

Supplementary material to Molleman et al. ‘Personal experience and reputation interact in human decisions to help reciprocally’

1. Regression models fit to data underpinning claims in the main text

Table S1. Results of four regression models fit to all data, supporting the claims in the results section of the main text. Columns *a-c* show effect estimates of generalised linear mixed logit models (with associated *p*-values in brackets) using subject nested in session as random effect. The factors including ‘period’ account for temporal patterns in the data. The factors ‘noise’ and ‘asymmetric’ refer to the two treatments that were run in addition to the baseline treatment. All models detect strong temporal patterns. Furthermore, the asymmetric treatment shows significantly higher levels of requests for indirect information. Column *d* shows effect estimates of a generalised linear logit model that tests the relative use of direct and indirect information between treatments (cf. Fig. 2 of the main text). The model is fit to the overall per-period number of requests for indirect information divided by the total number of requests for information, aggregated over all sessions per treatment. As suggested by Figure 2 of the main text, at the aggregate level, adding noise to indirect information leads to lower overall request rates for this information. The asymmetric treatment shows a higher overall rate of requests for indirect information.

	(a) Decision to help	(b) Request for direct information	(c) Request for indirect information	(d) Proportion of requests for indirect information
intercept	0.215 (0.598)	-6.118 (<0.001)	-2.362 (<0.001)	1.205 (<0.001)
period / 100	2.439 (<0.001)	14.607 (<0.001)	4.105 (<0.001)	-4.060 (<0.001)
period^2 / 100^2	-4.760 (<0.001)	-11.912 (<0.001)	-5.014 (<0.001)	2.574 (<0.001)
noise	-0.223 (0.693)	0.736 (0.280)	-0.505 (0.322)	-0.395 (<0.001)
asymmetric	0.898 (0.112)	-0.508 (0.460)	1.016 (0.043)	0.555 (<0.001)
N=	9180	9180	9180	1496

Table S2. Direct and indirect information affect decisions to help differently. Columns present effect estimates of generalised linear mixed logit models fit to decisions that were preceded by requests for either direct or indirect information. Subject nested in session was included as random effect. Positive information on the recipient’s helpfulness leads to higher levels of helping (cf strong positive estimate for ‘help donor or help others’) . We observe a significant interaction effect between the observed helping rate of the recipient and the type of information, indicating that subjects react differently to personal experience than to reputations. The same effects are obtained when we consider not the fraction of helping (as opposed to passing) decisions, but the difference between the two (the number of helping minus passing decisions ‘image scoring’, column *b*).

	(a) Decision to help (fractions)	(b) Decision to help (image scoring)
intercept	-3.540 (<0.001)	0.697 (0.010)
period / 100	3.213 (0.021)	0.915 (0.248)
period^2 / 100^2	-4.414 (<0.001)	-2.913 (<0.001)
noise	-0.177 (0.597)	0.012 (0.962)
asymmetric	-0.584 (0.089)	-0.265 (0.307)
help donor or help others	7.238 (<0.001)	5.809 (<0.001)
info type (direct or indirect)	-0.577 (0.132)	0.039 (0.811)
fraction help x info type	1.175 (0.030)	-1.811 (<0.001)
N=	2987	3652

2. Individual-level statistics

The results reported in the paper concern mainly group-level and population-level statistics. Here, we present the underlying individual-level data.

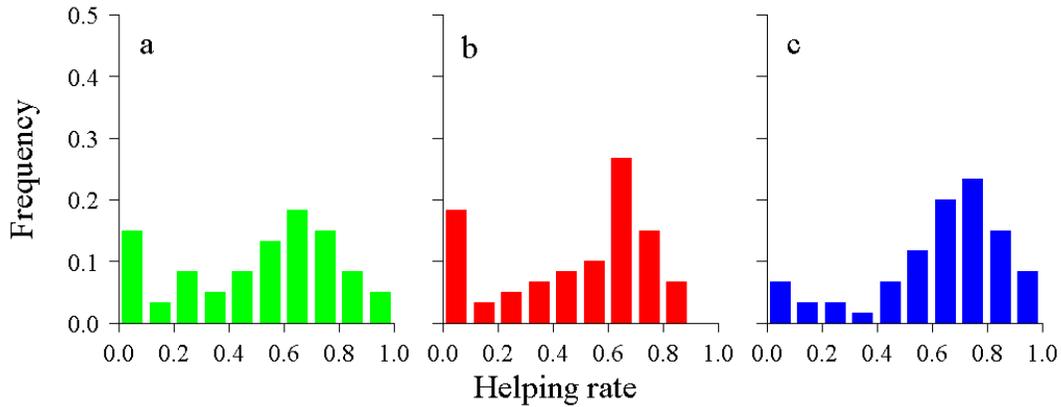


Fig. S1. Individual variation in helping behaviour. Panels show frequency distributions of helping rates in the baseline (a), the noise (b) and the asymmetric (c) treatment. Rates were calculated over the entire sessions (on average 51 decisions). The broad distributions indicate that individuals vary a lot in their helpfulness. In each of the three cases a bimodal distribution appears, with modi at 0 (individuals that never helped) and around 0.6-0.8.

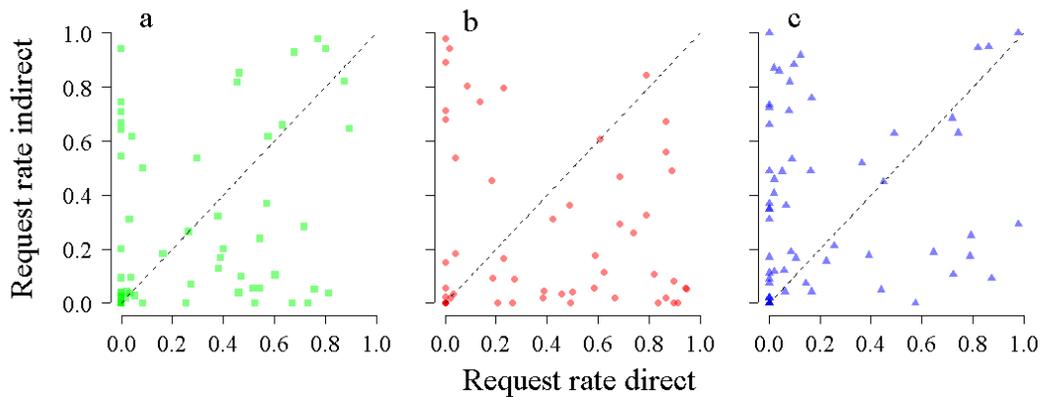


Fig. S2. Most individuals are biased towards either direct or indirect information. Panels show individual request rates for direct and indirect information the baseline (a), the noise (b) and the asymmetric (c) treatment. The horizontal and vertical axes represent request rates for direct and indirect information, respectively. Dots represent values of individual subjects. Individuals vary considerably in how they condition their decisions to help. Concentrations are higher close to the axes, indicating that most individuals request either direct or indirect information throughout the

experiment. At the diagonal direct and indirect information was requested equally often, suggesting an equal importance of personal experience and reputations. Below, the data from this scatter plot is split out in total reliance on historical information (Fig S3) and relative importance of direct and indirect information (Fig S4), respectively.

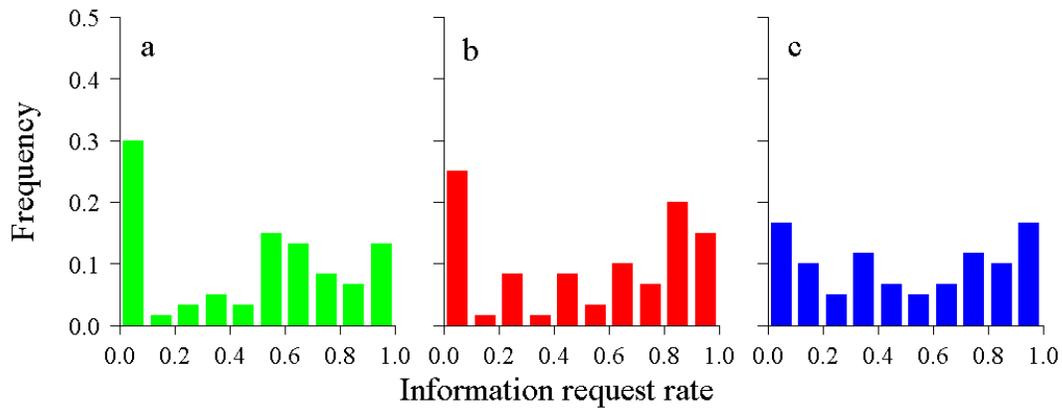


Fig. S3. Individual variation in reliance on historical information in helping behaviour. Panels show frequency distributions of fractions of decisions that were based on any information in the baseline (a), the noise (b) and the asymmetric (c) treatment. Rates were calculated over the entire sessions (on average 51 decisions). We observe considerable variation between individuals in their choice to access costly information.

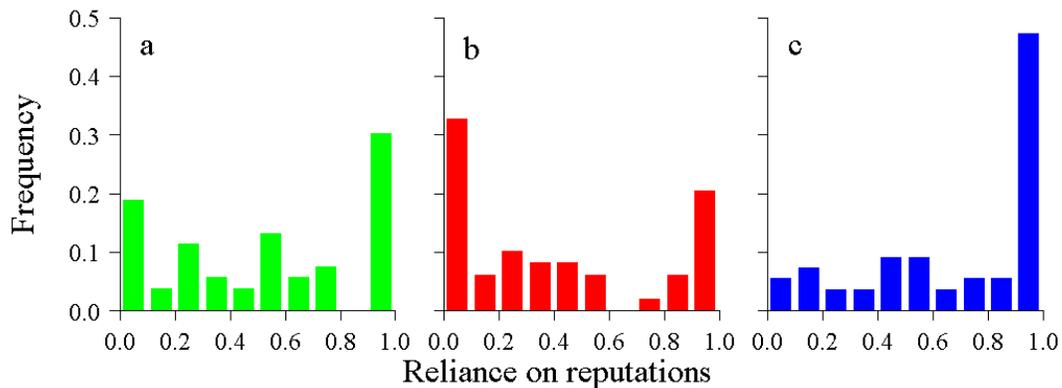


Fig. S4. Individual variation in use of direct experience and reputations. Panels show frequency distributions of relative importance of reputations in the baseline (a), the noise (b) and the asymmetric (c) treatment. Values were calculated as the fraction of an individual's requests for indirect information, as a fraction of his total number of requests. We observe considerable

variation in information use strategies. A large fraction of the population (about 50%) relies on either personal experience or reputations exclusively. In the presence of noise in indirect information, individuals tend to rely more on direct information (i.e. personal experience; b). When direct and indirect information are presented in unequal amounts (c), more people exclusively rely on reputations (c; Kruskal-Wallis multiple comparison $P < 0.05$). A GLMM with session replicate as random factor does not detect significant effect of individual reliance on reputations and overall helping rate ($p = 0.331$).

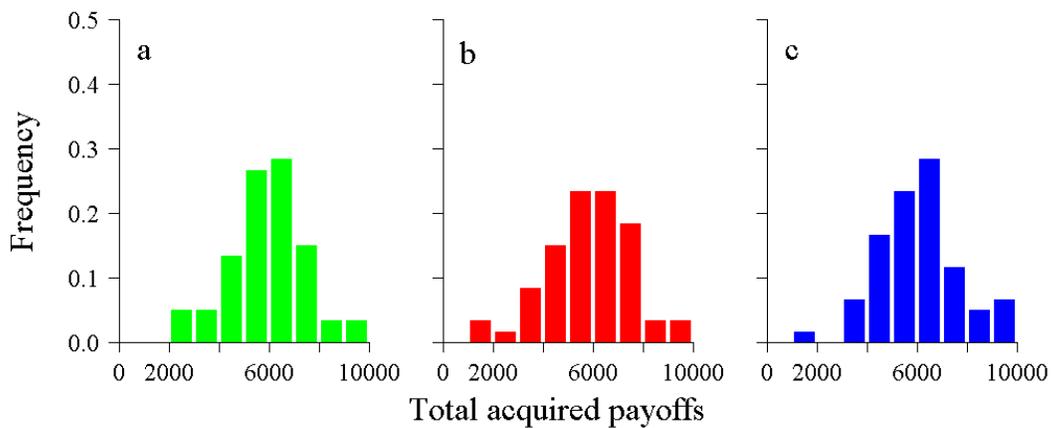


Fig. S5. Total payoffs vary between individuals. In the experiment, individuals collected 5921 points on average (corresponding to €19.75, excluding the show-up fee). A linear mixed regression model with session as random factor reveals significant (negative) associations between helping rates and the total number of points collected. Information use (either direct or indirect, or both) has no significant effects.

Table S3. Correlations between individual characteristics ($n = 60$ individuals per treatment). Requests for direct and indirect information are negatively correlated in each of the three treatments: when individuals request direct information, they are less likely to *also* request indirect information. Individuals that request more information tend to be more helpful. No relationships are observed between information use and payoffs. Note that the correlations presented here do

not take into account the fact that individual payoffs are strongly affected by average helpfulness within their session replicate.

Baseline treatment (a)

	direct				
indirect	-0.224 (0.085)	indirect			
both	-0.204 (0.118)	-0.016 (0.906)	both		
helping rate	0.334 (0.009)	0.253 (0.051)	0.112 (0.394)	helping rate	
payoff	-0.168 (0.201)	0.013 (0.921)	-0.048 (0.714)	-0.167 (0.202)	payoff
informed				0.488 (<0.001)	-0.146 (0.265)

Noise treatment (b)

	direct				
indirect	-0.322 (0.012)	indirect			
both	-0.028 (0.832)	-0.107 (0.415)	both		
helping rate	0.277 (0.032)	0.196 (0.134)	0.281 (0.03)	helping rate	
payoff	-0.026 (0.844)	0.048 (0.713)	-0.067 (0.613)	0.124 (0.346)	payoff
informed				0.515 (<0.001)	-0.018 (0.893)

Asymmetric treatment (c)

	direct				
indirect	-0.256 (0.048)	indirect			
both	-0.042 (0.749)	-0.245 (0.059)	both		
helping rate	0.092 (0.486)	0.228 (0.08)	0.056 (0.672)	helping rate	
payoff	0.044 (0.738)	0.083 (0.527)	-0.095 (0.471)	-0.075 (0.571)	payoff
informed				0.292 (0.024)	0.37 .778

3. Robustness of the statistical findings

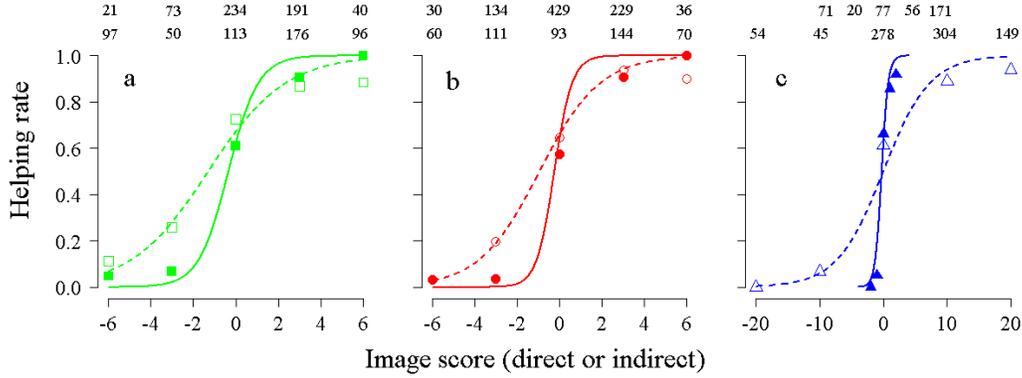


Fig. S6. Fraction of helpful decisions preceded by requests for either direct (solid symbols) or indirect information (open symbols), in the baseline (a), the noise (b) and the asymmetric (c) treatment. Lines represent best least-square fits to the experimental data using logistic regressions (solid lines: behaviour towards the donor; dashed lines: behaviour towards others). The recipient’s interaction history is calculated as the difference in the number of helpful decisions, i.e. as ‘image score’ (12). In (a) and (b), shown points are rounded towards the nearest modulus of 3. In (c) indirect information was rounded towards the nearest modulus of 10. The steeper slopes associated with direct information indicate that subjects react in a more extreme way to information coming from personal experience than to reputational information.

Table S4. Estimates of slope and inflection point from fits of the logistic model to data when the history of a recipient is evaluated as (a) ‘fraction help’ (i.e., the lines presented in Fig 3), or as (b) an ‘image score’ (the difference between the number of helping and passing decisions; i.e., the lines presented in Fig S6). Under the image scoring model, we observe for all treatments that the estimated slopes in case of direct information are steeper than in case of indirect information, suggesting that subjects respond to direct information in a more extreme way. This pattern is not observed when we evaluate the recipients’ history as the fraction of helping decisions.

(a) Fraction help (cf. Fig. 3)		Baseline	Noise	Asymmetric
		Estimate (SE)	Estimate (SE)	Estimate (SE)
direct	slope	4.886 (0.405)	6.308 (0.489)	5.212 (0.516)
	inflection point	0.497 (0.026)	0.554 (0.014)	0.544 (0.030)
indirect	slope	6.858 (0.791)	8.188 (0.936)	8.385 (0.802)
	inflection point	0.374 (0.022)	0.412 (0.016)	0.535 (0.013)

(b) Image score (cf. Fig. S6)		Baseline	Noise	Asymmetric
		Estimate (SE)	Estimate (SE)	Estimate (SE)
direct	slope	1.424 (0.157)	2.393 (0.265)	1.934 (0.294)
	inflection point	-0.343 (0.083)	-0.242 (0.044)	-0.239 (0.078)
indirect	slope	0.552 (0.056)	0.704 (0.073)	0.275 (0.027)
	inflection point	-1.287 (0.229)	-0.943 (0.171)	-0.001 (0.368)

Table S5. To examine the robustness of the effects found in the regression model (Table 1 of the main text), we fitted another regression model where information on interaction histories was represented as the ‘image score’ rather than the fraction helpful decisions. Before entering the analysis, image scores for direct and indirect interactions were normalised as follows. In the baseline and noise treatment all image scores are divided by 6. In the asymmetric treatment direct and indirect image scores are divided by 2 and 20, respectively. Results of this generalised linear mixed model were in full agreement with the findings presented in the main text (including significant interaction between direct and indirect information). Another regression model fitted to the complete data set with all decisions – including those decisions not preceded by information requests – still detects significant effects of direct and indirect information, as well as the interaction between these types of information. Regression models based on alternative assumptions about the cumulative distribution function on the probability of helping (i.e. probit instead of a logit model) yield very similar patterns (not shown).

GLMM regression results

	estimate	<i>p</i>
intercept	1.230	0.126
period	5.276	0.049
period ²	-7.391	0.002
help donor	3.407	<0.001
help others	2.067	<0.001
help donor x help others	-1.838	0.001
noise	-0.204	0.731
asymmetric	-1.284	0.037

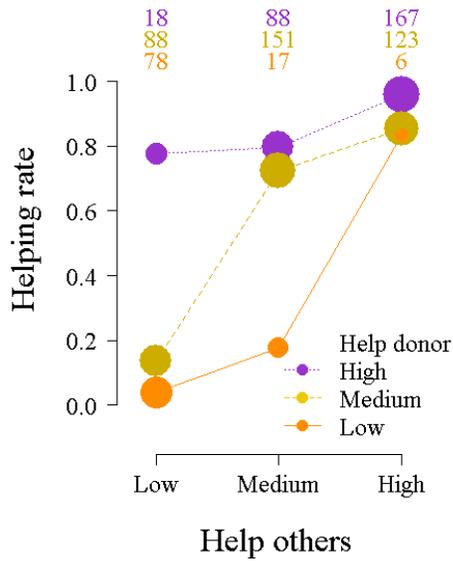


Figure S7. Rates of receiving help under varying recipients’ signatures of helpfulness when both direct and indirect information were requested. The recipients’ helpfulness towards the donor (‘Help donor’) and towards third parties (‘Help others’) are calculated as ‘image scores’ (IS); number of passing decisions is subtracted from the number of helping decisions. Categorizations concern ‘Low’ ($IS < -2$), ‘Medium’, ($-2 \leq IS \leq 2$), or ‘High’ ($2 < IS$) for the baseline and the noise treatment. For the asymmetric treatment categorizations concerned $\{‘Low’ < 0, ‘Medium’ = 0, ‘High’ > 0\}$ for direct information and $\{‘Low’ < -5 \leq ‘Medium’ \leq 5 < ‘High’\}$ for indirect information, so that the categories span similar fractions of the scale in the treatments. The sizes of the plotted dots indicate the natural log of the number of constituent data points (these numbers are also shown above). The panel shows receiving rates as a function of helping others, for the three categories of Help Donor. Effects of indirect information are largest for small values of Help Donor (orange). When direct information provides a good image score (purple), indirect information has weaker effects (compare the slopes of the orange and purple lines). In line with the findings presented in Figure 4 of the main text, the effect of reputation is weak when personal experience is good. A similar pattern is found in the reverse case: when a recipient’s reputation is good, the impact of personal experience is weaker (data points on the left hand side, where ‘help others’ is low, are farther apart than the data points on the right hand side, where ‘help others’ is high).

4. Instructions for the experiment

Welcome to this experiment on decision making. The experiment will last for approximately 90 minutes. During the session it is not allowed to talk or communicate with the other participants. If you have a question, please raise your hand and one of us will come to you to answer it. During this experiment you will make money. The amount you earn is dependent of your decisions and the decisions of others. At the end of the experiment the amount you have earned, plus a show up fee of 7 euros, will be paid to you in cash. These payments are anonymous; you will be paid individually in the reception room. Please remain seated at the end of the experiment until your desk number is called. We will not inform any of the other participants about your earnings. It is impossible for us to associate your desk number with your identity. You start out with an amount of 3000 points; 300 points are worth 1 euro.

Experimental procedure

1. Instructions
2. Quiz to verify if you understand the experiment
3. The experiment
4. Questionnaire
5. Payment

The experiment consists of at least 100 rounds. From round 100 upon, there is a chance of 90% that a new round starts. Every round, you will be paired with another participant in the room. Everybody stays anonymous; you will not be informed about the identity of the participant you are paired with.

The chance to be paired with a particular participant is for all participants the same in every round. Hence, the chance to be paired with the same participant twice in a row is very small.

Every round you will be assigned a role (A or B). You only have to make a decision when you are assigned role A. If you are assigned role B, you do not have to do anything.

Choice options

If you are assigned role A, you can choose between two alternatives. If you choose 'yellow', participant B, who is paired with you, receives 250 points. You lose 150 points. If you choose 'blue', the participant paired with you receives nothing, and you do not lose any points.

Summarized:

Yellow has cost 150 for participant A. Participant B receives 250 points.

Blue yields 0 for both participants.

--- the following was specific to the three different treatments ---

a) *Baseline treatment*

Information

Before you make your decision, you have the opportunity to request information on the decisions of participant B in earlier rounds. By clicking the boxes you obtain a summary of the actions of participant B in up to **6 previous decisions in the role of A**. You can request two kinds of information.

1. Information about what participant B decided, in the role of A, when he was paired with **you**
2. Information about what participant B decided, in the role of A, when he was paired with **others**

This information is obtained by clicking the boxes. The information will be displayed on the screen like this:

1. Participant B decided in earlier rounds, when he was paired with **you** in role A: ...
times yellow and ... times blue
2. Participant B decided in earlier rounds, when he was paired with **others** in role A: ...
times yellow and ... times blue

Requesting information about participant B comes at a **cost**. This amounts to 5 points per requested information item. If you request both kinds of information, it costs 10 points. Only the participant clicking on the buttons obtains this information. The number of decisions of B you can see is 6 at maximum. If participant B has not been in the role of A yet, you will see a 0.

b) For noise treatment, this paragraph was added to the instructions of the baseline treatment

The information about what player B decided when he was paired with **you** is **perfectly reliable**. Information about what participant B decided when he was paired with **others** is **not perfectly reliable**. In one out of six cases, a 'blue' choice is displayed as 'yellow', or a 'yellow' choice is displayed as 'blue'. Thus, the information on what participant B did, when he was paired with others, is not completely reliable.

*c) For the asymmetric information treatment, the next paragraph replaced the 'Information' paragraph in sessions where indirect information was more abundant than direct information ****

Information

Before you make your decision, you have the opportunity to request information on the decisions of participant B in earlier rounds. By clicking the boxes you obtain a summary of the most recent actions of participant B. You can request two kinds of information.

3. Information about what participant B decided, in the role of A, when he was paired with **you** (maximally 2)
4. Information about what participant B decided, in the role of A, when he was paired with **others** (maximally 20)

This information is obtained by clicking the boxes. The information will be displayed on the screen like this:

3. Participant B decided in earlier rounds, when he was paired with **you** in role A: ... times yellow and ... times blue
4. Participant B decided in earlier rounds, when he was paired with **others** in role A: ... times yellow and ... times blue

Requesting information about participant B comes at a **cost**. This amounts to 5 points per requested information item. If you request both kinds of information, it costs 10 points. Only the participant clicking on the buttons obtains this information. If participant B has not been in the role of A yet, you will see a 0.

--- the final paragraphs were shown in all treatments ---

When participant A has made his decision, both participants will be informed about their payoffs in this round. This is the end of the round. In the next round you will be paired with another randomly drawn participant. The roles of A and B are randomly assigned.

Please remain seated at the end of the experiment, until we call your desk number. You will be paid in the reception room individually.

*** We ran two pilot sessions for the asymmetric treatment with instructions stating that with a request for direct or indirect information, a donor would obtain the recipient's decisions in the past 44 rounds of the experiment. In these two sessions cooperation levels were slightly higher, perhaps because subjects were more primed to the fact that cleaning their record would take a long time. Patterns of requests for direct and indirect information were very similar to the results reported in the main text.