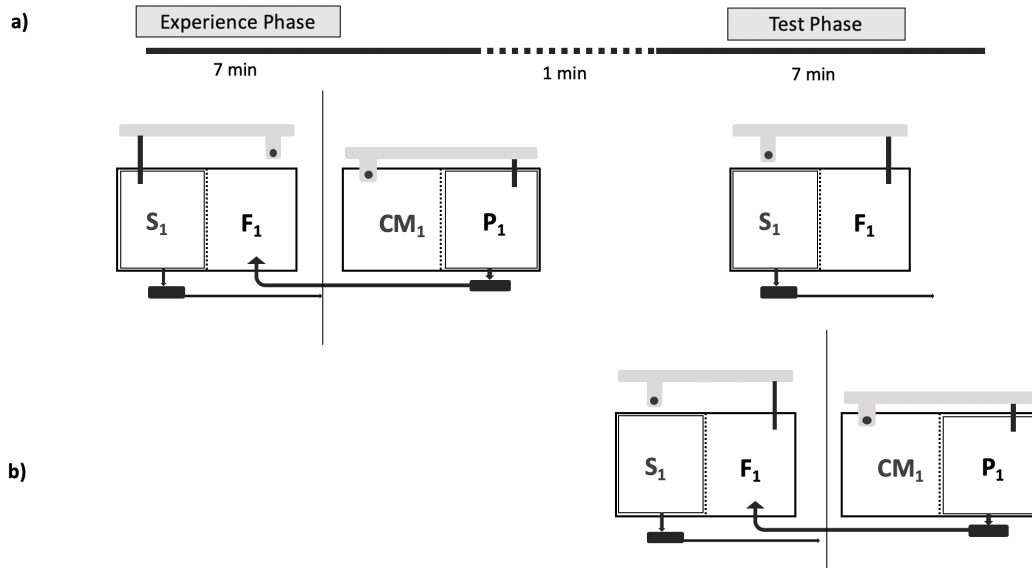
Figure S4 Experimental procedure and set up for experiment 4. Focal individuals (n= 24) experienced the same partner either cooperating or in a neutral context in a randomized order. The experimental period was always preceded by one minute of acclimatisation time.
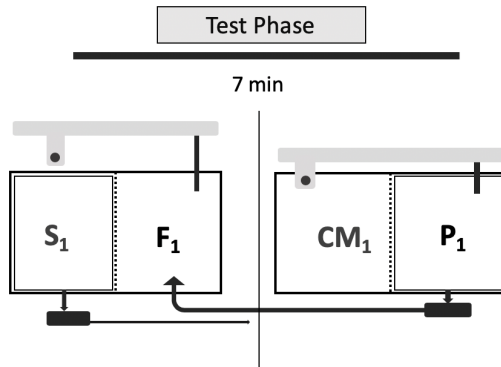
Figure S5 Comparisons of number of pulls from experiment 1 including the empty cage control; The letters indicate significant differences from the posthoc Tukey comparison of a generalized liner mixed model includeing the number of pulls as respose variable, treatment as explanatory variable and the identity as a random factor.
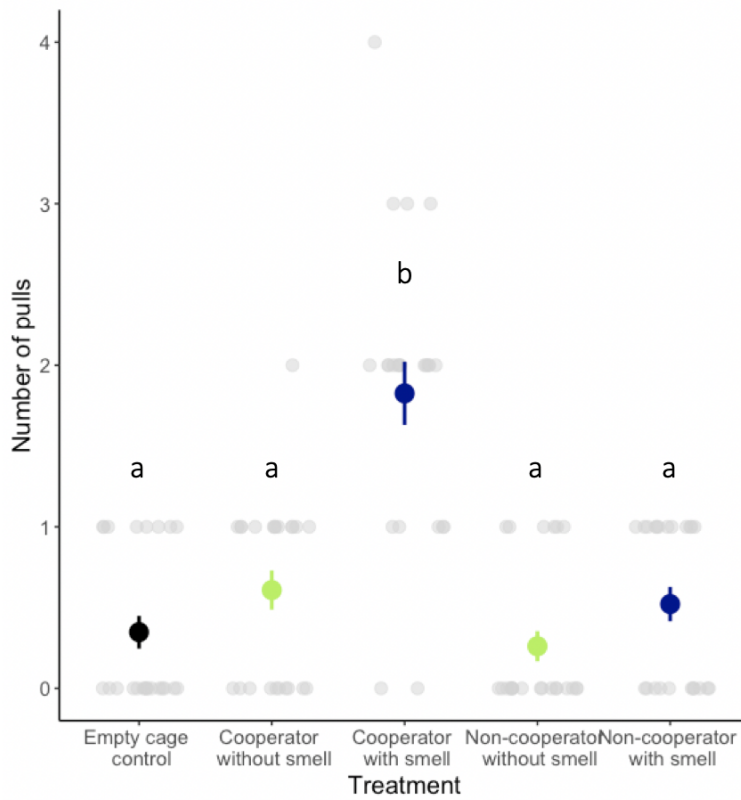

Figure S6 Correlation plot of the number of pulls of cooperative rats and the number of pulls of focal individual as a proxy for the effect of "activity" for the pooled data from all experiments (N=159). r =0.014, p=0.88.