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Experimental Ultimatum Game**

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2003/01

Institute of Economic Theory, Economic Policy
and Economic History

Institute of Public Finance

Bargaining under time pressure in an experimental ultimatum game^{*}

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Abstract

We examine the influence of time pressure on bargaining behavior in an ultimatum game. Controlling for offers, rejection rates of responders are significantly higher under a tight than under a very weak time constraint. However, this effect vanishes with repetition.

JEL classification: C71, C91

Keywords: time pressure, bargaining, ultimatum game, experiment

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^{*} Financial support from the Center for Experimental Economics at the University of Innsbruck (sponsored by *Raiffeisen Landesbank Tirol*) is gratefully acknowledged.

1 Introduction

Frequently, economic decisions have to be made under severe time pressure. Trading on the stock market is the prime example, because resulting profits from trading may depend crucially on the reaction velocity of the trader to new information or developments emerging from the markets. Buying or renting an apartment is an example, where time pressure may apply in a bargaining situation. Of course, time pressure is not as severe here as on the stock market, but decisions on accepting or rejecting an offer have to be made almost instantaneously, especially in those cities where apartments are very scarce.

Even though many economically interesting and also important decisions obviously have to be made under severe time pressure, the influence of time pressure on economic decision-making seems to have been rather neglected so far in the literature. Therefore, we believe that it is worthwhile studying the possible effects of time pressure on decision-making. There are several dimensions of decision-making that may be affected by a tight time constraint: the quality of decision-making¹, the type of deals that can be reached and the probability to strike a deal in bargaining.

The latter aspect, on which we concentrate in this paper, is not only relevant for economic decision-making, but also for the realm of political negotiations of conflict management. Carnevale and Lawler (1987) as well as Mosterd and Rutte (2000) provide evidence that time pressure reduces the frequency of reaching agreements in bilateral negotiations, where bargaining parties can make offers and counter-offers.²

In this paper, we have chosen a very simple bargaining process to study the effects of time pressure on economic decision-making experimentally. We use a standard ultimatum game (introduced by Güth et al., 1982), in which a proposer offers an amount $x \leq X$ to a responder. The latter can accept the offer, in which case the responder earns x and the proposer $X - x$, or reject the offer, which yields zero payoffs for both bargaining parties. We compare responder behavior under (i) a tight time constraint, and (ii) a very weak time constraint. In particular, we are interested in whether time pressure is a hindrance to making deals in bargaining,

¹ Recently, Kocher and Sutter (2003) have analyzed the influence of time pressure on the quality of individual decision-making and related payoffs in an experimental beauty-contest game. Not surprisingly, their results show that time pressure is detrimental to the quality of decision-making and reduces payoffs. This finding is in line with some psychological research indicating that time pressure negatively affects the information processing capacity when solving complex tasks (Gilliland and Schmitt, 1993; Weenig and Maarleveld, 2002).

² They also show that the effects of time pressure on bargaining behavior depend on personal characteristics (like individualistic orientation in bargaining) or the specific process of bargaining.

respectively whether time pressure influences the probability of accepting a given offer. Failing to reach an agreement may have efficiency costs. In our experimental study, we can test whether decision-making with a tight deadline is associated with higher efficiency costs than bargaining with a very loose deadline only.

The rest of the paper proceeds as follows. Section 2 introduces our experimental design. Section 3 presents the results, and Section 4 concludes.

2 Experimental Design

We set up two treatments of the ultimatum game. In our FAST-treatment, proposers and responders had 10 seconds time to make a decision on the offer (out of the proposer's endowment of 10 Euro), respectively on accepting or rejecting the offer. In the SLOW-treatment, the time limit was 100 seconds, which is, actually, no binding time limit and was also not perceived as binding by the participants.

In order to prevent participants from having too much time to think about their decisions in advance, they were only informed in the instructions (see Appendix B) that they were about to participate in a two person game in which two paired subjects, A and B, had to make exactly one decision in each of 9 rounds within a pre-specified time limit. After the time was up, no decision could be entered and people were told that they will not earn money in that round.

Participants learned in the instructions that subject A would get an initial endowment of 10 Euro per round which had to be allocated according to certain rules. Subject B would, then, be informed about subject A's decision before making her own decision by choosing from certain options. The precise rules were only displayed on the first screen after starting the computerized (Fischbacher, 1999) experiment. Participants had 20 (FAST), respectively 100 (SLOW) seconds time to read the following text and, then, 10 seconds to make their decision: 'You are in role A. You have an endowment of 10 €. You can choose any amount between 0 € and 10 € (in steps of 0.5 €) as an offer to the participant in role B that is paired with you. If your offer is accepted you will earn 10 € minus the amount you offered, and B will earn the amount you offered. If your offer is rejected, both of you will earn nothing in this round.' (text for subjects A); 'The participant A that is paired with you offers you ... €. If you accept the offer, you will earn this amount, and B will earn the difference between 10 € and the amount offered to you. If you reject the offer, both of you will earn nothing in this round.' (text for subjects B) From the second round on, the time limit in the FAST-treatment was

reduced to 10 seconds, but the text reappeared in any round above the decision button as a reminder.³

Before the experiment started, participants learned about the following features of the matching. There are 2 participants in role A (proposers) and 18 in role B (responders) in every session. In each round, both subjects A make a decision, which is transmitted to two subjects B. All other subjects B receive an exogenously determined decision by a ‘fictitious’ subject A. The matching is such that subject B face a decision of a ‘real’ subject A only in 1 out of 9 rounds, whereas in 8 rounds the decision is generated by us in advance. However, subjects B are not informed about the round in which the ‘real’ decision of subject A appears.

Therefore, subjects B were told that it is optimal to treat any round as real. Participants did not know that the ‘fictitious’ offers were chosen in a way to cover the range between 0 and 7 Euro. The ‘fictitious’ offers varied randomly within this range, with steps of half an Euro from 0 to 5 Euro.⁴ A complete table with all offers and acceptance behavior for both treatments can be found in the Appendix.

Determination of payoffs was explained to participants as follows: Since subjects A were always paired with a ‘real’ subject B, they were paid the average earning over 9 rounds. However, subjects B were paid according to the decisions in the very round in which they faced a ‘real’ subject A-decision.⁵ It is important to note here that we are only interested in responder behavior, specifically in acceptance/rejection rates. The ‘real’ proposers simply served as a mean to trigger real bargaining behavior. Since participants did not know when the interaction was real, our experimental design ensured preference revelation in acceptance behavior for all the offers.

For each treatment, we ran two sessions on May 28, 2002, at the University of Innsbruck. FAST-sessions lasted about 15 minutes, SLOW-sessions approximately 25 minutes, including about 10 minutes for explaining the instructions. In total, we gathered data from 4 proposers, respectively 32 responders⁶, per treatment and round.

³ Participants were informed about this change of the time constraint already in the instructions.

⁴ Of course, not everybody received the same offers, but we made sure that the distribution of offers over the range was even for any subject.

⁵ Cubitt et al. (1998) investigate random lottery incentive schemes that are similar to our experimental design of real and fictitious offers. It is comforting to note that random lottery incentive schemes seemingly do not bias individual choices in simple tasks.

⁶ Unfortunately, due to an error in the program, we could not use the data of responders no. 17 and 18 in all sessions, because for them the ‘fictitious’ offer was mistakenly always set at 7 Euro. Consequently, we could only consider the data from 16 responders in each session.

3 Results

3.1 First round behavior

Even though average offers to responders in the first round are almost identical in means as well as distribution in both conditions (with means of 2.69 in FAST, respectively 2.63 in SLOW), the overall acceptance rate is substantially lower in FAST than in SLOW (40.3% vs. 78.2%; $\chi^2 = 9.3$; $df = 1$; $p < 0.01$). Table 1 shows in detail the absolute frequency of accepting or rejecting a given offer in the first round in FAST and in SLOW. As can be seen, all offers above 1 Euro are accepted in SLOW, whereas only offers above 4.5 Euro are always accepted in FAST.⁷ Hence, our most important result is that time pressure in the form of imposing a tight time limit for decision-making leads to significantly more rejections and, thus, failures to strike a deal than when decisions have to be made under a very weak time constraint. Therefore, time pressure entails quite a high degree of efficiency costs. Whereas in FAST 59.4% of the endowment is destroyed (!), it is only 21.9% in SLOW. Not surprisingly, low offers are also much more often rejected in FAST than in SLOW.

Table 1: Responder behavior in round 1

treatment	offer	0.5	1	1.5	2	3.5	4	4.5	5	6	7	10	Sum
FAST	accept	2	-	-	3	-	-	1	2	4	-	1	13
	reject	6	2	4	4	2	-	1	-	-	-	-	19
SLOW	accept	4	-	3	6	2	2	2	1	4	1	-	25
	reject	4	3	-	-	-	-	-	-	-	-	-	7

3.2 The effects of repetition

Figure 1 shows the relative frequency of accepting an offer in rounds 1 to 9. As already indicated, there is a marked difference in the very first round. However, starting from the second round, there is no longer any statistically significant difference between acceptance rates in FAST and SLOW in any single round. Taking averages over rounds 2 to 9, the acceptance rate is 64.1% in FAST versus 63.7% in SLOW. Note that the average offers to responders are indicated below the bars in Figure 1. These offers – which have been generated

⁷ Note that strategic teaching of proposers cannot be the reason for rejecting offers in our repeated ultimatum game since subjects were informed that they would meet a ‘real’ proposer only in one single round and that all other offers would be determined by a ‘fictitious’ proposer.

by chance in 8 out of 9 cases⁸ – are in no round significantly different between both treatments. Summing up the evidence shown in Figure 1, we have to conclude that time pressure has no effect on responder behavior as soon as repetition comes into play. There are three possible explanations to account for this finding.

The first one is that subjects were rather quick to make up their mind about how to play the game as soon as they had obtained full information about the game and had played it once. Casual evidence from talking to participants in the FAST-treatment after the experiment supports this explanation. Most of the participants indicated that the feeling of time pressure had vanished quickly after 2 or 3 rounds.⁹

The second explanation refers to the patterns of responder behavior from rounds 2 to 9. We can define responder behavior to be monotonic if a responder accepts all offers where the offer is equal to or larger than a certain amount M . We find that 22 out of 32 responders exhibit such monotonicity in FAST, respectively 24 responders in SLOW. The difference is not significant, implying that the patterns guiding responders' behavior is very similar in both conditions from the second round on.

A third explanation would be that the experience from the first round triggered a routine in decision-making. Responders may have learned from the first round that it is sub-optimal to reject a positive offer. If such a routine has evolved, then one cannot distinguish between the FAST and the SLOW treatments, even if the process of decision-making were different in the sense that routine maintenance prevailed in FAST, and deliberation in SLOW. Betsch et al. (1998) show that time pressure increases the likelihood of applying behavioral routines, which would support this explanation.

Figure 2 pools the data of all 9 rounds and presents the acceptance rates depending upon a certain offer. It illustrates nicely that there is an almost linear relationship between the proposer's offer and the responder's probability of accepting the offer.¹⁰

⁸ Recall that we have only 4 'real' proposers in any treatment. Taking averages over all 9 rounds, 'real' proposers in FAST (SLOW) offered 4.4 (3.63) Euro. Average offers to responders were smaller (3.11 in FAST vs. 3.00 in SLOW) since they included the evenly distributed fictitious offers.

⁹ By the way, participants in the SLOW-treatment reported not to have considered the time limit of 100 seconds as a binding time constraint.

¹⁰ Note that there were no offers of 5.5, 7.5 or 10 in the SLOW-treatment.

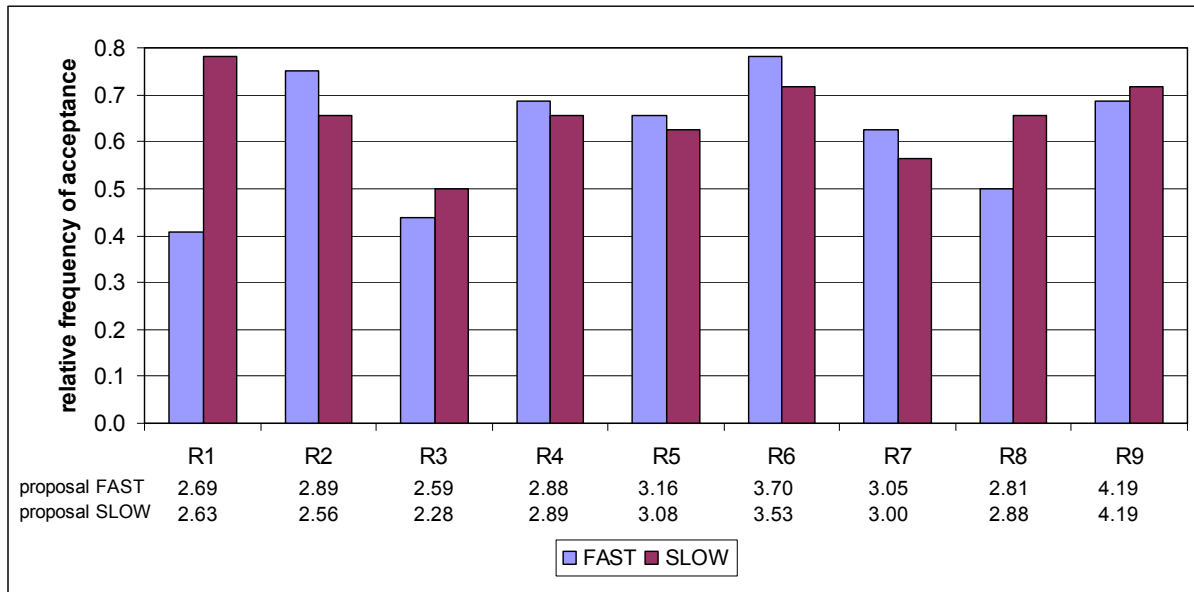


Figure 1: Acceptance behavior across rounds

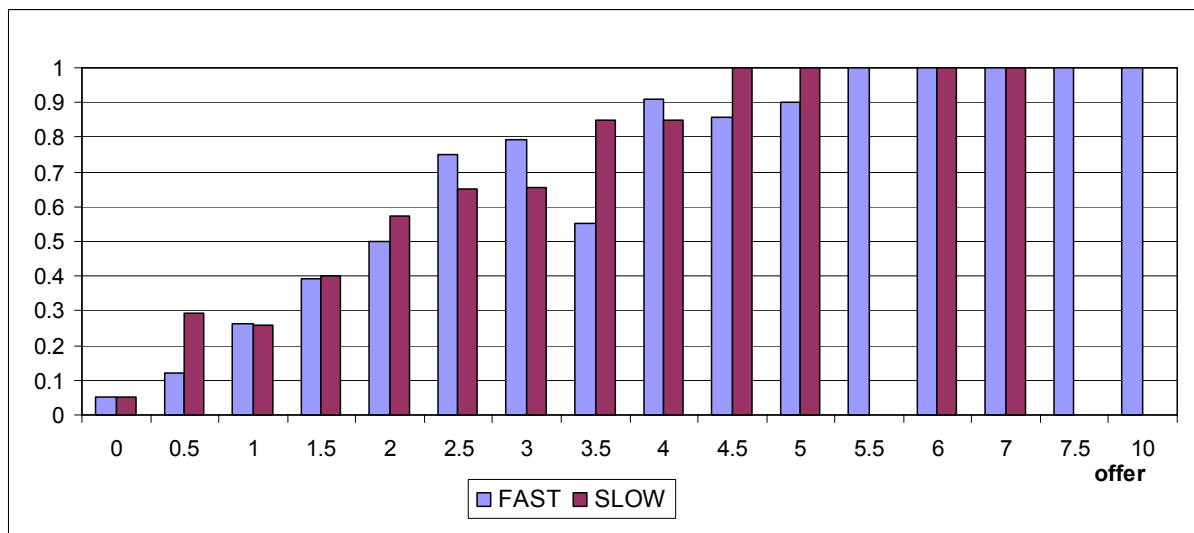


Figure 2: Acceptance rates depending upon offers

4 Conclusion

The main finding of this paper is a marked effect of a tight time limit on responder behavior in an ultimatum game. Under time pressure, responders reject about 60% of offers, especially those below the equal split. Without time pressure, responders reject only 20% of offers, in particular only those below 20% of the pie. Note that the difference in rejection rate is not due to the fact that responders under a tight time constraint just choose arbitrarily between acceptance or rejection because of lack of time. We do not observe a single rejection of an offer above 4.5 €. It seems to be the case that under a tight time limit people's

immediate emotions transform into a (economically sub-optimal) revenge decision. Having more time to deliberate probably leads to an awareness of the sub-optimality of such a reaction and drives down the number of rejections in the treatment without time pressure.

Interestingly, this effect of time pressure, which entails high efficiency losses, vanishes with repetition. Subjects learn very quickly that rejecting offers costs money, and most of the subjects adhere to a monotonic responder strategy of accepting all offers equal to or above a certain threshold.

Therefore, there is a simple and obvious lesson one can draw from our results: Do not put bargaining partners under severe time pressure – especially not in situations that are uncommon or new to them – because there is a high probability that they may turn down even a mutually advantageous deal.

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Appendix – These tables could be made available on the internet in order not to exceed the maximum length of a paper

Real and fictitious proposals – FAST

FAST										
	Subj.No.	R1	R2	R3	R4	R5	R6	R7	R8	R9
Responders	1	5*	0	2	4,5	1	3	2,5	4	6
	2	10*	6	3	0,5	1,5	4,5	4	0	2,5
	3	0,5	10*	1	4	2	3	6	0	4,5
	4	6	2,5*	0	2,5	4,5	3,5	3	1,5	0,5
	5	1	2	2,5*	4	3	0	1,5	4,5	6
	6	1,5	3	10*	4	2,5	0,5	0	5	7
	7	2	1,5	3,5	1,5*	4,5	6	3	1	0
	8	0,5	2,5	3,5	2,5*	4,5	6	1,5	1	0
	9	6	5	3,5	2,5	2,5*	4	1,5	1	0
	10	1,5	1	0,5	4	1,5*	3	5	7	2,5
	11	3,5	2	3	0,5	1	3,5*	0	4,5	7
	12	0,5	2,5	3,5	4	2	1*	1,5	5	6
	13	4,5	5	3,5	2	3	1	3,5*	0,5	7
	14	0,5	1	2	2,5	4	5	0,5*	3,5	7
	15	2	1,5	0,5	3	5	6	7	2,5*	4
	16	2	2,5	0,5	1	3,5	4,5	5	1,5*	7
	17	5**	0	2	4,5	1	3	2,5	4	6
	18	2**	6	3	0,5	1,5	4,5	4	0	2,5
	19	0,5	4**	1	4	2	3	6	0	4,5
	20	6	5**	0	2,5	4,5	3,5	3	1,5	0,5
	21	1	2	5**	4	3	0	1,5	4,5	6
	22	1,5	3	5,5**	4	2,5	0,5	0	5	7
	23	2	1,5	3,5	4**	4,5	6	3	1	0
	24	0,5	2,5	3,5	6**	4,5	6	1,5	1	0
	25	6	5	3,5	2,5	3**	4	1,5	1	0
	26	1,5	1	0,5	4	10**	3	5	7	2,5
	27	3,5	2	3	0,5	1	7**	0	4,5	7
	28	0,5	2,5	3,5	4	2	7**	1,5	5	6
	29	4,5	5	3,5	2	3	1	3**	0,5	7
	30	0,5	1	2	2,5	4	5	7,5**	3,5	7
	31	2	1,5	0,5	3	5	6	7	2**	4
	32	2	2,5	0,5	1	3,5	4,5	5	7**	7
Pro- posers	1	5*	10*	2,5*	1,5*	2,5*	3,5*	3,5*	2,5*	2,5*
	2	10*	2,5*	10*	2,5*	1,5*	1*	0,5*	1,5*	3,5*
	3	5**	4**	5**	4**	3**	7**	3**	2**	1**
	4	2**	5**	5,5**	6**	10**	7**	7,5**	7**	8**

* real offer in Session 1

** real offer in Session 2

..... responder accepted offer

Real and fictitious proposals – SLOW

SLOW										
	Subj.No.	R1	R2	R3	R4	R5	R6	R7	R8	R9
Responders	1	4*	0	2	4,5	1	3	2,5	4	6
	2	7*	6	3	0,5	1,5	4,5	4	0	2,5
	3	0,5	3*	1	4	2	3	6	0	4,5
	4	6	3*	0	2,5	4,5	3,5	3	1,5	0,5
	5	1	2	4*	4	3	0	1,5	4,5	6
	6	1,5	3	5*	4	2,5	0,5	0	5	7
	7	2	1,5	3,5	5*	4,5	6	3	1	0
	8	0,5	2,5	3,5	4,5*	4,5	6	1,5	1	0
	9	6	5	3,5	2,5	5*	4	1,5	1	0
	10	1,5	1	0,5	4	4,5*	3	5	7	2,5
	11	3,5	2	3	0,5	1	4*	0	4,5	7
	12	0,5	2,5	3,5	4	2	4*	1,5	5	6
	13	4,5	5	3,5	2	3	1	4*	0,5	7
	14	0,5	1	2	2,5	4	5	4*	3,5	7
	15	2	1,5	0,5	3	5	6	7	4*	4
	16	2	2,5	0,5	1	3,5	4,5	5	3,5*	7
	17	5**	0	2	4,5	1	3	2,5	4	6
	18	4**	6	3	0,5	1,5	4,5	4	0	2,5
	19	0,5	1**	1	4	2	3	6	0	4,5
	20	6	4**	0	2,5	4,5	3,5	3	1,5	0,5
	21	1	2	1**	4	3	0	1,5	4,5	6
	22	1,5	3	3**	4	2,5	0,5	0	5	7
	23	2	1,5	3,5	1**	4,5	6	3	1	0
	24	0,5	2,5	3,5	4**	4,5	6	1,5	1	0
	25	6	5	3,5	2,5	1**	4	1,5	1	0
	26	1,5	1	0,5	4	4**	3	5	7	2,5
	27	3,5	2	3	0,5	1	1**	0	4,5	7
	28	0,5	2,5	3,5	4	2	4**	1,5	5	6
	29	4,5	5	3,5	2	3	1	2**	0,5	7
	30	0,5	1	2	2,5	4	5	3**	3,5	7
	31	2	1,5	0,5	3	5	6	7	4**	4
	32	2	2,5	0,5	1	3,5	4,5	5	3,5**	7
Pro- posers	1	4*	3*	4*	5*	5*	4*	4*	4*	4*
	2	7*	3*	5*	4,5*	4,5*	4*	4*	3,5*	4*
	3	5**	1**	1**	1**	1**	1**	2**	4**	5**
	4	4**	4**	3**	4**	4**	4**	3**	3,5**	3,5**

* real offer in Session 1

** real offer in Session 2

..... responder accepted offer

Appendix B – NOT for publication (the instructions will be made available upon one of the authors’ homepages)

These are the instructions for the FAST treatment. [Changes for the SLOW treatment are indicated in squared brackets.]

Instructions for the experiment

You are about to participate in an experimental study on decision-making. You can earn “real” money, which will be paid to you privately and confidentially at the end of the experiment. During the experiment you and the other participants will be asked to make decisions. Your own decision as well as the decisions of the other participants determine your payoff according to the following instructions. If you have questions, please raise your hand. One of the instructors will come to you and answer your question privately. Do not ask questions aloud or talk with another participant.

Order of events

The experiment consists of 9 rounds. In each round each participant has to make one decision. By drawing your identity card you have been randomly assigned to a role A, respectively B. You get to know your role on your computer screen at the beginning of the experiment. The participants in role A get an endowment of € 10 in each round. Participants in role B do not receive an initial endowment.

Participants in role A have to allocate their endowment by adhering to certain rules. Participants in role B are informed about A’s decision, and then they have to make their own decision.

You will see the details for making your decisions at the beginning of the experiment on your screen.

Roles

There are 20 participants in this room. Two of them are in role A, 18 in role B.

If you are participant A, all the decisions you make are real. You will be matched to the participants in role B randomly in the 9 rounds.

If you are in role B, only one of your 9 decisions of A, who is matched with you, is real. In the remaining 8 rounds the decisions by participant A are determined exogenously by the experimenter. You are not told in which of the 9 rounds the decision by participant A has actually been taken by one of the two persons in role A. As the decision situation is the same for you in all rounds (also the presentation on the screen does not differ), you cannot distinguish whether the decision is made by a subject in role A or by the experimenter.

Payoff/Earnings

Role A: Your earnings are the average payoffs over all 9 rounds. That means the earnings of every round are summed up and divided by 9 for calculating your earnings.

Role B: Your earnings depend exclusively on your behavior in the very round in which you are matched with a real person in role A. We ask you to act in every round as if it were real. As you cannot know which round is real and therefore determines your payoff, it is the best for you to act as if all decision situations were real. At the end of the experiment you will be told, which round was relevant for your payoff.

Time Limit

Round 1 to 9: In each round you have 10 [100] seconds time to make your decision.

If you exceed the time limit, an input is not possible anymore and you earn nothing in this round (0 €). If this round has been a real round the decision will be simulated via computer for calculating the result for your matching partner. In the following round you can participate again.

Anonymity

You do not learn neither during nor after the experiment with whom you have been matched in the single rounds. The other participants do not learn during the experiment nor afterwards in which role you have been and how much you have earned.

Computer screens

Before round 1 you get the exact instructions on your screen. You can see them for 20 seconds. Then the 9 rounds start where you have to make your decisions by either entering a number or clicking at one of several options with the mouse.

Your decisions must be confirmed by clicking on the OK-Button in the lower right corner. In the right upper corner you can see the remaining time (counting down to zero). Please test right now if your computer mouse works properly.

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