Strategic Risk and Response Time Across Games
Supplementary Online Material

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1 Experimental Instructions

Welcome and thank you very much for participating in this experiment. Please read the instructions carefully. If you have any questions or concerns, please raise your hand. It is strictly forbidden to communicate with other participants during the experiment. It is very important that you follow this rule. Otherwise we must exclude you from the experiment and from all payments. Should you have any question, please raise your hand and we will answer it individually.

During the experiment, we use ECU (Experimental Currency Unit) instead of euro. At the end of the experiment, the ECU you have earned, will be converted to euro (10 ECU = 1€) and the obtained amount will be paid to you in cash.

In this experiment, two participants will interact with each other just once. Each of the two members of a pair will be randomly assigned one of two roles: X or Y. In the top right corner of the computer screen, you can read which role (either X or Y) has been assigned to you and to your partner.

Each pair can share 100 ECU. X has the right to propose the distribution of the 100 ECU. In particular, X chooses the distribution (x, y) meaning that X wants to keep x ECU for him/herself, and to give y ECU to Y. More specifically, X can choose any of the following 9 distributions:

x	10	20	30	40	50	60	70	80	90
y	90	80	70	60	50	40	30	20	10

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Ultimatum Game Only

Y must decide for each possible distribution of the 100 ECU, if he or she accepts or rejects it. Thus, Y will face the following table:

x	10	20	30	40	50	60	70	80	90
y	90	80	70	60	50	40	30	20	10
Accept									
Reject									

For each possible distribution, Y must specify if he or she accepts or rejects it by checking the corresponding box (thus Y is required to make 9 decisions). After X and Y have made their choices, their payoffs are determined as follows:

- If Y has accepted the actual proposal by X, then both get what X has proposed, i.e., X earns x and Y earns y.
- If Y has rejected the actual proposal, then both earn nothing, i.e., the 100 ECU are lost.

Yes-or-No Game Only

Without knowing which of the 9 possible proposals X has chosen, Y must accept or reject it.

After X and Y have made their choices, their payoffs are determined as follows:

- If Y has accepted, then both get what X has proposed, i.e., X earns x and Y earns y.
- If Y has rejected, then both earn nothing i.e., the 100 ECU are lost. It must be emphasized that Y does not know the actual distribution (x, y) proposed by X when deciding whether to accept or reject it.

At the end of the experiment, the actual payoff will be paid out in cash, together with the show-up fee of €2.50 for having shown up on time.

2 Game Presentations

Figures 1 to 3 display the way in which the game was presented to subjects in our experiment. Notice that the screen for proposers in the UG and the YNG was exactly the *same*.

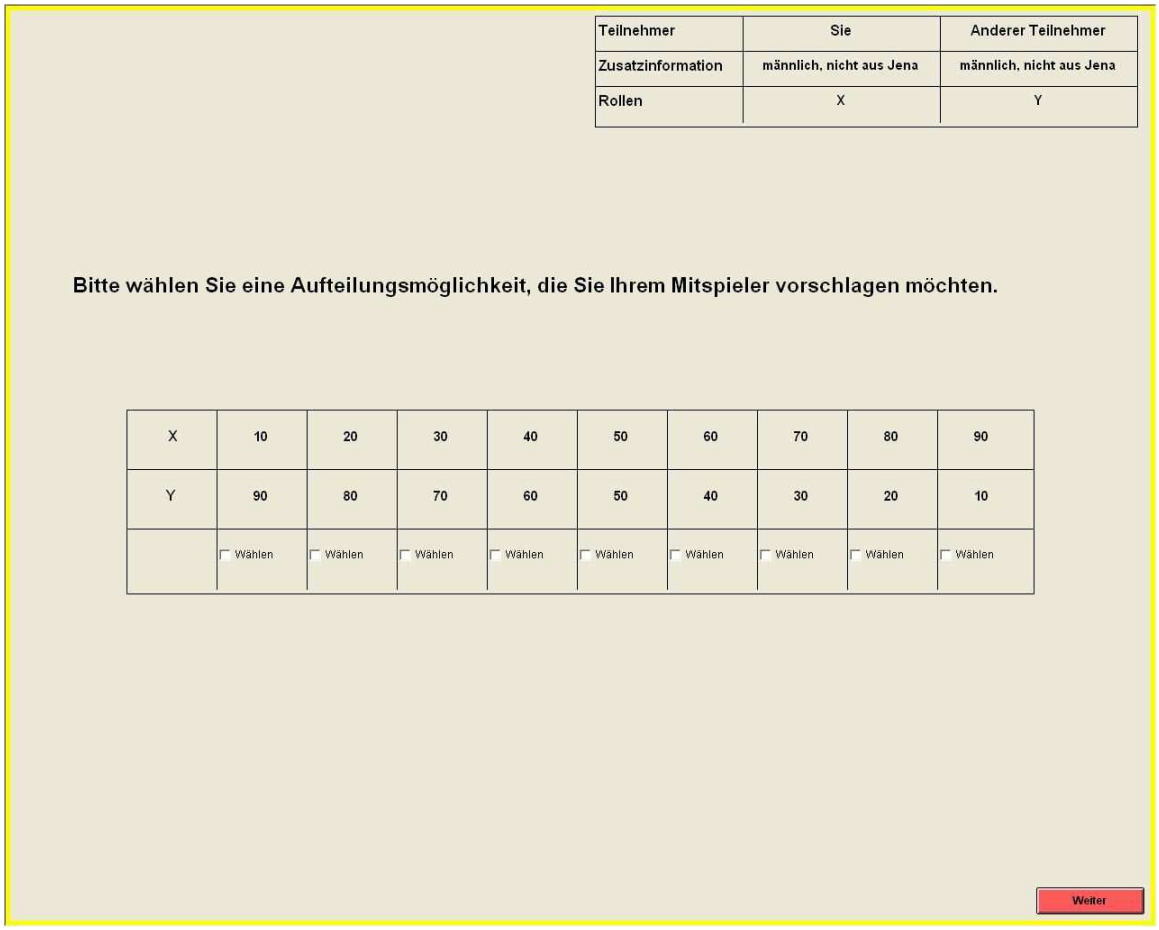
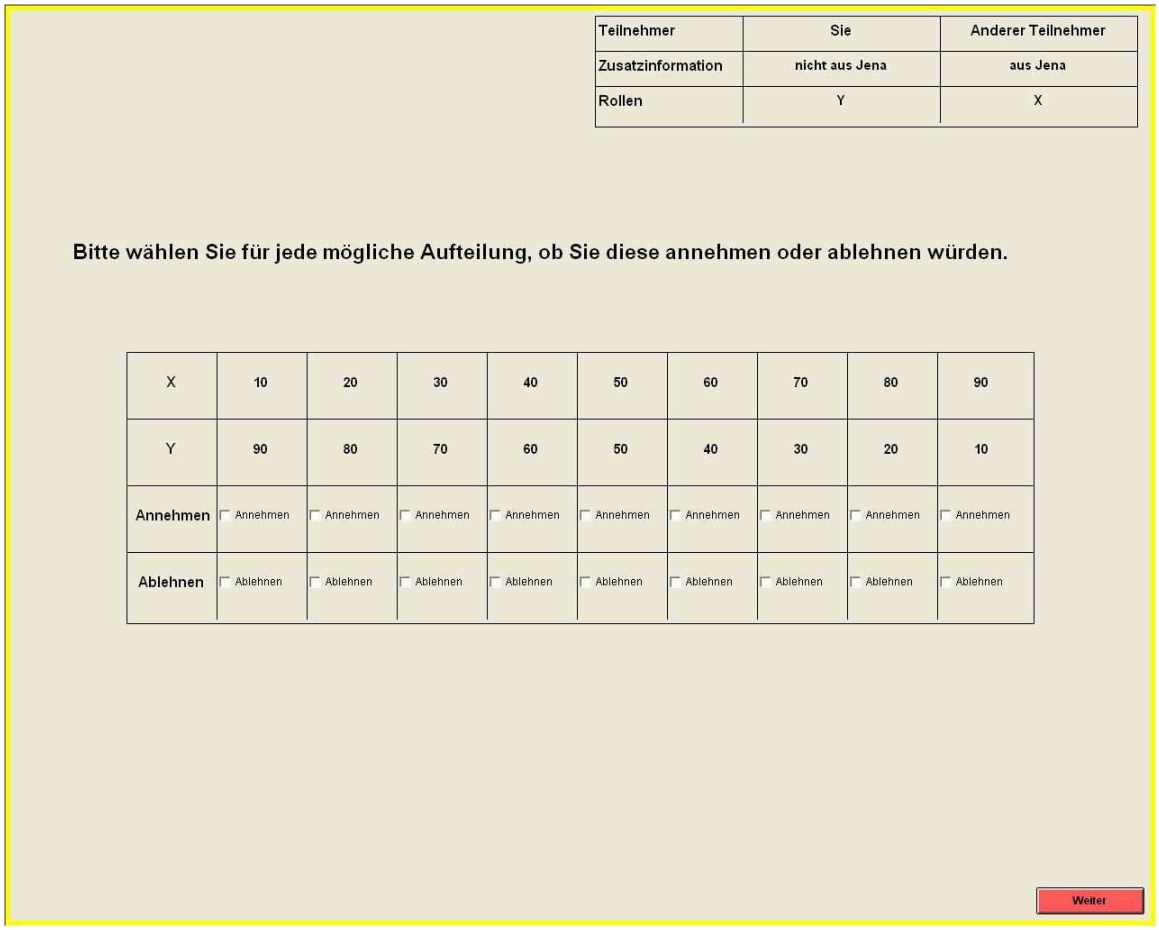


Figure 1: Screen where proposers in either the UG or the YNG were presented their available options and made their choice.



Teilnehmer	Sie	Anderer Teilnehmer
Zusatzinformation	nicht aus Jena	aus Jena
Rollen	Y	X

Bitte wählen Sie für jede mögliche Aufteilung, ob Sie diese annehmen oder ablehnen würden.

X	10	20	30	40	50	60	70	80	90
Y	90	80	70	60	50	40	30	20	10
Annehmen	Annehmen	Annehmen	Annehmen	Annehmen	Annehmen	Annehmen	Annehmen	Annehmen	Annehmen
Ablehnen	Ablehnen	Ablehnen	Ablehnen	Ablehnen	Ablehnen	Ablehnen	Ablehnen	Ablehnen	Ablehnen

Weiter

Figure 2: Screen where responders in the UG were presented their available options and made their choice.

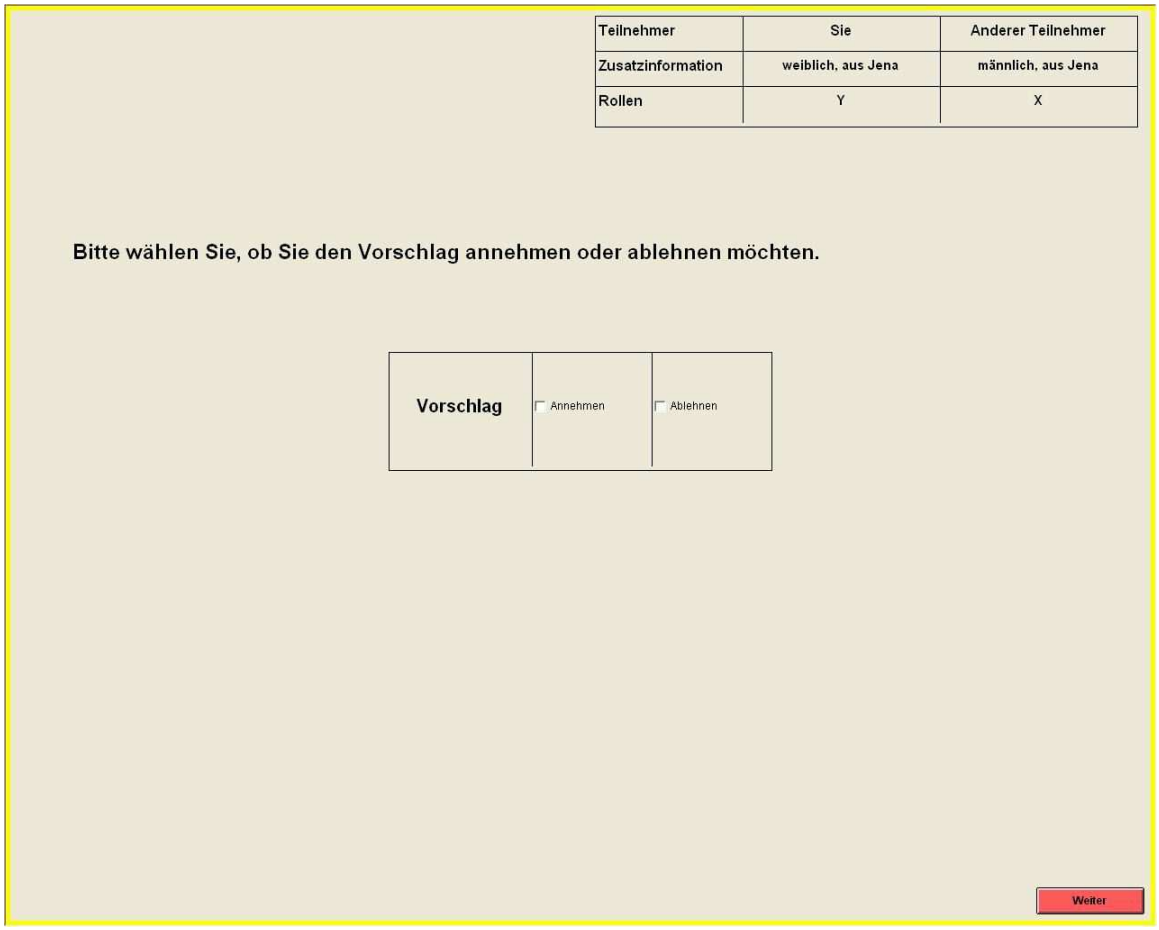


Figure 3: Screen where responders in the YNG were presented their available options and made their choice.

3 Further Details of Collected Data

In the YNG we had a total of 186 participants, 94 in the role of responders and 92 in the role of proposers. The mismatch is due to an inconsequential technical issue that matched two responders to the same proposer in two separate occasions. Subjects involved in this situation were not aware of it and both responders in both occasions "accepted every offer", meaning that the decision for the payoff of their proposer was unambiguous. Not all YNG data were used: there were two proposers who made offers larger than 50, we excluded them from all data analysis.

In the UG we had a total of 192 participants, 96 in each role. Not all data were used. We have five proposers who make offers larger than 50, we exclude them from all statistical analysis. We also have four responders who do not have a minimal acceptable offer (MAO) since they submitted non-monotonic strategies. The four instances are: Subject 321, who rejects offers where he receives 90, 10, or 20. Subject 414 accepts the offer where he receives 10 and rejects all other offers. Subject 513 rejects offers where he receives more than 60. Finally, subject 1308 only accepts offers where he receives either 40, 50, or 60.

Tests repeated using all proposer data, without excluding offers larger than 50, for both the UG and the YNG, led to minor quantitative changes with no qualitative consequences.

4 Gender and Origin Effect on Proposals

In table 1 we report interval regressions of proposer offers on a game dummy and the controls of gender, gender match, origin (either from Jena or from elsewhere), origin match and cross effects. Gender is measured with a dummy variable taking value 1 if the proposer was female (variable $female$). Gender match is measured with a dummy variable taking value 1 if the proposer was matched with a responder of the same gender (variable $gmatch$). Origin is measured with a dummy variable taking value 1 if the proposer was **not** from Jena (variable $foreign$). Origin match is measured with a dummy variable taking value 1 if the proposer was matched with a responder of the same origin; i.e., both proposer and responder were from Jena or both proposer and responder were not from Jena (variable $omatch$). Finally, cross effects of both gender match and origin match were measured with a dummy variable called $gomatch$.

Interval regressions are maximum likelihood estimations where data points are matched to an entire interval and its probability instead of to a single point. Being maximum likelihood estimations, we do not give goodness of fit for each model using R^2, but using instead the χ^2 estimator for the likelihood ratio between the estimated model and a model with only a constant. In the models reported in table 1, the likelihood ratio test is significant, meaning that the models are useful beyond computing a simple mean. This is not the case

	Models		
Variables	Model 1	Model 2	Model 3
game	-16.523^{***}	-16.085^{***}	-16.019^{***}
	(1.996)	(2.019)	(2.020)
$female$	-0.718		-0.363
	(1.997)		(2.017)
gmatch	1.430		-0.360
	(2.102)		(4.249)
$foreign$		-1.128	-1.228
		(3.731)	(3.761)
omatch		4.296	3.475
		(2.670)	(3.152)
gomatch			2.373
			(4.885)
Constant	40.727^{***}	38.408^{***}	38.77^{***}
	(1.84)	(3.194)	(3.720)
Observations	181	181	181
Likelihood ratio χ^2	58.67^{***}	60.96^{***}	61.72^{***}

Table 1: Interval regressions of proposal as a function of game type (UG or YNG, UG used as base), and several control variables. $(^{***})\quad p < 0.01$, $(^{**})\quad p < 0.05$, $(^{*})\quad p < 0.1$.

if we drop the game dummy from regressions.

In table 2 we report interval regressions of proposal on the control variables only, with the data separated by games. If we do not separate by games (not reported here) the variance of the coefficients of the control variables is even larger and the qualitative result of no explanatory power holds through. As can be seen in table 2, none of the control variables has a significant effect on the value of proposals, and the models have no meaningful explanatory power beyond the computation of a simple mean of proposals (likelihood ratio test is never significant, not even at the 0.1 level). This is true for both the UG and the YNG.

5 Gender and Origin Effect on Response Tiimes

Table 3 contains t-tests of the difference in mean RT of proposers across games, without controls, as well as with different controls of gender and origin of subjects ($female$, *gmatch*, $foreign$, *omatch*, and *gomatch* as defined in section 4). The p-values for the treatment effect (variable YNG) are given for a one-sided test of the difference in means – the alternative hypothesis being that RT is larger in the UG than in the YNG.

	UG			YNG		
Variables	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
$female$	2.760		2.906	−4.150		−3.591
	(2.243)		(2.245)	(3.266)		(3.346)
$gmatch$	−0.407		−3.521	3.128		1.922
	(2.362)		(5.559)	(3.437)		(6.227)
$foreign$		−2.156	−1.573		0.454	−1.076
		(4.225)	(4.219)		(6.581)	(6.606)
$omatch$		4.305	3.321		4.372	3.536
		(3.586)	(3.955)		(3.889)	(4.738)
$gomatch$			3.502			2.101
			(6.127)			(7.477)
Constant	39.70***	39.282***	38.392***	25.333***	20.807***	23.456***
	(1.730)	(3.143)	(3.720)	(2.613)	(5.912)	(6.783)
Observations	91	91	91	90	90	90
Likelihood ratio χ^2	1.52	1.52	3.54	2.46	1.51	3.83

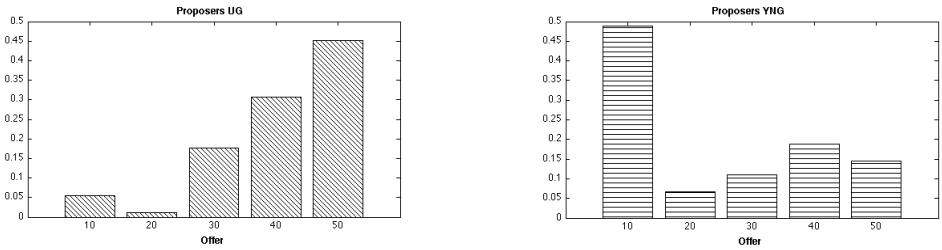
Table 2: Interval regressions of proposal as a function of several control variables. Data separated by game. (***) $p < 0.01$, (**) $p < 0.05$, (*) $p < 0.1$.

6 Response Time and Behavior Figures

Figure 4a clearly indicates that the most frequent offer in the UG is [50, 50], and figure 5a indicates that this is overwhelmingly the modal offer among the *Very Fast* proposers. Figures 5a and 5b show histograms of proposer behavior (offers) divided into four categories according to RT. Each category contains approximately 25% of the data (slightly more or slightly less when the total data are not divisible by four). The *Very Fast* category contains behavior for the 25% of proposers that have the smallest RT, with growing RT up to category *Very Slow*.

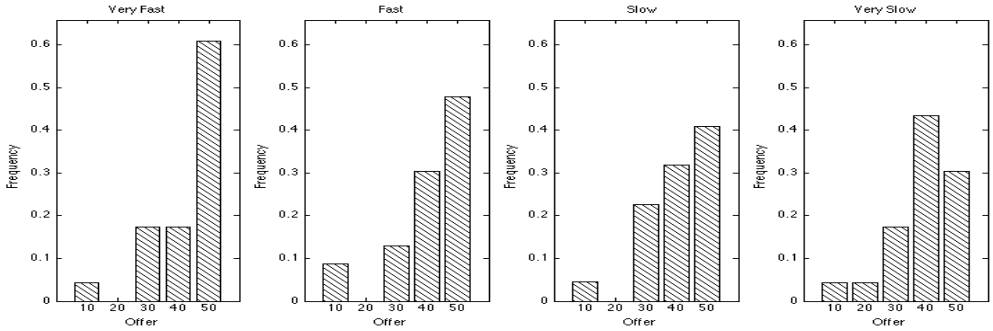
Proposer behavior in the YNG differs significantly from that in the UG, both overall and by speed category. The modal offer is [90, 10], and this is particularly accentuated among the fastest proposers (see figures 4b and 5b).

Figure 6 contains information on RT and the joint histograms of RT and behavior (MAO) for responders in the UG. Figure 7a shows histograms of MAO across all RT categories. The table shows the expected payoff of each offer the proposers can make, that is implied by the distribution of responder behavior. That is, given the MAO set by responders in our dataset, each offer of the proposers in the UG may be rejected or not. Given these rejection rates and the payoff that each proposal gives to the proposer him/herself, the proposals will have different expected payoffs that are summarized in the table in figure 7b (G_x denotes probability of acceptance of offer x).

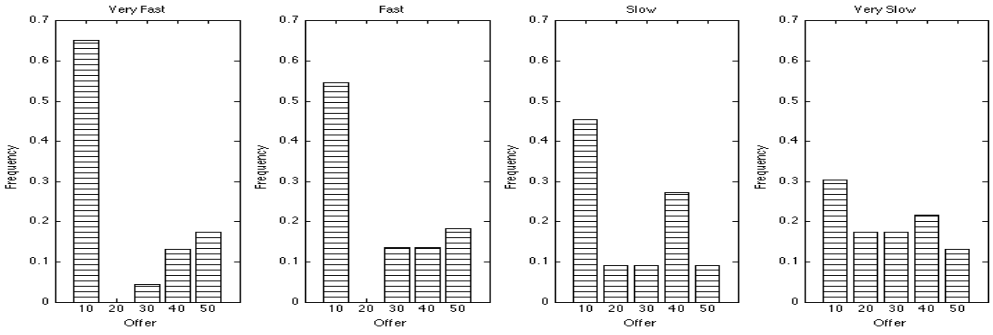


(a) Proposer offers in the UG. (b) Proposer offers in the YNG.

Figure 4: Histograms of offers $[100 - x, 100]$, where $x \in \{10, 20, 30, 40, 50\}$.

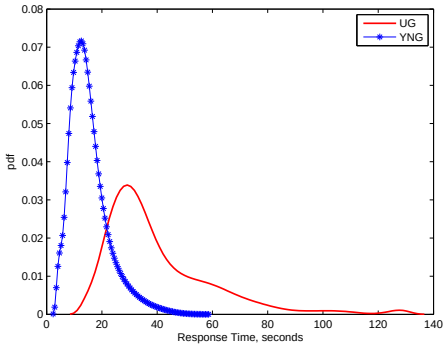


(a) Histograms of offers in each RT category for proposers in the UG.

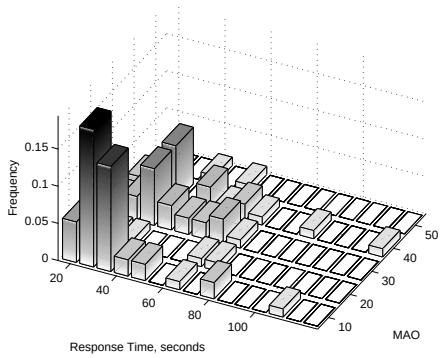


(b) Histograms of offers in each RT category for proposers in the YNG.

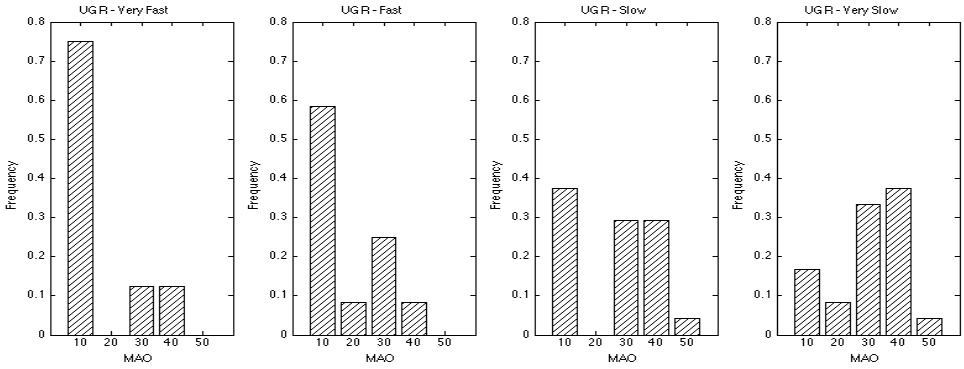
Figure 5: Four categories according to proposer RT: There are 9 subjects in *Very Fast* and in *Very Slow*, 36 subjects in *Slow*, and 36 in *Fast* in the YNG, and 37 in the UG.



(a) Empirical PDF of RT for responders in either game.

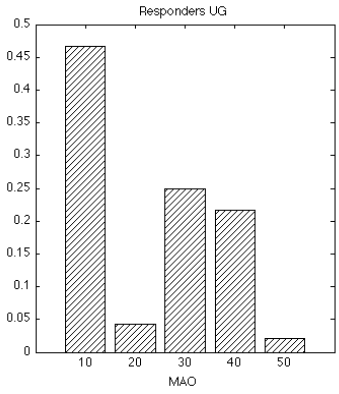


(b) Joint histogram of responder MAO and RT in the UG



(c) Histogram of MAO for responders in different RT categories.

Figure 6: Data on choices and RT for responders.



(a) Histogram of responder MAOs.

	Proposer's offer of $[100-x, x]$				
$x \rightarrow$	10	20	30	40	50
G_x	*0.4688*	*0.5104*	*0.7604*	***0.9792***	*1*
P_x	42.19	40.83	53.23	**58.75**	50
SE_x	44.91	39.99	29.88	**8.57**	0

(b) Distribution of payoffs for each offer, given the distribution of MAOs. P_x : expectation, and SE_x : std. error of payoff, for offer x.

Figure 7: Responder behavior in the UG induces a binomial distribution of payoffs for each strategy chosen by proposers in the UG.

Variables	Model 1	Model 2	Model 3	Model 4
YNG	-5.391**	-5.414**	-6.024**	-5.859**
	(3.091)	(3.106)	(3.135)	(3.155)
$female$		1.079		0.657
		(3.107)		(3.151)
$gmatch$		-1.654		-7.913
		(3.271)		(6.637)
$foreign$			0.136	0.521
			(5.790)	(5.874)
$omatch$			-6.877**	-9.717**
			(4.144)	(4.923)
$gomatch$				8.270
				(7.632)
Constant	30.802***	30.855***	36.200***	38.166***
	(2.179)	(2.864)	(4.957)	(5.811)
Observations	181	181	181	181

Table 3: Linear regressions of RT as a function of the game and several control variables. (***) $p < 0.01$, (**) $p < 0.05$, (*) $p < 0.1$.

7 Pseudo-UG

The variety of choices in the YNG suggests the presence of pro-social types who play certain strategies regardless of their profitability. There may be correlation between RT and behavioral type in both the YNG and the UG. There are good reasons for wishing to eliminate such correlation from our data. For example, the hypothesis that larger RT corresponds to a higher level in a cognitive hierarchies model, may be falsely rejected only because behavioral types with a tendency to make proposal [50, 50], also tend to have a larger RT. Let us assume that the percentages of pro-social behavior observed in the YNG are representative of the percentages of pro-social "types" that are also present in the UG. To explain this better, suppose 35% of all proposals in the UG are [50, 50], while only 5% of proposals in the YNG are [50, 50]. According to our assumption, approx. 14% of the 35% of egalitarian proposals in the UG (5% of all proposals) are made by *egalitarian* types who would have made such a proposal under any circumstance. We wish to remove these proposals. Since we do not know which proposals among all [50, 50] proposals are made by egalitarian types, our procedure will randomly remove an appropriate percentage from the UG sample repeatedly, to simulate a data set that is behavioral-type free. Let f_i be the frequency of offer $i \in \{[70, 30], [60, 40], [50, 50]\}$ in the YNG. To generate the *pseudo-UG* data we randomly choose a fraction f_i of proposers in the UG who make offer i to be removed from the sample. We repeat this random process 100 times and obtain a sample with proposer offers and response times, which we call the *Pseudo-UG* sample.

The *Pseudo-UG* sample has mean offers that differ significantly (at the 5% level) between all pairs of speed categories (mean offer equals 38.09 for the slowest 25% proposers and 43.4 for the fastest 25%). Kullback-Leibler divergence is decreasing with RT. The histogram of offers is unimodal with mode at 50 for all speed categories except the slowest, which has two modes: one at 40 and one at 50. The pseudo-UG data maintains most qualitative features of the original UG data, with two differences: the relative frequency of proposal [90, 10] is higher overall in the pseudo-UG data and the slowest group has two modes instead of the unique mode at [60, 40] that we obtained with the original data. The hypothesis that fast behavior is more concentrated than slow behavior cannot be rejected with pseudo-UG data either. Also, the hypothesis that RT positively correlates with levels of reasoning is rejected with the pseudo-UG data as well as with the original data.