'MY FRIENDS: IT WOULD BE AN ERROR TO ACCEPT': COMMUNICATION IN A BARGAINING SETTING

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ABSTRACT. In this paper we introduce communication into intergroup ultimatum bargaining in a lab. The responder groups vote whether to accept the proposals with unanimity required either for acceptance or for rejection. In contrast with the no-communication results reported in our previous study (Elbittar *et al.* 2011), the group decision rule does affect the individual voting behavior when subjects are allowed to deliberate before voting. In fact, when acceptance is the default, subjects become substantially more likely to vote to reject an offer. As a result, the formal group decision-making rule turns out to have little impact on group decisions, which follow the behavior of the more confrontational subjects, as predicted by the "group discontinuity hypothesis" of the psychological literature. Our findings also mirror those of Girardi and Yariv (2007) who find that within-group communication may eliminate the impact of group decision rules in jury settings.

Keywords: Bargaining games; Group decision making; Communication; Experiments.

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1. INTRODUCTION

This paper continues our previous study (Elbittar, Gomberg and Sour, 2011) of the impact of the intra-group decision rules on the intergroup bargaining. It has long been observed (see, for instance, Schelling, 1980; Putnam, 1988; Haller and Holden, 1997; Manzini and Mariotti, 2005) that in many settings, such as collective bargaining between management and unions, conference negotiations between legislative chambers or treaty negotiations between countries, formal internal decision-making rules within the groups may turn out to be crucial for bargaining outcomes.

In fact, the theory predicts that supermajority ratification requirements would be advantageous in negotiation by strengthening the threat of the negotiation break-down. The theoretically well-established advantage treaty negotiators obtain from stringent ratification rules makes it all the more surprising that requirements, such as the approval by the two thirds of the US Senate, which the constitution imposes on treaty ratification, are not that common. In recent decades, the US itself has been largely switching to negotiating international agreements, that do not require a supermajority to ratify. Perhaps, the corresponding negotiation advantage is less obvious in practice than it is in theory. As measuring such advantage using field data might be difficult, controlled laboratory setting with observed payoffs becomes useful.

The experimental evidence for the above theoretical proposition has been mixed even in the simplest bargaining context, such as the ultimatum bargaining, where one side makes a "take it or leave it" offer to divide certain surplus, which gets implemented if their opponents accept, with the surplus destroyed in case of rejection. In particular, Messick, Moore and Bazerman (1997) in their well-known experimental study fail to establish any advantage for groups that need unanimous consent to accept offers as compared to groups that need unanimity to overturn the default acceptance of these. In contrast, in our earlier work (Elbittar *et al.*, 2011), we found that, when faced with opponents operating under the distinct internal rules, ultimatum proposers tend to be more cautious when the responder group rules require higher voting thresholds for acceptance.

An important insight on group interaction in games, which may be relevant to the issue at hand, has come from the psychological literature. In a meta-study of a large body (some 130 studies) of experimental evidence Wildschut *et al.* (2003) provide evidence on what is known in psychology as the *group discontinuity effect*: the general tendency of groups of agents, when observed as a unit, to behave more "competitively" than individuals in similar circumstances. This result has been attributed to either social reinforcement of aggressive behavior, greater anonymity within the group, or fear of aggressive behavior by the opposing group.

In the context of ultimatum bargaining, Bornstein and Yaniv (1998) claim to find indications of more aggressive proposer behavior in groups combined with greater willingness to accept by responder groups as compared with individual responders. Their findings however do rely on a small number of observations. Notably, Grosskopf (2003), comparing one-on-one and one-on-group ultimatum bargaining under a group decision rule, similar to one of the treatments in Messick *et al.*'s (1997) when unanimity is required for rejection, finds that though the agents might not be able to figure out the difference immediately, with experience a clear difference emerges between the play against groups versus play against individuals. In particular, she observes that when playing against groups, utilizing a "low threshold" rule for acceptance, proposers eventually learn to be more aggressive.

The above-mentioned studies can be classified into those, where actual groups of people interact (e.g., Bornstein and Yaniv, 1998, and most of the studies cited by Wildschut *et al.*, 2003) and those where the groups are essentially notional: individuals taking decisions independently, and aggregation rules being applied to these individual decisions (e.g., Messick *et al.*, 1997, Grosskopf, 2003, and Elbittar *et al.*, 2011).

Our initial conjecture, which motivated both the earlier study and this work, was that explicitly stated group decision rules may be determinant of group behavior. In this light, we believed that our results in Elbittar *et al.* (2011), when viewed in conjunction with those surveyed in Wildschut *et al.* (2003), could be indicative of the internal rules, frequently not directly observed, that prevail in actual group decisions. However, as our groups in Elbittar *et al.* (2011) were purely notional, with no direct interaction between group members permitted, it remained to be verified directly, if allowing such within-group interaction would preserve the results.

In order to test this, we introduced intra-group communication into the ultimatum bargaining experiments otherwise identical to some the group bargaining treatments of our previous paper. We did this by allowing subjects free form communication within their group, using an instant messenger software, before making their decisions. We wanted to test if the subjects' ability to communicate may affect their individual decisions. Though our initial conjecture was that whatever the impact of communication, the impact of group decision-rules we impose would still dominate. It turned out, however, that the impact of communication we observed in the lab was strong enough to overcome the effect of the group decision rules, in a manner which may provide additional evidence for the nature of the *group discontinuity.*

As we have reported in Elbittar *et al.* (2011), without communication the responders' individual behavior was identical, whatever the rule used to aggregate their decisions. Of course, the result of this was that when unanimity was required to reject an offer, the group decisions tended to acceptance compared with the treatment where unanimity was required for acceptance. Appropriately, proposers did internalize the responder decision rules, and tend to be more generous in their offers when high threshold is imposed for acceptance.

All of this radically changed, once communication was allowed: when the low threshold was imposed (that is, when acceptance was the default unanimity that was required to overturn), subjects tended to increase their likelihood of voting to reject, so that group rejection probabilities became, essentially identical, no matter what formal group decision rule was used. In a way, responder groups tended to act "as if" utilizing the more aggressive rule, with both group types being more likely to reject than responders in the control individual bargaining sessions. This, naturally, leads to proposers becoming sharply more cautious in the "acceptance default" treatment: though the offers never became statistically identical, the difference between them across treatments shrunk sharply, when communication was allowed.

Our findings suggest that the formal decision-making rules may be less important, compared with the usual theoretical prediction. The advantage the sides extract from more strenuous ratification requirements may also be obtained by individuals within groups acting in a more aggressive fashion, which is exactly what we seem to observe. In terms of the psychological literature this provides new evidence for the group discontinuity effect of Wildschut *et al.* (2003), with a surprising twist: when communication is allowed, groups may be acting similar to their more aggressive members no matter what formal rule is imposed on them! This suggests that the formal super-majority ratification rules may be less important than the ratification requirement by (legislative) groups itself: the more aggressive behavior characteristic of groups may be a sufficient negotiating threat.

An alternative interpretation of our results is provided by recent experimental work Goeree and Yariv (2011) on the interaction between group decision rules and communication in a jury. That setting is distinct in that their subjects, unlike those in our experiment, do not face an opposing group, but face the task of determining the correct state of the world. Like us, Goeree and Yariv (2011) find that availability of communication negates the impact of the group decision rule that is observed without communication - but only when subjects share a common preference, while possibly receiving distinct signals. In contrast, when subjects' preferences differ, the voting rule matters even when communication is present.

Previous theoretical work by Gerardi and Yariv (2007) has suggested that, at least in jury settings, cheap talk communication, similar to the one we introduce in this study, may allow agents to imitate outcomes corresponding to decision rules different from the ones formally imposed - something which we observe in this case as well. Together this suggests to us that responders in our experiment may be viewing their task as selecting a common response that is "right" for the group as a whole.

The rest of this paper is organized as follows: section 2 develops the testable predictions of a simple model of bargaining between groups; section 3 discusses experimental design; section 4 presents laboratory results; section 5 concludes.

2. The Game

As in our previous paper (Elbittar *et al.* 2011), we follow a simple incomplete information model of ultimatum bargaining between groups. In order to explain empirical incidence of rejections, we follow Kennan and Wilson (1993), who suggested that responders have unobservable preference for being treated fairly by the proposers, so that "[e]ven the basic single-offer ultimatum game becomes a game of private information in which the optimal offer depends on beliefs about how much the responder is willing to forgo to punish unfair behavior", in which the rejection thresholds are explicitly modeled as responder *types* y_r[1].

Facing the uncertain reaction of the responders, each proposer attempts to maximize his/her expected payoff according to a strictly increasing Bernoulli utility function $u_p(x_p)$, where x_p is how much money she gets. Throughout, we shall assume that this $u_p(x_p)$ is concave, meaning that proposers are either weakly risk-averse or risk-neutral.

The total payoff size available for sharing between a proposer and a responder is $\pi > 0$. The proposer has to choose a number $x \in [0, \pi]$ that she will offer to the responder, with the balance of $\pi - x$ being left to herself. The responder will accept the offer whenever the offer is bigger than his/her private threshold $x > y_r$. If the proposer knows preferences of the responder, the subgame-perfect equilibrium is obvious. The proposer should choose $x^* = y_r$. Of course, the proposer can't *ex ante* observe the responder's preferences. The only things subject to observation and experimental control are the monetary offer x and the total prize π. Therefore, the only thing known to the proposer is that each responder r will reject offers below a certain cut-off value x_r and that this x_r is drawn from some probability distribution with the support $[0, \pi]$ with the distribution function $F(x)$, where $F(x)$ can be interpreted as the acceptance probability of offer x.

We shall denote the probability of rejection $P(x) = 1 - F(x)$. Let's suppose that if you give everything to the responder she always accepts, $P(\pi) = 0$, and that offers of nothing are always rejected, $P(0) = 1$.[2] These assumptions clearly imply impossibility of corner solutions to the proposer's maximization problem. The proposer's expected payoff from the ultimatum x is

$$\Pi(x) = u_p(\pi - x)(1 - P(x))$$

Consider now the ultimatum bargaining between groups of three proposers and three responders for a prize 3π. The proposers' share of the prize will be divided equally between the proposers and the responders' share between the responders. An ultimatum x shall mean that each proposer gets $\pi - x$, and each receiver gets x. In what follows we explore consequences of two intra-group

[1] As experimenters we cannot control responder types.

[2] Both assumptions are very robust empirical regularities observed in ultimatum game experiments.

decision rules among the responders: unanimity needed to overturn acceptance; unanimity needed to overturn rejection.

If we assume that individual responders' thresholds themselves are unaffected by being part of the responder group, the intra-group decision-making rule does not change individual responder incentives in those cases where the voter is pivotal (i.e., the voter is indifferent when s/he is not). If we only were to consider the sincere voting according to individual types,[3] the outside observer's *ex ante* probability $P(x)$ of an agent voting to reject an offer x would be *constant across the group decision rules*. If, however, individual thresholds are affected, or else group members can coordinate their individual votes, this prediction may break down.

As even the simple cut-off acceptance/ rejection strategies are relatively complex objects, if voting over them would be allowed, empirically disentangling the multiple equilibria could be hard. On the other hand, at their action node the responders face a simple binary decision: accept or reject the offer in front of them. Unfortunately, the action of proposers is more complicated: they have to choose a number in the $[0, \pi]$ interval. As in the responder case, we want to avoid voting complications and/or having to impose an elaborate voting protocol in the lab. For this reason, given a more complicated decision facing the proposers, we shall let each proposer make his ultimatum on his/her own, and then randomly choose one of the ultimatums to be presented to the responders. In this case individual's proposal only matters, on average, a third of the time. However, unless the proposer has some non-monetary motivation, it is optimal for him to make decisions as if he were alone: either he does not matter, or his decision problem is unchanged.

Taking *individual* responder behavior $P(x)$ to be constant across treatments, which is consistent with our observation in Elbittar *et al.* (2011), *group* rejection probabilities should vary predictably with the group decision rule. The following table summarizes the rejection probability under each of our intra-group decision rules on the ultimatum responder side: if individual's rejection probability is $P(x)$, then acceptance-default groups would reject with probability $P^3(x)$ and rejection-default groups would reject with probability $1-(1-P(x))^3$. From this it follows, as we show in

[3]Notice, that, in general, in these binary voting games there will always be equilibria in which subjects do not vote sincerely. In particular, if the voting rule requires unanimity to overcome a default, if I believe that any one of my group partners voted for the default, I am indifferent between casting any vote. However, this would involve playing a weakly dominated strategy, if I, in fact, choose to vote insincerely.

Elbittar *et al.* (2011) that the following proposition must hold, where x_{UAD} be an agent's optimal proposal when the responder decision is taken under the unanimity with acceptance default, x_{URD} - the same for the unanimity with rejection default, and x_I be the optimal offer in the one-on-one bargaining.

Proposition 1. *Let $P(x)$ be (weakly) convex whenever $P(x) \leq \frac{1}{2}$. Then $x_{UAD} < x_I < x_{URD}$.*

Proof. Elbittar *et al.* (2011).

Empirical predictions summarized by the Proposition 1 admit a broad array of the shapes of u and P. Furthermore, the (weak) risk-aversion and (weak) convexity of P in the relevant part of the domain are not necessary and could be further relaxed. However, they are contingent on the individual rejection probability $P(x)$ being constant across treatments. One could imagine situations where this is not the case. For instance, among the explanations for the group discontinuity effect mentioned by Wildschut *et al.* (2003), is the idea that individuals might "hide" behind the other group members: as their individual votes within the group may not be observable by the proposers, they may choose to vote more aggressively, "blaming" it on other group members. Alternatively, intra-group interaction might strengthen the "group identity", making possible either a coordination of individual votes, or establishing "socially acceptable" rejection thresholds. *Ex ante* we conjectured absence of such individual rejection probability changes, though we were cognizant of the possibility that these could occur, especially when groups were truly interacting, utilizing some sort of independent communication, as compared to purely notional groups, in which communication is only possible through voting. Of course, if $P(x)$ is affected by group membership, this would also affect the group rejection probabilities, and, consequently, change implied optimal decisions by the proposers.

3. Experimental Design

3.1. **Structure of the Ultimatum Bargaining.** Our experimental design looks at the outcomes of the ultimatum bargaining game when two groups of players have to bargain over an amount of money: a group of 3 players ("proposers") suggests a division of a fixed amount of money, and

TABLE 1. Experimental treatments

Ultimatum Bargaining Experimental Treatments	Treatment	Group Size	# of Subjects per Session
Standard One-on-One	**ONO**	1	24, 30, 28
Unanimity with Rejection Default	**URD**	3	30, 30, 30
Unanimity with Rejection Default - C	**URD-C**	3	30, 30, 24
Unanimity with Acceptance Default	**UAD**	3	30, 30, 30
Unanimity with Acceptance Default - C	**UAD-C**	3	30, 30, 30

a second group of 3 players ("responders"), accepts or rejects it. After observing the proposal, responders must decide whether to accept or reject it following a pre-determined voting rule. If responders reject the proposal, no group receives any pay, and if responders accept, each group receives the amount specified in the proposal.

In this paper we consider two different group decision-making rules:

Unanimity with Rejection Default (URD): An offer is considered accepted when every member of the responder group votes to accept it. Otherwise it is considered rejected.

Unanimity with Acceptance Default (UAD): An offer is considered rejected when every member of the responder group votes to reject it. Otherwise it is considered accepted.

The two unanimity rules were implemented both without communication **(URD and UAD)** and with communication (**URD-C and UAD-C**, respectively) In the communication treatments, both the proposers and responders had an opportunity to exchange (free form) instant messages during a limited time before they make their decisions (no communication is allowed once the decisions are made).

As a control treatment, we use a standard one-on-one ultimatum bargaining (**ONO**), where an agent, the proposer, suggests a division of a fixed amount of money, and a second agent, the responder, accepts or rejects it. If the responder rejects, no individual receives any pay, and if he accepts, each individual receives the amount specified in the proposal. In total, the voting rules, communication, and the control define 5 distinct experimental treatments.

Tables 1 summarizes for each experimental design the treatments, the group size, and the number of subjects per session.

3.2. **Design Parameters.** This section describes the general experimental procedure.

Participants and Venue. Subjects were drawn from a wide cross–section of undergraduate students at Instituto Tecnológico Autónomo de México (ITAM) in Mexico City. The recruitment was done from among those enrolled in introductory classes, in order to avoid those exposed to higher-level economics courses, such as game theory. Each subject participated in only one session. The experiment was run at ITAM using computers.

Number of Periods. In order to familiarize subjects with the procedures, two practice periods were conducted before the 10 real (affecting monetary payoff) periods.

Agent Types. For each of the group-on-group treatments, each participant was designated as a member of a type A group (i.e., proposers) or a member of a type B group (i.e., responders). For the one-on-one treatment, each participant was designated either as a type A agent (i.e., proposer) or as a type B agent (i.e., responder) before the beginning of the practice periods. All designations were determined randomly by the computer at the beginning of the experimental session, and remained constant during the entire session.

Matching Procedure and Group Size. For each of the group-on-group treatments, membership of each group was changed in a random fashion, so that each participant formed part of a new group (of the same type) at the beginning of each period. Each group consisted of three participants. For the one-on-one treatment, a type A agent was paired with a type B agent, and each pairing was randomized for each period. Furthermore, agents did not know who they were paired with in any given period.

Bargaining Procedure. Subjects were informed that they had to bargain over 100 points. For the group-on-group treatments, the task of each pair of groups was to divide 100 points in each period using the following rules: a) group A had to make a final offer of points to group B; b) to make a final offer, each group A member had to write and send an offer via computer, each offer being in the range from 0 to 100 points; c) one of these offers was chosen randomly by the computer as group A final offer to group B; d) upon receiving the final offer, group B members had to decide whether to accept or reject the offer according to the voting rule announced for this session. No communication, except as explicitly discussed in this and next paragraph, was allowed among participants. For the one-on-one treatment a type A agent had to make and send an offer to a type B agent, and after receiving the offer, the type B agent had to decide on his own whether to accept or reject it.

Communication Procedure. In communication treatments only, in each period both proposers and responders had up to 2 minutes before making their decisions to send free form messages to other members of their group using the specially designed instant-messaging software. They could not send any messages during the period once they made their decisions or after the two minutes expired. However, they could take any amount of time to make their decisions.

Information Feedback. No information for a period was provided until all agents of a given type in the room made their decisions. For the group-on-group treatments, group A members observed only their own offer and the final offer sent to group B. Group B members observed the final offer, but not the other offers made by group A members. At the end of each period, members of both groups were informed whether the final offer was accepted or rejected, the number of individual acceptance and rejection votes (between 0 and 3) in the responder group, and the number of points obtained by their group in that period. For the one-on-one treatment, each agent learned whether the offer was accepted or rejected and her own amount of points obtained for that period.[4]

Payoffs. The final payoff for each treatment in the independent design was determined by randomly selecting one of the 10 real periods. The pay for the chosen period was calculated as follows: Each group member got $2.6 Mexican pesos (about 20 US cents) for each point obtained by her own group, in addition to the basic amount of $20 pesos (roughly US$1.75) for participation. Thus, each pair of groups effectively bargained over $780 pesos (around US$68 in year 2004 when the experimental sessions where conducted). For the one-on-one treatment, each pair of agents had to bargain over $260 pesos.

[4]Note that the proposer group is observing the decision made by each member of the responder group. Revealing this information could help proposers to update their beliefs about the probability of individual and group rejection, and thus may induce some kind of learning behavior across periods.

4. Experimental Results

This section compares the experimental results from the five treatments of ultimatum bargaining discussed in the previous section. We concentrate on measuring how different voting rules affect individual and group rejection rates and proposals.[5]

4.1. **Responder Behavior.** We begin by estimating how the individual voting behavior and group rejection rates differ across treatments, conditional on the offer size. Since subjects played the game for multiple periods, individuals' actions over time are clearly non-independent. Thus, in what follows, we present results of statistical analysis using a random effect logit model. We consider the following models for estimating individual and group rejection probabilities:

$$(1) \quad Reject_{it} = 1\{Intercept + \beta_{offer} Offer_i + \beta_{urd} URD + \beta_{uad} UAD + \beta_{urdc} URD \times C + \beta_{uad} UAD \times C + \beta_{per} Per + v_i + \varepsilon_{it} \geq 0\}$$

$$(2) \quad Reject_{kt} = 1\{Intercept + \gamma_{offer} Offer_k + \gamma_{urd} URD + \gamma_{uad} UAD + \gamma_{urdc} URD \times C + \gamma_{uadc} UAD \times C + \gamma_{per} Per + w_k + \mu_{kt} \geq 0\}$$

In both equations, $1\{\cdot\}$ is an indicator function that takes the value of one if the left-hand side of the inequality inside the brackets is greater than or equal to zero and the value zero otherwise. $Offer_{it}$ is the offer *individual i* receives from 0 to 100 at period t. Model (2) does the same for

[5] Table 6 in the Appendix 1 describes for the one-on-one treatment the distribution of individual proposals and rejections aggregated across all ten periods. The offer range indicates the amount of points a proposer is willing to give to a responder. Consider, for example, the offer range from 35 to 39. In the one-on-one treatment, the number of proposals within this range was 49 out of a total of 410 offers, 12.0% (49/410). Likewise, the number of offers in this range rejected by the responders was 14, resulting in the empirical rejection rate of 28.6% (14/49). As in the one-on-one case, consider the offer range from 35 to 39 for the unanimity with rejection as a default and no communication. The total number of individual proposals within this range was 37, which makes up 8.2% of the total of 450 offers in this treatment. Since just 1 out of 3 proposals was randomly chosen to be sent to a responder group, the group proposals are simply a random selection of the individual ones. The number of group proposals within this range was 13 out of a total of 150 offers sent. Therefore, the group offers proportion was 8.7% (13/150). Since all 3 members of a responder group received the same offer, the individual rejection number within this range was 8; with a total of 39 observations (13×3), the individual rejection rate for this range was 20.5% (8/39). At group level, the number of rejections within this range was 6 out of 13, resulting in a 46.2% (6/13) group rejection rate.

group rejection decision, where $Offer_{kt}$ is the offer *group k* receives from 0 to 100 at period t. *URD* and *UAD* are dummies for each of the voting rules, while C is the dummy for presence of communication. Note, that we do not estimate it separately, but only in interaction with the voting rules; the corresponding coefficients should be interpreted as reflecting the difference between the communication and no-communication treatments of the same voting rule. Finally, *Per* is a variable for every period, treating time as a continuous variable. We use a random effect logit model to account for individual and group variability, where v_i and w_k are *i.i.d.*, $N(0,\sigma_v^2)$ and $N(0,\sigma_w^2)$, respectively. Likewise, ε_{it} and μ_{it} are *i.i.d.* logistic distributed with mean zero and variance $\sigma_\varepsilon^2 = \sigma_\mu^2 = \sigma^2/3$, independently of v_i and w_k.

For both models, we expect the offer size coefficient to be less than zero ($\beta_{offer} < 0$ and $\gamma_{offer} < 0$), meaning that the rejection probability should be lower for higher offers. For model (1), we expected all treatment coefficients be equal to zero ($\beta_{urd} = \beta_{uad} = \beta_{urdc} = \beta_{uadc} = 0$). If that were true, then for model (2), we should expect that the unanimity treatment coefficients differ in sign (γ_{urd} and $\gamma_{urdc} > 0$, γ_{uad} and $\gamma_{uadc} < 0$), where a positive coefficient should indicate a higher probability of rejection for a given offer. In Table 2 we present all parameter estimates.

Result 1 Propensity to reject without communication is unaffected by the voting rule. When no subject communication is allowed, responders' propensity to vote against accepting an offer is independent of the group decision-making rule used. Random effect logit estimation does not find any statistically significant difference in individual decisions to reject whether they are alone or in groups, or whether the default is acceptance or rejection.[6] Though both group decision rule coefficients are positive, which could have indicated a slightly more aggressive behavior on the part of individuals who are group members, as compared with individuals operating alone, neither coefficient is significant even at 10% level. Consistently with the individual voting behavior being unaffected by the voting rule, group rejection probabilities vary substantially across no-communication treatments. Overall, subjects seem to exhibit a tendency to reject less with time,[7]

[6]In our earlier work (Elbittar *et al.*, 2003) we report the same for the groups operating under the majority rule.
[7]This is preserved whether we have a single time-related variable, as in the reported regression, or if we interact period with the voting rule, in which case both coefficients are negative.

but the effect halves if we exclude the last period observations. If we do this, the corresponding coefficient also barely misses significance at 5%.

Result 2 Propensity to reject when acceptance is default goes up with communication. When communication is allowed, responders' individual decisions to reject are affected by the group decision-making rule. In particular, when unanimity with acceptance default is used, subjects tend to sharply raise their likelihood of voting to reject. The change, in fact is quite drastic: the estimated 3.10 coefficient translates in an increase of the likelihood of an individual vote to reject an offer of 32% of the prize from 24% in the no-communication case to 88% if communication is allowed! The effect of communication on decisions under the rejection default rule is less clear-cut. In particular, the individual coefficient is not significant, but the group coefficient is negative and significant at 5%. As a result, the group rejection probabilities are essentially the same in the UADC and URDC treatments, very close to those in the URD responder behavior, indicating that even under the acceptance default rule groups in which members may communicate may be more prone to reject offers than individual bargainers. In particular, we cannot reject the hypothesis that $\gamma_{urd} + \gamma_{urdc} = \gamma_{ard} + \gamma_{ardc}$ are the same, being both sums positive and significantly different from zero.

4.2. **Proposer Behavior.** For this analysis we consider all individual offers submitted. Recall that only a random selection of a third of the offers in the group treatments was sent to responders. Given the differences in group rejection probabilities for different voting rules, we should expect changes in offers across treatments. We consider the following specification for estimating the offer size differences across all treatments for all periods:

$$(3) \quad Offer_{it} = Intercept + \alpha_{urd}URD + \alpha_{uad}UAD + \alpha_{urdc}URD \times C + \alpha_{uadc}UAD \times C + \delta_{per}Per + v_i + \varepsilon_{it}$$

where $Offer_{it}$ is the offer proposer i sent at time period t, expressed as the share of the maximum, from 0 to 100 (percent); Per is the period time in which an offer was made; URD and UAD are

TABLE 2. Probability of offer rejection for all periods

Coefficients	Individual Level	Group Level
Intercept	8.00^{***}	9.61^{***}
	(0.78)	(1.61)
Offer	-0.28^{***}	-0.33^{***}
	(0.02)	(0.05)
Unanimity with Rejection Default	0.85	3.00^{***}
	(0.58)	(0.79)
Unanimity with Acceptance Default	0.30	-2.67^{***}
	(0.56)	(0.93)
Unanimity with Rejection Default × C	0.59	-1.29^{*}
	(0.56)	(0.65)
Unanimity with Acceptance Default × C	3.10^{***}	4.41^{***}
	(0.57)	(0.99)
Period	-0.10^{***}	-0.14^{*}
	(0.03)	(0.06)
# of Obs.	2180	1000
Log Likelihood	-905.0	-313.3

$^{*}: p \leq 0.05,^{**}: p \leq 0.01 and^{***}: p \leq 0.001.$

Note: The number in parentheses below each coefficient represent the coefficient standard error.

TABLE 3. Offers by the proposals

Coefficients	Offers
Intercept	41.97^{***}
	(1.20)
Unanimity with Rejection Default	3.01^{*}
	(1.62)
Unanimity with Acceptance Default	-2.88^{*}
	(1.62)
Unanimity with Rejection Default × C	-0.83
	(1.61)
Unanimity with Acceptance Default × C	5.70^{***}
	(1.58)
Period	-0.24^{***}
	(0.05)
# of Obs.	2180

$^{*}: p \leq 0.05,^{**}: p \leq 0.01 and^{***}: p \leq 0.001.$

Note: The number in parentheses below each coefficient represent the coefficient standard error.

dummies for each of the voting rules and C is the dummy for the presence of communication. Given our previous results, we expect the offer size coefficients for the treatments where group responders have shown higher rejection probabilities to be greater than zero (α_{urd} and $\alpha_{uadc} > 0$), meaning that compared to the one-on-one treatment proposers should be willing to offer more given the high rejection probability in the corresponding treatments. For unanimity with acceptance default we should expect a coefficient less than zero ($\alpha_{uad} < 0$), which means that compared to the one-on-one treatment proposers should be willing to offer less, given the low probability of rejection. We may also expect to see $\alpha_{urdc} < 0$, given the small but negative additional effect on rejection probability that communication has when rejection is default. We use a random effect model to account for individual variability, where v_i is the random disturbance characterizing the ith individual and is constant through time and ε_{it} is the random disturbance that varies independently across time and individuals. Table 3 presents the results.

Result 3: Proposer behavior is affected by the voting rule. As can be seen from the results of the estimation, it seems that the proposers do, indeed, react to the voting rule used by the responders. Even though each of the two voting rule coefficients is only significantly different from zero at the 10% level, the difference between the two, which amounts to about 6 percentage points of the prize size, is significantly different from zero at 5%. However, when one includes communication the situation changes radically: though there seems to be no effect of communication when rejection is the default, when acceptance is the default the offers become substantially more generous. In fact, they are essentially indistinguishable for the two communication treatments, somewhere between 5 and 6 percentage points of the prize above the acceptance default without communication case. This, of course, reflects our results in the previous subsection: the proposers seem to internalize the fact that when communication is allowed, acceptance default does not lead to lower rejection probabilities by the responder groups![8] We should also note the substantial trend to decrease the offers over time. Unlike the similar trend to lower rejection probabilities on the responder side, this

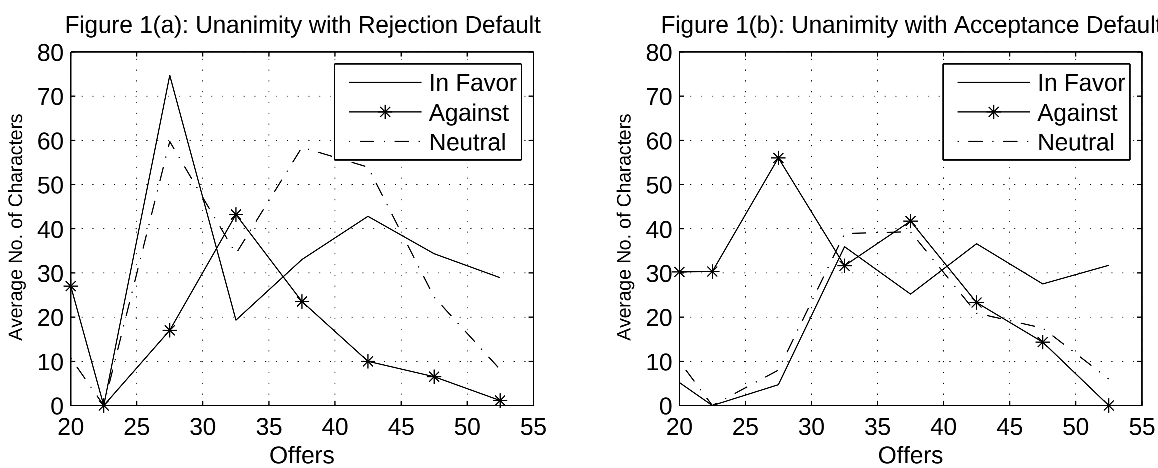
[8]However, we cannot identify whether this change in behavior is because proposers could not communicate or because they actually anticipated how communication might affect the response. After analysing the communication transcripts, we did not find any evidence that might support this last conjecture.

does not seem to be even partially explainable by end-period effects, as dropping the last period data does not substantially affect either the size or the statistical significance of the coefficient.

5. Analysis of Communication

As noted in the experimental design section, communication within groups was conducted via an electronic instant messenger, with the record of all such conversations preserved by the computer system used to run the experiment. The recorded comments ranged from monosyllabic to fairly extensive (one of them appears in the title of this paper). In order to better understand the role of communication we had two independent research assistants code the messages sent among the responders as arguing for acceptance, for rejection, or those ambiguous/neutral and counted the number of characters in messages of each type. The correlation between the data obtained from the two coders was around 0.8, which we take as supporting the validity of the coding.[9] In what follows, we base ourselves on the average of the two codes, which we shall take as a measure of communication intensity in favor or against acceptance of the proposal.

FIGURE 1. Average number of characters by offer size



In Figure 1 we present the distribution of communication intensity of the three types: for acceptance, for rejection and neutral/unclear, among the responders by the offer size and the voting rule, normalized by the number of proposals in a given range. Overall, relatively little chatting

[9]This relatively simple analysis may be compared to Sutter and Strassmair (2009) who classified message content into 11 categories, achieving reported cross-coder correlation of 0.57.

was observed when offers were very low or very high, with chat intensity going up at intermediate offers. Furthermore, the subjects seemed to be more "voluble" in arguing for rejection when offers were small, while they argued more for acceptance, when the proposals were more generous. Interestingly, the neutral/unclear comments seemed to track pro-acceptance comments when the offers were low and pro-rejection comments, when the offers were high.

FIGURE 2. Difference between pro-acceptance and pro-rejection comment intensity

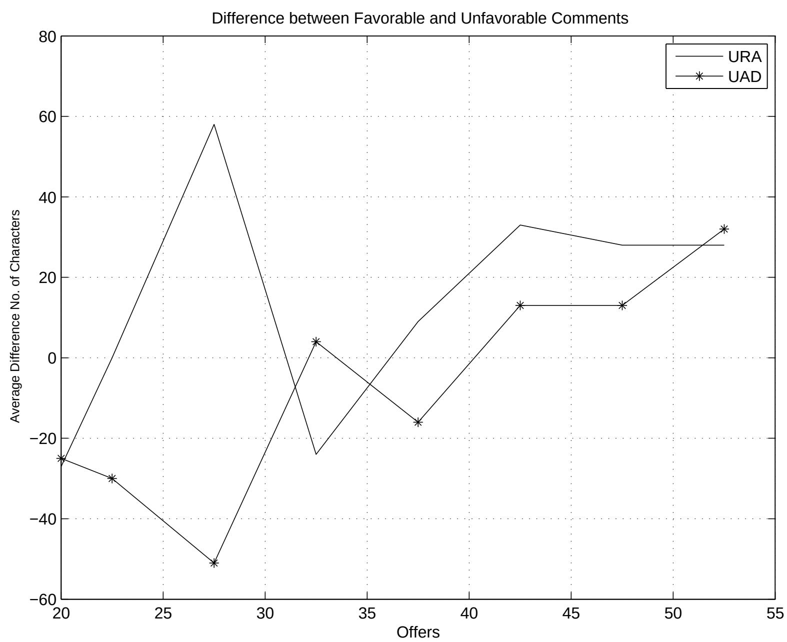


Figure 2 shows the distribution of the difference between the pro-acceptance and pro-rejection comments separated by the voting rule (as in Figure 1 it is normalized by the number of proposals in a given range). As can be seen, for most offer ranges this difference tended to be much more skewed in favor of the "negative" comments when acceptance default was in force, as if subjects were trying to compensate for the rule stacked in favor of acceptance.

These observations are confirmed statistically, as seen in Table 4, which presents the results of regressions of a number of comments on the offer size and voting rule.

$$Chat_{it} = Intercept + \alpha_{offer} Offer_{it} + \alpha_{uad} UAD + \delta_{per} Per + v_i + \varepsilon_{it} \tag{4}$$

To see if the communication patterns respond in expected manner, we separately estimate the above model for pro-acceptance and pro-rejection comments, as well as for the difference between the two. In case of the pro-acceptance and pro-rejection models we present random-effect Tobit regressions, with the chat intensity censored at zero; for the difference regression we present a random-effect GLS; in this and the next regression we only use the data from the two treatments with communication. The results of this regression are presented in Table 4.

Overall, the subjects seem to be more intensely arguing for acceptance when offers are large and for rejections when offers are small or acceptance is the default. Notably, the pro-acceptance comments seem to react much less on what is going on: their numbers are much less responsive than the pro-rejection comments to the offer size and the coefficient on the role of the voting rule narrowly misses being significantly different from zero at 5%. On the other hand, pro-acceptance comments appear throughout the experiment: over 80% of the time subjects say at least something that would be interpreted as arguing for or suggesting acceptance of the offer. In contrast, the pro-rejection comments are much more rare: subjects say something against rejection less than half the time. But when they do, they do this for a reason: the number of such comments is sharply sensitive to both to the offer size and to the voting rule: they do try a lot harder when acceptance is default.

In order to estimate the effect communication intensity has on individual votes, we introduce communication intensity by other members of the group into the random-effect logit estimation of the likelihood of the individual rejection vote according to the following model:

$$(3) \quad Reject_{it} = 1\{Intercept + \beta_{offer} Offer_{it} + \beta_{uad} UAD + \beta_{accept} chat_{accept_{it}} + \beta_{reject} chat_{reject_{it}} + \beta_{neutral} chat_{neutral_{it}} + w_i + \mu_{it} \geq 0\}$$

where chat variables stand for the number of characters in messages of different types sent by members. Table 5 presents the results of this last regression.

TABLE 4. Chat intensity

	Comments		
Coefficients	Pro-Accept	Pro-Reject	Difference
Intercept	-25.33	144.31***	-71.21***
	(14.28)	(17.78)	(16.83)
Offer	1.37***	-3.60***	2.10***
	(0.29)	(0.38)	(0.35)
Unanimity with Acceptance Default	-13.30	25.53**	-20.17**
	(7.12)	(8.17)	(8.59)
Period	-0.26	-1.69*	0.86
	(0.46)	(0.67)	(0.58)
# of obs.	870	870	870
# of left-censored obs.	169	449	
Log Likelihood	-3752	-2512	

$^{*}: p \leq 0.05,^{**}: p \leq 0.01 and^{***}: p \leq 0.001.$
Note: The number in parentheses below each coefficient represent the coefficient standard error.

As in the previously presented regressions, the greater offer size is associated with lower regression probability and the acceptance default is shown to increase the likelihood of the rejection. The new chat variables appear significantly in the expected way: the more intense are the negative comments by other subjects in the group, the more likely is the receiver of such comments to vote for rejection, with the opposite being true of the pro-acceptance comments. Notably, the impact of negative comments appears to be bigger. In particular, the difference in absolute value between the two coefficients is statistically significant. Neutral comments are not associated with any effect on the subject vote.

Figure 3, which presents the distribution of the number of rejection votes as a function of the offer size, illustrates the important role that communication plays in allowing responders to come to a unanimous agreement. As should be expected, without the communication such unanimous agreement is rare, irrespective of the default rule. Once communication is allowed, unanimous votes become much more common and the default option appears to become important: unanimous agreement against the default is notably more frequent. Communication is, thus, successful in

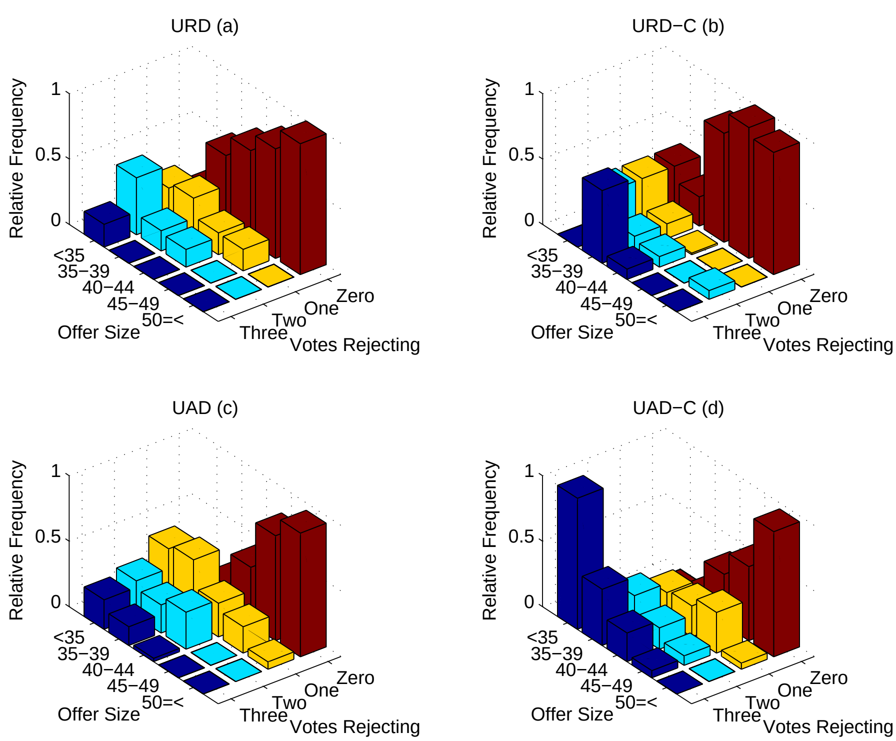
TABLE 5. Impact of communication on individual rejection votes

Coefficients	Offers
Intercept	11.05^{***}
	(1.84)
Offer	-0.33^{***}
	(0.05)
Unanimity with Acceptance Default	1.74^{***}
	(0.50)
chatreject	0.020^{***}
	(0.002)
chataccept	-0.010^{***}
	(0.002)
chatneutral	-0.002
	(0.002)
# of Obs.	870
Log Likelihood	-277

$^{*}: p \leq 0.05, ^{**}: p \leq 0.01 and ^{***}: p \leq 0.001.$

Note: The number in parentheses below each coefficient represent the coefficient standard error.

FIGURE 3. Rejection votes distribution condition on offer size



persuading subjects to agree on a common objective, when that is necessary to overcome the bias built into the exogenously imposed decision rule.

6. Conclusions

In this paper we introduced intra-group communication between the subjects making up a group in intergroup ultimatum bargaining. While, as we have shown in previous work (Elbittar *et al.*, 2003), in the absence of such communication different within-group voting rules are associated with different bargaining outcomes, availability of communication appears to largely eliminate this effect: when responder groups need unanimity to overcome acceptance default, their members become much more willing to vote for rejection. In a way that leads them to essentially match the group rejection behavior of the groups that need unanimity to overcome rejection default. This supports the previous findings that when groups bargain, they tend to behave more aggressively than individuals, what the psychological literature calls the "discontinuity hypothesis"(see Wildschut *et al.*, 2003 for the details). As this happens irrespective of the voting rule in use, it appears to suggest that the formal voting institution might be less important for bargaining outcome than the fact that bargaining is happening between groups, rather than between individuals.

When we analyze the content of communication within responder groups, we observe that subjects seem to be reacting more to both the change in the offer size and the voting rule by changing the intensity of comments arguing for rejecting the proposal. In contrast, pro-acceptance comments appear to respond substantially less both to offers and to the voting rule. Furthermore, the impact of pro-rejection comments by other members of the group on individual votes appears to be greater than that of the pro-acceptance comments. The reason for this asymmetry remains to be understood.

We believe, however, that our results might also shed some light on the nature of the "discontinuity effect"observed here. Wildschut *et al.* (2003) propose three distinct reasons for the "more aggressive"group behavior as compared to that of individuals, two of which may be directly addressed by our study. Of these, the difficulty of identifying the "guilty"side within the opposing group appears to be least likely to explain our results: when acceptance is default, every voter is directly responsible if the group decides to reject. Hence, the group members cannot "hide" behind the aggressiveness of their partners. Nevertheless, it is precisely this treatment where we observe increase in individual propensity to vote to reject offers. It would seem that it is the other reason proposed by Wildschut *et al.* (2003): the social support provided by group members to each other - that would be more plausible as an explanation for this behavior, as the subjects do seem to reinforce each other in their willingness to reject the offer. Comparison with the results of Goeree and Yariv (2011) suggests that, at least when communication is allowed, our subjects view the task of the responder group in terms of figuring out the common “right”response to the offer they receive, rather than aggregation of independent individual choices. Further research may be required to confirm this last conjecture.

We believe our results highlight the importance of informal within-group interaction determining bargaining outcomes between groups. In particular, we observed that introducing communication may have an impact that is powerful enough to overcome the inbuilt weakness of the group decision rule. Consequently, the study of within-group communication patterns appears to be especially important for understanding the outcomes of between-group negotiations.

7. Appendix

Appendix A. Tables

Table 6. Summary of experimental results (One-on-one and group-on-group treatments)

Offer Range	One-on-One		Unanimity with Rejection Default				Unanimity with Rejection Default - C			
	Ind. Off.	Ind. Rej.	Ind. Off.	Grp. Off.	Ind. Rej.	Grp. Rej.	Ind. Off.	Grp Off.	Ind. Rej.	Grp. Rej.
more than 50	3.9	0.0	11.1	9.3	0.0	0.0	3.6	3.6	0.0	0.0
	(16)	(0)	(50)	(14)	(0)	(0)	(15)	(5)	(0)	(0)
= 50	14.6	1.7	14.7	10.0	0.0	0.0	7.1	7.1	6.7	10.0
	(61)	(1)	(66)	(15)	(0)	(0)	(30)	(10)	(2)	(1)
45 - 49	20.7	5.9	32.7	36.7	5.5	16.4	17.1	17.1	0.0	0.0
	(85)	(5)	(147)	(55)	(9)	(9)	(72)	(24)	(0)	(0)
40 - 44	25.6	9.5	20.2	20.0	14.4	30.0	63.6	63.6	13.5	16.9
	(105)	(10)	(91)	(30)	(13)	(9)	(267)	(89)	(36)	(15)
35 - 39	12.0	28.6	8.2	8.7	20.5	46.2	6.4	6.4	66.7	77.8
	(49)	(14)	(37)	(13)	(8)	(6)	(27)	(9)	(18)	(7)
30 - 34	7.6	6.5	8.9	10.0	40.0	80.0	1.4	1.4	16.7	50.0
	(31)	(2)	(40)	(15)	(18)	(12)	(6)	(2)	(1)	(1)
25 - 29	9.0	37.8	2.2	2.7	75.0	100.0	0.0	0.0	0.0	0.0
	(37)	(14)	(10)	(4)	(9)	(4)	(0)	(0)	(0)	(0)
less than 25	6.6	81.5	2.2	2.7	91.7	100.0	0.7	0.7	66.7	100.0
	(27)	(22)	(9)	(4)	(11)	(4)	(3)	(1)	(2)	(1)
All Off.	100.0	16.6	100.0	100.0	15.1	29.3	100.0	100.0	14.0	17.9
	(410)	(68)	(450)	(150)	(68)	(44)	(420)	(140)	(59)	(25)
Avg.	41	28	44	43	31	34	43	43	39	38
Med.	41	29	45	45	30	35	42	42	40	40
Var.	175	157	95	97	143	110	47	21	26	31

Note: Number in parentheses below each percentage represents the number of times the occurrence was observed.

TABLE 7. Summary of experimental results (One-on-One and group-on-group treatments)

Offer Range	One-on-One		Unanimity with Acceptance Default				Unanimity with Acceptance Default- C			
	Ind. Off.	Ind. Rej.	Ind. Off.	Grp. Off.	Ind. Rej.	Grp. Rej.	Ind. Off.	Grp Off.	Ind. Rej.	Grp. Rej.
more than 50	3.9	0.0	8.4	8.7	2.6	0.0	0.4	0.7	0.0	0.0
	(16)	(0)	(38)	(13)	(1)	(0)	(2)	(1)	(0)	(0)
= 50	14.6	1.7	2.4	3.3	0.0	0.0	15.8	14.0	1.6	0.0
	(61)	(1)	(11)	(5)	(0)	(0)	(71)	(21)	(1)	(0)
45 - 49	20.7	5.9	13.8	16.7	4.0	36.0	36.7	36.7	20.6	5.5
	(85)	(5)	(62)	(25)	(3)	(9)	(165)	(55)	(34)	(3)
40 - 44	25.6	9.5	24.4	26.0	9.4	2.6	34.0	36.7	40.6	21.8
	(105)	(10)	(110)	(39)	(11)	(1)	(153)	(55)	(67)	(12)
35 - 39	12.0	28.6	23.8	18.7	25.0	14.3	9.8	9.3	69.0	42.9
	(49)	(14)	(107)	(28)	(21)	(4)	(44)	(14)	(29)	(6)
30 - 34	7.6	6.5	11.6	12.7	54.4	15.8	1.6	0.7	100.0	100.0
	(31)	(2)	(52)	(19)	(31)	(3)	(7)	(1)	(3)	(1)
25 - 29	9.0	37.8	6.7	4.0	44.4	16.7	1.1	0.7	100.0	100.0
	(37)	(14)	(30)	(6)	(8)	(1)	(5)	(1)	(3)	(1)
less than 25	6.6	81.5	8.9	10.0	64.4	33.3	0.7	1.3	100.0	100.0
	(27)	(22)	(40)	(15)	(29)	(5)	(3)	(2)	(6)	(2)
All Off.	100.0	16.6	100.0	100.0	23.1	15.3	100.0	100.0	31.8	16.7
	(410)	(68)	(450)	(150)	(104)	(23)	(450)	(150)	(143)	(25)
Avg.	41	28	38	39	29	28	43	43	40	37
Med.	41	29	39	40	30	33	45	45	40	40
Var.	175	157	122	145	112	107	31	37	63	96

Note: Number in parentheses below each percentage represents the number of times the occurrence was observed.

APPENDIX B. EXPERIMENTAL INSTRUCTIONS

The following is the verbatim translation (from Spanish into English) of experimental instructions administered to subjects at ITAM (the Spanish original is available from the authors upon request).

B.1. **Instructions for Group-on-Group treatments.** This is an experiment about decision-making. The instructions are simple and if you follow them carefully and take good decisions, you can earn a CONSIDERABLE AMOUNT OF MONEY, which will be PAID YOU IN CASH at the end of the experiment

General Proceedings

In this experiment you will participate as a member of a GROUP A or a GROUP B. Your participation as a part of one of these two groups shall be determined at the beginning of the experiment and will be constant during the entire session. Each group shall consist solely of three (3) participants.

The experiment shall consist of 12 periods: two practice periods, and 10 periods played for money, one of which shall be randomly selected at the end of the experiment to determine your final pay. For this reason you should consider each period as if it were "the chosen period" for your pay.

At the beginning of each period, each TYPE A GROUP will interact with a TYPE B GROUP. The formation of pairs of GROUPS A and B will be done randomly. Likewise, the membership composition of each group will change in a random fashion, so that each participant will form a part of a new GROUP (of the same type) at the beginning of each period.

Specific Proceedings

In each period the task of each pair of groups is to try to divide 100 points using the following rules.

1) The members of GROUP A must make an offer of points to members of GROUP B.

1.1) To make the final offer from GROUP A to GROUP B each member of GROUP A must write and send an offer via the computer. Each offer must be in the range of 0 to 100 points.

Only inserted in communication treatments Before writing and sending their offer, members of Group A will have 2 minutes to communicate by means of an instant messenger screen (chat). The chat will be activated at the beginning of the period and will be deactivated once an offer is sent. Only members of GROUP A will be able to write and read the text sent.

1.2) After that, one of these offers made shall be chosen randomly by the computer as the final offer of GROUP A to GROUP B.

2) The final offer of GROUP A shall be sent to each member of GROUP B. After observing the offer sent, the members of GROUP B must decide if they accept of reject the offer according to the following rule:

The offer is considered accepted when every one of the members of the group votes to accept it. Otherwise it is considered rejected.[10]

Only inserted in communication treatments Before deciding whether to accept or reject the offer, members of Group B will have 2 minutes to communicate by means of an instant messenger screen (chat). The chat will be activated once the offer is received and will be deactivated once it is accepted or rejected. Only members of GROUP B will be able to write and read the text sent.

2.1) If GROUP B rejects the offer, no GROUP receives any pay.

2.2) If GROUP B accepts the offer, the GROUP A receives the amount of 100 points minus the points offered to GROUP B. In its turn, GROUP B receives the amount of points which has been offered by GROUP A.

3) Once taken, the decision to accept or reject the offer of points is final, no counter-offer shall be possible, and the next period shall start with a new grouping of participants for each group type.

Payment Proceedings

Once the 10 periods played for money are over, one of them will be chosen randomly to determine the final pay. For this reason, you should consider each period as if it were final "chosen period" for your pay.

The pay for the chosen period shall be calculated as follows: Each member of each group shall get $2.6 pesos for each point obtained by the group to which she/he belongs, in addition to the basic amount of $20 pesos for participation.

At the end of the session, each of the participants shall be called by the identification number assigned by the computer at the beginning of the experiment to receive his/her pay in a sealed envelope, thus ensuring the complete anonymity of his/her decisions and their results.

B.2. **Instructions for the One-on-One treatment.** This is an experiment about decision-making. The instructions are simple and if you follow them carefully and take good decisions, you can earn a CONSIDERABLE AMOUNT OF MONEY, which will be PAID YOU IN CASH at the end of the experiment

General Proceedings

In this experiment you will participate as a TYPE A or TYPE B AGENT. Your participation as one of these agent types shall be determined at the beginning of the experiment and will be constant during the entire session

The experiment shall consist of 12 periods: two practice periods, and 10 periods played for money, one of which shall be randomly selected at the end of the experiment to determine your final pay. For this reason you should consider each period as if it were "the chosen period" for your pay.

At the beginning of each period, each TYPE A AGENT will interact with a TYPE B AGENT. The formation of pairs of TYPE A and TYPE B AGENTS will be done randomly.

Specific Proceedings

In each period the task of each pair of agents is to try to divide 100 points using the following rules.

1) Each TYPE A AGENT must make an offer of points to a TYPE B AGENT. For this each TYPE A AGENT must write and send an offer via the computer. Each offer must be in the range of 0 to 100 points.

[10]This corresponds to rejection default; instructions for acceptance default are as follows:
"The offer is considered rejected when every one of the members of the group votes to reject it. Otherwise it is considered accepted".

2) After observing the offer sent by the TYPE A AGENT, the TYPE B AGENT must decide if she/he accepts or rejects it.

2.1) If the TYPE B AGENT rejects the offer, no AGENT receives any pay.

2.2) If TYPE B AGENT accepts the offer, the TYPE A AGENT receives the amount of 100 points minus the points offered to TYPE B AGENT. In its turn, TYPE B AGENT receives the amount of points which has been offered by TYPE A AGENT.

3) Once taken, the decision to accept or reject the offer of points is final, no counter-offer shall be possible, and the next period shall start with a new grouping of agent pairs.

- Payment Proceedings

Once the 10 periods played for money are over, one of them will be chosen randomly to determine the final pay. For this reason you should consider each period as if it were final "chosen period" for your pay.

The pay for the chosen period shall be calculated as follows: Each agent shall get \$2.6 pesos for each point obtained, in addition to the basic amount of \$20 pesos for participation.

At the end of the session, each of the participants shall be called by the identification number assigned by the computer at the beginning of the experiment to receive his/her pay in a sealed envelope, thus ensuring the complete anonymity of his/her decisions and their results.

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