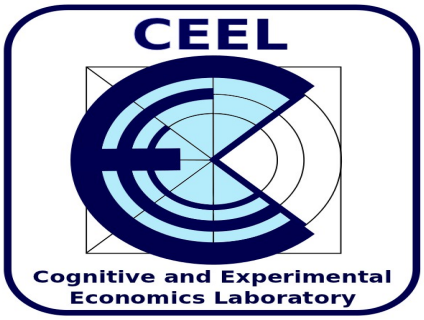

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Anticipated communication in the ultimatum game

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Abstract

Anticipated verbal feedback in a dictator game has been shown to induce altruistic behavior. Xiao and Houser (2009), and Ellingsen and Johannesson (2007), find that when the allocator donates an amount to a recipient, and the recipient sends an anonymous written message after learning of the amount, donations are higher in relation to the standard (no-communication) condition. We experimentally investigate whether strategic considerations crowd out anticipatory effects of communication in an ultimatum game, and find that such effects still persist in the presence of two-sided communication.

Keywords: ultimatum game; anticipated communication; experiment

JEL classification: C78, C91, D03

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1 Introduction

There is evidence that anticipated verbal feedback induces altruistic behavior. Xiao and Houser (2009), and Ellingsen and Johannesson (2007), find that in a dictator game where the allocator donates an amount to a recipient, and the recipient sends an anonymous written message after learning of the amount, donations are significantly higher in relation to the standard (no-communication) condition. In both studies, there is a strong emotional response by recipients who receive what they perceive to be unfair donations (below the 50:50 split), and this is expressed in terms of expressions of disapproval, and even at times foul language. For Ellingsen and Johannesson, individuals are motivated by concerns for pride and blame, whereas Xiao and Houser argue that allocators in the dictator game have a preference for avoiding written expression of disapproval, or negative emotions.

One suspects that such motivations persist in similar decision problems where individuals are required to make allocation decisions. However, in the extended environment of the ultimatum game, in determining what proportion of endowment to offer, the proposer is not only concerned about her pro-social behavior, but must factor in the possibility of her offer being rejected by the responder. Previous studies have shown that such strategic considerations have a significant effect on allocation decisions. Charness and Gneezy (2008), for example, compare how anonymity and social distance affect behavior in dictator- and ultimatum-games, and find contrasting effects. In the dictator game, reducing social distance significantly increases donations, whereas in the ultimatum game, there is no significant effect on offers. Thus, for them, it appears that strategic considerations crowd out impulses toward generosity or charity.

In this study, we thus propose to study whether strategic considerations crowd out anticipatory effects of communication. We achieve this by implementing Xiao and Houser's communication sequence in the ultimatum game with strategy method. In this setup, the proposer makes a binding proposal that

cannot be subsequently changed. Thereafter, the responder, without knowing the actual choice of the proposer, has to indicate for each possible offer whether she "accepts" or "rejects". We include three treatments. The base treatment *No Communication* (henceforth NC) is the standard condition where participants are anonymous and are not allowed to communicate, with a three minute time-gap between choices of the proposer and responder. The two communication treatments *One-Sided Communication* (henceforth OSC), and *Two-Sided Communication* (henceforth TSC), consist of a three minute communication phase in between the proposer and responder choices. The treatments differ only in terms of how we manipulate communication: In the OSC treatment, the proposer unilaterally communicates to the responder in writing, whereas in the TSC treatment, both the proposer and responder communicate with each other in writing.

In a related paper, Xiao and Houser (2005) allow responders in the standard ultimatum game to attach a written message to their "accept" or "reject" decision, after learning of the offer from the proposer. They find that proposer offers do not differ compared to the standard condition, but responders reject unfair offers significantly less frequently. One fundamental difference between our designs is that the proposer's offer focalizes the communication content in Xiao and Houser's study, whereas in our study, the responder has an uninformative prior. As Xiao and Houser infer, responders' expression of negative emotions for what they perceive to be unfair offers decreases the likelihood that they reject such offers, and thus it appears that communication supplements costly punishment (by providing an additional medium where an aggrieved responder can express her negative emotions). Our study allows communication in the form of expressions of negative emotions, such as may occur if a proposer reveals that she offered an amount perceived to be unfair by the responder, in the two-sided communication condition. However, such communication is neither exclusive nor even expected to be significant in quantity. Therefore, since offers are never revealed prior to the conclusion of play, our design allows us to examine the

effect of anticipated communication that is not constrained in some predefined way.

Furthermore, the strategy method (Selten, 1967) allows us to elicit the full strategy vector of the responder. In the ultimatum game, little is known about responder choices corresponding to especially high offers since such offers are rarely observed in practice, and previous studies have mostly elicited responses using the direct-response method. Considering a sample of 75 standard ultimatum game experiments, Oosterbeek *et al.* (2004) find that less than a fifth elicited responses using the strategy method. As Zultan (2012, p. 18) observes, "... [responder behavior in ultimatum games] has received relatively little attention in previous studies, when compared to proposer behavior, possibly because 'The recipients' action[s],... are easier to interpret' (Thaler, 1988, p. 197)". Empirically, Brandts and Charness (2011) conclude that both the strategy- and the direct response-method generally yield similar results, thus consistent with the standard theoretical view. In addition, from the view-point of a single study, given that an experimentalist applies the same method consistently across treatments, any existential differences between the methods would not invalidate conclusions from that particular study.*

The content of the communication is not restricted in OSC and TSC, but because identifiability may introduce nonpecuniary influences on preferences, participants are not allowed to divulge information in the messages that can lead to them being identified. In contrast to the result of Xiao and Houser (2005), we find that anticipated communication effects still persist in the presence of strategic considerations with two-sided communication, with offers in TSC being significantly higher to either OSC or NC. Offers in NC and OSC do not differ, suggesting that anticipation effects also crucially depend on the form of communication. In terms of responder behavior, we observe a significant amount of non-monotonicity in responder choices across all three treatments,

*In experiments where methods yield different results, one can distinguish between "hot" effects and "cold" effects. However, the responsibility rests on the experimentalist to explain if and how such observed differences matter.

with higher conditional rejection frequencies for high (above equal-split) and low (below equal-split) offers in TSC, relative to either OSC or NC. However, as was the case for offers, responder rejection rates do not differ between NC and OSC. An analysis of the informational content of communication in OSC and TSC reveals that the vast majority of participants communication are statements or discussions of the ultimatum game being played (such as references to "offer", "accept", "reject"). In addition, we find evidence that proposers restrict the content of communication to conversations that exclude references to fairness in OSC, when they unilaterally communicate to responders, which may account for why we observe behavioral differences in TSC relative to either OSC or NC, but not in OSC relative to NC.

The paper is organized as follows: Section 2.1 presents our experimental design. Section 2.2 outlines our behavioral predictions. Section 2.3 describes the experimental procedures and protocols. Section 3 presents the results of the experiment, and provides an analysis of the informational content of messages in OSC and TSC. Eventually, Sect. 4 concludes.

2 Method

2.1 Experimental Design

We investigate behavior in the ultimatum game with strategy method. In our setting, the proposer (henceforth X) chooses an amount x to offer to the responder (henceforth Y) from a pie of 10 *Euros*, with the restriction that each player gets at least 1 *Euro*. This results in nine possible offers: $x \in \{1, 2, ..., 9\}$. In turn, Y, without knowing the actual choice of X, indicates for each possible offer whether she accepts or rejects. We denote Y's choice $y_x \in \{accept, reject\}$. A strategy of Y assigns y_x to each x choice of X, and is a 9-element vector collected by having Y fill in a table similar to Table 1, with either "accept" or "reject" at each blank box.

Table 1: Ultimatum game with strategy method: Y's decision task

x	1	2	3	4	5	6	7	8	9
y_x	☐	☐	☐	☐	☐	☐	☐	☐	☐

An outcome of the game is a matched pair (x, y_x) with the following payoffs:

$$\pi^X = \begin{cases} (10 - x)\ Euros & \text{if } y_x = \text{accept} \\ 0\ Euros & \text{if } y_x = \text{reject} \end{cases} \tag{1}$$

$$\pi^Y = \begin{cases} x\ Euros & \text{if } y_x = \text{accept} \\ 0\ Euros & \text{if } y_x = \text{reject} \end{cases} \tag{2}$$

where π^X and π^Y denote the payoffs to X and Y respectively.

Before Y makes her choices, but after X has chosen a binding offer x, there is a three minute communication phase in each of the game experiments. We distinguish three treatments:

1. *NC* (***No Communication***): Standard anonymous no-communication condition with a time gap during the communication phase.

2. *OSC* (***One-Sided Communication***): X has the option to anonymously and unilaterally communicate in writing with Y during the communication phase.

3. *TSC* (***Two-Sided Communication***): Both X and Y have the option to anonymously communicate with each other in writing during the communication phase.

2.2 Behavioral Predictions

Previous ultimatum game experiments have shown that even in the absence of communication, proposers on average offer about 40 percent of stakes on offer, and responders frequently reject offers of less than 20 percent, independent of

the size of initial endowment (refer to the meta analysis by Oosterbeek *et al.*). Therefore, based on these studies, we predict the following for the NC treatment:

H1 X participants will make positive offers, on average in excess of 30 percent of endowment.

H2 Y participants will both frequently reject offers of less than 20 percent of endowment, and will accept offers in excess of 30 percent of endowment.

A few ultimatum bargaining experiments have examined the effect of communication on bargaining outcomes, and have for the most part found that communication induces more egalitarian offers, and lower rates of disagreement between bargaining parties (see, for example, Roth, 1995; Zultan, 2012). However, apart from Xiao and Houser (2005), none has examined the effect of anticipated communication on proposer behavior, or provided a detailed analysis of responder choices when communication proceeds the offer. Nevertheless, these studies alongside the dictator game studies of Ellingsen and Johannesson (2007), and Xiao and Houser (2009), provide us with some insights on expected behavior in our experiment.

Xiao and Houser (2005) does not find an anticipated communication effect (present in the two dictator game studies), suggesting that strategic considerations crowd out such anticipated communication effects in the standard ultimatum game. However, our design allows for a stronger effect to be observed in TSC, since two-sided communication implies that the proposer plays an active role (participates) in the communication, as opposed to where the proposer is passive and simply receives the accept/reject decision, along with a written message from the responder. Participation of the proposer implies that the responder can ask directly about how much the proposer offered, and subsequently the proposer may incur the wrath of the responder if the offer is judged to be unfair. On the other hand, the proposer may choose to lie about the offer to avoid any emotional backlash from the responder, but the proposer may feel guilty about lying later on. Therefore, due to guilt aversion, the proposer may

simply choose to be more other-regarding. Therefore, we expect the fact that the proposer is active in TSC will result in an anticipated communication effect.

H3 X participants will make higher offers in TSC relative to either NC or OSC.

It is clear from the dictator game studies of Ellingsen and Johannesson (2007), and Xiao and Houser (2009), that the crucial aspect is the feedback mechanism of (anticipated) communication. Since it is the proposer that makes the offer, we do not expect that she will increase or decrease her offers if she unilaterally communicates, but does not expect feedback of any form. Charness and Dufwenberg (2006), for example, argue that communication in the form of promises from second movers in the trust game is what is crucial in inducing first movers to cooperate. They observe that one-sided written communication from first movers has no effect on cooperation levels, in comparison to the no communication condition. Similarly, Andreoni and Rao (2011), in the dictator game, find that the amount allocated is lowest in the standard no communication condition, and when the allocator communicates unilaterally to the recipient in writing, compared to all other conditions (one-sided communication from the recipient, and two-sided communication). Therefore, we expect that one-sided communication from the proposer will have no effect on offers, or responder choices, compared to no communication.

H4 Offers of X participants will not differ between OSC and NC.

H5 Choices of Y participants will not differ between OSC and NC.

Finally, Xiao and Houser (2005) note that communication supplements costly punishment in the standard ultimatum game, with responders being less likely to reject what they perceive to be unfair offers from proposers if they can show their disdain for the offers in the form of written messages. However, we note that since our design does not allow for the responder to definitively learn of the proposer's offer prior to the conclusion of the one-shot ultimatum game, it is not clear that the content in Xiao and Houser's study will be the same as that in our

study. In a face-to-face communication treatment of an ultimatum game with strategy method similar to ours, Zultan (2012) observes that responders act less cooperatively when communication is unrestricted, compared to the standard no-communication condition, whereas restricting communication to social conversations results in responder behavior not different to the standard condition. Therefore, since we impose no restrictions on the content of communication in TSC, it is highly likely that behavior will be similar to Zultan's unrestricted communication result.

H6 Rejection frequencies will be significantly higher in TSC relative to either NC or OSC.

2.3 Participants and Procedures

The experiment was conducted at the Cognitive and Experimental Economics Laboratory (CEEL) at the University of Trento. A total of 120 participants took part in six experimental sessions compromising two sessions per treatment. The participants were recruited from the undergraduate populations at the University. None of the participants had previously taken part in this series of experiments.

On their arrival, participants were allocated separate computer terminals, and given a copy of the instructions for the experiment. Time was allocated for private reading of these instructions. Thereafter, a member of the experimental staff read aloud the instructions in an attempt to make the rules and procedures of the experiment common knowledge.

Each participant was then randomly assigned either the role X or Y, and maintained that role for the remainder of the experiment. To ensure comprehension with the instructions, participants had to answer a set of control questions relating to the contents of the instructions prior to the actual start of the experiment.

The experiment consisted of five periods. At the start of each period, each

participant with the role X was randomly paired with a participant with the role Y. No participant was paired with the same participant at a subsequent period, and this detail of the matching protocol was explicit in the instructions.

In the communication treatments, a member of the experimental staff monitored the contents of the messages to make sure that they complied with the instructions. Participants in these treatments were explicitly made aware of this fact prior to the actual start of the experiment.

3 Results

3.1 Descriptive Statistics

3.1.1 Choices of X

We begin with a summary of the choices of X participants across the three treatments. Figure 1 exhibits the distribution of individual-level average offers over the five periods of the experiment.

[Figure 1 about here]

Most offers are between $40-50$ percent of endowment in TSC, and $30-40$ percent of endowment in NC and OSC. Both the first-period- and overall-mean-offer across periods are higher in TSC compared to either NC or OSC. A series of Mann-Whitney U tests on period averages shows that offers differ between NC and TSC ($\rho = .010$), and OSC and TSC ($\rho < .001$). However, the tests do not reveal a statistically significant difference between offers in NC and OSC.

Observation 1 *Behavior of X participants in NC and OSC does not differ. However, offers are significantly higher in TSC.*

These results are consistent with our behavioral hypotheses H1, H3, and H4, and show that anticipated two-sided communication induces higher offers from proposers. Whether two-sided communication results in higher levels of cooperation, generally, depends on the behavior of Y participants analyzed below.

3.1.2 Choices of Y

Figure 2 exhibits a grouped bar plot of conditional acceptance rates of Y participants across the three experimental treatments.

[Figure 2 about here]

What is immediately apparent from the bar plots is the non-monotonicity of Y choices across all treatments. A monotonic strategy of Y requires that if $y_x =$ "accept", then $y_{x'} =$ "accept" for all $x' > x$. Therefore, for example, if a participant accepts an offer $x = 5$, to adhere to monotonicity, she must also accept all offers $x > 5$. In addition, the bar plots reveal that acceptance rates are consistently lowest in TSC. For low offers, i.e., $x \in [1, 3]$, Mann Whitney U-tests on period averages show that acceptance rates differ between TSC and NC ($\rho = .003$), and TSC and OSC ($\rho = .007$). However, the tests do not reveal a difference in acceptance rates between NC and OSC ($\rho = .767$).

Across all treatments, acceptance rates are highest for intermediate offers, i.e., $x \in [4, 6]$. The maximum acceptance rate is observed at the equal split of the pie, $x = 5$, with nearly all such offers accepted by Y participants. For this range of offers, Mann Whitney U-tests do not highlight a significant difference in acceptance rates between treatments. For high offers, i.e., $x \in [7, 9]$, acceptance rates differ only between NC and TSC ($\rho = .024$).

Observation 2 *Y participants are significantly less cooperative in TSC if offers are either low or high. For intermediate offers, there are no behavioral differences between treatments.*

Hypothesis H2 is not fully supported due to the non-monotonicity of a large number of participant Y strategy vectors. Even though we observe that Y participants frequently reject offers of less than 20 percent of endowment, the frequency of rejection of high offers is also high (relative to the expectation that no high offer is rejected). In NC, for example, 10 percent responder choices corresponding to the maximum offer of $x = 9$ were "reject", which is significantly

different to the case where all choices are "accept" (Wilcoxon signed-rank test, $\rho = 0.020$). Hypothesis H5 is supported, and hypothesis H6 holds with the qualification that rejection rates do not differ between OSC and TSC for the range of high offers.

3.2 Regression Analysis

We specify regression and probability models in this section in order to gain an in-depth analysis of choices of X, and rejection behavior of Y. The models take into account dependencies that arise from the matching protocol implemented, and repeated play across periods.

3.2.1 Analysis of Proposer behavior

To analyze choices of X, we specify a random effects linear model. The dependent variable *offer* represents the *Euro* value of the offer made by participant i, and takes on values in the range [1,9]. The model takes the form:

$$offer_i = \beta_0 + \beta_1 OSC_i + \beta_2 TSC_i + \beta_3 period_i + u_i$$

where as explanatory variables, we include indicator variables for the OSC and TSC treatments, and a period variable. In addition, as a robustness check, we estimate two random effects probit models where the dependent variable *offer* takes on the value one if $x = 5$, and $4 \leq x \leq 6$, respectively, and equals zero otherwise. The baseline treatment in the regression analysis is NC. Table 2 summarizes the results of the regressions.[†]

[Table 2 about here]

The results show that across all specifications, anticipated two-sided communication has a positive and significant effect on participant X offers relative to either no communication or one-sided communication (see $W-st1$ statistics). In

[†]The random effects linear model is estimated using the two-stage FGLS estimator (Balestra and Nerlove, 1966), and the random effects probit models are estimated using maximum likelihood.

general, anticipated one-sided communication has no effect on X offers relative to no communication, but significantly decreases the likelihood that participant X splits the endowment fifty−fifty. Experience has no effect on participant X offers.

Observation 3 *X participants offer more if they anticipate two-sided communication. Anticipated one-sided communication generally has no effect on X offers, but decreases the probability that X will split the endowment equally.*

3.2.2 Analysis of Responder behavior

To analyze the rejection behavior of Y, we specify a multilevel logit model. The dependent variable *reject* takes the value one if Y rejects an offer of X, and equals zero if she accepts. To account for the non-monotonicity of a significant proportion of participant Y strategies, we include in our set of explanatory variables dummies for the possible offer levels of X (x_LOW for $x \in [1,3]$, and x_HIGH for $x \in [7,9]$).[‡] Other explanatory variables as previously defined are *OSC*, *TSC*, and *Period*. The baseline offer level in the regression analysis is x_INT where $x \in [4,6]$, and the baseline treatment is NC. The logit model takes the form:

$$p_i = prob(reject_i = 1) = f(\beta_0 + \beta' X_i)$$

where

$$\beta' X_i = \beta_1 OSC_i + \beta_2 TSC_i + \beta_3 x\_LOW_i + \beta_4 x\_HIGH_i + \beta_5 Period_i.$$

The model is estimated with GLLAMM (Stata), and we allow error terms to be correlated within sessions. Table 3 summarizes the results of the regressions.

[Table 3 about here]

Beginning from a very general model in column (1) of the table, we eliminate insignificant interactions until we are left with the desired model in column

[‡] A feasible estimation approach with monotonic strategy-vectors is to define a minimum acceptance threshold for a responder, i.e., the minimum amount that the responder is willing to accept, and then analyze how it changes across treatments (see, for example, Zultan 2012).

(2). The results show that two-sided communication has a significant effect in increasing the likelihood that Y rejects an offer relative to either no communication or one-sided communication (see $W - St1$ statistic), whereas one-sided communication has no effect on the rejection behavior of Y relative to no communication. The non-monotonicity of Y choices exhibited in Figure 2 is confirmed by the probability model, where it emerges that either low- or high-offers of X increase the likelihood of rejection by Y participants, relative to intermediate offers. In addition, low offers significantly increase the likelihood of rejection relative to high offers (see $W - st2$ statistic), while rejection rates decline across periods.

Observation 4 *Y participants are more likely to reject X offers with two-sided communication, whereas one-sided communication has no effect on the rejection behavior of Y.*

Observation 5 *Unequal offers (both high and low) are more likely to be rejected by Y participants, whereas experience makes it less likely that an offer is rejected.*

3.3 Analysis of the informational content of messages

In the behavioral predictions section, following the anticipated communication results of Ellingsen and Johannesson, and Xiao and Houser, as well as the communication studies of Andreoni and Rao in the dictator game, and Charness and Dufwenberg in the trust game, we correctly predicted that one sided communication will have no effect on behavior of proposers in our experiment. We argued that from these studies, what appears to be of crucial importance is the feedback mechanism of communication, which can only occur if the responder is active in the communication. However, our experimental design differs from those implemented in previous studies in the sense that communication occurs after the proposer has committed to a binding offer, whereas the responder never definitively learns about the offer until the end of the game. Therefore, there is no way to determine a priori what the content of communication will

be. We therefore implement a qualitative analysis of the informational content of communication in OSC and TSC, to see if we can spot differences in the content of communication between the treatments, which may in turn explain observed behavioral differences.

Our analysis strategy is to identify communication-content classifications that have previously been identified as having an effect on observed behavior in experiments. Roth (1995), and subsequently Zultan (2012), identified differences in responder behavior between game-related communication, and non-game-related communication (social conversations) in the ultimatum game.[§] Such a classification is feasible in our experiment because even though the content of communication in OSC and TSC are unrestricted ex-ante, proposers in OSC may choose to restrict content to non-game-related conversations since they unilaterally communicate with responders.

We categorize the content of communication as either *game-related* or *non-game-related*. Specifically, we define game-related communication as any communication that includes reference to a parameter in the ultimatum game, such as, offer, accept, reject, payoff, and earning. Non-game-related communication on the other hand is any communication that does not fall into the defined category. We add a third category, *No communication*, since participants in both treatments are given the option of not engaging in communication if they so wish. The categorization was conducted using Stata, and Appendix D presents details of the procedure.

In total, there were twenty proposers in OSC, and twenty proposer-responder pairs in TSC, communicating over five periods resulting in a potential total of one hundred conversations per treatment. Figure 4 summarizes the breakdown of the conversations by content for the treatments.

[Figure 4 about here]

[§]Recall that Zultan (2012) finds that responders behave less cooperatively under game-related communication. Therefore, the preliminary hypothesis is that the there is a significantly higher percentage of conversations that exclude game-related content in OSC relative to TSC.

84/100 conversations in OSC relative to 77/100 in TSC included game-related content. Only 9/100 conversations were classified as non-game-related in OSC, relative to 7/100 in TSC.

Observation 6 *The vast majority of proposer and proposer-responder pair conversations is game-related.*

Since there is no significant difference in the proportion of game-related communication across treatments, we further refine the game-related category and consider the proportion of conversations in which the proposer explicitly stated the offer amount. In OSC, there was an explicit statement of the amount in 49/93 cases, relative to 49/84 cases in TSC. Out of this, 2/49 cases in OSC involved deception, compared to 1/49 in TSC, implying that most proposers who stated their offer amount were being truthful. The percentage differences in the number of conversations falling into either sub-category is not significant to explain differences in responder choices in OSC relative to TSC. In addition, we cannot attribute the differences to deception on the part of proposers.

3.3.1 An alternative classification

The previous categorization does not explain differences in behavior across our communication treatments, and therefore, it is likely that an alternative process is in effect. As in many instances involving social preferences, Fehr and Schmidt's inequality aversion model is robust in explaining behavior across a wide range of games. Following this theory, we test the degree to which communication included notions of fairness across treatments, thus potentially explaining the presence of higher offers and higher disagreement frequencies in TSC relative to OSC.

Our hypothesis is that there were more fairness-oriented conversations in TSC relative to OSC. With more notions of fairness prominent, responders have an induced expectation of fairness, and if this expectation is not met, then they are more willing to punish proposers, compared to absent the expectation. Con-

currently, proposers anticipate responders' expectations, and respond positively to these expectations (the feedback mechanism).

To test whether there is evidence in support of the hypothesis, we analyze the content of messages in the communication treatments, focusing on the whether it included any fairness-oriented language. Therefore, we categorize a message as fairness-oriented if it includes a term referencing fairness such as fair, equal, equitable, even, half, fifty-fifty, same, and identical.[¶] Otherwise, we categorize the message as non-fairness oriented. As with the previous case, the categorization was conducted using Stata, and Appendix D presents details of the procedure.

[Figure 5 about here]

Figure 5 exhibits the distribution of messages that fall into our defined categories. In total, 32/100 conversations in OSC included fairness-oriented content relative to 53/100 in TSC. The mean offer for this category in OSC and TSC was, respectively, ≈4.19 and ≈4.39. Conversely, 61/100 conversations in OSC, relative to 31/100 in TSC included non-fairness oriented content. The mean offer for this category in OSC and TSC was, respectively, ≈2.90 and ≈3.55.

Observation 7 *A significantly higher proportion of conversations in TSC includes fairness-oriented content. In both OSC and TSC, mean offers are significantly higher when the content of communication is fairness-oriented.*

When the content of communication is fairness-oriented, there is no significant difference in the amounts offered in OSC and TSC, but there is a significant difference in the relative frequency of such conversations between the treatments. One, however, has to exercise caution when reading this result as it relates to OSC. It is possible that causality runs from offer to communication, in the sense that proposers who offer higher amounts, and unilaterally communicate to responders, are more likely to engage in fairness-oriented conversations. However,

[¶]As a disclaimer, we acknowledge that equal is not necessarily fair. However, for most participants in the ultimatum game, there is a high positive correlation between the two concepts.

what is not in doubt is that there is a clear anticipation effect of communication in TSC. The inclusion of responders into the conversation in TSC results in a significantly larger number of fairness oriented conversations in comparison to OSC, and proposers appear to anticipate such conversations, offering higher amounts on average, compared to OSC. The result provides support for the view that communication in unrestricted bargaining enhances cooperation by focusing participants' attention on a small number of fairness norms.

4 Conclusion

This paper has investigated whether the anticipated communication result of Xiao and Houser (2009), and Ellingsen and Johannesson (2007), is robust to the presence of strategic considerations. In these studies, it is observed that donations in the dictator game are significantly higher in relation to the standard (no-communication) condition when the allocator knows that she will receive feedback in the form of an anonymous written message from the recipient. We show that such anticipation effects still persist in the ultimatum game if communication is two-sided. Thus, even though one might imagine that the proposer in the ultimatum game mainly focuses on whether the responder will accept or reject her offer, it is also apparent that if the proposer knows that she will have to interact with the responder by exchanging anonymous written messages, then this additionally affects her allocation behavior. In other words, strategic considerations do not fully crowd out the anticipated communication effect.

Eliciting choices using the strategy method allowed us to study responder behavior at offer levels that are rarely observed in the actual course of play. Interestingly, this revealed a great deal of non-monotonicity in responder choices both in the presence, and absence of communication. Inequality aversion models such as that of Fehr and Schmidt implicitly assume that individuals suffer a psychological cost if they are either better off or worse off than other individuals (i.e., they dislike inequality). We provide evidence that a significant number of

responders are willing to sacrifice their own material payoff to avoid inequality, even if this inequality is in their favor.

One-sided communication from the proposer does not result in behavior that differs with no communication, a result that mirrors Andreoni and Rao's result of one-sided communication from allocators to recipients in the dictator game. By analyzing the informational content of communication in our experiment, we observe that proposers restrict the content of communication to non-fairness oriented content when they unilaterally communicate with responders. This behavior can seemingly be explained by guilt aversion. Knowing that they have offered lower amounts (relative to the equal split), proposers want to avoid conversations that remind them of fairness, since such conversations may trigger a guilty conscience within them.

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A Instructions (Translation from Italian)

[text corresponding to OSC treatment is shown in square brackets]

{text corresponding to TSC treatment is shown in braces}

Thank you for taking the time to attend this session. If you have any question at any point before, during or at the end of the experiment, please raise your hand and one of the experimenters will assist you. You are not allowed to talk to anyone else in the room except for the experimenters.

You will receive a show-up fee of €2.50 for taking part in this session. In addition, you have the opportunity to earn more money depending on the decisions that you and others make during the session. At the end of the session, you will personally be paid the total sum of your show-up fee and earnings in private.

The experiment will take place on a computer where you will be paired with a different individual at each period. There will be a total of five periods. At no point during or after the experiment will any individual know the identities of individuals that he or she is paired with across the periods.

Decision Tasks

At the very beginning, the computer will randomly assign you either the role of X or Y. Once this assignment is complete, you will remain in that role for the remainder of the session. If you are assigned the role of X, you will be paired with an individual assigned the role of Y and vice-versa. Your earnings will depend on the decisions that you make in your pair.

On the computer screen, each individual X will select one of nine divisions of €10. These divisions are (€1, €9), (€2, €8), (€3, €7), (€4, €6), (€5, €5), (€6, €4), (€7, €3), (€8, €2), (€9, €1), where the Euro amounts within the parenthesis represent (Amount to X, Amount to Y) respectively.

Not knowing the choice of X, for each of the nine divisions, Y has to indicate whether he or she accepts or rejects. If Y accepts, then X and Y both receive the amounts as per the division. If Y rejects, then both X and Y receive €0. Note that there will be a three minute time-gap between the choice of X, which temporally comes first, and Y's decision.

[A message

X has the option of sending a message(s) to Y prior to Y choosing whether to accept or reject the offers corresponding to each division. However, the message(s) will be after X has chosen one of the nine divisions. The following sequence illustrates the chronology of events:

$$X\text{'s choice} \rightarrow \text{optional message(s) from } X \text{ to } Y \rightarrow Y\text{'s decision}$$

There will be a message window on the computer screen where X can write a message(s) to Y within the three minute time-gap between X's choice and Y's decision. If X does not intend to send a message(s) to Y, then he or she can click on the button labeled "no message" at the bottom right hand corner of the screen. If this happens, then Y will be notified that X has chosen not

to send any message(s). At any point within the allotted three minutes, X can send a message(s) to Y regardless of whether he or she had earlier opted not to.

In the message(s), X is not allowed to identify him or herself. Therefore, he or she cannot include personal details such as name, gender, appearance, age, address, phone number, and program or year of study. (Experimenters will monitor the message(s). Violations (to the discretion of the experimenters) will result in X forfeiting the €2.50 show-up fee and leaving the session with no earnings. The paired Y will receive the average amount received by other Y's.) Apart from these restrictions, X may say anything that he or she wishes in the message(s).

{Messages

Both X and Y have the option of sending messages to each other prior to Y choosing whether to accept or reject the offers corresponding to each division. However, the messages will be after X has chosen one of the nine divisions. The following sequence illustrates the chronology of events:

$$X\text{'s choice} \rightarrow \text{optional messages between } X \text{ and } Y \rightarrow Y\text{'s decision}$$

There will be a message window on the computer screen and both X and Y can send messages to each other within the three minute time-gap between X's choice and Y's decision. If either X or Y does not intend to send a message(s) to the other, then he or she can click on the button labeled "no message" at the bottom right hand corner of the screen. If this happens, then the paired participant will be notified that either X or Y has chosen not to send any message and subsequently, he or she will decide whether to send a message(s) to him or her. At any point within the allotted three minutes, X and Y can send a message(s) to the paired participant regardless of whether they had earlier opted not to.

In the messages, both X and Y are not allowed to identify themselves. Therefore, they cannot include personal details such as name, gender, appearance, age, address, phone number, and program or year of study. (Experimenters will monitor the messages. Violations (to the discretion of the experimenters) will result in the violator forfeiting the €2.50 show-up fee and leaving the session with no earnings. The paired individual will receive the average amount received by other participants.) Apart from these restrictions, both X and Y may say anything that they wish in the messages.

Earnings

Out of the five periods, one period will be randomly selected for payment. Total earnings at the end of the experiment for both X and Y will be the sum of the show-up fee and earnings in the period that is randomly selected.

B Figures

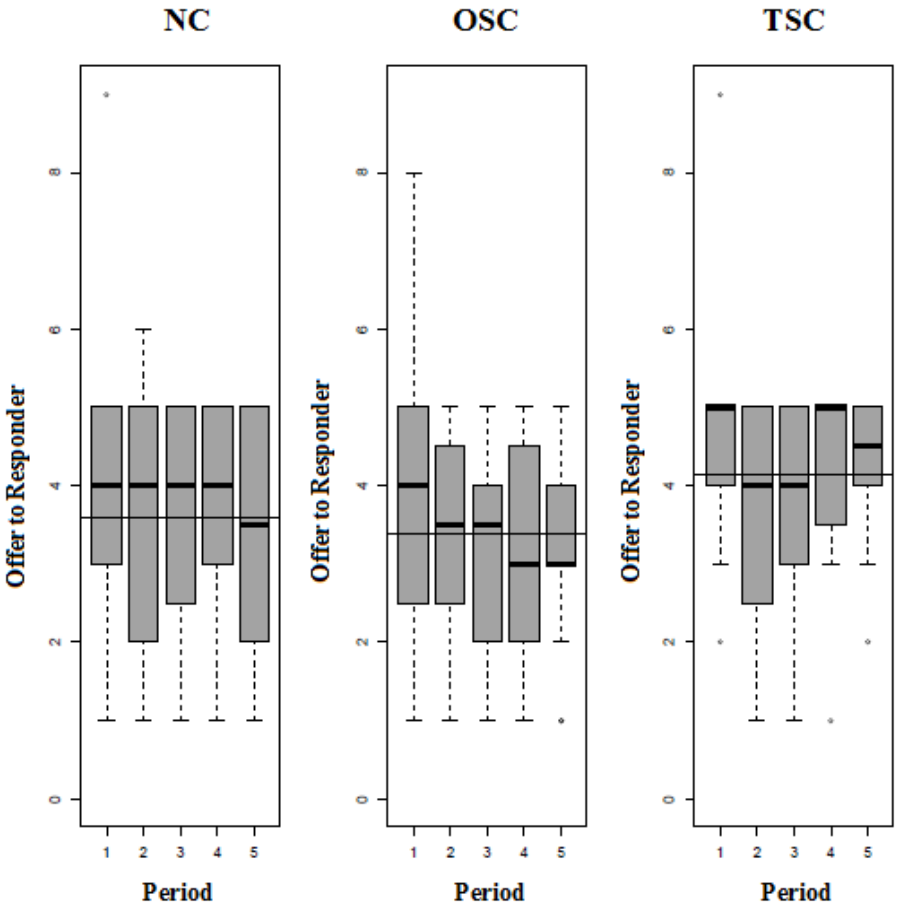

Figure 1: Choices of X (average at the individual level)

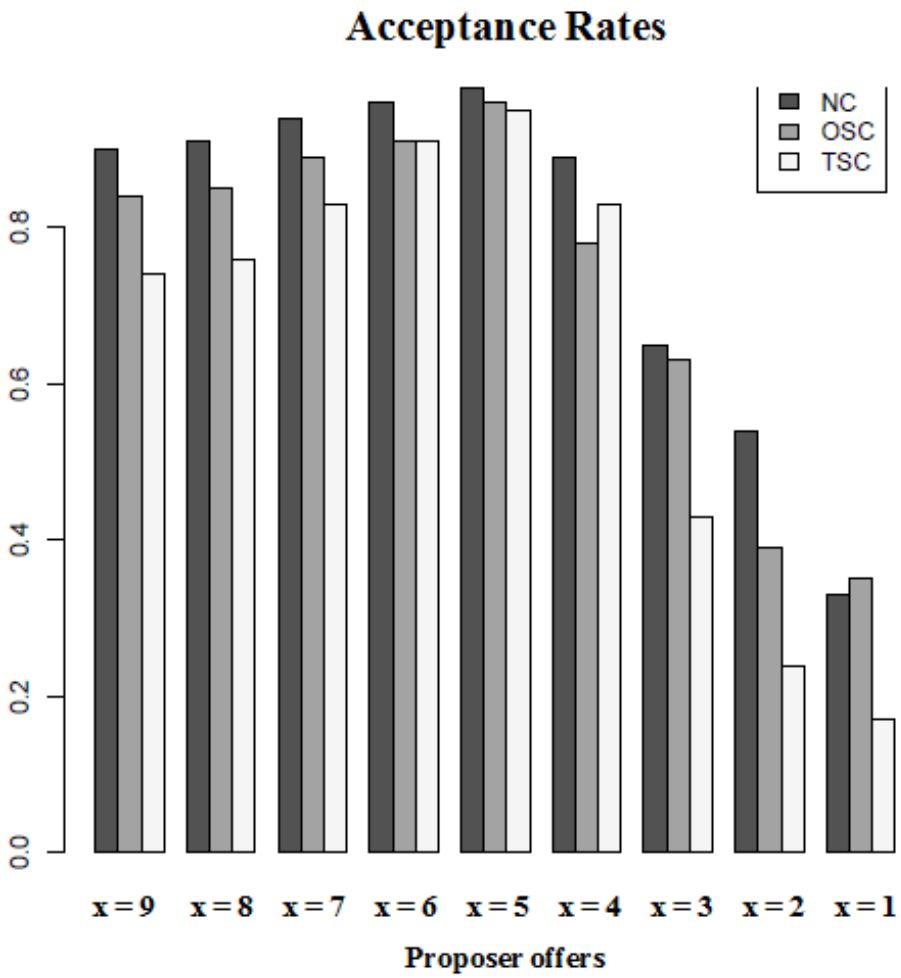

Figure 2: Conditional choices of Y (comparison across treatments)

```
. list  message game_related

1.
  message
  i decided to offer you six leaving me with four you did not split ha..
                                                          game_r~d
                                                                 1

2.
  message
  hello it is hot outside today is it not
                                                          game_r~d
                                                                 0

3.
  message
  NO MESSAGE
                                                          game_r~d
                                                                 0
```

Figure 3: Stata Output

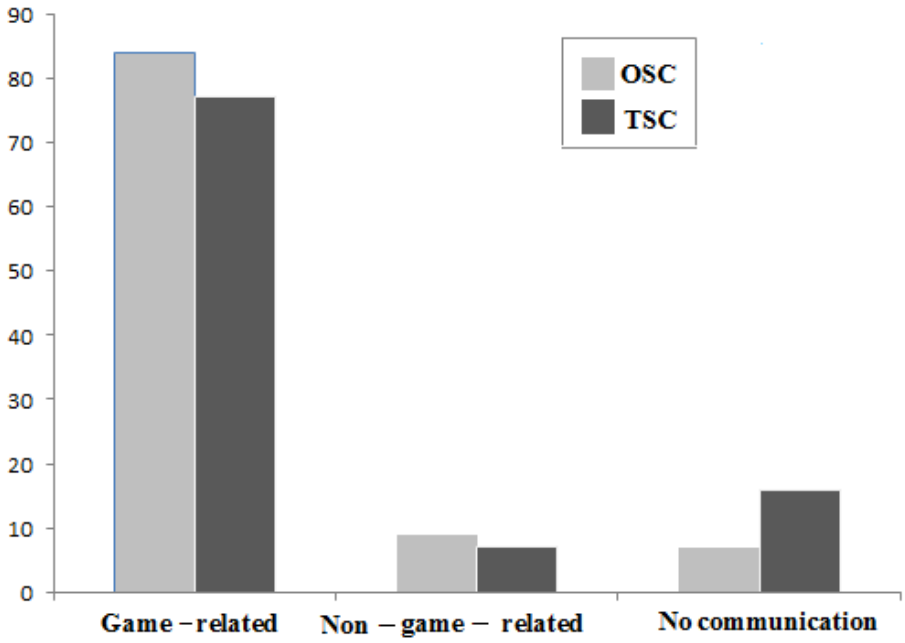

Figure 4: Communication breakdown by content

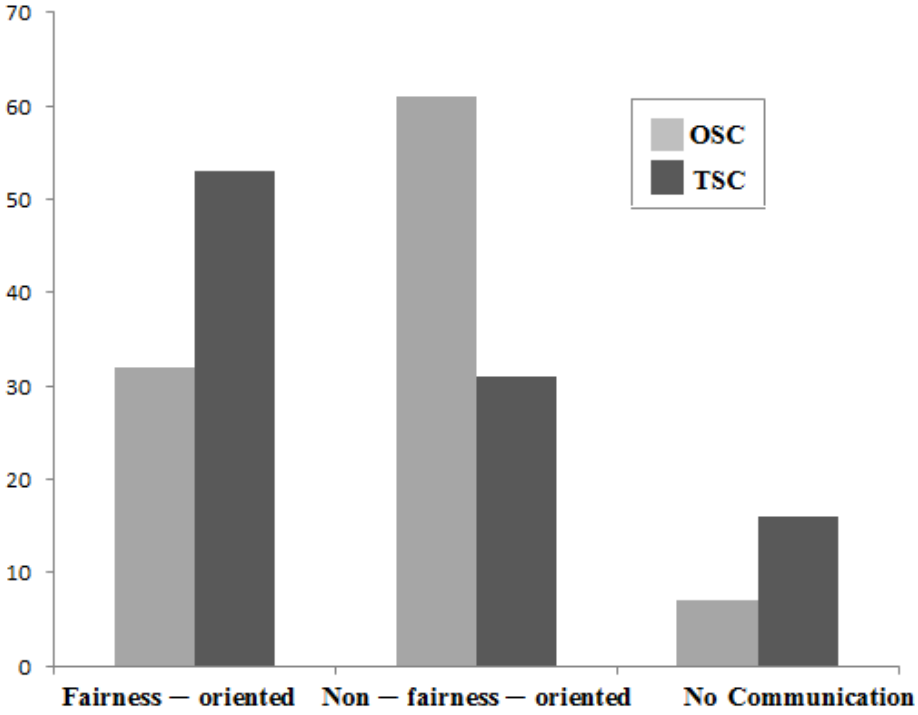

Figure 5: Fairness-oriented vs. Non-fairness-oriented content

C Tables

Table 2: Choices of X (Random Effects: linear and probit)

	Coeff (Std. Err.)		
Offer$\sim$	*All* ($x \in [1,9]$)	$x = 5$	$4 \leq x \leq 6$
(Intercept)	3.775 (0.236)***	-0.476 (0.262)*	0.332 (0.239)
OSC	-0.210 (0.189)	-0.417 (0.206)**	-0.260 (0.188)
TSC	0.550 (0.189)***	0.443 (0.192)**	0.434 (0.192)**
Period	-0.062 (0.054)	-0.002 (0.057)	-0.023 (0.055)
W-$st1$	16.250***	17.300***	13.010***
No. of observations (groups)	300 (20)	300 (20)	300 (20)
Random intercept of Level–2$^{\diamond}$	0.479	0.629	0.493

W-$st1$: Wald statistic for the hypothesis that OSC= TSC
$^{\diamond}$Experimental participants
***(0.01);** (0.05); *(0.1); significance level

Table 3: Analysis of Responder Choices (GLLAMM: logit)

	Coeff (Std. Err.)	
reject $\sim$	(1)	(2)
(Intercept)	-3.640 (0.744)***	-3.496 (0.382)***
OSC	0.646 (0.917)	0.345 (0.290)
TSC	0.944 (0.888)	0.851 (0.289)***
x_LOW	1.344 (0.740) *	1.386 (0.320)***
x_HIGH	3.487 (0.722)***	3.283 (0.315)***
$Period$	-0.088 (0.034)*	-0.088 (0.034)***
OSC*x_LOW	-0.075 (0.913)	
OSC*x_HIGH	-0.385 (0.891)	
TSC*x_LOW	0.155 (0.880)	
TSC*x_HIGH	-0.189 (0.862)	
W-$st1$	0.16	3.11*
W-$st2$	96.04***	318.35***
No. of observations (sessions)	2700 (6)	2700 (6)
Log-likelihood	-1301.80	-1302.77
Random effects variance$^{\diamond}$	0.067	0.069

W-$st1$: Wald statistic for the hypothesis that OSC= TSC
W-$st1$: Wald statistic for the hypothesis that x_LOW= x_HIGH
$^{\diamond}$Sessions
***(0.01);** (0.05); *(0.1); significance level

D Categorization procedure

All statistical analysis and categorization of messages in this paper was conducted using Stata. Included in each observation, which is a row in Stata, was a string variable of maximum length 244 characters (Stata type str244), which contained the entire message of the proposer in OSC, and proposer-responder pair in TSC in a given period. All punctuation marks were removed from the messages prior to the creation of the variable, and all characters were converted into lower-case. In the instances where a participant(s) chose not to engage in communication, the variable had the entry "NO MESSAGE".

For the first category, we identified a list of key words that reference a parameter in the ultimatum game, including ultimatum, game, offer, accept, reject, payoff, euro, currency, period, earnings (and different combinations of these: in Italian), as well as numbers representing monetary amounts.

Following identification of key words, we used the -inlist- command in Stata to generate an indicator variable that took the value one if a message included game-related content, and zero otherwise. However, prior to this, a loop was used to separate the message variable into constituent word variables using Stata's string function -word-, so that the software could handle the length of messages.

For the sake of illustration, we translate three messages from the list of messages in TSC and OSC, and explain the procedure.

Example message from TSC:

X I decided to offer you 6 leaving me with 4.

Y You did not split half-half?

X No I chose a little less for myself.

This message exchange is entered into Stata as follows:

"i decided to offer you six leaving me with four you did not split half half no i chose a little bit less for myself"

Example message from OSC:

X Hello, it's hot outside today... isn't it?

This message is entered into Stata as follows:

"hello it is hot outside today is it not"

Example message from OSC or TSC:

X or X-Y pair [No communication occurred]

This message is entered into Stata as follows:

"NO MESSAGE"

The commands below enter the data above into Stata, and separate the message variable into constituent word variables using a loop (note that here we generate a maximum of 25 word variables because the longest message has 25 words):

```
   input str244 message
"i decided to offer you six leaving me with four you did not split
half half no i chose a little bit less for myself"
"hello it is hot outside today is it not"
"NO MESSAGE"
end
forvalues i = 1(1)25 {
gen word‘i’=word( message, ‘i’)
}
```

Finally, we use another loop to identify the occurrence of our defined keywords in the messages. A version of the following (expanded to include all combinations of words, e.g., accepts, accepted, etc.) generate an indicator variable which we label "game_related" that tells us how many conversations included our defined keywords.

```
   forvalues i = 1(1)25 {
gen game_r‘i’ = inlist(word‘i’, "ultimatum", "offer", "accept", "reject",
"payoff", "euro", "currency", "earn")
}
egen game_related= rowtotal( game_r1 - game_r25)
replace game_related=1 if game_related>1
list message game_related
```

The resulting Stata output is as shown below. It is clear from the messages that only the first one has a game related content.

[Figure 3 about here]

For the second category, we included all synonyms of the word "fair" that we could identify as keywords, including, reasonable, equal, half, and generous. The ensuing categorization followed the above description.