Messaging in Bargaining: To Name Your Price, or Not to Name Your Price?

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Abstract

Using a laboratory experiment involving extended ultimatum bargaining games, I test how different forms of messaging used by responders affect bargainer outcomes. In particular, I examine whether sharing cheap-talk explicit messages about reserve values is more or less effective than rejecting offers without sending an explicit message, or doing both. I find that while all of these forms of messaging significantly increase average responder payoffs relative to a non-messaging baseline, there is no significant difference in average responder payoffs between them. Analysis of proposer strategies suggests that while many proposers appear to disbelieve messages from responders who claim high minimum acceptable offers, they still send offers which are higher than when no message was sent, despite theoretical predictions to the contrary from cheap talk. Because messages are constrained to specific forms and subjects use a strategy method, these effects are unlikely to be due to conversational manipulation of social preferences - messages appear to carry some degree of apparent credibility. This may be explained by proposer beliefs about lying costs for responders, and has implications for negotiation strategy and design of bargaining institutions.

1. Introduction

A potential new hire enters a salary negotiation with their prospective new employer. The firm makes the candidate an offer – a decent salary, surely, but knowing that there may be room to improve, the ready to bargain prospect considers their next move carefully. They could, for one action, accept the offer outright if it's already good enough – in an ultimatum situation, this would be the only possible rational move. In the same spirit, if it's the last possible offer and still not good enough, the only sensible decision would be to walk away.

But this prospective hire knows that this probably isn't the last possible offer – if they says no, the discussion will continue, at least long enough for another option to be considered. There are more options to choose from, then. For one, they could decline, and make a counter. This would leave the firm to respond to the new proposal – would they reissue their offer at her new demanded salary, resubmit their previous offer claiming it to be the best they can do, or perhaps find somewhere in the middle? The potential employee's decision of whether to name a counter surely relies on her expectations of how the company reacts. Alternatively, the candidate may decline without countering, instead demanding a new and (hopefully better) offer without providing a specific number. This approach comes with potential costs – perhaps the opportunity to set a potential anchor on her price, but in compensation, does not accidentally cap potential gains by accidentally proposing less than the employer would have followed up with otherwise. Then again, perhaps its easier for the employer to recognize the candidate's talk as cheap when it is explicit

– it's not hard to believe someone would misrepresent their own number. But in the absence of a number, perhaps the employer must be more cautious in the employee's favor to ensure a deal is made.

So which course of action is best – should the candidate name a price, or let rejection per se do the talking? Ultimately, this is a choice about messaging, a crucial strategic element of any bargaining interaction. In bilateral bargaining, it is natural to think that each side of the negotiation has a reserve price, and if the buyer's maximum willingness to pay is less than the seller's minimum willingness to accept, then there is room to find a price in between those numbers. How that potential surplus is divided, however, is the question, and when those reserve prices are uncertain, the opportunity for deception about one's own reserve price arises. This deception is core to negotiation; in John Nash's words: "The usual haggling process is based on imperfect information, the hagglers trying to propagandize each other into misconceptions of the utilities involved" (Nash [26], p.138). A bargainer seeking success should consider whether and how the messages they choose will be credible to their bargaining partner, in order to achieve better deals.

In this study, I use a laboratory experiment to examine how subjects employ and react to different types of strategic messaging in bargaining to identify which messages (if any) are apparently credible, whether they induce better outcomes for bargainers, and whether stating a reserve price outperforms declining without counter. Specifically, I use three ultimatum game variations (in addition to a non-messaging control) which each minimally extend the structure of the game to allow for strategic messages to be sent. These messages come in different forms: explicit messages, which directly make claims of a responder's willingness to accept, implicit messages, in which a responder rejects an offer (and thus implicitly claims that their minimum willingness to accept is above the offered amount), and both together, where a responder rejects an offer while also making an explicit claim, akin to the common decline-and-counter. Unlike other studies, I focus specifically on the strategic signaling value of messaging, devoid of conversational nuance, social preference manipulation, or other well-studied channels - using a strategy method and highly constrained message types, I limit subject to subject interactions to examine only how their actions depend on messages.

A simple model of one-sided incomplete information predicts that no form of messaging by responders should not impact proposer strategies, nor eventual bargaining outcomes in equilibrium. The basic insight is as follows: if low and high-reservation price responders send different messages on average, then proposers can optimally respond by sending the high-type responders larger offers than the low types. But if this is the case, low-type responders have a direct incentive to mimic the messages sent by high-type responders, to get themselves the better offers. Because this mimicry is free (cheap talk), proposers cannot learn from the message in equilibrium (babbling), and thus act as if they are responding to their priors in all cases.

This prediction is not particularly unbelievable. Proposers considering what explicit messages imply about reserve values could very easily come to the conclusion that messages sent freely have no information

content, in particular, since responders presumably always want to receive larger offers to smaller ones. Likewise, when a proposer makes two offers instead of one while considering implicit messaging, it is reasonable to suspect that little real information is transmitted, and final offers resemble those sent in the non-messaging game.

Nonetheless, I find that while no form of messaging particularly outclasses the others, all three lead to significant and substantial gains for responders relative to the non-messaging treatment. These improvements come directly through eliciting larger offers from proposers, which mechanically are also more often accepted, though the total gains disproportionately favor responders. Proposers appear to recognize that responders exaggerate their preferences in explicit messages when those messages suggest high reserve values, however still send offers which are larger on average than those sent without messaging. Similarly, most proposers raise their offers after facing first-offer rejections (implicit messages). In total, this suggests that messages are treated as if they are at least somewhat credible. A candidate explanation for this observation is the existence of or a proposer-side belief in psychological costs of lying , as studied by Kartik [22].

Additionally, I ask if there is selection into types of messaging based on some skill or inclination. I find no relationship between selection into particular games and expected payoffs in those games, suggesting subjects are not particularly well-calibrated to their likely outcomes in each game.

This paper seeks to contribute to two literatures. First, on the bargaining and negotiation side, I am the first to compare explicit messages with implicit messages to see if they vary in apparent credibility or result in different outcomes. Moreover, I do so in a way which examines, to the greatest extent possible, the purely strategic elements of messaging, controlling for effects through prosocial or other channels. Second, I contribute to a literature on cheap talk in the laboratory. Bargaining is one of the more frequent environments in which most people run into cheap (or seemingly cheap) talk, and so their ability to recognize the relevant incentives and consider strategies is particularly pertinent.

2. Literature

Many experiments have studied communication in bargaining or bargaining-adjacent domains. Two that consider in particular the role of *asking* for a particular amount are Rankin [30] and Andreoni and Rao [4]. In the former, responders in an ultimatum game were permitted (but not required) to make requests for certain offer amounts, and finds that while responders who chose to make requests received smaller offers than those who did not, conditional on making a request, requesting more led to larger average offers. Many responders making requests eventually accepted offers below those request amounts, indicating that their requests were not intended to send a truthful signal about minimum willingness to accept. In Andreoni and Rao [4], subjects played a dictator game in which the researchers varied which roles could

communicate, to see how communication impacted distribution decisions from allocator players. They find that communication has a major impact on allocations, and in particular, when recipients spoke, allocations to those recipients were substantially larger. In the same vein, studies examining bargaining with free or nearly-free communication (in which bargainers can say almost whatever they want) also must consider subtle conversational nuances as a partial driver of results. For example, Roth [33] varies ultimatum game treatments in which subjects communicate prior to play about topics related to the game about to be played, or topics unrelated to the game, and finds both lead to more equitable outcomes, attributing this to a sense of camaraderie that comes from communication. Zultan [36] extends and reinterprets this finding to show that game-relevant and non-game-relevant communication both increase cooperative play through different channels: other-regarding preferences, and social norms respectively. Unlike these studies, the current study seeks to examine the purely strategic value of messaging through manipulation of beliefs about reserve values, rather than potential influence of prosocial motives or other channels.

Perhaps the nearest studies in the literature to my experiment are Boles et al. [8] and Croson et al. [12], both of which allowed subjects to send cheap talk messages under incomplete information about both outside options for responders and pie size for proposers. The former finds that while responders used deceptive strategies about as often as proposers, they told fewer outright lies. The latter finds that responder threats and lies increased the offers those responders received. Like these studies, I examine bargaining as a particularly useful arena to study cheap talk threats for its ubiquity - many people are familiar with haggling and the deception that may come with it. I diverge by limiting the form of source of explicit messages, and additionally examine implicit messaging directly.

The decision of whether and how to message, as used in this paper, is closely related to the question of whether or not to make the first offer – indeed, sending a message before receiving an offer could be interpreted as making a (non-binding) offer. In the negotiation first-offer literature, Galinsky and Mussweiler [19] show, for example, that first-offers can act as anchors, leading to more favorable outcomes for the first-offering party (as is also demonstrated by Ritov [31]), although this advantage wanes when the second mover was directed to focus on their opponent's reservation price. Construing messages (in particular, explicit messages) as first offers in my data does not lead to conclusive findings about a first-offer effect. In particular, responder payoffs improve when messages are added in front of a proposer's single ultimatum offer, but do not significantly decrease again when this message occurs in between two proposer offers.

This experiment deals with bargaining under incomplete information. Other experiments on bargaining with incomplete information, such as Mitzkewitz and Nagel [25] and Huck [21], examine how asymmetric information on pie size affects play. The current study differs from these in that incomplete information is not induced by any outside option, but rather by the well observed variation in individuals' willingness

to accept in ultimatum games. This heterogeneity (and why low offers are rejected at all) is commonly explained with differential preferences for fairness, altruism, or reciprocity (e.g. Bolton and Ockenfels [9]; Rotemberg [32]; Rabin [29]) or spite (Levine [24]). In this paper, I am agnostic to the source of positive offer rejections and simply rely on the fact that they robustly occur and vary across individuals.

In order to test implicit messaging, I use a multi-stage bargaining design. Other multi-stage bargaining experiments including Binmore et al. [7], Ochs and Roth [28], and Neelin et al. [27] find behavior closer to subgame perfection than ultimatum games, but often rely on large induced discounting rates. I induce no discounting between rounds, instead considering bargaining in the immediate short term where delay costs come with strategic uncertainty risks but no meaningful losses of surplus. Messaging in bargaining has also been examined in multilateral settings, for example Agranov and Tergiman [3] and Baranski and Kagel [5], which show that when groups of negotiators are able to communicate, proposer premiums increase, becoming closer to the predictions of Baron and Ferejohn [6]. This occurs through a combination of mitigated uncertainty of what non-proposers will accept and competition between non-proposers to enter the winning coalition. The latter channel does not exist in a bilateral bargaining environment, although the former may lead to better outcomes for proposers if responders are truthful; my results show that in this experiment they are not, and proposers are not better off.

Core to the hypotheses driving this study is the idea of a bargainer misrepresenting themself, in terms of their reservation price. Misrepresentation in a similar way is a central feature of theories of reputational bargaining (Abreu and Gul [1], Abreu and Pearce [2] and Fanning [15]). These theories generally show how bargaining delay can emerge when strategic bargainers co-exist in the theoretical population with a proportion of non-strategic behavioral bargainers, who instead obey simple heuristics. Embrey et al. [14] examines the theory of Abreu and Gul (2000) directly and validates that subjects do indeed attempt to mimic other types.

There is literature evidence that cheap talk messages are often sent truthfully even when there is no incentive to do so, and they are believed more than theory predicts. Duffy and Feltovich [13] find cheap talk to be informative in their games, and subjects condition on cheap talk messages as if it is informative, overall improving payoffs. Gneezy [20] shows that subjects avoid lying in cheap-talk communication even when they have a financial incentive to sway the receiver by lying.

Broadly, bargaining research with communication has examined how various social factors interplay with strategies that attempt to manipulate preferences or redirect conversational focus for the sake of improving overall or individual outcomes. This study furthers that literature by focusing on communication which is strictly strategic, and in particular, comparing whether the form of strategic communication (explicit or implicit) matters in terms of their impact on offers and final outcomes.

3. Experimental Design

3.1. Overview

The experiment consists of four bargaining games in which a proposer and responder attempt to divide a pie of 10 points, in two parts. In both parts, all four games are played, in the same order as presented. Part 1 was a practice segment in which subjects were read instructions for all four of the bargaining games, and had to answer comprehension questions to ensure understanding. Each subject also specified practice strategies for each game as both a proposer and a responder to learn how the interface worked and how their actions would map into payoffs if their own proposer choices had been matched with their own responder choices. No decisions made in Part 1 affected subjects' final payments.

In Part 2, each subject was assigned a role, either proposer or responder, and this role was fixed for the remainder of the experiment. Subjects specified full strategies for each game using a strategy method (a la Selten Selten [34]), without any feedback between games, so they could not learn about any other players' choices until observing their final results the end of the experiment. To help prevent mistakes or misclicks, an on-screen prompt appeared before any decision was submitted, requiring subjects to confirm their choices and allowing them to go back and make any changes if they desired before submitting. In order to calculate subjects' final payoffs, proposers and responders in the same session were randomly matched (and rematched across games), and at the end of the experiment, one game from Part 2 was independently selected for each player to be used for payment. Participants received a \$5 completion payment for finishing the experiment, plus \$2 for each point they earned in the randomly selected game, for an average total payment of around \$14.

3.2. Minimum Acceptable Offers

Prior to learning one's role and choosing strategies for the games, each subject was asked to provide a "Minimum Acceptable Offer" (MAO). This represents the smallest final offer, out of the 10 possible points, that the participant would be willing to accept should they be assigned the role of responder. This choice was binding for all four games and could not be changed in between games. This constraint is important - knowing that this constraint exists, proposers could expect that the set of final offers which would be accepted or rejected in each game would not be impacted by any actions in the early stages of games, or across games. Furthermore, this constraint begets a very natural notion of deception in context: any responder's message which asserts a Minimum Acceptable Offer other than the one they have already committed to is unambiguously deceptive.

3.3. The Games

3.3.1. Game 1: Ultimatum Game (UG)

The first game is the usual ultimatum game. The proposer chooses an offer of a whole number of points from the 10 point pie to send to the responder, whose choice of whether to accept or reject is determined by their MAO specified prior to the games. If the offer is accepted (it meets or exceeds the responder's MAO), it is implemented, so the responder earns the amount offered and the proposer retains the remainder of the pie. If the offer is rejected, both players earn 0 points.

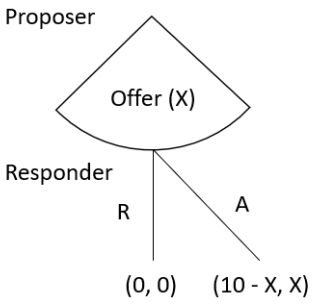


Figure 1: Ultimatum Game

3.3.2. Game 2: Ultimatum Game with Explicit Messaging (UGM)

The ultimatum game with explicit messaging is played identically to the ultimatum game (UG), with an additional step prior to the proposer's offer. In this game, the responder must send a message to the proposer of the form "My Minimum Acceptable Offer is ___" where the blank is filled in by a whole number of points from 0 to 10 (inclusive).

Participants are made aware in the instructions that this message need not be truthful, so proposers may consider whether the message they receive is likely to be true or not. Using the strategy method, proposers submit an offer for every possible message they may receive, from "My Minimum Acceptable offer is 0" to "My Minimum Acceptable Offer is 10". The actual offer sent to calculate a subject's final outcome and payment is the one corresponding to the actual message sent by their matched responder.

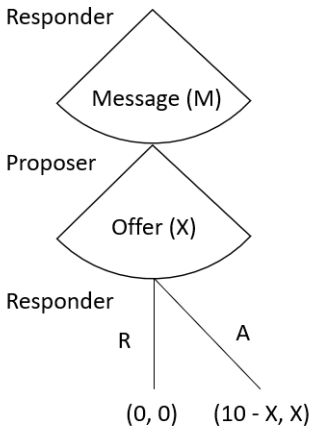


Figure 2: Ultimatum Game with Explicit Messaging

3.3.3. Game 3: Penultimatum Game (PUG)

The penultimatum game extends the ultimatum game by adding a single additional round of offers and responses before the ultimatum stage. In this way, responders are able (if they desire) to reject a first offer and receive a follow up offer, introducing implicit messaging. In this game, proposers make both offers (instead of alternating), and there is no reduction of the pie in the second round.[1]

The complete order of play is as follows: first, the proposer makes a first-round offer, and the responder accepts or rejects this offer. If the responder accepts, the game ends and the offer is implemented, and if the responder rejects, then the proposer makes a second offer which the responder may again accept or reject. Payoffs proceed as in the ultimatum game.

Implementing with the strategy method, the responder indicates a "first-round minimum acceptable offer" which determines the smallest first-round offer they are willing to accept, while their original MAO governs their second-round accept or reject decision. Proposers indicate a first-round offer, and a second-round offer conditional on the event that the first-round offer is rejected.

[1]Fudenberg and Tirole [17] study a version of this game theoretically. The experiment in Konovalov and Krajbich [23] uses a version of this game with induced values and examines the signaling value of decision time.

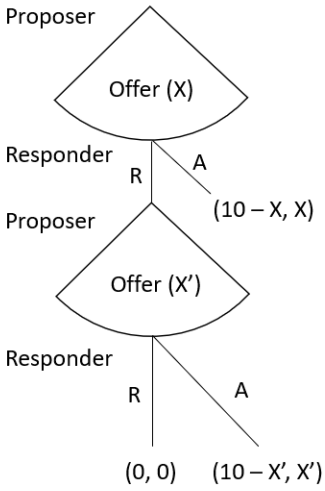


Figure 3: Penultimatum Game

3.3.4. Game 4: Penultimatum Game with Explicit Messaging (PUGM)

The final game, the penultimatum game with explicit messaging, extends the Penultimatum Game by adding an explicit message between the first and second rounds if the first offer is rejected. Like in the UGM, this message is of the form "My Minimum Acceptable Offer is ___".

In addition to a first-round minimum acceptable offer, responders indicate a message for each possible first-round offer they may receive. Proposers indicate a first-round offer and a second-round offer for each possible message they may receive.

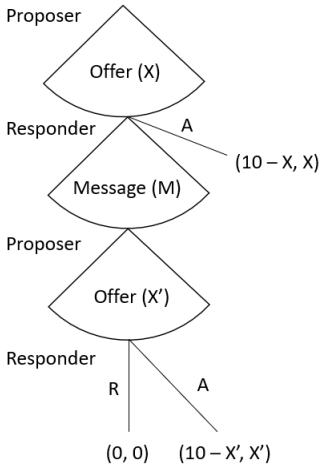


Figure 4: Penultimatum Game with Explicit Messaging

3.4. Probability Boost Choice

After all games were completed, subjects made one additional decision. Each subject could choose, if they desired, to increase the probability of a particular game being chosen by the random payment selection mechanism from 25% to 40% (and naturally, reduce the chance of each other game being selected to 20%). This allows me to observe an indication of in which games subjects believe they earned the most (in expectation), identifying to some extent how well-calibrated subjects are to the best forms of messaging for their personal roles and decisions. This question serves also for a basic simulation of self-selection in practice: the use of a particular form of messaging while bargaining in practice may correlate to more familiarity and superior strategies when using it. It's natural then to expect subjects who select into those games to perform better in them.

4. Theory and Hypotheses

In order to form baseline expectations for the strategies and outcomes in the game above, I consider a simple model of each game under incomplete information. In this model, proposers' preferences are determined solely by their game payoffs, whereas responders are indexed by different types depending on their willingness to reject positive offers (that is, a responder of type t is only willing to accept offers greater than or equal than t, and otherwise will reject even if it is the final offer). A responder's type is private information, and proposers decide on which offers to send based on their (common knowledge) prior over responder types and whatever they may learn about the responder's type through messaging.

4.1. Model Preliminaries

Assume that a proposer wants to maximize their earnings, while a responder of type t prefers to reject offers below a certain offer t, prefers to accept at or above an offer of t, and prefers more earnings to less when accepting. This can be characterized with the utility function

$$U_t(x) = \begin{cases} 0 & \text{if reject offer} \\ x - t & \text{if accept offer} \end{cases}$$

Because participants are constrained to discrete offer amounts in this experiment, I consider the model with finitely many discrete types - in particular, let these be integer types from 0 to 10. Since the experimental design requires subjects to indicate the smallest offer that they would accept, I use the following preferences to avoid indifference.[2]

[2]We could imagine that underlying types are distributed over a continuum, and the type they indicate is the least integer greater than their underlying preference. In this case, the probability of indifference would be 0.

$$U_t(x) = \begin{cases} 0 & \text{if reject offer} \\ x - t + \varepsilon & \text{if accept offer} \end{cases}$$

where ε is (very) small.

4.2. Propositions

The following propositions describe the pure strategy perfect Bayesian equilibria (PBE) of the games. Proofs of propositions are available in Appendix A.

Proposition 1:

Let x^* indicate the offer x which maximizes a proposers expected payoff when facing the prior distribution of responders (i.e. the optimal offer in the UG) and assume x^* is unique. Then:

(i) A perfect Bayesian equilibrium exists in the ultimatum game with explicit messaging in which the proposer sends offer x^* with certainty on the equilibrium path.

(ii) No PBE exists in the ultimatum game with explicit messaging in which the proposer uses a pure strategy and sends a different offer than x^* with positive probability.

Proposition 2:

In the penultimatum game, all perfect Bayesian equilibria in which the proposer uses a pure strategy involve the proposer sending greatest offer x^*.

Proposition 3:

In the penultimatum game with explicit messaging, all equilibria in which the proposer uses a pure strategy involve the proposer sending greatest offer x^*.

In summary, the proposer cannot learn anything about responder's type in pure strategy equilibrium. This comes from the fact that low-type responders are always able to mimic high-type responders in order to induce better offers if the proposer attempts to discriminate offers across observed behaviors. From this observation emerge the following hypotheses:

4.3. Hypotheses

Hypothesis 1: Proposers' final-round offers in all games will be equal.

Because (greatest and final) offers are the same in each game, and MAOs are distributed the same in each game, the following follows:

Hypothesis 2: Average expected payoffs (within role) will be equal across all games.

Hypothesis 3 considers the final probability boost decision. Suppose players are well-calibrated in their beliefs about the expected payoffs from their strategies in each game. Then, if they want to maximize their expected payoff, they should choose to boost the probability of a game for which their strategy was most effective.

Hypothesis 3: Subjects will choose to increase the probability of randomly selecting the game (or one of the games) in which their strategy had the greatest empirical expected payoff.

The above hypotheses come from a model which expects players to perfectly deduce the consequences of not only their own behavior, or their opponents' behavior, but also every type of responder in the room. Responders must then conclude that their message will be substantially ignored, proposers must believe that messages (explicit or implicit) are uninformative, and both must act accordingly.

Why may this not occur? There are many potential reasons. For one, any anticipation of strategic unsophistication may break down the reasoning used to rule out separating equilibria. If *some* responders heuristically tell the truth, or commit to strategies like constant-addition shading (i.e., always reporting their MAO + 1 in an explicit message), the additional information may skew expected payoffs in response to the posterior distribution of types sending each message enough for proposers to begin discriminating. While sophisticated responders would still pool, they would pool on high messages leaving low messages capable of being believed.

Alternatively, consider a world in which people have a basic preference for honesty in their negotiations. One way of interpreting this is in the form of a lying cost, for example as analyzed by Kartik [22]. Basic lying aversion has demonstrated in the laboratory by Gneezy [20], suggesting a psychological penalty may be at play, even if there are no external incentives to tell the truth. If these costs are sufficiently high as to induce truth-telling among some portion of responders, then discrimination could emerge here as well. Note that even if psychological costs to lying in this environment do not exist, or are not high, a proposer-side *belief* in lying costs may lead to some degree of separation anyway. In particular, the Kartik [22] model predicts type-inflation in messages and equilibria where low types separate and high types pool.

The basic model used to generate hypotheses is agnostic to the specific content of explicit messages - language is indeterminate. Nonetheless, in the presence of heuristic or cost-driven truth-telling, one would expect deceptive messages to be upward in order to mimic truthfully higher types using natural language. This prediction is consistent with the type-inflation present in the Kartik (2009) model. It is not as easy, but possible, to imagine a simple case for signaling a lower MAO than one's own without unusual beliefs; for one, a bargainer could expect a tremendous amount of reciprocity for honesty.

One of the main questions of this paper is if one of explicit or implicit messaging is more effective than the other, and if there are gains from combination. Because the basic model predicts no changes in outcomes from either type of messaging, I make no formal prediction for a directional effect. However, there are reasons to believe either explicit or implicit messaging could prevail for responders as the consequence of different mechanisms.

One such possibility has to do with the conspicuousness of cheap talk. The UGM treatment is designed in such a way that the fact that talk is cheap is made very clear to subjects. It's also a very common bargaining tactic to misrepresent reserve prices - something that subjects may be familiar with through practice and accustomed to accounting for. In contrast, the PUG treatment relies on a bargaining tactic which is perhaps less common - rejecting without a counter. Facing a rejection, proposers may consider an erroneous forwards-induction argument: the offer *could have been taken*, so the responder must *expect* a larger offer in the second round, and so will reject the same offer if it were made again. If either of the above arguments prevail, implicit messaging may outperform explicit messaging.

On the other hand, rejecting an offer does not on its own suggest which alternative offers would also be rejected (or not), whereas explicit messaging says exactly this. From an anchoring perspective, implicit messaging keeps the (only) anchor at the proposer's first offer, while explicit messaging can set a first anchor or a new higher anchor on a particular value. If the canonical insufficient adjustment bias (Tversky and Kahneman [35]) occurs, final offers may skew higher for explicit messaging than implicit messaging.

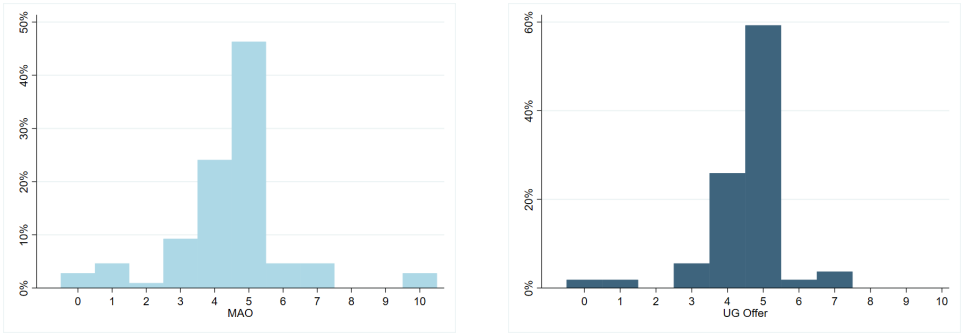
Combining the two forms of messages, and combining the arguments above, has no clear prediction. Effects could be plausibly constructive, outperforming either form of messaging alone, destructive performing worse than both, or somewhere in between. Of course, the model predicts no effect of either type of messaging, nor the combination.

5. Results

5.1. Baseline Statistics

The sample consisted of 108 subjects (54 proposers and 54 responders) recruited in the EconLab at University of California San Diego, using Sona Systems. Six in-person sessions were performed using experimental software oTree (Chen et al. [11]).The smallest session had 16 subjects and the largest session had 20 subjects.

To begin, I examine strategies in the no-messaging treatment (UG) for sensibility. Figures 5 shows histograms for all MAOs and proposer ultimatum game offers.



(a) Minimum Acceptable Offers (b) UG Offers

Figure 5

The average MAO was 4.50 and the average offer was 4.56. These values are consistent with typical ultimatum game results (Camerer [10]). Moreover, I verify that the greatest expected payoff for a proposer is to offer 5 points given the full population distribution of MAOs (Table 1).

Offer	0	1	2	3	4	5	6	7	8	9	10
E[UG Payoff]	.28	.67	.67	1.2	2.5	4.4	3.7	2.9	1.9	.98	0

Table 1: Empirical Expected payoffs for each potential offer in UG using full sample of MAOs.

5.2. Payoffs

Figure 6 shows the average expected payoffs for each game by role. For each individual, expected payoffs are calculated by comparing his or her strategy against all strategies used by subjects in the opposite role. Error bars shown use two bootstrapped standard errors with 5000 samples.

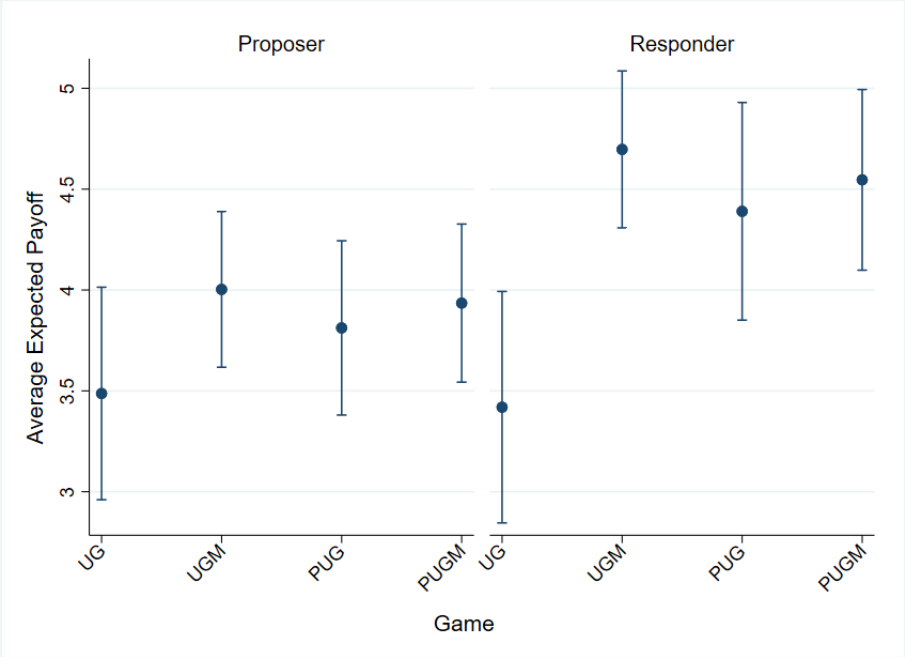


Figure 6: Average Payoffs by Role

In table form:

Game	UG	UGM	PUG	PUGM
Expected Proposer Payoff	3.487	4.003	3.812	3.935
	(1.28)	(.588)	(1.06)	(.593)
Expected Responder Payoff	3.419	4.697	4.390	4.546
	(1.25)	(.863)	(1.15)	(1.21)

Standard Deviations in parentheses.

Table 2: Average Expected Payoffs by Role

Result 1a: Average responder expected payoffs for all types of messaging (UGM, PUG, PUGM) are statistically greater than those for the non-messaging game (UG).

A bootstrap test (5000 repetitions) for the difference in mean expected payoffs between games for responders gives a gain of 1.278 points from the UG to UGM ($z = 4.84, p < .001$), .971 points from the UG to PUG ($z = 4.18, p < .001$), and 1.126 points from the UG to PUGM ($z = 4.31, p < .001$). No other comparisons were significant (see Appendix B for details on other pairwise comparisons).

Result 1b: Proposers earn statistically significantly more in treatments with explicit messaging (UGM, PUGM) than no messaging (UG). Proposers do not perform statistically significantly differently between any forms of messaging, nor from the introduction of implicit messaging alone.

A bootstrap test (5000 repetitions) for the difference in mean expected payoff for proposers gives an

improvement of .516 points ($z = 2.54, p = .011$) from the UG to UGM, and .448 points ($z = -2.32, p = .02$) to the PUGM. No statistical difference is detected when evaluating the introduction of implicit messages alone compared the the UG ($z = 1.64, p = .101$) nor between any of the messaging treatments (see Appendix B for full table of comparisons).

Notably, there is no statistical gain or loss for either proposers nor responders when combining the two forms of messaging relative to either in isolation.

The primary goal of this analysis is to observe whether a proposer or responder individually can earn more depending on the type of messaging used in bargaining. Nonetheless, a striking observation from the data is how much larger responder expected payoffs are compared to proposers' in all messaging games, despite being nearly identical in the basic ultimatum game. In particular, differences between payoffs in all messaging games are significant in a bootstrap test for difference in mean expected payoff with 5000 repetitions. (UGM: $z = 3.62p < .001$; PUG: $z = 2.96, p = .003$; PUGM: $z = 3.21, p = .001$).

This cannot be a function of a last-offer advantage, since the proposer possesses that role in all games, nor does it appear to be a first-mover advantage, since the proposer acts first in both two-stage games as well. It appears that when one side is permitted to use messaging and the other is not, the former acquires a meaningful advantage.

Results 1a and 1b clearly refute Hypothesis 2: in spite of messages being cheap talk, the impersonality of the strategy method, and practice with the games before beginning, expected payoffs are clearly not the same across games. Average payoffs are of course a function of the offers proposers send and the rate of agreement conditional on those offers; Table 3 shows the average final offers sent in each game (the ultimatum stage), and the average expected agreement rate from simulating matching. Because final-round offers in the explicit messaging games are a function of responder message, expectations are taken over all possible proposer-responder matchings using the strategies reported.

Game	UG	UGM	PUG	PUGM
Final Round Offer	4.55	5.200	5.037	5.27
	(1.11)	(.760)	(1.27)	(.640)
Agreement Rate	69.1%	87.0%	82.0%	84.8%
	(5.15%)	(3.40%)	(4.48%)	(3.75%)

Standard Deviations in parentheses.

Table 3: Average Expected Offers

Result 2: Average expected final offers are larger in all messaging treatments than average UG offers.

To compute the difference between the UG offer and PUG final offer, I use a two=sided t-test for differences in means ($t(53) = 2.26, p = .028$). To compare UG offers with UGM and PUGM final offers, I

again use a bootstrap test for difference in means with 5000 repetitions (UG vs UGM: $z = 3.45, p = .001$; UG vs PUGM: $z = 4.04, p < .001$).

Result 3: Average expected agreement rate is larger in all messaging games compared to the non-messaging games. There is no significant difference between messaging games.

Again, a bootstrap test for differences in mean expected agreement rate shows significance at a $p < .001$ level for all UG comparisons to messaging treatments, and no other differences. Mechanically, larger offers lead to a greater chance of agreement, and more expected agreement translates one to one into improvements in total combined payoffs. Note, however, that the gains are felt much more on average by responders than proposers, as evidenced by the payoff advantage emerging once messaging is introduced.

Considering the fairly low rate of failure even in the lowest such messaging game (PUG, 82%), it may be the case that a ceiling effect is occurring. Since some subjects indicated high MAOs, the theoretical limit of agreement is less than 100%, and these treatments may be achieving close to the upper bound of what is possible. In fact, simulating matching up the sample based on reported MAOs alone to see if agreement is possible, I find a predicted potential agreement rate of 83% - *less(!)* than the UGM and PUGM achieve. This is not an impossibility - it can be explained by proposers offering more than their responder-side MAO would allow, but certainly suggests that further improvements may be hard to achieve.

Evidently, the simple possibility of different types of cheap talk messages improves payoffs dramatically for responders, and in the case of explicit messaging, also for proposers. Next, I examine specific strategies employed by proposers and responders leading to these outcomes.

5.3. Explicit Messaging Strategies

5.3.1. Messages Sent

Figure 7 shows a jittered scatterplot of the UGM messages chosen by responders, by their MAOs. Dots above the 45-degree line indicate inflating one's MAO in the message, dots on the line indicate truth-telling, and dots below the line indicate deceptive under-representation.

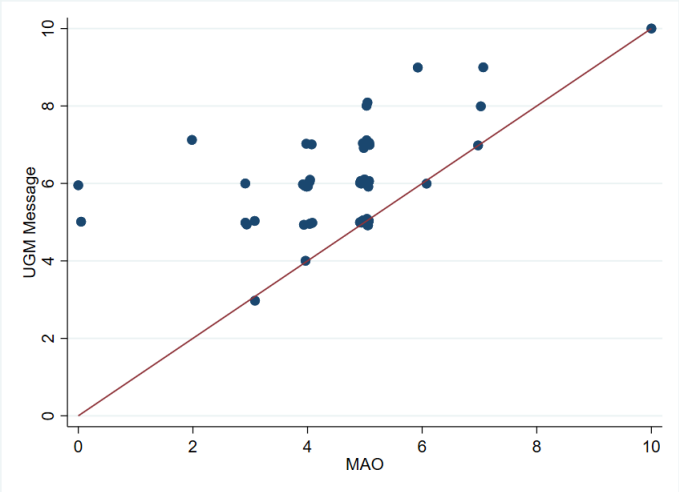


Figure 7: Explicit Messages vs Minimum Acceptable Offers in UGM

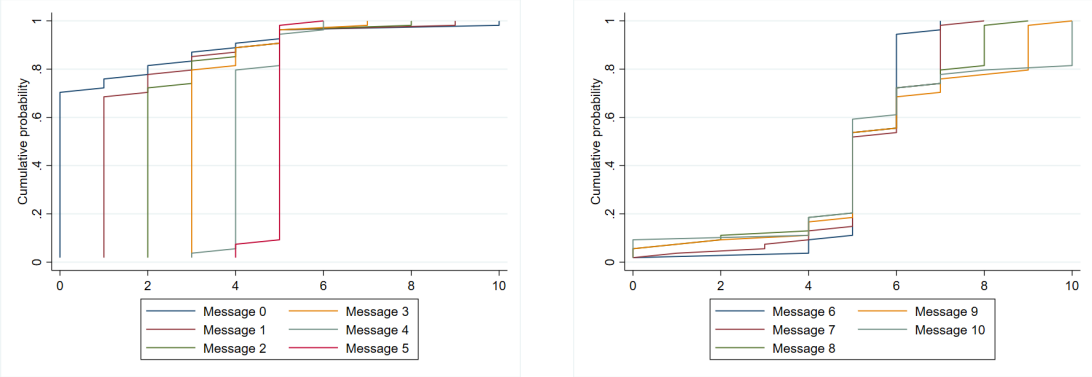
Result 4: 38/54 (70%) of responders report messages greater than their MAO in the UGM. None shade downward.

Perhaps unsurprisingly, the strong majority of responders (38/54) shade their messages upward from their true preferences in the UGM. The remainder are truthful.

Is this pattern consistent with the theory? Given the distribution of messages, it is the case that the empirical best offer for a proposer to send conditional on messages 5,6,7, and 8 are all an offer of 5. This range of messages captures all but five observations (90.7%), and is therefore not inconsistent with pooling. There is, however, a clear relationship between MAO and message - the message has predictive power about the MAO of the responder (Robust OLS regression of MAO on UGM message, $\beta = .614, t = 3.65, p = .001, r^2 = .27$), even if this change in average MAO does not change the best response.

5.3.2. Offers Sent

How do proposers respond to these messages? Figure 8 shows the cumulative distribution of offers sent by proposers in response to each message in the UGM.



(a) (b)

Figure 8: UGM Offers Sent by Message

The left (panel a) shows cumulative distributions functions of offers sent in response to messages from 0 to 5. A clear pattern emerges: a strong majority of subjects offer exactly what the message claims, with only a small portion undercutting the message, and hardly any, if any, offering more.

On the right (panel b) are cdfs of offers in response to messages 6 to 10. A different pattern emerges: a much larger proportion of proposers undercut the stated message, most commonly but not always offering 5 instead. It's in this "not always" where the evidence for apparent credibility of messages, and the greatest opportunities for responders, lie. Even very high messages are sometimes paid off in full, and they are rarely punished with offers worse than 5 (the best that a message of 5 ever really receives) - message 6 in particular very nearly stochastically dominates message 5.

Is this potential separation and pooling an artifact of aggregating the data, or does it exist within-subject? Because each proposer indicated a full strategy, I can examine how each proposer's offers varied with each possible received message. A full characterization of proposer strategies in the UGM is available in Appendix C; here, I consider three categories of strategies, the only types used by more than one proposer in the sample.

First, consider a flat offer for all messages. Cautiously, this is the model prediction of proposers responding to pooling.[3] Only two proposers out of 54 fit this profile, whereas all others vary their offers depending on message.

Next, consider a proposer who sends exactly the amount claimed as the responder's MAO. These proposers act in a manner consistent with the belief that all responder types are truthful. Seven proposers (13%) fit this description. So long as they do not expect downward misrepresentation, these proposers can always

[3]so long as the proposer believes the distribution of messages is full-support, otherwise she can do whatever she wants in perceived 0 probability events.

expect to transact, though are exploitable by ambitious responders sending large messages.

Finally, a substantial segment of proposers adopt a pattern of behavior resembling a plateau - that is, they send offers equal to claimed MAOs up to a certain point, and thereafter keep the offer amount constant (I include only cases in which the highest offer is made for at least two different messages). Adhering strictly to that definition[4], there are 14 proposers who follow this pattern. Figure 9 shows this pattern for one such participant.

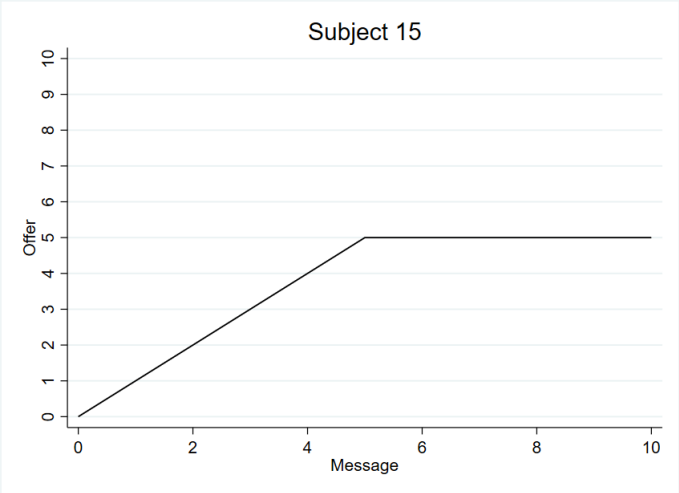


Figure 9: Plateau Strategy

This particular form of strategy may be explained by multiple mechanisms. A first candidate is that proposers do believe responders' messages, but simply are not willing to offer more than their plateau amount - anything more, and they would rather not transact at all. this does not preclude finding the message credible. A second potential explanation is that proposers are willing to believe low messages are truthful, but not high ones. If these proposers accurately anticipate responders will not misrepresent themselves downwards, by sending a low offer in response to a low message, they can transact at a favorable price with a high probability of success. The modest benefit of a potential extra point from accurately undercutting the message would come with a particularly large risk of failure that may not be worth it. For high messages, the potential cost of disbelief is much more modest.

Alternatively still, the proposer may believe that the responder faces some sort of lying cost or aversion. Note that the plateau strategy is predicted by the low-types separate, high-types pool equilibrium class which arises under lying costs in Kartik [22].

[4]In all three categories, there exist cases which very nearly fit a specific type, but err only very slightly. For example, consider one proposer who sent an offer exactly corresponding to the message for every possible message except 7, for which they sent an offer of three. While there is a chance that this may be intentional, it is reasonable to suspect that this proposer may have wanted to put 7 and was temporarily confused. If we allow for single-deviations, we get one additional flat offerer, three additional always-believers, and three additional plateaus.

I cannot fully distinguish between these candidate explanations, but I can start by looking at cases in which the portion of the pie retained by a plateau proposer's largest offer is not equal to their reported MAO (recall that prior to play, eventual-proposers also indicated MAOs in case they were assigned to be responders). This is the case for 8 of 14 [5], suggesting that the reported MAO is not a complete explanation, and another influence plays a role.

5.4. Implicit Messaging Strategies

How do responders and proposers play with implicit messaging? Figure 10 shows responders' first-round minimum acceptable offers relative to their MAOs in the PUG.

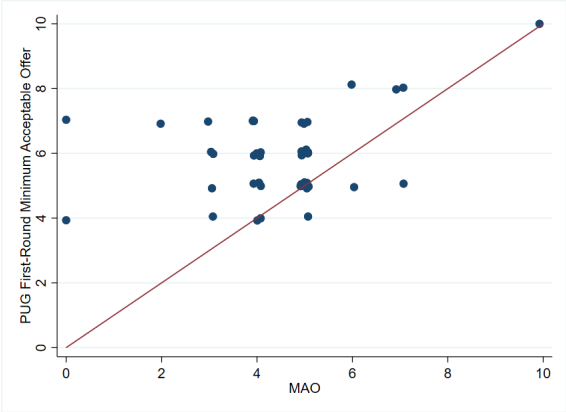


Figure 10: PUG Responder first-round minimum acceptable offers vs MAOs

Result 5: Responder first-round minimum acceptable offers on average exceed their MAOs.

The average first-round minimum acceptable offer in the penultimatum game was 5.83, statistically larger than the 4.57 average MAO (two-tailed paired t-test, $t(53) = 5.9, p < .001$).

As with explicit messaging, responders attempt deception with implicit messaging - they possess a willingness to reject offers that meet or exceed their actual MAO. "Attempt" is an important distinction here - the actual message sent is only a "no" response to the offer received, so a responder who receives an offer of 3 and rejects it, but *would have* rejected an offer of 5, has no additional way of signaling this in the PUG. This means the messages *effectively* sent in the PUG may be milder (despite the ambiguity) than those sent in the UGM or PUGM.

Nonetheless, implicit messages still lead to significant gains for responders relative to no messaging. Recall that proposers in this game had only to specify two offers instead on one when setting up their strategies -

[5] Five of these 8 made offers which still gave them more than their MAOs. The remaining three were willing to make offers giving them less than their plateau proposers MAO, suggesting that there is an extent to which MAO does not fully capture proposer preference as they do responder preferences.

it would have been very easy to make a low first offer, and then revert to the ultimatum offer for the final round - this is one potential path to equilibrium in the basic model. Instead, average first-round offers fell significantly short of ultimatum game offers at 4.15 (two-tailed paired t-test, $t(53) = 2.25$ $p = .028$), but average second round offers were significantly higher at 5.04 (two-tailed paired t-test, $t(53) = 3.59$ $p < .001$). Lowballing makes sense: a "free" attempt to get a particualrly good deal against a weak responder is tempting and low cost. However, it is somewhat surprising that final offers exceed average ultimatum offers.

Recall that proposers did not actually see rejections because they used the strategy method, they only considered what they would do after rejection conditional on it occurring. Clearly, something about the act of considering a first rejection triggers an improved offer - whether that be a belief that the implicit message is credible, or a behavioral response which "gets the lowball out of their system." Moreover, by sending low first offers, proposers actually *reduce* the signaling power that the implicit message can convey: it's not surprising when lower first offers are more often rejected. It appears that even simple consideration of rejection leads proposers to improve their proposals.

As in the UGM, this is not just an artifact of averaging: Figure 11 compares first-round offers in the penultimatum game to second round offers indicated by proposers conditional on their first round offer being rejected.

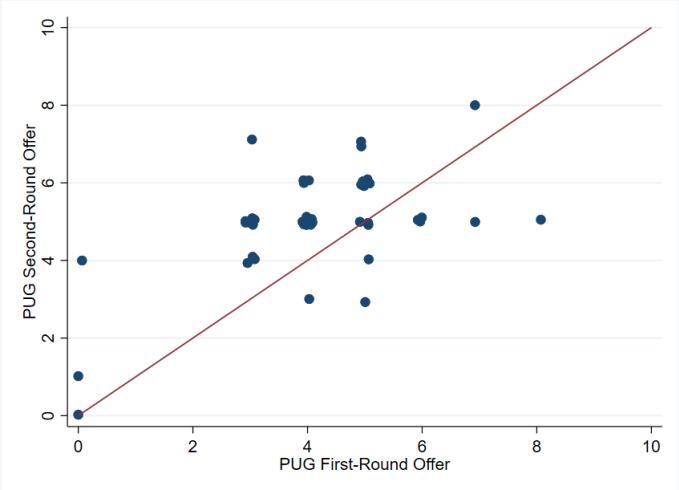


Figure 11: PUG offers by round

Result 6: A majority of proposers increase their offers when rejected in the penultimatum game.

Among those increasing their offers, almost all choose to increase by either one or two points - perhaps evidence of a heuristic approach, although also possibly a limitation of the coarse environment - an increase of more than 2 points would be quite dramatic.

5.5. Explicit and Implicit Messaging Strategies

Most qualitative observations of the UGM and PUG persist into the PUGM. First offers are not statistically different from PUG first offers (two tailed paired t-test, $t(53) = 1.34, p = .185$), nor are second offers (bootstrap test, 5000 reps, $z = 1.20, p = .23$). Though average explicit messages are lower than in the UGM (5.61 vs 6.02, two tailed paired t-test, $t(53) = 2.66, p = .01$). This may be a consequence of having to condition the message on an unknown offer, or a belief that implicit messaging bolsters the credibility of the message enough to substitute away from a stronger explicit message. This explanation may follow from convex lying costs. First round MAOs are also indistinct between the PUG and PUGM (two-tailed paired t-test, $t(53) = 1.09, p = .28$).

5.6. Self-selection: Probability Boost Decision

Table 4 shows the number and proportion of subjects who chose to boost the probability of each game being selected for payment.

Game Selected	Number of Proposers (%)		Number of Responders (%)	
UG	8	(14.8%)	6	(11.1%)
UGM	3	(5.5%)	12	(22.2%)
PUG	5	(9.2%)	8	(14.8%)
PUGM	23	(42.6%)	18	(33.3%)
No Preference	15	(28.7%)	10	(18.5%)

Table 4: Probability Boost Decision

This question was intended to identify whether people with more effective strategies in one game or another select into the games they perform best in. Consequently, I calculate for each subject the empirical expected value of their strategy in each game, and see if they manage to choose the game which they did best in.

Result 7: A minority of subjects select into the game in which their strategy performed best.

Of 83 subjects who chose to do a probability boost, 31 selected to boost the probability of a game in which their strategy had the highest expected payoff. This includes 11 of 39 proposers (28.2%) and 20 of 44 responders (45.5%). Among those incorrect, the median difference in expected values between their choice and their best choice was .34 points.

Regressions of expected payoffs in each game on probability boost choice reveal no significant effects (see Appendix D). In my sample, it cannot be said that selecting into a particular game through the probability boost choice increases average expected payoffs, and subejcts do not appear to have a sense of in which games they perform best.

6. Discussion and Conclusion

I find that adding opportunities for responders to indicate their willingness to accept in an ultimatum-style bargaining game increases responder payoffs compared to the typical ultimatum game, both for implicit and explicit messages. This is in spite of theoretical predictions from a model of incomplete information that suggest there should be no such differences in equilibrium. Moreover, as the design utilizes highly constrained messages and the strategy method, these impacts can be attributed to the pure apparent signaling value of messages rather than manipulation of interpersonal norms or expectations.

Offers made by proposers are meaningfully larger in treatments with messaging, suggesting that subjects likely believe there is a degree of truth to the messages other subjects send. This is evidenced in particular by larger-sized messages generally receiving larger average offers in explicit messaging games. On further analysis of strategies, I observe that while some subjects choose to send constant offers irrespective of the message they see, and others send offers suggesting they believe any message they see, many more choose a combination of these approaches: sending offers corresponding to belief in messages when those messages are low, and disbelief in messages when messages are high. This, along with the prevalence of type-inflationary messages in explicit messaging treatments, give credence to a potential alternative model in the style of Kartik [22], in which responders incur psychological costs of lying (or proposers simply believe this to be the case). From that model arise equilibria in which "Low types Separate and High types Pool" - a pattern emergent in many proposers' strategies.

It appears subjects in general do not have the intuition to predict in which games their strategies perform best. Concurrently, the largest portion of subjects appear to believe that more messaging is better for them, among both proposers and responders.

To the extent that the findings of this study may extend to the practical world of negotiation, the clearest lesson should be that when there is the opportunity to bargain, and in particular, the opportunity to signal while bargaining, one is likely better off engaging in negotiation than making ultimatums. For those designing bargaining institutions, sellers of high-value items for example, enabling negotiation appears to weakly improve payoffs even for non-signalers, if only by increasing the rate of transaction. If a party, perhaps a government, seeks only to improve the chances for agreement, policy which enables messaging is more likely to lead to a deal than policies which prevent signaling.

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Appendix A Model and Proofs

In order to motivate the hypotheses of section 4, I construct a simple model in which responders preferences to accept or reject an offer depends on their type. Propositions, 1, 2, and 3 give us our null hypotheses of no differences in payoffs across all games, and no difference in within-proposer offers across games (where in two-stage games, the larger offer is considered).

A.1 Model Preliminaries

Assume that a proposer wants to maximize their earnings, while a responder of type t prefers to reject offers below a certain point t, prefers to accept at or above an offer of t, and prefers more earnings to less when accepting. This can be characterized with the utility function

$$U_t(x) = \begin{cases} 0 & \text{if reject offer} \\ x - t & \text{if accept offer} \end{cases}$$

Because participants are constrained to discrete offer amounts in this experiment, I consider the model with finitely many discrete types - in particular, let these be integer types from 0 to 10. Since the experimental design requires subjects to indicate the smallest offer that they would accept, I use the following preference to avoid indifference.[6]

$$U_t(x) = \begin{cases} 0 & \text{if reject offer} \\ x - t + \varepsilon & \text{if accept offer} \end{cases}$$

where ε is (very) small.

In a complete information model of any of the games in this experiment (i.e. a responder's type is common knowledge), the subgame perfect Nash equilibrium outcome is unique and uninteresting: the proposer always makes a final offer of t to get the responder to accept, which the responder does. Messages don't matter, and early round offers can be the same or less than t and do not change the final outcome. If a responder's type is unknown to the proposer, however, we have an environment simulating the tension of interest. For this case, the solution concept of choice is perfect Bayesian equilibrium (Fudenberg and Tirole [18]).

Consider first the basic ultimatum game. In any PBE, the responder will always accept the proposer's offer if it is equal to or above their type, and reject otherwise - this is the end-stage behavior for responders in all other games as well. Thus, the proposer's problem is simply to maximize their expected payoff given

[6] We could imagine that underlying types are distributed over a continuum, and the type they indicate is the least integer greater than their underlying preference. In this case, the probability of indifference would be 0.

their prior on t. Let F be a common prior cumulative mass function of responder types, so $F(x)$ is the proportion of responders who accept a final offer of x. Then for pie size 10, the proposer solves

$$\max_{x \in \{0,1,\ldots,10} (10 - x)F(x) \tag{1}$$

to find the optimal offer x^*. Call this the *prior-maximizing offer*. While x^* need not be unique, generically it will be, and so for the following arguments, I assume it is. This assumption is further borne out in the data; it is a standard result that a 50% offer is uniquely optimal for proposers in ultimatum studies (Camerer [10]). Because the problem is trivial otherwise, assume $F(x) > 0$ for at least one $x > 0$.

A.2 Extending to Games with Messaging

What happens when we consider the ultimatum game with explicit messaging (UGM) in this incomplete information world? Intuition suggests that the message sent by the responder is cheap talk which should not affect outcomes[7], and in fact this is the case, as shown by Proposition 1.

Proposition 1:

(i) A perfect Bayesian equilibrium exists in the UGM with incomplete information in which the proposer sends offer x^* with certainty on the equilibrium path.

(ii) No PBE exists in which the proposer uses a pure strategy and sends a different offer than x^* with positive probability.

Proof. (i) Suppose that all types of responders send the message "My Minimum Acceptable Offer is 10", and always accept if and only if the offer they receive is equal to or greater than their type. First note that this accept/reject strategy is a requirement of perfection for any equilibrium. Next, fix a proposer belief that all responder types send message 10, and that if any other message is sent, it is surely sent by type 0. This belief must be true in equilibrium, so let all responder types send message 10. The proposer's posterior after observing a message of 10 is identical to her prior, so in order to best respond she must send an offer of x^* when facing a message 10, and send an offer of 0 whenever the message is not 10. Responders cannot profitably deviate given this proposer strategy, since any other message besides 10 leads to an offer of $0 \leq x^*$. The proposer's belief is correct by construction, obeys Bayes' rule, and given their belief, they are optimizing and cannot profitably deviate. Thus, this is a perfect Bayesian equilibrium. In fact, any situation in which all responders send the same distribution of messages will work, in particular if the proposer sends offer x^* in response to any message.

(ii) First note that for the final accept or reject decision made by a responder, perfection requires that they accept if the offer is equal to or greater than their type, and reject otherwise. Then consider the following lemma:

[7] Cheap talk *can* matter in bargaining in a case where talk precedes a decision for negotiators to begin bargaining or not, as shown by Farrell and Gibbons [16].

Lemma 1: Suppose the proposer uses a pure strategy. Then only one unique offer may be sent with positive probability on the equilibrium path.

Proof of Lemma: Suppose for a contradiction there exists a PBE in which the proposer uses a pure strategy and sends more than 1 offer with positive probability. Take this equilibrium, and select two of the proposer's offers arbitrarily. Call these x_1 and x_2, where $x_1 > x_2$.

Since the proposer's strategy includes sending both of these offers, there must be a nonempty set of messages which induces offer x_1, and another disjoint (due to pure strategy assumption) nonempty set of messages which induces x_2. Consider how different types of responders best respond. A responder of type $t < x_2$ is willing to accept either offer, and consequently, prefers to send a message which induces the higher offer x_1. A responder of type $x_2 < t < x_1$ will only accept offer x_1, but is best off by sending a message which induces x_1. But since the proposer is sending x_2 with positive probability by assumption, there must be some responders sending messages which induces x_2. These responders must therefore be of type $t > x_1$. But if this is the case, the proposer updating on this information would want to send an offer which induces some amount of acceptance, rather than a sure 0, and so should send an offer $x_2 > x_1$! This is a contradiction, and so no such equilibrium exists. This proves the lemma.

It remains to show that if there is a unique offer sent with positive probability on the equilibrium path, this offer must be x^*. To prove this, consider an arbitrary pure-strategy equilibrium in this game and recall that in equilibrium the proposer must be best responding to true beliefs. Let M' be the set on on-path messages in our equilibrium., and let G_m represent the ex-ante probability of receiving message m according to a proposers (true) belief about the distribution of responder strategies for each type of responder. Let $F_m(t)$ represent the cmf of types given an observed message $m \in \{0, 1, \ldots, 10\}$, and $f_m(t)$ be the mass of a specific type t conditional on sending message m, so

$$\sum_{m=0}^{10} f_m(t) = 1$$

and

$$\sum_{m=0}^{10} f_m(t) G_m = f(t)$$

. A proposer strategy is a function $X : \{0, 1, \ldots, 10\} \to \{0, 1, \ldots, 10\}$ which takes a message and returns an offer.

In the equilibrium, the proposer is playing a best response after receiving each message. Denote X^* to be the proposers equilibrium strategy and $X^*(m)$ the best response after observing message m, so

$$X^*(m) \in \underset{x \ in\{0,1,\ldots,10\}}{\arg\max} \sum_{t=0}^{x} f_m(t)(10 - x) \tag{2}$$

Solving the maximization problem for all messages in M' is the same as solving the following ex-ante maximization problem:

$$\max_{X \in \{\{0,1,\ldots,10\} \to \{0,1,\ldots,10\}\}} \sum_{m=0}^{10} G_m \sum_{t=0}^{X(m)} f_m(t)(10 - X(m)) \tag{3}$$

By Lemma 1,

$$X^*(m) = X^*(m') \quad \forall m, m' \in M'$$

.

That is, $X^*(m)$ must in fact be constant over $m \in M'$. Call this constant x' and note that $X(m) = x'$ solves equation (3).

This means that x' also solves the more constrained maximization problem, which is same problem restricted to constant strategies.

$$\max_{x\in\{0,1,\ldots,10\}} \sum_{m=0}^{10} G_m \sum_{t=0}^{x} f_m(t)(10-x) \tag{4}$$

Rearranging, we get

$$= \max_{x\in\{0,1,\ldots,10\}} \sum_{t=0}^{x} \sum_{m=0}^{10} G_m f_m(t)(10-x)$$

$$= \max_{x\in\{0,1,\ldots,10\}} (10-x) \sum_{t=0}^{x} f(t)$$

so

$$x' \in \arg\max_{x\in\{0,1,\ldots,10\}} (10-x) \sum_{t=0}^{x} f(t)$$

This is the definition of $x*$, and since $x*$ is unique, we have $x' = x^*$ and this completes the proof.

□

In the penultimatum game, it is less obvious that the implicit message of rejecting a binding offer is actually cheap talk. Proposition 2 verifies that equilibrium outcomes are unchanged by introducing the first stage.

Proposition 2:

In the penultimatum game with incomplete information, all perfect Bayesian equilibria in which the proposer uses a pure strategy involve the proposer sending greatest offer x^*.

Proof. Once again, by perfection, in the final round accept/reject decisions are made in accordance with responder types. A proposer strategy in this game consists of a first-round offer x, and a second round offer x' conditional on first-round rejection. Consider a case where the proposer strategy involves reducing their offer if it is rejected ($x' < x$). Then any type of responder who would ever accept either offer must accept in the first round, else they could unilaterally improve by accepting in the first round instead or rejecting. This first round offer can then only be x^*. Alternatively, suppose the proposer strategy involves raising her offer in the second round if the first offer is rejected ($x' > x$). In this case, no responder should accept in round 1, either because the offer is below their t, or because they know a better offer will follow if they reject. Thus, the second round offer can only be x^* for the proposer to maximize their expected payoff. As a final case, if the offer is held constant in the case of rejection, then clearly both offers must be x^*.

□

Proposition 3:

In the penultimatum game with explicit messaging, all equilibria in which the proposer uses a pure strategy involve the proposer sending greatest offer x^*.

Proof. Consider the proposer's second round decision. Conditional on first-round rejection, the proof of Proposition 1 remains, using the portion of responder types which reject. Given this observation, the problem is then reduced to exactly that of Proposition 2, which we have already proven. □

Appendix B Average Expected Payoff Comparison Tables (Bootstrap Test Results)

B.1 Proposers

(column mean - row mean) (z-score) (p-value)	UGM	PUG	PUGM
UG	.516 z = 2.54 p = .011	.325 z = 1.64 p = .101	.448 z = 2.32 p = .02
UGM		-.191 z = -1.18 p = .239	.067 z = .63 p = .53
PUG			.123 z = .83 p =.408

B.2 Responders

(column mean -row mean) (z-score) (p-value)	UGM	PUG	PUGM
UG	1.277 z = 4.84 p <.001	.971 z = 4.18 p <.001	1.12 z = 4.31 p <.001
UGM		-.306 z = -1.22 p = .223	.151 z = 1.10 p = .271
PUG			.155 z = .64 p =.520

B.3 Agreement Rate

(column mean -row mean) (z-score) (p-value)	UGM	PUG	PUGM
UG	.179 z = 4.20 p <.001	.130 z = 3.33 p =.001	.157 z = 3.84 p <.001
UGM		-.050 z = -1.41 p = .159	-.021 z = -1.14 p = .254
PUG			.028 z = .79 p =.430

Appendix C All Proposer UGM Strategies

Figure B.1 is a complete-linkage dendrogram for proposer strategies. To read the figure, begin at the bottom. The sequence of digits (with T representing 10) represents the offer a proposer would send after receiving a message of "My Minimum Acceptable Offer is (the $(n-1)^{th}$ digit of the sequence). That is, a strategy indicated by 01234555555 sends an offer of 0 to the message "My Minimum Acceptable Offer is 0", an offer of 4 to the message "My Minimum Acceptable Offer is 4" since 4 is in the fifth position, and an offer of 5 to the message "My Minimum Acceptable Offer is 7" since 5 is in the 8th position.

Branches are determined by defining the distance between clusters to be the maximum difference element-wise between offers for each possible message category. This choice is mostly arbitrary - the actual distances between clusters does not matter, however, it may make it clearer when strategies are very similar to one another but not identical.

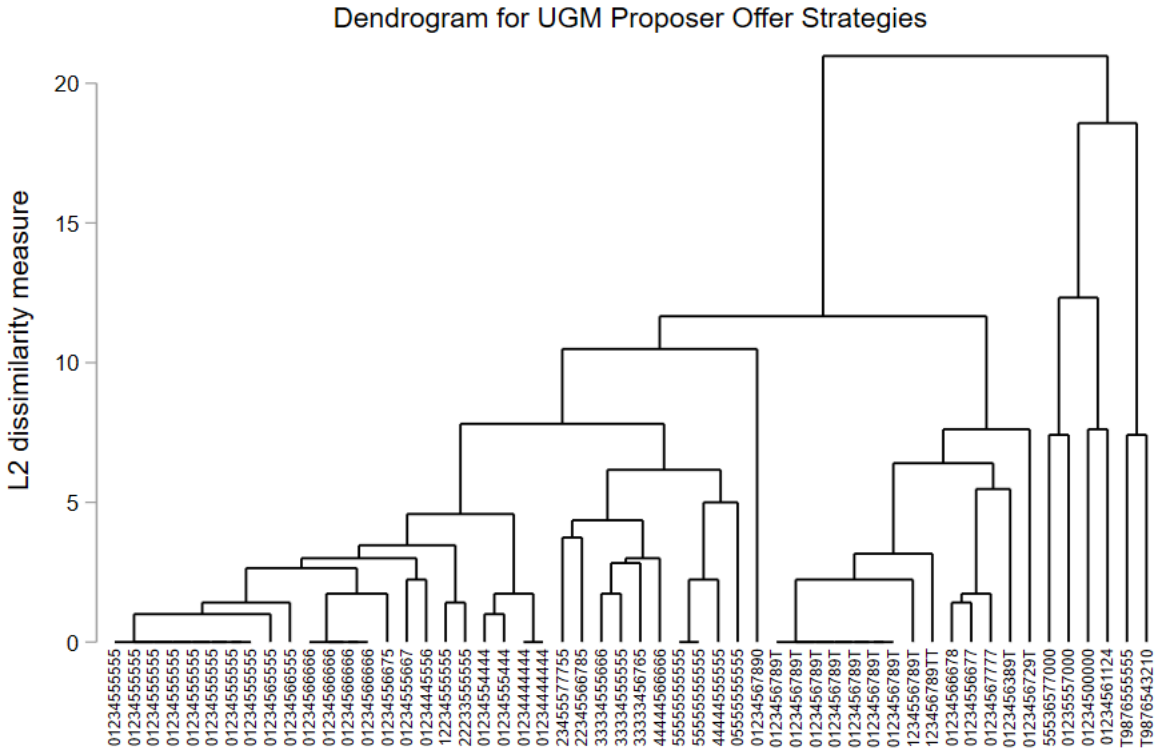


Figure C.1: All Proposer Offer Strategies

Appendix D Regression table for probability boost choice

	UG Exp. Payoff	UGM Exp. Payoff	PUG Exp. Payoff	PUGM Exp. Payoff
UGM Boost	-0.86*	-0.19	-0.22	-0.59
	(0.44)	(0.31)	(0.40)	(0.38)
PUG Boost	-0.21	-0.18	-0.33	-0.43
	(0.45)	(0.32)	(0.41)	(0.39)
PUGM Boost	-0.08	-0.07	0.12	-0.17
	(0.36)	(0.26)	(0.33)	(0.31)
Constant	3.76***	4.51***	4.24***	4.59***
	(0.31)	(0.22)	(0.29)	(0.27)
Observations	83	83	83	83

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Regression results for Game Expected Payoffs on Probability Boost Choice

Appendix E Interface Screenshots

E.1 Part 1: Practice Segment

Introduction

Welcome! Thank you for participating in today's experiment. Before we begin, please put away all cell phones or other devices and refrain from talking or communicating with others during the session. Additionally, please do not press back or refresh on your browser at any time unless asked to do so by the experimenter.

There are two parts of today's experiment. First, in Part 1, the experimenter will read the instructions for the tasks you will be completing, and you will be able to interact with the interface to learn how these tasks work. Your choices in Part 1 will not impact your payment from today's session, but may help you to prepare for Part 2.

In Part 2, you will complete the same tasks as in Part 1, however, one task will be randomly selected to count towards your payment, which will be calculated at the end of the experiment. After all tasks in Part 2 are completed, you will also answer a short bonus question.

Your final payment today will consist of two components: a $5.00 completion payment, which you receive by completing the experiment, and an additional payment from one randomly selected task in Part 2. In each task you can earn up to 10 points depending on your decisions and others' decisions, and you will be paid $2 for each point you earned in the randomly selected task in Part 2. You will learn which task was selected and your payment amount at the end of the experiment.

If you have questions at any time, please raise your hand and the experimenter will assist you.

Part 1: Minimum Acceptable Offer Instructions

Minimum Acceptable Offer Instructions

- Before we begin with Task 1, there is one decision that everyone will make: choosing a Minimum Acceptable Offer.
- Each task in this experiment involves the Proposer making **offers** of some number of points to the Responder, which the Responder may **Accept** or **Reject**.
- If a Responder **accepts** an offer sent by a Proposer, participants earn the amounts of points specified by the offer. For example, if a Proposer sends the offer "Responder gets X, I get Y" and the Responder accepts this offer, then the Responder will earn X points and the Proposer will earn Y points in the task.
  - In this experiment, the total points available is always 10, so in the example above, X + Y = 10.
- If a Responder **rejects** an offer, and it is the final offer that can be made in that task, then both the Proposer and the Responder will earn 0 points in the task.

Imagine you are assigned the role of **Responder**.

- Your Minimum Acceptable Offer is your way of telling us which final offers you would accept and which you would reject.
- Specifically, you will accept any final offer which gives you more than or equal to your Minimum Acceptable Offer, and reject any offer which gives you less than your Minimum Acceptable Offer.
- Recall that if a final offer is rejected, both the Proposer and Responder earn 0 points.
- This cannot be changed between tasks (within the same Part).
- Example 1: Suppose the Responder's Minimum Acceptable Offer is X and the Proposer makes a final offer of "Responder gets X+1, I get 10 - (X+1)".
  - Since X + 1 ≥ X, this offer is automatically accepted.
  - The Responder earns X + 1 points in this task, and the Proposer earns 10 - (X+1) point in this task.
- Example 2: Suppose the Responder's Minimum Acceptable Offer is X, and the Proposer makes a final offer of "Responder gets X, I get 10 - X".
  - Since X ≥ X, this offer is automatically accepted.
  - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.
- Example 3: Suppose the Responder's Minimum Acceptable Offer is X, and the Proposer makes a final offer of "Responder gets X - 1, I get 10 - (X-1)."
  - Since X-1 < X, this offer is automatically rejected.
  - Both the Proposer and Responder earn 0 points in this task.

Part 1: Minimum Acceptable Offer Choice

Imagine that you will be assigned the role of **Responder**. Please tell us your Minmum Acceptable Offer in the box provided. Recall that this is the smallest final offer that you would be willing to accept, and you will reject all final offers which give you less than this amount. This should be a whole number between 0 and 10, including 0 and 10.

Instructions from the previous page are provided below, for your reference.

My Minimum Acceptable Offer is:

Next

Minimum Acceptable Offer Instructions

- Before beginning Task 1, everyone will provide a Minimum Acceptable Offer.
- Each task in this experiment involves the **Proposer** making **offers** of some amount of points to the **Responder**, which the Responder may **Accept** or **Reject**.
- If a Responder accepts an offer sent by a Proposer, both participants receive the amount of points specified by the offer. For example, if a Proposer sends the offer "Responder gets X, I get Y" and the Responder accepts, then the Responder will get X points and the Proposer will get Y points.
- If a Responder **rejects** an offer in a task, and it is the final offer that can be made, then both the Proposer and the Responder earn 0 points in the task.
- Imagine you are assigned the role of **Responder**.
- Your Minimum Acceptable Offer is your way of telling us which final offers you would accept and which you would reject.
- Specifically, you will accept any final offer which is equal to or greater than your Minimum Acceptable Offer, and reject any offer which is less than your Minimum Acceptable Offer.

- Example 1: Suppose the Proposer makes the offer "Responder gets X+1, I get 10 - (X+1)" and the Responder's Minimum Acceptable Offer is X.
  - Since $X + 1 \geq X$, this offer is accepted.
  - The Responder earns X + 1 points in this task, and the Proposer earns 10 - (X+1) point in this task.

- Example 2: Suppose the Proposer makes the offer "Responder gets X, I get 10 - X" and the Responder's Minimum Acceptable Offer is X.
  - Since $X \geq X$, this offer is accepted.
  - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.

- Example 3: Suppose the Proposer makes the offer "Responder gets X - 1, I get 10 - (X-1)" and the Responder's Minimum Acceptable Offer is X.
  - Since $X-1 < X$, this offer is rejected.
  - Both the Proposer and Responder earn 0 points in this task.

Part 1: Task 1 Instructions

Please refer to the experimenter to hear the instructions for this task. Bullet points are provided below for your reference.

Task 1 Instructions

1. Proposer makes offer to Responder.

2. Offer is compared to Responder's Minimum Acceptable Offer.
    - If Proposer's offer gives Responder more than or equal to Responder's Minimum Acceptable Offer:
        - Offer is accepted.
        - Players earn amounts of points specified by offer in this task.

    - If Proposer's offer gives Responder less than Responder's Minimum Acceptable Offer:
        - Offer is rejected.
        - Participants earn 0 points in this task.

- The examples from the Minimum Acceptable Offer choice are provided as a reminder:
- Example 1: Suppose the Proposer makes the offer "Responder gets X+1, I get 10 - (X+1)" and the Responder's Minimum Acceptable Offer is X.
    - Since X + 1 ≥ X, this offer is accepted.
    - The Responder earns X + 1 points in this task, and the Proposer earns 10 - (X+1) points in this task.

- Example 2: Suppose the Proposer makes the offer "Responder gets X, I get 10 - X" and the Responder's Minimum Acceptable Offer is X.
    - Since X ≥ X, this offer is accepted.
    - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.

- Example 3: Suppose the Proposer makes the offer "Responder gets X - 1, I get 10 - (X-1)" and the Responder's Minimum Acceptable Offer is X.
    - Since X-1 < X, this offer is rejected.
    - Both the Proposer and Responder earn 0 points in this task.

Part 1: Task 1 Proposer Choices

Imagine you are a Proposer in this task. In the box provided, please indicate your choice of offer to send to the Responder and click Next when you are finished.

Recall that in Part 1, you are making choices for both roles, so your offer will be compared with your own Minimum Acceptable Offer provided earlier to see what would occur if you were matched with yourself. In Part 2, if you are a Proposer, your offer will instead be compared to your matched Responder's Minimum Acceptable Offer.

The task instructions are left below as a reminder.

My Offer:

Next

Task 1 Instructions

1. Proposer makes offer to Responder.
2. Offer is compared to Responder's Minimum Acceptable Offer.
    - If Proposer's offer gives Responder more than or equal to Responder's Minimum Acceptable Offer:
        - Offer is accepted.
        - Players earn amounts of points specified by offer in this task.
    - If Proposer's offer gives Responder less than Responder's Minimum Acceptable Offer:
        - Offer is rejected.
        - Participants earn 0 points in this task.

- Example 1: Suppose the Proposer makes the offer "Responder gets X+1, I get 10 - (X+1)" and the Responder's Minimum Acceptable Offer is X.
    - Since X + 1 ≥ X, this offer is accepted.
    - The Responder earns X + 1 points in this task, and the Proposer earns 10 - (X+1) points in this task.
- Example 2: Suppose the Proposer makes the offer "Responder gets X, I get 10 - X" and the Responder's Minimum Acceptable Offer is X.
    - Since X ≥ X, this offer is accepted.
    - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.
- Example 3: Suppose the Proposer makes the offer "Responder gets X - 1, I get 10 - (X-1)" and the Responder's Minimum Acceptable Offer is X.
    - Since X-1 < X, this offer is rejected.
    - Both the Proposer and Responder earn 0 points in this task.

Part 1: Task 1 Responder Choices

Now imagine you are a Responder in this task.

Because the Responder's decision to accept or reject an offer depends only on their Minimum Acceptable Offer from before this task, there are no decisions to make. Please click Next to advance to the results.

Next

Part 1: Task 1 Results

The Proposer's offer was "Responder gets 0, I get 10".

The Responder's Minimum Acceptable Offer was 0.

Thus, the offer was accepted. The Proposer earns 10 points in this task, and the Responder earns 0 points in this task.

Click Next to Continue.

Next

Part 1: Task 2 Instructions

Please refer to the experimenter to hear the instructions for this task. Bullet points are provided below for your reference.

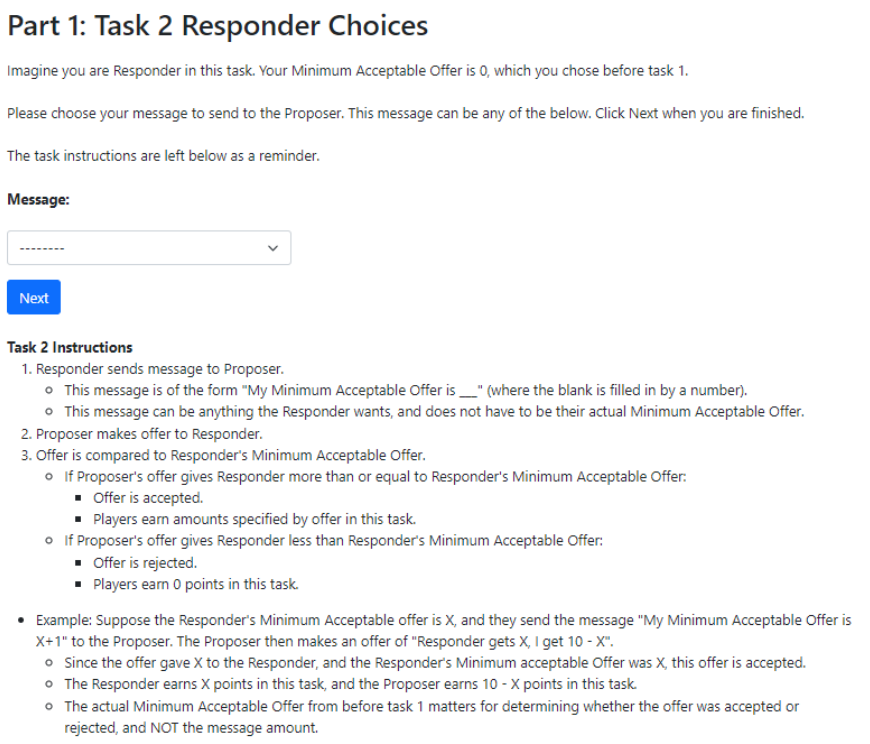
Task 2 Instructions

1. Responder sends message to Proposer.
   - This message is of the form "My Minimum Acceptable Offer is ___" (where the blank is filled in by a number).
   - This message can be anything the Responder wants, and does not have to be their actual Minimum Acceptable Offer.

2. Proposer makes offer to Responder.

3. Offer is compared to Responder's Minimum Acceptable Offer.
   - If Proposer's offer gives Responder more than or equal to Responder's Minimum Acceptable Offer:
     - Offer is accepted.
     - Players earn amounts specified by offer in this task.
   - If Proposer's offer gives Responder less than Responder's Minimum Acceptable Offer:
     - Offer is rejected.
     - Players earn 0 points in this task.

- Example: Suppose the Responder's Minimum Acceptable offer is X, and they send the message "My Minimum Acceptable Offer is X+1" to the Proposer. The Proposer then makes an offer of "Responder gets X, I get 10 - X".
  - Since the offer gave X to the Responder, and the Responder's Minimum acceptable Offer was X, this offer is accepted.
  - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.
  - The actual Minimum Acceptable Offer from before task 1 matters for determining whether the offer was accepted or rejected, and NOT the message amount.



Part 1: Task 2 Responder Choices

Imagine you are Responder in this task. Your Minimum Acceptable Offer is 0, which you chose before task 1.

Please choose your message to send to the Proposer. This message can be any of the below. Click Next when you are finished.

The task instructions are left below as a reminder.

Message:

Next

Task 2 Instructions

1. Responder sends message to Proposer.
   - This message is of the form "My Minimum Acceptable Offer is ___" (where the blank is filled in by a number).
   - This message can be anything the Responder wants, and does not have to be their actual Minimum Acceptable Offer.
2. Proposer makes offer to Responder.
3. Offer is compared to Responder's Minimum Acceptable Offer.
   - If Proposer's offer gives Responder more than or equal to Responder's Minimum Acceptable Offer:
     - Offer is accepted.
     - Players earn amounts specified by offer in this task.
   - If Proposer's offer gives Responder less than Responder's Minimum Acceptable Offer:
     - Offer is rejected.
     - Players earn 0 points in this task.

- Example: Suppose the Responder's Minimum Acceptable offer is X, and they send the message "My Minimum Acceptable Offer is X+1" to the Proposer. The Proposer then makes an offer of "Responder gets X, I get 10 - X".
  - Since the offer gave X to the Responder, and the Responder's Minimum acceptable Offer was X, this offer is accepted.
  - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.
  - The actual Minimum Acceptable Offer from before task 1 matters for determining whether the offer was accepted or rejected, and NOT the message amount.

Part 1: Task 2 Proposer Choices

Now imagine you are a Proposer in this Task. In order to determine the offer you send to the Responder, you will decide on an offer for *each possible message you may receive*. This choice will be implemented automatically based on the Responder's actual message sent.

For example, if your matched Responder sends the message "My Minimum Acceptable Offer is X," then the actual offer sent to calculate earnings will be the offer you indicate under "If message received from Responder is 'My Minimum Acceptable Offer is X'".
Thus, you will indicate a full plan, without knowing what the actual message sent was until the end.

Below, please select your offer for each message you may receive from the Responder. Click Next when you are finished. The previous instructions are left below as a reminder.

Offer for each possible message:

If message received from Responder is "My Minimum Acceptable Offer is 0", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 1", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 2", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 3", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 4", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 5", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 6", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 7", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 8", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 9", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 10", send offer:

Next

Task 2 Instructions

1. Responder sends message to Proposer.
    - This message is of the form "My Minimum Acceptable Offer is ___" (where the blank is filled in by a number).
    - This message can be anything the Responder wants, and does not have to be their actual Minimum Acceptable Offer.
2. Proposer makes offer to Responder.
3. Offer is compared to Responder's Minimum Acceptable Offer.
    - If Proposer's offer gives Responder more than or equal to Responder's Minimum Acceptable Offer:
        - Offer is accepted.
        - Players earn amounts specified by offer in this task.
    - If Proposer's offer gives Responder less than Responder's Minimum Acceptable Offer:
        - Offer is rejected.
        - Players earn 0 points in this task.

- Example: Suppose the Responder's Minimum Acceptable offer is X, and they send the message "My Minimum Acceptable Offer is X+1" to the Proposer. The Proposer then makes an offer of "Responder gets X, I get 10 - X".
    - Since the offer gave X to the Responder, and the Responder's Minimum acceptable Offer was X, this offer is accepted.
    - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.
    - The actual Minimum Acceptable Offer from before task 1 matters for determining whether the offer was accepted or rejected, and NOT the message amount.

Part 1: Task 2 Results

The message sent by the Responder was "My Minimum Acceptable Offer is 0".

In response to that message, the Proposer sent the offer "Responder gets 0, I get 10".

The Responder's Minimum Acceptable Offer was 0.

Thus, the offer was accepted. The Proposer earns 10 points, and the Responder earns 0 points in this task.

Click Next to Continue

Next

Part 1: Task 3 Instructions

Please refer to the experimenter to hear the instructions for this task. Bullet points are provided below for your reference.

Task 3 Instructions

1. Proposer sends first-round offer to Responder.

2. Responder may accept or reject using a "First-Round Minimum Acceptable Offer."
    - May be different from Minimum Acceptable Offer reported before task 1.

3. If the first-round offer gives the Responder more than or equal to the Responder's First-Round Minimum Acceptable Offer:
    - Participants earn amounts specified by offer.
    - Second-round does not occur.

4. If offer gives Responder less than Responder's First-Round Minimum Acceptable Offer:
    1. Proposer makes Second-Round offer to Responder.
    2. Second-Round Offer is compared to Responder's Minimum Acceptable Offer.
        - If Proposer's Second-Round Offer is greater than or equal to Responder's Minimum Acceptable Offer:
            - Offer is accepted.
            - Players earn amounts specified by offer in this task.
        - If offer gives Responder less than Responder's Minimum Acceptable Offer:
            - Offer is rejected.
            - Players earn 0 points in this round.

- Example 1: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y.
    - Since the offer gives the Responder Y, which is equal to the Responder's first-round Minimum Acceptable Offer, this offer is accepted.
    - The Responder earns Y points in this task, and the Proposer earns 10 - Y points in this task.
    - Any choices indicated for the second-round will not matter, because the second round does not occur.

- Example 2: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y + 1.
    - Since Y < Y+1, this offer is rejected.
    - The Proposer then makes their second-round offer.
    - Suppose the second round offer is "Responder gets X, I get 10 - X"
        - If X is greater than or equal to the Responder's Minimum Acceptable Offer (from before task 1):
            - The offer is accepted.
            - The Responder earns X poitns and the Proposer earns 10 - X points in this task.
        - If X is less than the Responder's Minimum Acceptable Offer (from before task 1):
            - The Offer is rejected.
            - Both participants earn 0 points in this task.

Part 1: Task 3 Proposer Choices

Imagine you are a Proposer in this task.

You must choose two offers to make: first, your first-round offer, and second, your second-round offer *in case of the event that your first-round offer is rejected.*

Please select your offers now. Click Next when you are finished. The task instructions are left below as a reminder.

First-Round Offer:

Second-Round Offer (used if first-round offer rejected):

Next

Task 3 Instructions

1. Proposer sends first-round offer to Responder.
2. Responder may accept or reject using a "First-Round Minimum Acceptable Offer."
    - May be different from Minimum Acceptable Offer reported before task 1.
3. If the first-round offer gives the Responder more than or equal to the Responder's First-Round Minimum Acceptable Offer:
    - Participants earn amounts specified by offer.
    - Second-round does not occur.
4. If offer gives Responder less than Responder's First-Round Minimum Acceptable Offer:
    1. Proposer makes Second-Round offer to Responder.
    2. Second-Round Offer is compared to Responder's Minimum Acceptable Offer.
        - If Proposer's Second-Round Offer is greater than or equal to Responder's Minimum Acceptable Offer:
            - Offer is accepted.
            - Players earn amounts specified by offer in this task.
        - If offer gives Responder less than Responder's Minimum Acceptable Offer:
            - Offer is rejected.
            - Players earn 0 points in this round.

- Example 1: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y.
    - Since the offer gives the Responder Y, which is equal to the Responder's first-round Minimum Acceptable Offer, this offer is accepted.
    - The Responder earns Y points in this task, and the Proposer earns 10 - Y points in this task.
    - Any choices indicated for the second-round will not matter, because the second round does not occur.
- Example 2: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y + 1.
    - Since Y < Y+1, this offer is rejected.
    - The Proposer then makes their second-round offer.
    - Suppose the second round offer is "Responder gets X, I get 10 - X"
        - If X is greater than or equal to the Responder's Minimum Acceptable Offer (from before task 1):
            - The offer is accepted.
            - The Responder earns X poitns and the Proposer earns 10 - X points in this task.
        - If X is less than the Responder's Minimum Acceptable Offer (from before task 1):
            - The Offer is rejected.
            - Both participants earn 0 points in this task.

Part 1: Task 3 Responder Choices

Now imagine you are a Responder in this task. Your Minimum Acceptable Offer was 0.

Indicate your First-Round Minimum Acceptable Offer below, and click Next when you are finished. This must be a whole number between 0 and 10, inclusive.

Recall that if you reject the Proposer's first-round offer, your Minimum Acceptable Offer from before Task 1 will determine whether you accept or reject the second-round offer. The task instructions are left below as a reminder.

Next

Task 3 Instructions

1. Proposer sends first-round offer to Responder.
2. Responder may accept or reject using a "First-Round Minimum Acceptable Offer."
    - May be different from Minimum Acceptable Offer reported before task 1.
3. If the first-round offer gives the Responder more than or equal to the Responder's First-Round Minimum Acceptable Offer:
    - Participants earn amounts specified by offer.
    - Second-round does not occur.
4. If offer gives Responder less than Responder's First-Round Minimum Acceptable Offer:
    1. Proposer makes Second-Round offer to Responder.
    2. Second-Round Offer is compared to Responder's Minimum Acceptable Offer.
        - If Proposer's Second-Round Offer is greater than or equal to Responder's Minimum Acceptable Offer:
            - Offer is accepted.
            - Players earn amounts specified by offer in this task.
        - If offer gives Responder less than Responder's Minimum Acceptable Offer:
            - Offer is rejected.
            - Players earn 0 points in this round.

- Example 1: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y.
    - Since the offer gives the Responder Y, which is equal to the Responder's first-round Minimum Acceptable Offer, this offer is accepted.
    - The Responder earns Y points in this task, and the Proposer earns 10 - Y points in this task.
    - Any choices indicated for the second-round will not matter, because the second round does not occur.
- Example 2: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y + 1.
    - Since Y < Y+1, this offer is rejected.
    - The Proposer then makes their second-round offer.
    - Suppose the second round offer is "Responder gets X, I get 10 - X"
        - If X is greater than or equal to the Responder's Minimum Acceptable Offer (from before task 1):
            - The offer is accepted.
            - The Responder earns X poitns and the Proposer earns 10 - X points in this task.
        - If X is less than the Responder's Minimum Acceptable Offer (from before task 1):
            - The Offer is rejected.
            - Both participants earn 0 points in this task.

Part 1: Task 3 Results

The Proposer's First-Round Offer was "Responder gets 0, I get 10".

The Responder's First-Round Minimum Acceptable Offer was 0.

Therefore, the first-round offer was accepted.

The Proposer's Second-Round Offer was "Responder gets 0, I get 10".

The Responder's Minimum Acceptable Offer was 0.

Therefore, the second-round offer was n/a (did not occur). Thus, the Proposer earns 10 points, and the Responder earns 0 points in this task.

Click Next to Continue

Next

Part 1: Task 4 Instructions

Please refer to the experimenter to hear the instructions for this task. Bullet points are provided below for your reference.

Task 4 Instructions

1. Proposer sends first-round offer to Responder.

2. Responder may accept or reject using a "First-Round Minimum Acceptable Offer."
    - May be different from Minimum Acceptable Offer reported before task 1.

3. If the offer gives the Responder more than or equal to the Responder's First-Round Minimum Acceptable Offer:
    - Second-round does not occur.
    - Participants earn amounts specified by first-round offer.

4. If first-round offer gives Responder less than Responder's First-Round Minimum Acceptable Offer:
    1. Responder sends message to Proposer.
        - This message is of the form "My Minimum Acceptable Offer is ___" (where the blank is filled in by a number).
        - This message can be anything the Responder chooses, and does not have to be their actual Minimum Acceptable Offer.

    2. Proposer makes second-round offer to Responder.

    3. Second-round offer is compared to Responder's Minimum Acceptable Offer.
        - If Proposer's second-round offer is greater than or equal to Responder's Minimum Acceptable Offer:
            - Offer is accepted.
            - Players earn amounts specified by offer in this task.
        - If offer gives Responder less than Responder's Minimum Acceptable Offer:
            - Offer is rejected.
            - Players earn 0 points in this round.

Part 1: Task 4 Proposer Choices

Imagine you are a Proposer in this task.

Below, choose your first-round offer, and your second-round offer *for each possible message you may receive*. Click Next when you are finished. The task instructions are provided below.

First-Round Offer:

Second round offer for each possible message (if first round offer rejected):

If message received from Responder is "My Minimum Acceptable Offer is 0", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 1", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 2", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 3", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 4", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 5", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 6", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 7", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 8", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 9", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 10", send offer:

Next

Task 4 Instructions

1. Proposer sends first-round offer to Responder.
2. Responder may accept or reject using a "First-Round Minimum Acceptable Offer."
    - May be different from Minimum Acceptable Offer reported before task 1.
3. If the offer gives the Responder more than or equal to the Responder's First-Round Minimum Acceptable Offer:
    - Second-round does not occur.
    - Participants earn amounts specified by first-round offer.
4. If first-round offer gives Responder less than Responder's First-Round Minimum Acceptable Offer:
    1. Responder sends message to Proposer.
        - This message is of the form "My Minimum Acceptable Offer is ___" (where the blank is filled in by a number).
        - This message can be anything the Responder chooses, and does not have to be their actual Minimum Acceptable Offer.
    2. Proposer makes second-round offer to Responder.
    3. Second-round offer is compared to Responder's Minimum Acceptable Offer.
        - If Proposer's second-round offer is greater than or equal to Responder's Minimum Acceptable Offer:
            - Offer is accepted.
            - Players earn amounts specified by offer in this task.
        - If offer gives Responder less than Responder's Minimum Acceptable Offer:
            - Offer is rejected.
            - Players earn 0 points in this round.

Part 1: Task 4 Responder Choices

Now imagine you are a Responder in this task. Your Minimum Acceptable Offer was 0.

Please indicate your First-Round Minimum Acceptable Offer, and a message to send *for each possible first-round offer you may receive.* Your choice of message will be implemented automatically based on the actual first-round offer sent to you.

Recall that if you reject the Proposer's First-Round Offer, your Minimum Acceptable Offer from before Task 1 will determine whether you accept or reject the Second-Round Offer.

First-Round Minimum Acceptable Offer

Message for each possible first-round offer received:

If offer received from Proposer is "Responder gets 0, I get 10", send offer:

If offer received from Proposer is "Responder gets 1, I get 9", send offer:

If offer received from Proposer is "Responder gets 2, I get 8", send offer:

If offer received from Proposer is "Responder gets 3, I get 7", send offer:

If offer received from Proposer is "Responder gets 4, I get 6", send offer:

If offer received from Proposer is "Responder gets 5, I get 5", send offer:

If offer received from Proposer is "Responder gets 6, I get 4", send offer:

If offer received from Proposer is "Responder gets 7, I get 3", send offer:

If offer received from Proposer is "Responder gets 8, I get 2", send offer:

If offer received from Proposer is "Responder gets 9, I get 1", send offer:

If offer received from Proposer is "Responder gets 10, I get 0", send offer:

Next

Task 4 Instructions

1. Proposer sends first-round offer to Responder.
2. Responder may accept or reject using a "First-Round Minimum Acceptable Offer."
   - May be different from Minimum Acceptable Offer reported before task 1.
3. If the offer gives the Responder more than or equal to the Responder's First-Round Minimum Acceptable Offer:
   - Second-round does not occur.
   - Participants earn amounts specified by first-round offer.
4. If first-round offer gives Responder less than Responder's First-Round Minimum Acceptable Offer:
   1. Responder sends message to Proposer.
      - This message is of the form "My Minimum Acceptable Offer is __." (where the blank is filled in by a number).
      - This message can be anything the Responder chooses, and does not have to be their actual Minimum Acceptable Offer.
   2. Proposer makes second-round offer to Responder.
   3. Second-round offer is compared to Responder's Minimum Acceptable Offer.
      - If Proposer's second-round offer is greater than or equal to Responder's Minimum Acceptable Offer:
        - Offer is accepted.
        - Players earn amounts specified by offer in this task.
      - If offer gives Responder less than Responder's Minimum Acceptable Offer:
        - Offer is rejected.
        - Players earn 0 points in this round.

Part 1: Task 4 Results

The Proposer's first-round offer was "Responder gets 0, I get 10."

The Responder's First-Round Minimum Acceptable Offer was 0.

Thus, the first-round offer was accepted.

The second offer did not occur. The Proposer earns 10 points, and the Responder earns 0 points in this task. Click Next to Continue

Next

Part 1 Complete

You have now completed Part 1 of the experiment. Next, you will proceed to Part 2, where your decisions will impact your final payment.

E.2 Part 2: Proposers

Part 2: Introduction

Welcome to Part 2 of this experiment! In this part of the experiment, you will complete the same four tasks as in Part 1, however this time, in each task you will be matched with another participant in the room, and your decisions will count towards your payments.

As a reminder, you will be assigned the role of Proposer or Responder, and you will keep this role for all four tasks. The person with whom you are matched in each task will be randomly and anonymously assigned for each task, so in each task you will not know with whom you are matched, nor if they are the same person you were matched to in an earlier task. If you are a Proposer, you will have an equal chance of being assigned to each Responder in each task, and vice versa.

After the four tasks are complete, there will be a brief final question for you to answer. Once everyone has completed these steps, you will be informed of the results from all tasks, and paid privately. Note that you will not receive feedback in between tasks and instead learn the results of all tasks at the end. Additionally, Proposers will not be informed of Responders' Minimum Acceptable Offers, only whether their offers were accepted or rejected.

Part 2: Minimum Acceptable Offer

First, please indicate your Minimum Acceptable Offer at the bottom of this page. As a reminder, you cannot change this value between tasks.

Minimum Acceptable Offer Instructions

- Before we begin with Task 1, there is one decision that everyone will make: choosing a Minimum Acceptable Offer.
- Each task in this experiment involves the Proposer making **offers** of some number of points to the Responder, which the Responder may **Accept** or **Reject**.
- If a Responder **accepts** an offer sent by a Proposer, participants earn the amounts of points specified by the offer. For example, if a Proposer sends the offer "Responder gets X, I get Y" and the Responder accepts this offer, then the Responder will earn X points and the Proposer will earn Y points in the task.
  - In this experiment, the total points available is always 10, so in the example above, X + Y = 10.
- If a Responder **rejects** an offer in a task, and it is the final offer that can be made, then both the Proposer and the Responder will earn 0 points in the task.

Imagine you are assigned the role of **Responder**.

- Your Minimum Acceptable Offer is your way of telling us which final offers you would accept and which you would reject.
- Specifically, you will accept any final offer which gives you more than or equal to your Minimum Acceptable Offer, and reject any offer which gives you less than your Minimum Acceptable Offer.
- This cannot be changed between tasks (within the same Part).

- Example 1: Suppose the Proposer makes the offer "Responder gets X+1, I get 10 - (X+1)" and the Responder's Minimum Acceptable Offer is X.
  - Since X + 1 ≥ X, this offer is accepted.
  - The Responder earns X + 1 points in this task, and the Proposer earns 10 - (X+1) point in this task.
- Example 2: Suppose the Proposer makes the offer "Responder gets X, I get 10 - X" and the Responder's Minimum Acceptable Offer is X.
  - Since X ≥ X, this offer is accepted.
  - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.
- Example 3: Suppose the Proposer makes the offer "Responder gets X - 1, I get 10 - (X-1)" and the Responder's Minimum Acceptable Offer is X.
  - Since X-1 < X, this offer is rejected.
  - Both the Proposer and Responder earn 0 points in this task.

Minimum Acceptable Offer:

Next

Your Role

You have been assigned the role of **Proposer.** You will remain a **Proposer** for all four bargaining tasks.

Next

Part 2: Task 1

You are a Proposer. Instructions and choices for this task are below:

Task 1 Instructions

1. Proposer makes offer to Responder.
2. Offer is compared to Responder's Minimum Acceptable Offer.
    - If Proposer's offer gives Responder more than or equal to Responder's Minimum Acceptable Offer:
        - Offer is accepted.
        - Players earn amounts of points specified by offer in this task.
    - If Proposer's offer gives Responder less than Responder's Minimum Acceptable Offer:
        - Offer is rejected.
        - Participants earn 0 points in this task.

- Example 1: Suppose the Proposer makes the offer "Responder gets X+1, I get 10 - (X+1)" and the Responder's Minimum Acceptable Offer is X.
    - Since X + 1 ≥ X, this offer is accepted.
    - The Responder earns X + 1 points in this task, and the Proposer earns 10 - (X+1) points in this task.
- Example 2: Suppose the Proposer makes the offer "Responder gets X, I get 10 - X" and the Responder's Minimum Acceptable Offer is X.
    - Since X ≥ X, this offer is accepted.
    - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.
- Example 3: Suppose the Proposer makes the offer "Responder gets X - 1, I get 10 - (X-1)" and the Responder's Minimum Acceptable Offer is X.
    - Since X-1 < X, this offer is rejected.
    - Both the Proposer and Responder earn 0 points in this task.

You are a Proposer. Please make your choices here:

My Offer:

As a reminder, you will not be told the results of this task until the end of all tasks.

Next

Part 3: Task 3

You are a Proposer. Instructions and choices for this task are below:

Task 3 Instructions

1. Proposer sends first-round offer to Responder.
2. Responder may accept or reject using a "First-Round Minimum Acceptable Offer."
    - May be different from Minimum Acceptable Offer reported before task 1.
3. If the first-round offer gives the Responder more than or equal to the Responder's First-Round Minimum Acceptable Offer:
    - Participants earn amounts specified by offer.
    - Second-round does not occur.
4. If offer gives Responder less than Responder's First-Round Minimum Acceptable Offer:
    1. Proposer makes Second-Round offer to Responder.
    2. Second-Round Offer is compared to Responder's Minimum Acceptable Offer.
        - If Proposer's Second-Round Offer is greater than or equal to Responder's Minimum Acceptable Offer:
            - Offer is accepted.
            - Players earn amounts specified by offer in this task.
        - If offer gives Responder less than Responder's Minimum Acceptable Offer:
            - Offer is rejected.
            - Players earn 0 points in this round.

- Example 1: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y.
    - Since the offer gives the Responder Y, which is equal to the Responder's first-round Minimum Acceptable Offer, this offer is accepted.
    - The Responder earns Y points in this task, and the Proposer earns 10 - Y points in this task.
    - Any choices indicated for the second-round will not matter, because the second round does not occur.
- Example 2: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y + 1.
    - Since Y < Y+1, this offer is rejected.
    - The Proposer then makes their second-round offer.
    - Suppose the second round offer is "Responder gets X, I get 10 - X"
        - If X is greater than or equal to the Responder's Minimum Acceptable Offer (from before task 1):
            - The offer is accepted.
            - The Responder earns X poitns and the Proposer earns 10 - X points in this task.
        - If X is less than the Responder's Minimum Acceptable Offer (from before task 1):
            - The Offer is rejected.
            - Both participants earn 0 points in this task.

You are a Proposer. Please make your choices below.

First-Round Offer:

Second-Round Offer (used if first-round offer rejected):

Next

Part 2: Task 3

You are a Proposer. Instructions and choices for this task are below:

Task 3 Instructions

1. Proposer sends first-round offer to Responder.
2. Responder may accept or reject using a "First-Round Minimum Acceptable Offer."
    - May be different from Minimum Acceptable Offer reported before task 1.
3. If the first-round offer gives the Responder more than or equal to the Responder's First-Round Minimum Acceptable Offer:
    - Participants earn amounts specified by offer.
    - Second-round does not occur.
4. If offer gives Responder less than Responder's First-Round Minimum Acceptable Offer:
    1. Proposer makes Second-Round offer to Responder.
    2. Second-Round Offer is compared to Responder's Minimum Acceptable Offer.
        - If Proposer's Second-Round Offer is greater than or equal to Responder's Minimum Acceptable Offer:
            - Offer is accepted.
            - Players earn amounts specified by offer in this task.
        - If offer gives Responder less than Responder's Minimum Acceptable Offer:
            - Offer is rejected.
            - Players earn 0 points in this round.

- Example 1: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y.
    - Since the offer gives the Responder Y, which is equal to the Responder's first-round Minimum Acceptable Offer, this offer is accepted.
    - The Responder earns Y points in this task, and the Proposer earns 10 - Y points in this task.
    - Any choices indicated for the second-round will not matter, because the second round does not occur.
- Example 2: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y + 1.
    - Since Y < Y+1, this offer is rejected.
    - The Proposer then makes their second-round offer.
    - Suppose the second round offer is "Responder gets X, I get 10 - X"
        - If X is greater than or equal to the Responder's Minimum Acceptable Offer (from before task 1):
            - The offer is accepted.
            - The Responder earns X poitns and the Proposer earns 10 - X points in this task.
        - If X is less than the Responder's Minimum Acceptable Offer (from before task 1):
            - The Offer is rejected.
            - Both participants earn 0 points in this task.

You are a Proposer. Please make your choices below.

First-Round Offer:

Second-Round Offer (used if first-round offer rejected):

Next

Part 2: Task 4

You are a Proposer. Instructions and choices for this task are below:

Task 4 Instructions

1. Proposer sends first-round offer to Responder.
2. Responder may accept or reject using a "First-Round Minimum Acceptable Offer."
    - May be different from Minimum Acceptable Offer reported before task 1.
3. If the offer gives the Responder more than or equal to the Responder's First-Round Minimum Acceptable Offer:
    - Second-round does not occur.
    - Participants earn amounts specified by first-round offer.
4. If first-round offer gives Responder less than Responder's First-Round Minimum Acceptable Offer:
    1. Responder sends message to Proposer.
        - This message is of the form "My Minimum Acceptable Offer is ___" (where the blank is filled in by a number).
        - This message can be anything the Responder chooses, and does not have to be their actual Minimum Acceptable Offer.
    2. Proposer makes second-round offer to Responder.
    3. Second-round offer is compared to Responder's Minimum Acceptable Offer.
        - If Proposer's second-round offer is greater than or equal to Responder's Minimum Acceptable Offer:
            - Offer is accepted.
            - Players earn amounts specified by offer in this task.
        - If offer gives Responder less than Responder's Minimum Acceptable Offer:
            - Offer is rejected.
            - Players earn 0 points in this round.

You are a Proposer. Please make your choices below.

First-Round Offer:

Second-Round Offer for each possible message(if first round offer rejected):

If message received from Responder is "My Minimum Acceptable Offer is 0", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 1", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 2", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 3", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 4", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 5", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 6", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 7", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 8", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 9", send offer:

If message received from Responder is "My Minimum Acceptable Offer is 10", send offer:

Next

E.3 Part 3: Responders

Part 2: Introduction

Welcome to Part 2 of this experiment! In this part of the experiment, you will complete the same four tasks as in Part 1, however this time, in each task you will be matched with another participant in the room, and your decisions will count towards your payments.

As a reminder, you will be assigned the role of Proposer or Responder, and you will keep this role for all four tasks. The person with whom you are matched in each task will be randomly and anonymously assigned for each task, so in each task you will not know with whom you are matched, nor if they are the same person you were matched to in an earlier task. If you are a Proposer, you will have an equal chance of being assigned to each Responder in each task, and vice versa.

After the four tasks are complete, there will be a brief final question for you to answer. Once everyone has completed these steps, you will be informed of the results from all tasks, and paid privately. Note that you will not receive feedback in between tasks and instead learn the results of all tasks at the end. Additionally, Proposers will not be informed of Responders' Minimum Acceptable Offers, only whether their offers were accepted or rejected.

Part 2: Minimum Acceptable Offer

First, please indicate your Minimum Acceptable Offer at the bottom of this page. As a reminder, you cannot change this value between tasks.

Minimum Acceptable Offer Instructions

- Before we begin with Task 1, there is one decision that everyone will make: choosing a Minimum Acceptable Offer.
- Each task in this experiment involves the Proposer making **offers** of some number of points to the Responder, which the Responder may **Accept** or **Reject**.
- If a Responder **accepts** an offer sent by a Proposer, participants earn the amounts of points specified by the offer. For example, if a Proposer sends the offer "Responder gets X, I get Y" and the Responder accepts this offer, then the Responder will earn X points and the Proposer will earn Y points in the task.
  - In this experiment, the total points available is always 10, so in the example above, X + Y = 10.
- If a Responder **rejects** an offer in a task, and it is the final offer that can be made, then both the Proposer and the Responder will earn 0 points in the task.

Imagine you are assigned the role of **Responder**.

- Your Minimum Acceptable Offer is your way of telling us which final offers you would accept and which you would reject.
- Specifically, you will accept any final offer which gives you more than or equal to your Minimum Acceptable Offer, and reject any offer which gives you less than your Minimum Acceptable Offer.
- This cannot be changed between tasks (within the same Part).

- Example 1: Suppose the Proposer makes the offer "Responder gets X+1, I get 10 - (X+1)" and the Responder's Minimum Acceptable Offer is X.
  - Since X + 1 ≥ X, this offer is accepted.
  - The Responder earns X + 1 points in this task, and the Proposer earns 10 - (X+1) point in this task.
- Example 2: Suppose the Proposer makes the offer "Responder gets X, I get 10 - X" and the Responder's Minimum Acceptable Offer is X.
  - Since X ≥ X, this offer is accepted.
  - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.
- Example 3: Suppose the Proposer makes the offer "Responder gets X - 1, I get 10 - (X-1)" and the Responder's Minimum Acceptable Offer is X.
  - Since X-1 < X, this offer is rejected.
  - Both the Proposer and Responder earn 0 points in this task.

Minimum Acceptable Offer:

Next

Your Role

You have been assigned the role of **Responder.** You will remain a **Responder** for all four bargaining tasks.

Your MAO was 0.

Next

Part 2: Task 1

You are a Responder. Instructions and choices for this task are below:

Task 1 Instructions

1. Proposer makes offer to Responder.
2. Offer is compared to Responder's Minimum Acceptable Offer.
    - If Proposer's offer gives Responder more than or equal to Responder's Minimum Acceptable Offer:
        - Offer is accepted.
        - Players earn amounts of points specified by offer in this task.
    - If Proposer's offer gives Responder less than Responder's Minimum Acceptable Offer:
        - Offer is rejected.
        - Participants earn 0 points in this task.

- Example 1: Suppose the Proposer makes the offer "Responder gets X+1, I get 10 - (X+1)" and the Responder's Minimum Acceptable Offer is X.
    - Since X + 1 ≥ X, this offer is accepted.
    - The Responder earns X + 1 points in this task, and the Proposer earns 10 - (X+1) points in this task.
- Example 2: Suppose the Proposer makes the offer "Responder gets X, I get 10 - X" and the Responder's Minimum Acceptable Offer is X.
    - Since X ≥ X, this offer is accepted.
    - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.
- Example 3: Suppose the Proposer makes the offer "Responder gets X - 1, I get 10 - (X-1)" and the Responder's Minimum Acceptable Offer is X.
    - Since X-1 < X, this offer is rejected.
    - Both the Proposer and Responder earn 0 points in this task.

You are a Responder. Please make your choices here:

Your Minimum Acceptable Offer is 0.

(You have no decisions to make in this stage. Please click Next.)

As a reminder, you will not be told the results of this task until the end of all tasks.

Next

Part 2: Task 2

You are a Responder. Instructions and choices for this task are below:

Task 2 Instructions

1. Responder sends message to Proposer.
    - This message is of the form "My Minimum Acceptable Offer is ___" (where the blank is filled in by a number).
    - This message can be anything the Responder wants, and does not have to be their actual Minimum Acceptable Offer.
2. Proposer makes offer to Responder.
3. Offer is compared to Responder's Minimum Acceptable Offer.
    - If Proposer's offer gives Responder more than or equal to Responder's Minimum Acceptable Offer:
        - Offer is accepted.
        - Players earn amounts specified by offer in this task.
    - If Proposer's offer gives Responder less than Responder's Minimum Acceptable Offer:
        - Offer is rejected.
        - Players earn 0 points in this task.

- Example: Suppose the Responder's Minimum Acceptable offer is X, and they send the message "My Minimum Acceptable Offer is X+1" to the Proposer. The Proposer then makes an offer of "Responder gets X, I get 10 - X".
    - Since the offer gave X to the Responder, and the Responder's Minimum acceptable Offer was X, this offer is accepted.
    - The Responder earns X points in this task, and the Proposer earns 10 - X points in this task.
    - The actual Minimum Acceptable Offer from before task 1 matters for determining whether the offer was accepted or rejected, and NOT the message amount.

You are a Responder. Please make your choices below.

Your Minimum Acceptable Offer is 0.

Message:

Next

Part 2: Task 3

You are a Responder. Instructions and choices for this task are below:

Task 3 Instructions

1. Proposer sends first-round offer to Responder.
2. Responder may accept or reject using a "First-Round Minimum Acceptable Offer."
    - May be different from Minimum Acceptable Offer reported before task 1.
3. If the first-round offer gives the Responder more than or equal to the Responder's First-Round Minimum Acceptable Offer:
    - Participants earn amounts specified by offer.
    - Second-round does not occur.
4. If offer gives Responder less than Responder's First-Round Minimum Acceptable Offer:
    1. Proposer makes Second-Round offer to Responder.
    2. Second-Round Offer is compared to Responder's Minimum Acceptable Offer.
        - If Proposer's Second-Round Offer is greater than or equal to Responder's Minimum Acceptable Offer:
            - Offer is accepted.
            - Players earn amounts specified by offer in this task.
        - If offer gives Responder less than Responder's Minimum Acceptable Offer:
            - Offer is rejected.
            - Players earn 0 points in this round.

- Example 1: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y.
    - Since the offer gives the Responder Y, which is equal to the Responder's first-round Minimum Acceptable Offer, this offer is accepted.
    - The Responder earns Y points in this task, and the Proposer earns 10 - Y points in this task.
    - Any choices indicated for the second-round will not matter, because the second round does not occur.
- Example 2: Suppose the Proposer makes the first-round offer "Responder gets Y, I get 10 - Y" and the Responder's first-round Minimum Acceptable Offer is Y + 1.
    - Since Y < Y+1, this offer is rejected.
    - The Proposer then makes their second-round offer.
    - Suppose the second round offer is "Responder gets X, I get 10 - X"
        - If X is greater than or equal to the Responder's Minimum Acceptable Offer (from before task 1):
            - The offer is accepted.
            - The Responder earns X poitns and the Proposer earns 10 - X points in this task.
        - If X is less than the Responder's Minimum Acceptable Offer (from before task 1):
            - The Offer is rejected.
            - Both participants earn 0 points in this task.

You are a Responder. Please make your choices below.

Your Minimum Acceptable Offer is 0.

First-Round Minimum Acceptable Offer:

Next

Part 2: Task 4

You are a Responder. Instructions and choices for this task are below:

Task 4 Instructions

1. Proposer sends first-round offer to Responder.
2. Responder may accept or reject using a "First-Round Minimum Acceptable Offer."
   - May be different from Minimum Acceptable Offer reported before task 1.
3. If the offer gives the Responder more than or equal to the Responder's First-Round Minimum Acceptable Offer:
   - Second-round does not occur.
   - Participants earn amounts specified by first-round offer.
4. If first-round offer gives Responder less than Responder's First-Round Minimum Acceptable Offer:
   1. Responder sends message to Proposer.
      - This message is of the form "My Minimum Acceptable Offer is ___" (where the blank is filled in by a number).
      - This message can be anything the Responder chooses, and does not have to be their actual Minimum Acceptable Offer.
   2. Proposer makes second-round offer to Responder.
   3. Second-round offer is compared to Responder's Minimum Acceptable Offer.
      - If Proposer's second-round offer is greater than or equal to Responder's Minimum Acceptable Offer:
        - Offer is accepted.
        - Players earn amounts specified by offer in this task.
      - If offer gives Responder less than Responder's Minimum Acceptable Offer:
        - Offer is rejected.
        - Players earn 0 points in this round.

You are a Responder. Please make your choices below.

First-Round Minimum Acceptable Offer:

Message for each possible first-round offer received:

If offer received from Proposer is "Responder gets 0, I get 10", send offer:

If offer received from Proposer is "Responder gets 1, I get 9", send offer:

If offer received from Proposer is "Responder gets 2, I get 8", send offer:

If offer received from Proposer is "Responder gets 3, I get 7", send offer:

If offer received from Proposer is "Responder gets 4, I get 6", send offer:

If offer received from Proposer is "Responder gets 5, I get 5", send offer:

If offer received from Proposer is "Responder gets 6, I get 4", send offer:

If offer received from Proposer is "Responder gets 7, I get 3", send offer:

If offer received from Proposer is "Responder gets 8, I get 2", send offer:

If offer received from Proposer is "Responder gets 9, I get 1", send offer:

If offer received from Proposer is "Responder gets 10, I get 0", send offer:

Next

E.4 Probability Choice and Results

Probability Choice

You have now completed all four tasks. On the next screen, you will be informed of your results, but first, there is one more question for you to answer.

You were told that the task selected for payment would be random, and it will be. By default, each of the four tasks will be selected for payment with probability 25%. However, if you would like, you may indicate a task below which will instead be chosen with 40% probability (and all of the rest will be chosen with 20% probability). If you have no preference, select "(no preference)"

Click Next to Submit.

Next

Results

Task 1:
Your offer was "Responder gets 0, I get 10" .
Your offer was accepted, and you earned 10 points.

Task 2:
Your matched Responder's message was "My Minimum Acceptable Offer is 0."
Your offer in response was "Responder gets 0, I get 10.
Your offer was accepted, and you earned 10 points.

Task 3:
Your first-round offer was "Responder gets 0, I get 10".
Your first-round offer was accepted.
The second-round offer did not occur. You earned 10 points .

Task 4:
Your first-round offer was "Responder gets 0, I get 10".
Your first-round offer was accepted.
You earned 10 points.

Final Payment
You chose to boost the probability of task .
The randomly selected task was task 2. Including your participation fee of $5.00, you earned a total of $25.00 in this experiment.
Thank you for participating. The experimenter will distribute payments shortly.

Next