How to act knowing how others acted in the same circumstances: some experimental evidence from the ultimatum game*

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Abstract

Contemporary works, such as Lusk & Hudson´s (2004), find that the greater knowledge regarding the possible results of the ultimatum game lead to results closer to the subgame perfect equilibrium. In this paper we seek to further this line of research beyond the fact of making the individuals aware of the game's purely strategical solution (the Nash Equilibrium). To this end, we use a scenario where the individuals are aware of the results obtained by previous players in the ultimatum game. Our results show that this knowledge doesn't necessarily lead to optimizing behavior (as in the standard solution), but, on the contrary, the heuristic rule of "offering 50%" strengthens.

Jel – classifying numbers: C78; C91; C72; B40

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Introduction

The anomalous results observed in the ultimatum game have been dealt with from various points of view within the field of Behavioral Economics. In this regard, the observed deviations from the "strategic behavior" occurring in multiple experiments have been explained by use of three different means: psychology, culture and the individual's social context.

Recent works, like that of Lusk & Hudson (2004), incorporate into the game the knowledge of its optimal result – the subgame perfect Nash equilibrium- which is explained to the participants beforehand. Formally, in Lusk & Hudson´s experiment two individuals had decide how to divide between them $10 by means of two treatments. In the first one, traditional one (without cheap talk), the participants only knew the games´ traditional information –i.e. the standardized rules-. In the second one, the participants knew the optimal outcome of the game predicted by rational choice in game theory (with cheap talk). [1] In the latter (with cheap talk), emitters and receivers knew from the game's protocol that the emitter's (proposer) best strategy is to offer the receiver $1 (the minimal non zero offer), and the receiver's is to accept it ($1 is better than nothing). Additionally, all participants were giving the following information contained in this phrase: "traditional outcomes of the ultimatum game are 50/50"; "This is due to the fact that the emitter may consider a low offer as something unfair to his/her partner or because they believed that low offers had higher probabilities of being declined" [2]

Lusk & Hudson's experimental results show that the mean offer in the "with cheap talk" treatment was smaller than in the "without cheap talk" one. The mean offer in the first treatment was $4.46 versus $4.89 in the second. The Mann-Whitney *U*-test was consistent with the hypothesis that the added information about the optimal result of the ultimatum game lead to smaller offers and smaller decline rates. [3] Lusk & Hudson's conclusions were that under bounded rationality scenarios people use traditional heuristic rules such as the 50/50 criteria. However, when they get hold of more information regarding the possible strategies, their actions become more akin to the profit maximization criteria (Nash equilibrium). Nonetheless, the modal offer was identical in both treatments, that is, 50/50.

In Fajfar´s 2004 experiment, 95 randomly constituted pairs of students had to bargain over the way to divide amongst them two extra credit points for the second mid-term exam of the course they were taking. In forty-eight of those pairs the roles (emitter-receiver) were randomly assigned (regardless of their first mid-term's grade –traditional version of the experiment-). The remaining 47 pairs of students were constituted using the following selection criterion: those students whose grades in the first mid-term exam were higher than their course's median were to act as emitters (alternative version). [4] The obtained results showed that the mean value of the offers made didn't differ significantly between both treatments of the experiment (traditional vs. alternative version). However, the acceptance rate of offers smaller than "one grade point" (50% of the bargained incentive) was significantly higher in the alternative version. [5]

In our latest experiment, a total of 41 pairs of students once again had to bargain over the way in which they would divide amongst them 2 extra credit points for the second

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[1] Both treatments of the experiment were performed on a population of 166 economics students of the Mississippi State University. In the "without cheap talk" treatment 56 pairs participated, and in the "with cheap talk" 27.

[2] This summarizes Lusk & Hudson´s experiment main viewpoints.

[3] In both treatments no offers were rejected.

[4] The experimental methodology used in the "alternative version" treatment in Fajfar (2004) was based on Hoffman et al. (1994). That is, the pairs (emitter-receiver) were determined using a ranking. The ones who were better seeded in the ranking were granted the property right of acting as emitters.

[5] The results of the experiment can be requested at: pfajfar@econ.uba.ar

mid-term exam of the course they were taking. The selection criterion of emitters and receivers was similar to that of Fajfar`s 2004 alternative version. However, each participant was presented a matrix containing the results obtained by previous participants before having to decide their actions. This way we restated Lusk & Hudson's experiment, making the participants aware of the distribution of results of previous participants in the same experiment (with the same instructions), instead of providing them with the purely logical-rational-strategic result of the game. In other words, in the bargaining process, the participants were aware of what other participants had done in identical circumstances.

This paper is divided into four sections. In the first one, we exhibit the performed experiment and its connections with Fajfar´s 2004 "alternative version" of the experiment. In the second one, we state our expected results based on Lusk & Hudson´s 2004 findings. In the third one we present our experimental results, and finally, in the fourth, we state our conclusions.

I. The experiment

A total of eighty two economics students from the University of Buenos Aires´ School of Economics (Argentina) took part in a series of ultimatum games during the months of September and October 2005. With those eighty two students, 41 pairs were made. Each pair had to decide the way to divide an incentive of two extra credit points for the second mid-term exam.[6] The students who took part in this experiment were taking the courses Microeconomics I (Principles of Microeconomics) and Mathematics for Economists, incorporated into the first year of the professional cycle in the student's degree academic program.

Following Fajfar´s 2004 experimental methodology, emitters were those students whose first exam grades were above the course median.[7] This information was of public domain for all students.[8] Each emitter had to make an offer regarding the amount of two bargained points that he/she decided to grant to the receiver. Then, the receiver must decide whether to accept or decline the proposed offer. If he were to accept it, each participant received the agreed upon amount. Should he decline it, they would both go empty handed.

The participants received the following instructions:

 Phase 1 (for all participants in each course):

The following game consists of the distribution of 2 (two) extra credit points for the course's last mid-term. The way in which they are to be divided up is entirely up to you, that is, according to the decisions you make. Each "emitter" student will decide upon a proposed distribution of the 2 points in question. Based on such offer, each "receiver" student must decide whether to accept or decline said offer. Should he accept it, both points will be divided up accordingly. If, however, he were to decline it, none of the students will receive any points. The interaction between the emitter and the receiver will be anonymous, that is, none of them (you) shall know each other. Each student will receive a number to identify him as emitter or receiver, keep this number since it will be used to redeem your extra credit.

Afterwards you will be presented with a form in which to state your desired course of action. This form will first be completed by a student appointed as emitter and then it will be given to one appointed as receiver to state his decision.

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[6] The exams are graded using a 0-10 point scale, considering any score below 4 points as a Fail. Students can have only fail one exam, in which case they have to take a make-up test at the end of the course.

[7] "Alternative Version" in Fajfar´s 2004 classroom experiment.

[8] In all cases all the students in each course were present. They were noticed of the experiment a week before it was to take place and the only information they received was about the extra credit incentive.

In case that the class had an odd number of students, one of them was randomly chosen and offered the experiment's mean accepted offers without taking part in it.

EMITTER Nº………………

Mark with an X the amount of points you offer as well as those you keep four yourself.
E.g.: if your offer is 0.8 points, you should mark with an X 0.8 in the first row and 1.2 in the second one. All other cells should be left blank

	0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	1,9	2
Amount offered:																					
Amount to keep:																					

RECEIVER Nº…………..

Mark with an X your decision:

ACCEPT THE OFFER:		DECLINE THE OFFER:	

Phase 2 (for all participants in each course):

The distribution of the roles into emitters and receivers will be done using the following criterion: "Those students whose grade in the first mid-term was above ...... points (course median) will assume the role of emitters and will stay in this room. Those students whose grade was below ...... points (course median) will act as receivers and will go to room nº...."

Phase 3 (for all participants in each course):

*The game you are currently participating in was previously performed with other students. Specifically, during 2004, a total of 190 students participated in the same experiment. Ninety five couples had to decide how to divide two extra credit points for the second mid-term exam. Forty eight out of those 95 couples were determined regardless of their first mid-term's grade (traditional version of the game). The other **47** (alternative version of the game) were determined using the same criterion being currently employed with you. That is, "emitters were those students whose grades in the first mid-term were above the course median". The following table show the results obtained with the **47** couples determined in the same way as you were:*

Previous results:

Points offered	Frequency (offer)	Declines	Decline Percentage (%)
0.2	1	1	100
0.5	3	2	66.6
0.7	3	0	0
0.8	4	0	0
0.9	6	0	0
1	29	0	0
1.1	1	0	0

The first column details the points offered by the emitters while the second, the number of offers in each case. For example: three individuals offered 0.7 points, three 0.5, twenty nine 1, etc. Notice that other possible offers weren't made, that is, no student offered 0.1 point, 0.3 points, or any offer greater than 1.1 points. The third column shows the number of declines (by the receivers) for each offer, and the fourth column the decline percentage for each offer. For example: the only offer of 0.2 points was rejected by the receiver, two out of three offers of 0.5 points were rejected either, etc.

Phase 4 (for all emitters in each course):

*As it was mentioned in the previous instructions, each of you must decide the amount of the two points that you offer the receiver, along with the amount that you keep for your self. Before being presented with the form where you have to emit your decision, a short questionnaire with your **identification number** will be given to you. This questionnaire won't be transferred to the receiver, that is, it will be kept by the conductor of the experiment. Once filled out, you will be given another form to fill out that will be transferred to a randomly selected receiver.*

Phase 5 (for all receivers in each course):

*As it was mentioned in the previous instructions, each of you must decide whether you accept or decline the emitter's offer. Before being presented with a form where you have to state your decision, a short questionnaire with your **ID** number will be given to you. This questionnaire won't be transferred to the emitter, that is, will be kept by the conductor of the experiment. Once filled out, a game form filled by a randomly selected emitter will be given to you. This form has a number that identifies the receiver and another that identifies the emitter. In this form you must decide your course of action, that is, whether to **accept** or **decline** his offer.*

II. Expected Results

Based on the information provided by the players in 2005 –based on Fajfar´s 2004 classroom experiment's results-, two matters arise:

The first one is the possibility of obtaining the same offer distribution in a context where the emitters are aware of the receivers´ potential behavior. In this regard, according to Lusk & Hudson (2004), we should expect that the greater knowledge regarding the optimum strategies leads to a result more akin to the subgame perfect equilibrium. In other words, if the emitters were to use the underlying information, their actions should be oriented towards offering a smaller amount of points since they are able to make assumptions regarding receivers´ rejection threshold, that is:

$H_1: mean\ x' > mean\ x^* / x^* = \arg\ \max\ u(2-x)F(x)$; where x' represents the offers made in a context where it isn't possible to predict the receivers´ behavior (Fajfar 2004); x^*, the offers made in the scenario where they are able to infer the receivers´ acceptance probability based on a historic distribution; and, $F(x)$ the historic probability distribution.

The second issue concerns the receivers´ behavioral pattern. In this regard, if they are to behave according to what their predecessors did, we shouldn't observe any declines for offers greater than 0.5 points. Formally, the expected rejection distribution can be expressed using the following hypothesis:

$$H_2: \begin{cases} 0 \text{ if } x^* > 0.5 \text{ points} \\ prox\ 66\% \text{ if } x^* = 0.5 \text{ points} \\ 100\% \text{ if } x^* < 0.5 \text{ points} \end{cases}$$

Once again, x^* represents the offers proposed by the emitters in a scenario where they are aware of the receivers` acceptance distribution.

III. Obtained Results

Table I (reproduced below) presents the global bargaining results of the 41 couples studied in 2005. **Table II** compares the results obtained in 2005 with those of 2004.
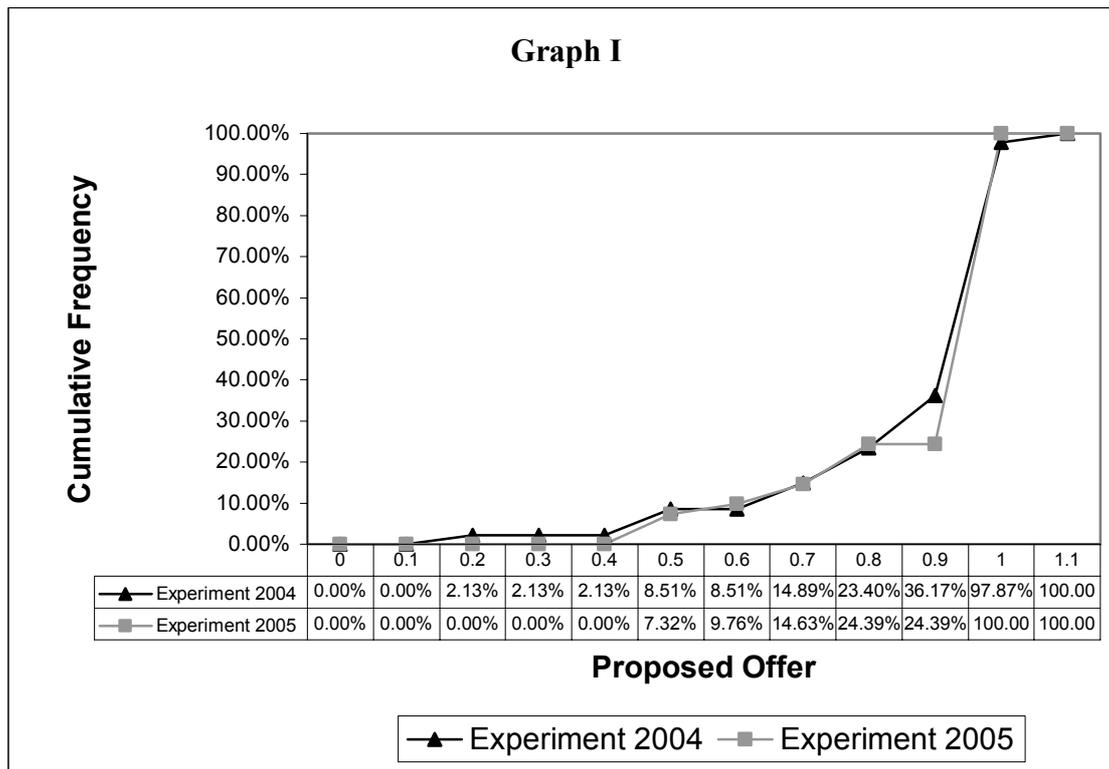
Table I: 2005 Bargaining Results

Points offered	Frequency (offer)	Declines
0.5	3	0
0.6	1	0
0.7	2	0
0.8	4	0
1	31	0

Table II: Experimental Results 2005 vs. 2004

Statistic	2005 Experiment	2004 Experiment
Emitters		
Mean offer (points)	0.92	0.9
Offer standard deviation	0.15	0.17
Median offer (points)	1	1
Minimum offer (points)	0.5	0.2
Maximum offer (points)	1	1.1
One point offers (%)	75.6	61.7
Mean MAO : Expectation (points)[1]	0.63	0.75
	(0.26)*	(0.28)*
Mean offer-Mean MAO (points)	0.29	0.15
Mean Dictator offer (points)	0.6	0.68
	(0.35)*	(0.36)*
Receivers		
Accepting offer (%)	100	93.6
Accepting offer ≤ 0.5 points (%)	100	25
Mean MAO (points)[1]	0.71	0.82
	(0.23)*	(0.27)*
Number of pairs	41	47

[1]MAO: Minimum Acceptable Offer
*Standard Deviations

Contrary to what was expected, the mean value of the emitters´ offers was 0.02 points greater in the 2005 experiment. In this regard, the Mann-Whitney U-test provides a critical value of z= -0.724, and a p-value=0.47, proving that the greater information regarding the receivers´ rejection threshold doesn't generate significant differences in the offers put forward. **Graph I** shows the accumulated frequencies of the offers made in both experiments. Notice that the percentage of offers greater than 0.5 points was 91.49% -in the scenario where they were unaware of the receiver's acceptance distribution (2004)-, and 92.68% when they where aware of it (2005).

Graph I

	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1
Experiment 2004	0.00%	0.00%	2.13%	2.13%	2.13%	8.51%	8.51%	14.89%	23.40%	36.17%	97.87%	100.00
Experiment 2005	0.00%	0.00%	0.00%	0.00%	0.00%	7.32%	9.76%	14.63%	24.39%	24.39%	100.00	100.00

Proposed Offer

In addition to the figures previously reproduced, note that the percentage of *one point offers* (50% of the amount in question) was significantly greater in the 2005 experiment. In this regard, 75.6% of the emitters in 2005 offered 1 point, whereas only 61.7% did so in 2004.

There are two other relevant facts regarding the emitter's behavioral pattern that should be pointed out: 1) The subjective expectation regarding the receivers´ rejection threshold, and 2) The dictator's role. As we mentioned in section I, before emitting their offers, each participant had to fill out a brief questionnaire.[9] Regarding the first issue (MAO expectation), each emitter had to reveal the critical fraction of the 2 points in question that he believes the receiver will demand so as not to reject his offer. Regarding the second issue, each emitter had to reveal which portion of the two points he would offer the receiver where the game played unilaterally (dictator's game).

The obtained results regarding the subjective expectation regarding the receivers´ rejection threshold were, in average, 0.63 points in 2005 and 0.75 points in 2004. This difference is due to the experimental context of 2005, where the individuals were able to make assumptions regarding the receivers´ possible actions –which have a lower acceptance limit of 0.7 points-.[10] However, the gap between the offers´ average and the expectation regarding the receiver's critical rejection value (Mean offer-Mean MAO) was 0.29 points in the 2005 version versus 0.15 points in the 2004 one. This gap proved to be significant in both experiments, as the Mann-Whitney U-test shows, giving a value of z = 2.079 and a p-

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[9] This questionnaire is reproduced in the appendix.

[10] Notice that based on the results distribution presented to the players in 2005 one could assume that an offer of 0.5 points has a probability of 1/3 of being accepted, whereas an offer of 0.7 points has 100% probability. This is why the expected rejection threshold is located in said interval, that is, 0.63 points.

value=0.037, proving that the difference between what the emitters offer and what they believe the receiver will demand is greater in the 2005 experiment.

Regarding the dictator's role, the emitters in the 2005 experiment offered in average 0.6 points, whereas in 2004 they offered 0.68 points. In this regard, the Mann-Whitney U-test gives us a $z = -1.611$ and a p-value=0.11, proving that the opportunist behaviors don't differ significantly in both experiments.

As for the receivers´ behavior, one should notice that in the 2005 experiment, all offers where accepted. In this regard, the lower boundary of the offers made by the emitters in 2005 was of 0.5 points -consistent with the information provided to the players-.[11] Notice that 100% of the 0.5 points offers were accepted! In this regard, contrary to what was assumed in our previous hypothesis, its acceptance rate widely overcame the expected 33%.[12]

The second relevant fact concerns the willingness to accept. In this regard, each receiver had to reveal in the questionnaire (before emitting his final decision) the minimal value he would be willing to accept so as not to decline the proposed offer (MAO).[13] The results obtained in 2005 differ significantly from those of 2004. The receivers in 2005 stated that they, in average, would demand a minimum of 0.71 points out of the 2 in question, whereas those from the 2004 experiment demanded 0.82 points ($z = -1.97$, p-value $= 0.047$). This difference is due to the fact that the former acted based on the latter's behavior. **Graph II**, depicted below, presents the minimum accepting offers (MAOs) frequencies for: a) 2004 Receivers and b) 2005 receivers.

Graph II

a) Receivers 2004

b) Receivers 2005

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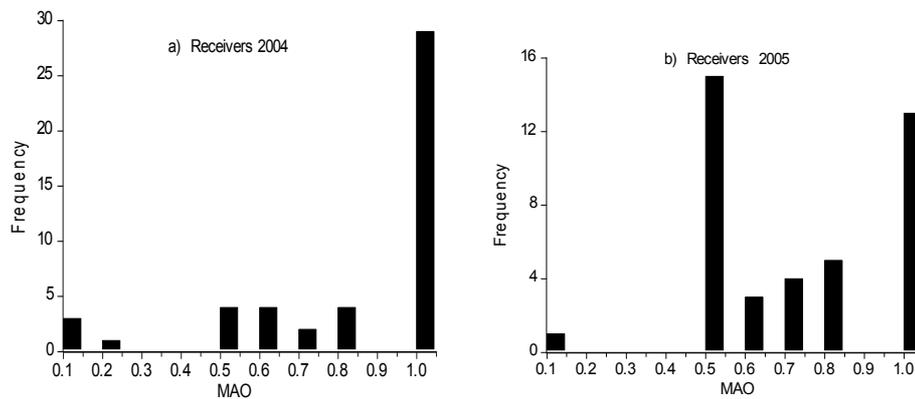
[11] The players´ assumptions in 2005 were based on Fajfar´s 2004 classroom experiment's results, where all of the offers greater than 0.5 points were accepted, whereas smaller ones where riskier choices.

[12] Specifically, of the 3 accomplished offers, none was declined. This issue will be dealt with later on.

[13] This information wasn't binding in terms of what he would actually accept ex-post. Additionally, the information supplied by each receiver was only accessible to the conductor of the experiment and kept from the emitters. Formally, the question's intention was to make the receiver's reveal their predisposition towards accepting some offers and declining others.

Notice that the mode of MAO´s values in the 2004 experiment was 1 point whereas in the 2005 one was 0.5 points. It is also worth mentioning that of the three 0.5 - points accepted offers in 2005; two were consistent with the receiver's MAO (0.5 points). The other one was consistent with an MAO of 0.1 points.

IV. Conclusions

The results obtained in the present paper show that a greater knowledge regarding the ultimatum game's optimum strategies doesn't necessarily generate results more akin to the subgame perfect behavior. In other words, the use of the rule "offer 50%" doesn't derive from the fact that in contexts of bounded rationality agents seek to assure themselves a certain payoff. Quite the contrary, said rule remains valid in scenarios where the property rights are set before the game takes place and, more important, when the agents are aware of the configuration of possible results. Performing an experiment where the participants were aware of the results previously obtained by other participants and, furthermore, the rights to act as a proposer (emitter) where acquired, the emitters and receivers´ behavioral patterns present the following characteristics:

Emitters:

    i.   When the emitters where aware of the acceptance distribution of possible offers, the achieved offers didn't vary significantly from those made under uncertainty (Fajfar, 2004). Linked to this fact, the percentage of 50/50 offers (one point offers) was greater in the case where the emitters had greater knowledge regarding the receiver's acceptance margin.

    ii.   The difference between the offers made and the receivers´ subjective rejection expectation (Mean offer - Mean MAO) was significantly greater in the case where the emitters had greater information regarding the receivers´ potential behavior. In this regard, an arbitrary rejection threshold of 0.75 points lead to offers of 0.9 points (in average), whereas a possible rejection threshold of 0.63 lead to offers of 0.92 points.

    iii.   Regarding the dictator's role, the proposed offers where a homogenous set. This means that the added information regarding the receivers´ acceptance distribution had no effect in the emitters' decisions.

Receivers:

    i.   When the receivers knew the acceptance distribution of previous players, their behavior tended to be consistent with them. In this regard, the minimum value they would be willing to accept (MAO) was close to those of previous players, however, the acceptance rate in terms of the critical value of "0.5 points" was greater than expected.

In general terms, the obtained experimental results depicted in this paper differ substantially from those of Lusk & Hudson (2004). In this regard, we consider that the 50/50 concept goes beyond the use of a heuristic rule. Regarding our methodological differences with Lusk & Hudson's experiment, two issues arise. The first one is the framework in which the bargaining took place, that is, the way in which the roles of emitter and receiver where assigned. The other one is the incentives used. Regarding

the former, we consider that undertaking the experiment using the selection criteria employed by Hoffman *et al.* (1994) doesn't affect the pursued objective. In this matter, Fajfar´s (2004) classroom experiment's results where encouraging enough to perform the experiment once again in a context where the participants where aware of said results.

As for the incentives used, according to D. Read (2005) "the use of monetary incentives in an experiment doesn't necessarily magically generate the sought after incentives". On the other hand, Forsythe *et al* (1994) and Cameron (1999) find that the experimental result of the ultimatum game is independent of the treatment "monetary-non monetary" of the used incentives.

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APPENDIX: Emitters´ and Receivers´ Questionnaires

Emitters´ Questionnaire:

Emitter Nº: ………….

Instructions: Answer all questions. Your answer is very important for our investigation. If you have any doubts, raise your hand and the conductor of the experiment will answer your question! Remember that once you finish the questionnaire you'll be given a form in which to fill out your offer.

1 Age: ……………………………..

2. Sex: …………………………….

3. First mid-term's grade: ……………………….

4. Of the two points at stake. What do you think will be the receiver's minimum accepting offer (M.A.O.) so as not to decline your offer?

	0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	1,9	2
M.A.O.																					

5. Imagine that you are the one who decides how to divide the extra credit for the second mid-term. In other words, if the receiver had no say in the division of the points and no power to decline the offer. This means that *"If you offered the receiver 10% of the points, the receiver has no choice but to accept them, since he no longer has power to decline your offer*". How many points would you be willing to offer the receiver?

	0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	1,9	2
Points offered																					

6. State your current G.P.A. (grade point average): …………………………….

Receivers´ Questionnaire:

Receiver Nº: ………..

Instructions: Answer all questions. Your answer is very important for our investigation. If you have any doubts, raise your hand and the conductor of the experiment will answer your question! Remember that once you finish the questionnaire you'll be given a form in which to decide whether to accept or decline the proposed offer.

1 Age: ……………………………..

2. Sex: …………………………….

3. First mid-term's grade: ……………………….

4. Of the two points at stake. What's the minimum you are willing to accept (M.A.O.)? Why?

	0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	1,9	2
M.A.O.																					

Why?:
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……………………………………………………

5. State your current G.P.A. (grade point average): …………………………….