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 study whether responders perform better by specifically claiming reserve prices ("explicit messages") or rejecting offers without claiming a particular reserve price ("implicit messages"). I find that while both forms of messaging and their combination all significantly increase average responder payoffs relative to no messaging, there is no significant difference in average responder payoffs between them - in short, it may not matter exactly how someone chooses to negotiate through reserve price disclosure, so long as they signal at all. Analysis of subjects' strategies reveals that proposers increase their offers in response to the presence of implicit messaging and the size of explicit messages (up to a point), indicating that proposers may treat messages with a limited degree of credibility. Findings have implications for practical negotiation strategy and the 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 – acceptable, perhaps, but knowing that there may be room to improve, the ready-to-bargain prospect considers their next move carefully. Were this a final offer, the candidate's decision would be straightforward: accept the offer if it is satisfactorily large, or reject otherwise. But when negotiations are ongoing, the type of communication that the candidate chooses to employ may impact the offers and potential agreements that follow.

A common negotiation approach used by bargainers is to make an explicit claim about one's reserve price - an "explicit message" that one will not accept less than a specific amount. This approach has potential advantages: if the message is perceived as truthful, or perhaps embellished but not distant from the truth, it may induce more favorable offers. A literature on first-offers in negotiation suggests that making the first offer can influence outcomes through anchoring effects (Galinsky and Mussweiler [20], Ritov [33]), which is only possible by naming a price. But precise demands may come with potential drawbacks as well. Claims which are too low may limit a bargainer's potential gains (what if the opponent would have offered more than they asked for?) while claims which are too high may be viewed as unreasonable, lessening the chances of agreement or even backfiring into worse subsequent offers.

Alternatively, one could choose to avoid making a claim of any particular reserve value, and instead communicate dissatisfaction with the current offer by rejecting without counter-proposing. This "implicit

messaging" by indicating displeasure through rejection (but inviting new offers) has the potential benefit of not limiting upside, but the drawback of providing little guidance for future offers.

So should bargainers name their prices, or are they better off communicating through rejection per se? In part, this is a question about apparent credibility: how does one convince their bargaining partner that they will turn down worse offers in order to achieve better ones? 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 [28], p.138). It is not clear, however, which methods successfully generate these misconceptions.

To approach this question, this study uses an ultimatum game experiment in which responders employ four different types of communication during play: explicit messaging, in the form of specific claims about offers they are willing to accept, implicit messaging, in the form of costless rejection of (binding) offers on the table, a combination of the two forms representative of a "decline-and-counter" approach, and a no messaging control. The experimental design constrains communication substantially; unlike studies involving fully free or mildly limited communication, the current study isolates the strategic channel of communication with little room for interpersonal effects.

I find that explicit messaging, implicit messaging, and their combination all lead to larger payoffs for responders than the no messaging baseline, though differences between messaging treatments are not significant. These responder gains follow directly from larger offers from proposers, improving both agreement rate and responder payoffs conditional on agreement.

An analysis of proposer strategies under explicit messaging reveals that proposers' offers respond to the content of responder threats: larger demands tend to successfully induce larger offers. However, messages are not fully *believed*: offers are often less than demanded amounts, but still greater than they would be without any message. In this way, proposers appear to anticipate deception, but do not ignore message content completely. Against offer rejections without explicit threats, proposers still improved offers beyond baseline ultimatum game levels, even when the rejected initial offers were very low. For these reasons, I claim that despite the inexpensive nature of communication, both explicit and implicit messages are as-if credible among laboratory subjects.

This paper seeks to contribute to the literature on negotiation strategy as the first to compare explicit messaging with implicit messaging to see whether these forms of communication induce different bargaining outcomes, as well as the experimental literature on communication and cheap talk in bargaining.

2. Related Literature

The current study considers the role of two specific forms of strategic communication during a bargaining process: reserve price disclosure and offer rejection. Multiple experiments have studied the effects of communication in bargaining and adjacent domains through non-strategic channels. Roth [35] compares ultimatum game treatments in which subjects could converse freely, or were prevented from discussing the game to be played (though otherwise free), and finds that both types of communication lead to similarly more equitable outcomes than a treatment with no communication. This is attributed to communication fostering a sense of camaraderie between players, although Zultan [38] extends and reinterprets this finding to show that while proposer offers do not appear to depend on the capability of participants to discuss the game, responders' (un-)cooperative behavior does: responders are willing to reject more offers when communication can pertain to the game than when it cannot, indicating different mechanisms operating on different roles. Andreoni and Rao [4] considers the effect of introducing one and two-sided communication to a dictator game. Allocators in that game passed more to recipients when those recipients were allowed to send messages (including text content and a numerical request for a passed amount) than when they were not, suggesting communication from recipients enhances prosocial behavior from allocators. With a different type of communication, Schotter and Sopher [36] use an intergenerational bargaining game design in which advice is transmitted from previous players to new players, and this is shown to make senders' offers less variable.

This experiment and most others consider bilateral bargaining, however messaging in bargaining has also been examined in multilateral settings. Agranov and Tergiman [3] and Baranski and Kagel [6] show that when groups of many negotiators are able to communicate, proposer premiums increase and become closer to the predictions of Baron and Ferejohn [7].

All of the prior mentioned experiments allow communication which is largely free in form (sometimes mildly limited in subject). This freedom enables features of dialogue other than strategic threats to transmit as part of communication, such as empathy, charisma, or logical reasoning, all of which may play their own roles. Unlike these studies, the current study highly restricts the form and content of communication to isolate the strictly strategic influence of message content. One similar and similarly restrictive study is Rankin [32], which permitted (but did not require) responders in an ultimatum bargaining game to send non-binding requests to proposers by completing the sentence "I request $___." In that experiment, responders who made requests received lower offers on average than those who did not, though conditional on making such a request, those who asked for more tended to receive more. This contrasts with the finding of Andreoni and Rao [4], where requests increased allocator generosity; it is not clear if the difference is a result of game

structure, limitations on message content, or compulsoriness of numeric requests. In any case, it should be noted that the conversational implicature of a request is not necessarily the same as a demand or threat.

Both explicit and implicit messaging in the current study are analyzed through a lens of incomplete information and cheap talk. A deep literature in ultimatum bargaining has examined various consequences of these features; among them, Mitzkewitz and Nagel [27] and Huck [23] examine how asymmetric information on pie size affects play, and Boles et al. [8] and Croson et al. [13] allow subjects to send cheap talk messages in repeated bargaining settings with particular emphasis on retribution behavior when deception is revealed. These studies find, in general, that cheap talk messages are impactful in bargaining. This is corroborated by evidence in the literature demonstrating that subjects often tell the truth with costless messages even when there is no incentive to do so, or even an incentive against: Duffy and Feltovich [14] find subject cheap talk to be informative, and Gneezy [21] demonstrates that subjects avoid lying in cheap-talk communication even when they have a financial incentive to sway the receiver by lying. Not everyone is a truth -teller, however. Kriss et al. [25] show that proposers are willing to act both explicitly and implicitly deceptively with respect to pie size in bargaining.

The current study relies on heterogeneity in individual willingness to accept offers in bargaining environments. Such heterogeneity is well documented in the ultimatum game, and has been modeled using differential preferences for fairness (Bolton and Ockenfels [9]; Fehr and Schmidt [18]; Rotemberg [34]), reciprocity (Rabin [31]), spite (Levine [26]), and other qualities. The current study remains agnostic on the source of this heterogeneity, but relies on the uncertainty it generates in order to enable strategic misrepresentation about willingness to reject offers. Reserve price misrepresentation is a central feature of theories of reputational bargaining including Abreu and Gul [1], Abreu and Pearce [2] and Fanning [16]. Embrey et al. [15] examines the theory of Abreu and Gul [1] directly and validates that subjects attempt to mimic others' types as predicted.

Broadly, bargaining research with communication has examined how communication can influence bargaining outcomes by acting on prosocial preferences or misrepresenting private information. This study furthers the literature by focusing on how different specific forms of potentially deceptive information disclosure from responders affect proposer offers, and in particular, compares whether withholding or providing potentially deceptive reserve price information influences final outcomes for bargainers empirically.

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, performed in two parts. Part 1 was a practice portion during which subjects read and

listened to instructions for all four of the bargaining games, answered comprehension questions to ensure understanding, and submitted practice decisions for each game in both roles[1] to learn how the interface worked and actions mapped into payoffs. No decisions made in Part 1 affected subjects' final payments.

In Part 2, subjects played all four games introduced in Part 1 again in the same order, though this time in a single role fixed across all games.[2] Subjects specified full strategies for each game using the strategy method (a la Selten [37]) without any feedback between games, so subjects could not learn about any other players' choices until observing final results at the end of the experiment.[3] To help prevent mistakes or misclicks, an on-screen prompt appeared before any decision was submitted, requiring subjects to confirm their choices or return to the decision screen to make changes. For calculation of final payments, proposers and responders in the same session were randomly matched (independently for each of the four games in Part 2) and one game from Part 2 was randomly selected to count for payment. Participants received a $5 completion fee for finishing the experiment and $2 for each point they earned in their randomly selected game, for an average total payment of around $14.

3.2. Minimum Acceptable Offers

Prior to choosing any strategies or even learning roles in Part 2, subjects were asked to provide a "Minimum Acceptable Offer"(MAO). This value was chosen to be the smallest final offer out of 10 possible points which the participant would accept, conditional on being assigned the role of responder. This choice was binding for *all four games* and could not be changed in between games. This constraint is useful for multiple reasons. First, knowing that this constraint exists, proposers can expect that the set of final offers which are accepted in each game is invariant across games and cannot be affected by their own actions. Any observed differences in proposer offers between games, then, cannot be attributed to different prior beliefs about final stage responder preferences. Furthermore, this constraint affords a precise and natural definition 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.

[1] Brief exposure to the opposite role could potentially have an effect on behavior for subjects who otherwise would not consider their opponent's perspective. Analysis may be viewed through the lens of applying only to individuals who have considered their opponent's perspective.

[2] All subjects completed the four games in the same order. The particular order used was chosen to minimize subject confusion, as the games become progressively more complex and consistency between the order of games practiced and played may limit errors. In general, an experimenter must be cautious about whether treatment effects could be impacted by the order of games played. Because subjects practice all games before playing any, the potential impacts of treatment-specific novelty or institutional learning are reduced.

[3] Concern may be raised that using the strategy method could lead to different outcomes than using "hot" in-the-moment decisions. Brandts and Charness [10] offers a review of experiments which compare strategy-method decision making and hot decision making. In bargaining and similar settings, many studies show minimal differences between elicitation methods. Of particular note, Armantier [5] allowed subjects in an ultimatum bargaining environment to change their initially indicated minimum acceptable offers after observing actual offers received, and found very few chose to do so. Two ultimatum bargaining environments are mentioned in the review which do demonstrate differences: Güth et al. [22] and Oxoby and McLeish [30]. In both of these studies, differences between elicitation methods are not demonstrated to be statistically significant.

Despite the advantages of this constraint, it should be noted that it enforces a strong assumption of consistency in final round behavior which may not hold if this choice were instead free to vary. If, for example, responders would actually select higher MAOs when messaging is permitted than when it is not, this design choice would miss an element of the setting affecting outcomes. Nonetheless, because responders know the rules of all games before deciding on an MAO and are aware of this constraint when choosing, their decisions can still be interpreted as a reflection of their preferences with the multi-game structure in mind.

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 that offer is determined by their MAO. 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. This serves as the non-messaging control treatment from which all further treatments extend.

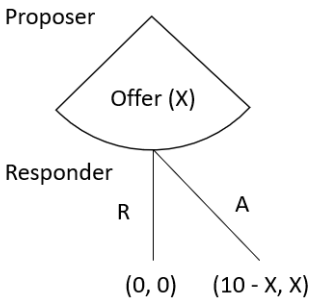


Figure 1: Ultimatum Game

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

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

All subjects are made aware in the instructions that this message need not be truthful. To respond to messages with the strategy method, proposers submit an offer for every possible message they could receive, from "My Minimum Acceptable offer is 0" to "My Minimum Acceptable Offer is 10". The actual offer used for the purpose of calculating final outcomes and payments is the one corresponding to the actual message sent by a proposer's matched responder.

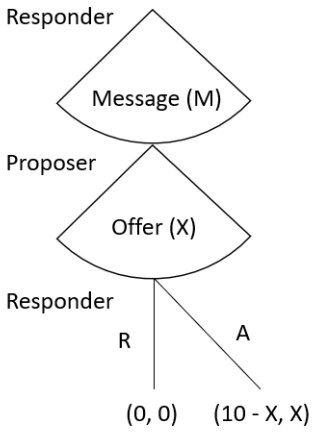


Figure 2: Ultimatum Game with Explicit Messaging

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 to reject an initial offer and receive another offer, introducing implicit messaging. The complete order of play is as follows: first, the proposer makes a first round offer, which the responder accepts or rejects. If the responder accepts, the game ends and the offer is implemented. If the responder rejects the first round offer, then the proposer makes a final offer which the responder may again accept or reject. Payoffs follow from this final offer stage as in the ultimatum game.[4]

To implement this game with the strategy method, responders indicate a "first round minimum acceptable offer" which determines the smallest first round offer they are willing to accept. This is a completely free choice and need not correspond to their MAO in any particular way. Final round offer acceptance decisions are governed by responders' originally specified MAOs. Proposers indicate two offers simultaneously: a first round offer and a final round offer in case of first round rejection.

[4]Fudenberg and Tirole [19] study a version of this game theoretically. The experiment in Konovalov and Krajbich [24] uses a version of this game with induced values and examines the signaling value of decision time.

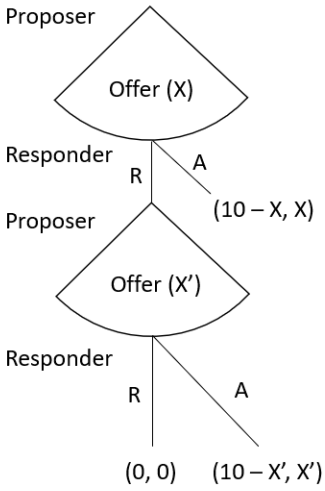


Figure 3: Penultimatum Game

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

The final game, the penultimatum game with explicit messaging, extends the penultimatum game (PUG) 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 ___."[5]

In addition to a first round minimum acceptable offer, responders indicate a message to send for each possible first round offer they may receive. Proposers indicate a single first round offer and final round offers for each possible message they may receive.

It bears consideration that because the strategy method is used, games with messaging involve reporting strategies that are more complex than the simple UG. This is particularly apparent in the PUGM, where both roles report 12 decisions. While analysis assumes that this complexity does not inherently affect how people consider contingencies, it is noted that meaningfully more contingencies must be considered while reporting a strategy.

[5]The "voice" treatment of Ong et al. [29] implements a game with a similar concept.

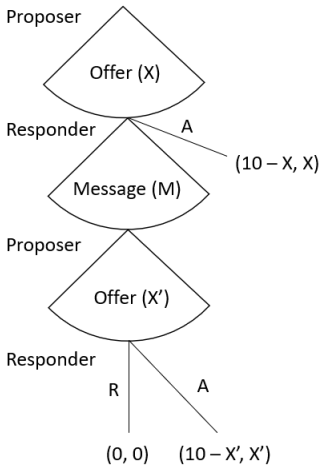


Figure 4: Penultimatum Game with Explicit Messaging

3.4. Probability Boost Choice

After all games were completed but before results were revealed, subjects made an additional decision: each subject could opt, if they desired, to increase the probability of a particular game being chosen by the random payment selection mechanism from 25% to 40% (and correspondingly reduce the chance of each other game being selected to 20%). This provides a coarse measure of selection into different messaging approaches. In the experiment, subjects are required to use particular types of messaging in their respective games, but in practice, bargainers can choose which types of messaging they use, and what they choose may depend on their confidence about their strategies in each.

If a subject expects to perform better in one game than the others, then increasing the likelihood of that best game is payoff-maximizing. Thus, this probability boost choice provides an incentive-compatible evaluation of how well-calibrated subjects are to differences in their earnings across games.

4. Hypotheses

In order to form benchmark predictions for strategies and outcomes in the games above, I use a simple model employing one-sided incomplete information about MAOs provided in Appendix A.

The primary takeaway from this parsimonious construction of the problem is that while explicit and implicit messages operate differently, both essentially amount to cheap talk. As a result, in all four games, the equilibrium-predicted proposer strategies maximize their expected payoff based only on their prior over MAOs. Consequently, predicted payoffs across games are identical. The simple cheap talk theory, therefore, gives little reason to suspect naming a price or not naming a price should perform better than the other, or better than no messaging. Hypotheses 1 and 2 report this basic prediction.

If the simple models give no particular reason to believe differences should emerge, why study the question? Mainly, because there are many potential reasons why differences may emerge anyway. For one, the logic of cheap talk may not be immediately evident to subjects. Either form of message may be accepted as (at least somewhat) credible by proposers for pure naivete, and even if proposers are sensitive to pooling, messages may could be perceived as credible if responders *use* messages credibly. If responders de facto reveal their MAOs through individual decision or population-level patterns, proposers can take advantage of this information transmission in expectation.

Along these lines, consider a world in which people have a basic preference for honesty in their negotiations. Basic lying aversion has been demonstrated in the laboratory by Gneezy [21], suggesting a psychological penalty may be at play even if there are no external incentives to tell the truth. If these costs are extremely high, it is clear that responders would have to separate. If only some people choose to tell the truth for preferential reasons, this may be enough for proposers to act on.

Hypothesis 1: Proposers' greatest offers in all games will be equal.

Hypothesis 2: Average expected payoffs for proposers and responders will be equal across all games.

Hypothesis 3: There is no relationship between explicit message content and MAO.

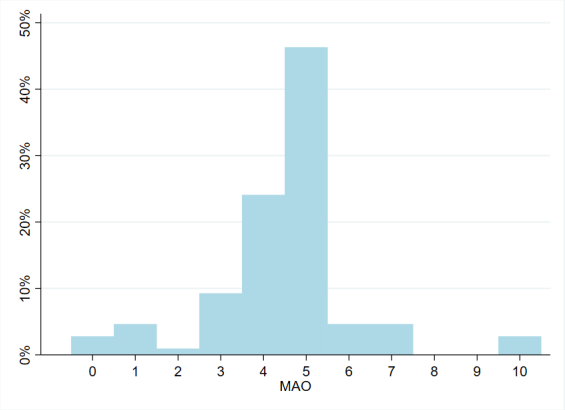
Hypothesis 4: Subjects will choose to increase the selection probability of a game in which they earned the greatest empirical expected payoff.

5. Results

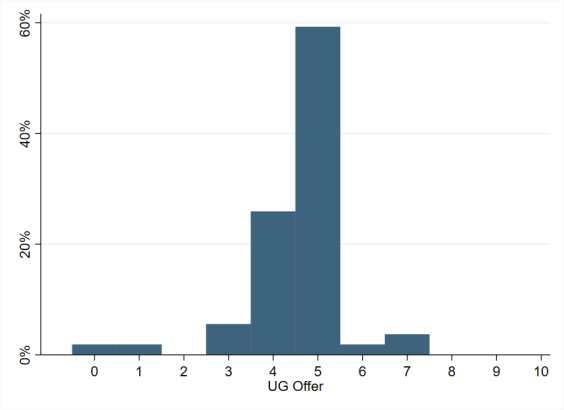
5.1. Sample Summary and UG Behavior

The sample consisted of 108 subjects (54 proposers and 54 responders) recruited to the EconLab at University of California San Diego using Sona Systems. Six in-person sessions were performed using oTree experimental software (Chen et al. [12]). Sessions contained between 16 and 20 subjects each.

Figure 5 shows histograms for all MAOs and proposer ultimatum game offers. Note that since all subjects commit to an MAO (and not only responders), the number of observations for MAO is twice the number of observations for other decisions.



(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 [11]). Table 1 provides the expected ultimatum game payoffs from each possible offer given the observed MAO distribution. Confirming the findings of previous work on ultimatum games, the proposer payoff-maximizing offer is 50% of the pie.

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. Game Payoffs

Because subjects provide full strategies in all games, it is possible to consider not only specific payoffs for each subject generated by a particular matching of proposers to responders, but also *expected* payoffs over all possible matchings, with bootstrapped standard errors for inference. Figure 6 displays the mean expected payoffs for each role in each game. Error bars represent two bootstrapped standard errors with 5000 samples. Table 2 presents mean and standard deviation statistics.

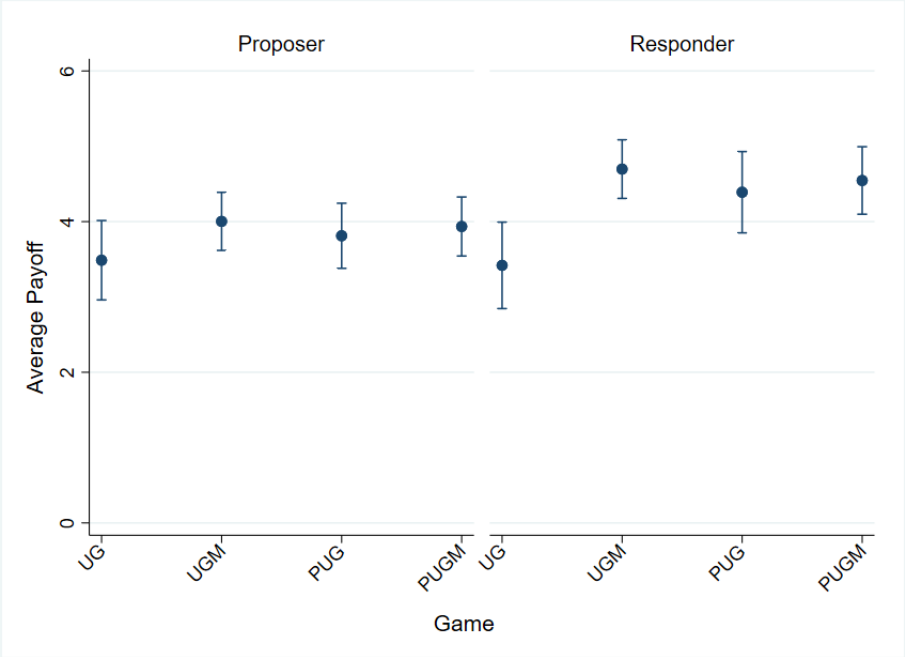


Figure 6: Average Expected Payoffs by Role

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 significantly 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 an expected 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 other pairwise comparisons).

While this study mainly focuses on the possibility of potential gains for responders since they are the users of messaging in this experiment, there remains a question of how proposers are impacted by the presence of messaging: do responder gains stem from proposer losses competitively, or are the benefits mutual?

Result 1b: Proposers earn statistically significantly more in treatments with explicit messaging (UGM, PUGM) than without messaging (UG). Differences are not significant between the UG and PUG, the UGM

and PUG, or the UGM and PUGM.

A bootstrap test (5000 repetitions) of the difference in mean expected payoffs for proposers gives an improvement of .516 points ($z = 2.54, p = .011$) from the UG to UGM, and .448 points ($z = -2.32, p = .02$) from the UG to the PUGM. No statistical difference is detected when evaluating the introduction of implicit messages alone (PUG) to the UG ($z = 1.64, p = .101$) nor between any of the messaging treatments (see Appendix B for full table of comparisons).

Combining these observations leads to a question beyond the study's initial motivation: does messaging change who has an advantage in bargaining games? Comparing proposer and responder expected payoffs reveals very similar earnings in the standard ultimatum game, but significant differences in responders' favor between payoffs in all games with messaging (bootstrap test for difference in mean expected payoff with 5000 repetitions; UGM: $z = 3.62p < .001$; PUG: $z = 2.96, p = .003$; PUGM: $z = 3.21, p = .001$).

5.2.1. Discussion

Findings do not show significant difference in expected payoffs for either player between the use of explicit messaging and implicit messaging (or both together). Both forms of messaging, however, appear to significantly improve responder payoffs relative to no messaging, even when final round acceptance decisions are enforced by the design to be consistent. Responder payoffs improve relative to proposer payoffs, leading to an apparent responder advantage in the games with messaging. This newly observed advantage cannot be a simple last-offer advantage, since the proposer possesses that role in all games, and does not appear to be a first-mover advantage, since the proposer acts first in both the PUG and PUGM.

Results 1a and 1b reject Hypothesis 2: in spite of messages being ostensibly cheap talk, the impersonality of the strategy method, and practice with the games before beginning, expected payoffs are unequal across games, to the benefit of responders in particular. It remains to show what strategic choices lead to these outcomes.

5.3. Offer Sizes

Expected payoffs are, of course, a function of the offers proposers send and the rates of agreement resulting from those offers. Table 3 demonstrates the average final offers sent in each game (the ultimatum stage), and the average expected agreement rate. Because final offers in explicit messaging games (UGM and PUGM) are not single values but instead functions of responders' messages, expected final offers over all possible proposer-responder matchings are reported.

Game	UG	UGM	PUG	PUGM
Expected 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 round offers are larger in all messaging treatments than in the UG.

Because final round offers in the PUG are independent of any responder actions, it is sufficient to compare the mean of UG offers to the mean of final round PUG offers using a paired two-sided t-test ($t(53) = 2.26, p = .028$). To compare expected UG offers to UGM and PUGM expected final offers (which depend on responder messages), bootstrap tests for differences in means with 5000 repetitions are used (UG vs UGM: $z = 3.45, p = .001$; UG vs PUGM: $z = 4.04, p < .001$). Bootstrap tests for differences in mean expected agreement rates between games show significance at a $p < .001$ level for all comparisons between the UG and messaging treatments, and no other differences.

Result 3: Average expected agreement rate is larger in all messaging games than without messaging.

5.3.1. Discussion

Hypothesis 1 makes a claim about the largest offers sent by proposers, not the final offers sent by proposers. However, as will be examined in further depth in implicit messaging strategies, final offers in both the PUG and PUGM are significantly larger the first offers both on average and for a majority of subjects, so considering final round offers as representative of largest offers is sensible. Hypothesis 1 is rejected.

Mechanically, larger offers lead to greater chances of agreement, and more agreement translates one-to-one into improvements in total combined payoffs. Considering the fairly high rate of agreement even in the worst messaging game (PUG, 82%), it is conceivable that somewhat of a ceiling effect is occurring. Since some subjects indicated high MAOs, the theoretical limit of expected agreement rate is less than 100%, and therefore messaging treatments could be achieving close to the upper bound of what is possible. Because all subjects indicate an MAO prior to learning their role, it is possible to estimate a theoretical upper bound on agreement rate under the assumption that proposers' offers would never leave those proposers with less than their reported MAO.

Performing this estimation, the predicted maximum agreement rate is 83% - *less(!)* than the UGM and

PUGM achieve. This is not an impossibility, since the assumption that proposers never offer more than their MAO would permit is sometimes violated. However, this rough estimate still suggests that further improvements in agreement rate may be difficult to achieve.

5.4. Explicit Message Strategies: Responders

The most direct observation of explicit messaging strategies comes from the UGM, since messages do not depend on an observed first offer in that game.

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

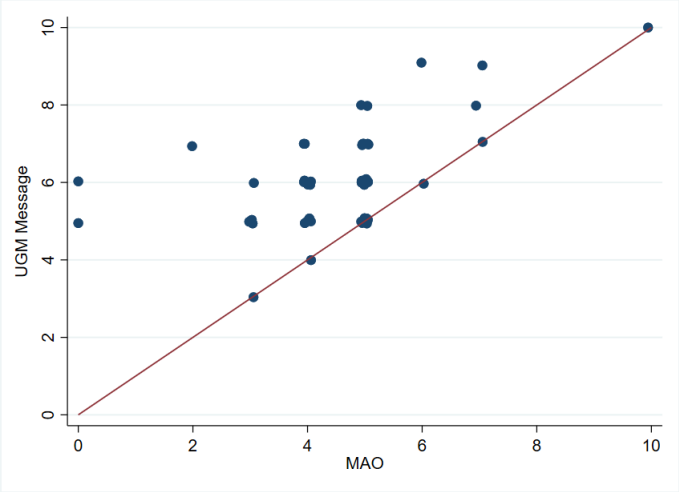


Figure 7: Explicit Messages vs Minimum Acceptable Offers in UGM

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

A strong majority of responders report MAOs larger than their true MAOs in their UGM messages. The remainder are truthful. From inspection, there is an obvious positive relationship between reported MAOs and the UGM messages sent by responders. This observation is validated by a robust OLS regression ($\beta = .614, t = 3.65, p = .001, r^2 = .27$) indicating that individuals with larger MAOs on average report larger messages. The mean message was 6.02, and 33/54 responders sent messages demanding more than 50% of the pie.

In the PUGM, explicit messages cannot be so straightforwardly plotted, since within-subject they can vary in response to first round offers. While for simplicity, subjects reported messages for all possible offers, appropriate analysis considers only messages sent in response to offers less than a responder's first round

minimum acceptable offer. This is because other contingencies are irrelevant (never occur) and subjects may have treated them as such.

The least ambiguous analysis of responder messaging strategies in the PUGM examines individuals who chose the same message regardless of the first round offer observed. This qualification describes 31/54 responders (54%). Figure 8 repeats the analysis of Figure 7 for these individuals in the PUGM.

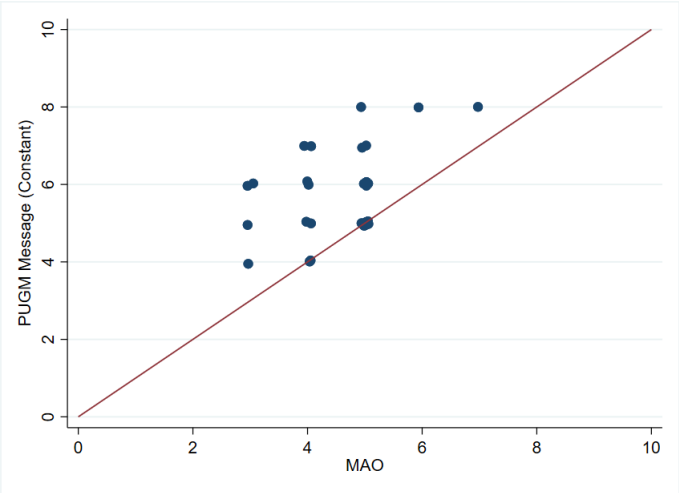


Figure 8: Explicit Messages vs Minimum Acceptable Offers in PUGM, for Responders with Constant Messages

When responders choose a constant offer, is it the same offer that they chose in the UGM? Figure 9 scatters constant PUGM messages against their corresponding UGM messages.

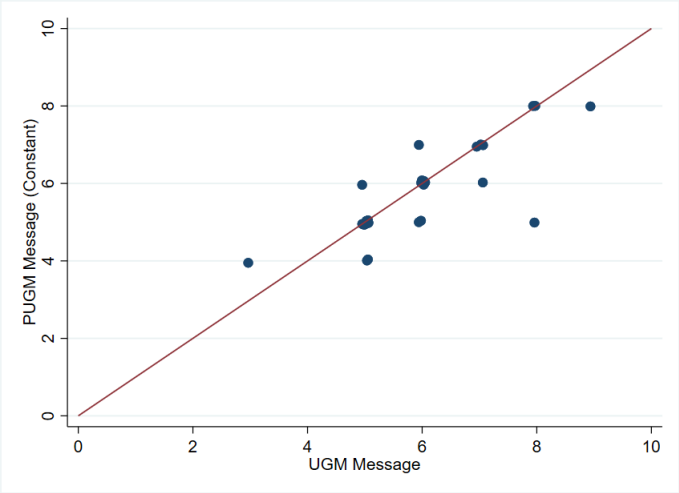


Figure 9: UGM Messages versus PUGM messages (for constant PUGM messages)

Message selections are not perfectly consistent between games, though a majority are (21/31). Among the remainder, only three increase their message in the PUGM, while seven decrease their message in the PUGM. All differences are within one point except in a single case.

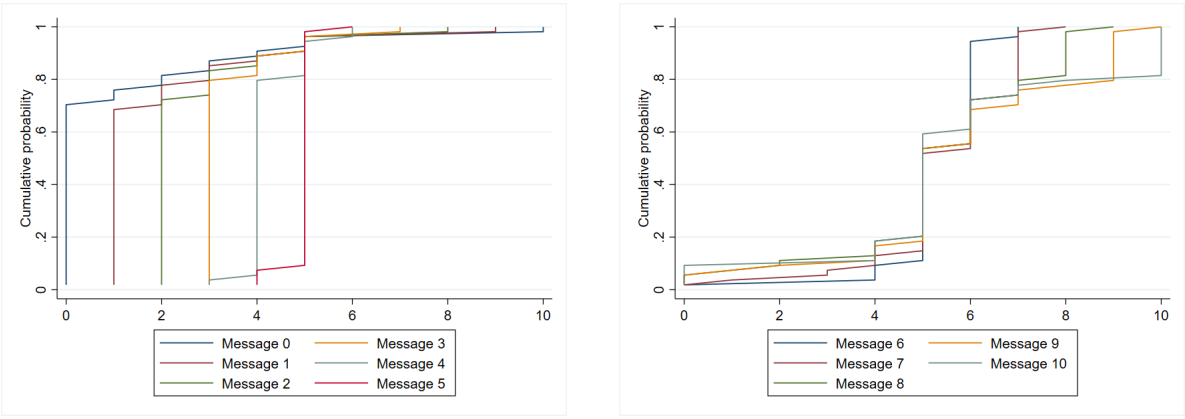
The remainder of responders with non-constant messages adopt a variety of approaches. Strategies include increasing messages as observed offers increase (8/23), decreasing messages as offers increase (10/23) or changing messages non-monotonically (5/23). 10 of 23 non-constant messaging strategies vary only within a one point range, and are in this way "close" to constant.

5.4.1. Discussion

Responders overwhelmingly choose to either truthfully disclose their MAOs or deceptively shade upward. Examining the degree of shading in the UGM, nearly all messages if not truthful shade upward by one, two, or three points. In this way, the UGM reveals a clear pattern of separation in the messages sent as a function of type (MAO). This separation violates Hypothesis 3, and creates an opportunity for proposers to send offers differentially across messages within the range of actual messages sent.

5.5. Explicit Messaging Strategies: Proposers

Figure 10 reports the cumulative distributions of offers sent by proposers in response to each message in the UGM, split between messages from 0 to 5 (panel a) and messages from 5 to 10 (panel b).



(a) (b)

Figure 10: UGM Offers Sent by Message

Figure 10 captures proposer's aggregate behavior independent of matching. For illustrative purposes, Figure 11 shows proposer offers in response to messages for a particular matching (in fact, the matching used to generate payoffs).

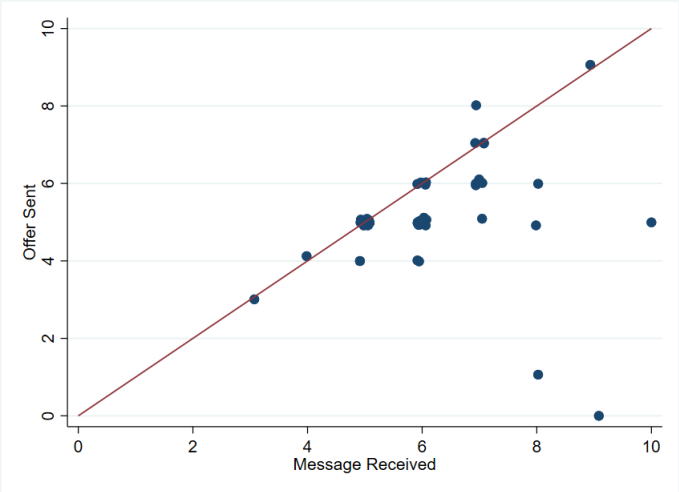


Figure 11: Proposer Offers by Message (Particular Matching)

Finally, Table 4 gives the average offer sent in response to each UGM message.

UGM Message	0	1	2	3	4	5	6	7	8	9	10
Offer	1.12	1.94	2.67	3.38	4.22	4.94	5.35	5.48	5.42	5.78	5.76

Table 4: Average UGM Offers by Message

For within-subject analysis, a complete set and cluster analysis of proposer strategies in the UGM is available in Appendix C. Among these strategies, three categories stand out as the only types used by more than one proposer in the sample.

The first strategy to consider is a uniform offer for all messages. If a proposer believes messages contain truly no content, then this would be the expected behavior (so long as the proposer assigns positive probability to all messages). Only two proposers out of 54 fit this profile; all others vary their offers depending on the message received. Both choose a constant offer of 5. Next, a proposer can send exactly the amount claimed by the responder's message. These "true believer" proposers act in a manner consistent with the belief that all responder types are truthful. Seven proposers fit this description. So long as they do not expect responders to misrepresent their MAOs downward (which does not exist in the UGM data), these proposers can always expect to transact. This strategy, however, is exploitable by responders willing to deceive; the previous analysis reveals attempted deception is common.

Finally, proposers could adopt a pattern of behavior resembling a plateau - that is, they send offers equal to explicitly claimed MAOs up to a certain point, and keep the offer constant for all larger messages. Including only proposers who choose their highest offer for at least two different messages,[6] there are 14

[6]Else, the previous category would also count as a plateau. In all three categories, there exist cases which very nearly fit

proposers who use such a strategy. Figure 12 illustrates a plateau strategy chosen by one participant.

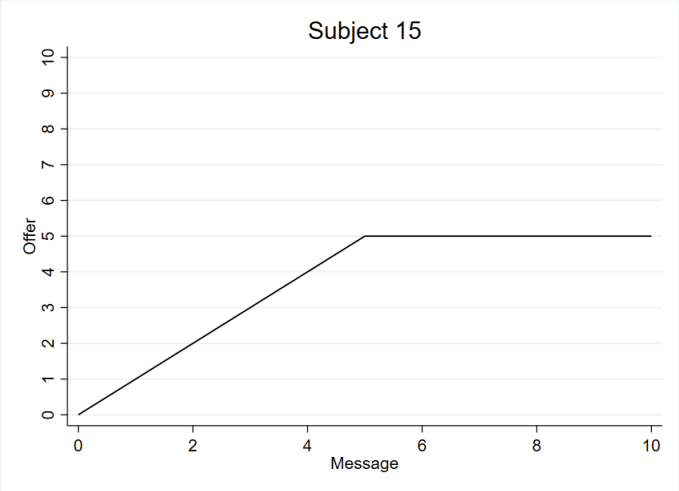


Figure 12: Plateau Strategy

5.5.1. Discussion

The low-to-fair offers of Figure 10 panel (a) reveal a clear pattern of behavior, which is then sharply contrasted by the responses to larger offers in panel (b). When proposers face low offers, a majority of offers sent are exactly the amount suggested. This is visible in the sharp upward spikes in the CDFs in panel (a). In this low-offer range, proposers generally appear to act *as if* they believe those messages. Low messages are treated as if credible in this way.

When messages increase to above 5, however, proposer behavior becomes starkly different. Instead of offering the demanded amounts, the modal offer becomes 5, though modest spikes in the CDFs at the each message's value indicate that about 20% of proposers send offers as if the message is truthfully believed. So if proposers do not believe these high messages, what do they do? Figure 11 tells a story: offers often shade slightly downward from the messaged demands. Larger demands successfully induce larger offers in the in the low range but typically do not induce offers as large as the messages sent.

Average data from Table 4 and many individuals adopts behavior resembling a plateau, where offers increase with messages at the low end but flatten off at the high end. This pattern can be explained with at least two potential mechanisms: differences in beliefs about message truthfulness, and simple unwillingness to offer more than a threshold amount. Consider first differences in beliefs about truthfulness: so long as responders are not believed to claims MAOs less than the truth, proposers may have little reason to believe

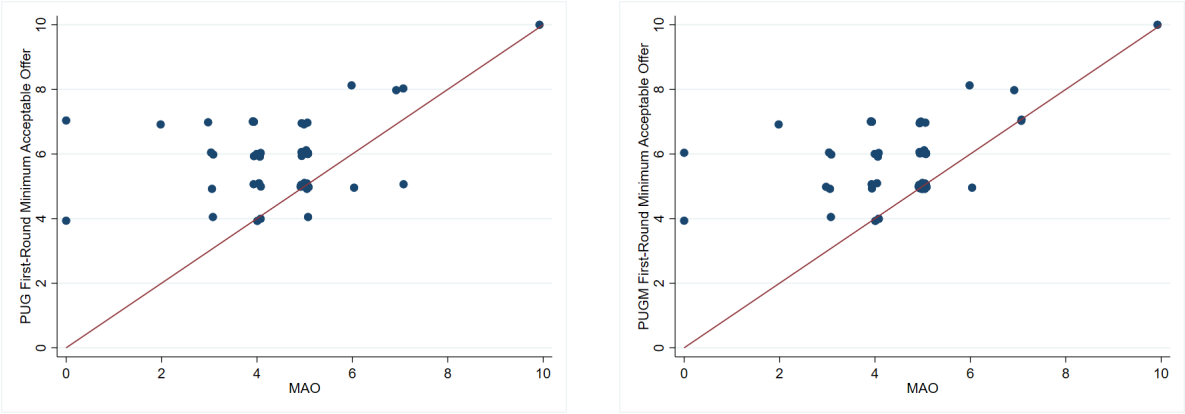
a specific type, but err only very slightly. For example, consider one proposer who sent an offer exactly corresponding to the message for every possible message except 7, for which they sent an offer of three. While there is a chance that this may be intentional, it is reasonable to suspect that this 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.

someone claiming a non-aggressive MAO would be lying. It is easy, in some sense, to propose an offer of 2 when facing a message of two, because the motivation to say such a thing when that offer would not be taken is unclear. There are also greater risks in attempting to call bluffs: perhaps the responder claiming an MAO of 2 is actually misrepresenting a true MAO of 1, but to make that prediction is to risk the very good payoff of 8 a proposer could reasonably expect by offering 2.

Alternatively, just as responders are willing to reject positive offers, proposers may be unwilling to offer more than certain amounts for fairness reasons. This experiment cannot fully distinguish between these candidate explanations, but a hint can be gathered by again examining the MAOs provided by subjects who eventually became plateau-strategy proposers. In particular, it can be examined whether these subjects' largest offers (the plateau value) leave them with an amount other than their reported MAO - if this is the case, then their upper-bound offers are presumably less likely to come from fairness-based unwillingness to offer more. This is the case for 8 of 14 such proposers,[7] suggesting that reported MAOs do not fully explain plateau strategies.

5.6. Implicit Messaging Strategies: Responders

How do responders use implicit messaging? Figure 13 gives responders' first round minimum acceptable offers relative to their MAOs in the PUG and PUGM.



(a) (b)

Figure 13: PUG and PUGM first round minimum acceptable offers vs MAOs

Result 5: Responders' first round minimum acceptable offers exceed their MAOs on average and a majority of the time in both the PUG and PUGM.

[7] Five of these eight made offers which still delegated themselves 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.

The average first round minimum acceptable offer in the PUG was 5.83, more than a full point and statistically significantly larger than the average MAO at 4.57 (two-tailed paired t-test, $t(53) = 5.9, p < .001$). The average first round minimum acceptable offer in the PUGM was 5.74, also significantly larger than MAO ($t(53) = 6.08, p < .0001$). 42 of 54 responders chose the same PUG first round minimum acceptable offer and PUGM first round minimum acceptable offer. 5 and 6 were the most popular choices for both games.

5.7. Discussion

Whether and when an implicit message should be considered deceptive is less clear than was the case with explicit messages. Nonetheless, a willingness to reject an offer in the first round which one would accept in the second round could reasonably be interpreted as deceptive.

By this definition, responders often attempt deception with implicit messaging. "Attempt" is an important distinction here: the actual messages sent are limited to "no" responses to the offers received. This means that a responder who receives an offer of 3 and rejects it, but *would have* rejected an offer of 5, has no way of signaling this additional willingness to reject in the PUG.

5.8. Implicit Messaging Strategies: Proposers

Proposers in the PUG had to specify two offers: a first round offer and a final round offer conditional on the first round offer being rejected. Figure 14 presents proposers' final round offers relative to their first round offers.

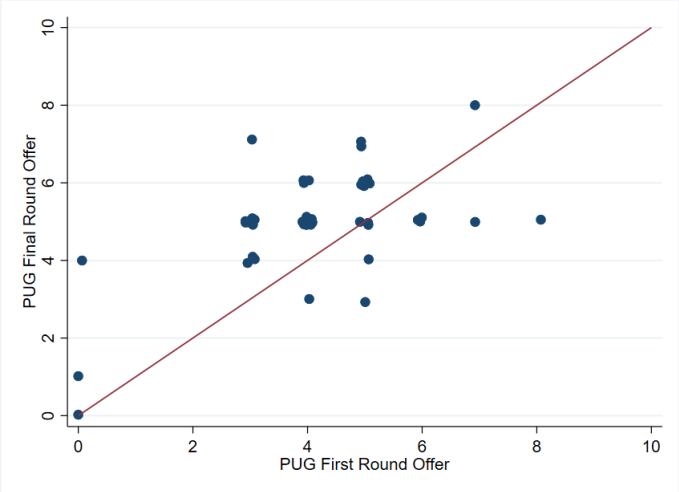


Figure 14: PUG Offers by Round

Ignoring whether the second round offer occurred or not, all but 4 proposers change their offer from the first round to the second round; 8 decrease their offers and 42 increase their offers. The average first round offer was 4.15 and the average second round offer was 5.04, a statistically significant difference (two-tailed paired t-test, $t(53) = 5.09, p < .0001$).

First round offers in the PUG are significantly less than UG offers (two-tailed paired t-test, $t(53) = 2.26$ $p = .028$), but average final round offers were significantly greater than UG offers (two-tailed paired t-test, $t(53) = 3.59$ $p < .001$).

Result 6: A majority of proposers increase their offers when rejected in the penultimatum game, and second-round offers are larger than first round offers on average.

When explicit messages are added again in the PUGM, final round offers become complex as they depend on the explicit content of messages, but PUG and PUGM first round offers can be compared directly, as well as first round PUGM offers and UG offers. PUG and PUGM first round offers are not statistically different on average (two sided paired t-test; PUGM mean: 4.00; $t(53) = 1.34, p = .185$), and 38/54 (70.4%) proposers chose the same first round offer in both the PUG and PUGM. Like the PUG, PUGM first round offers are statistically smaller on average than UG offers (two-sided paired t-test, $t(53) = 3.38, p = .001$).

As in previous analyses, to consider PUGM final round offers, a bootstrap test is used. The difference in expected final offer between the UG and PUGM with 5000 repetitions is performed. From Table 3, the expected PUGM final offer is 5.27, compared to 4.55 for the UG, $z = 4.04, p < .001$. PUG and PUGM final round offers are not statistically different ($z = 1.20, p = .23$)

5.8.1. Discussion

Proposers in the PUG have only to consider if their first offer will be rejected, and so face a possibly simpler task than when considering how to respond to a wider set of explicit messages. Nonetheless, the existence of this first round and potential rejection still serves to increase final offers relative to UG offers.

Many proposers appear to adopt a "lowball first" strategy: their initial offer is small, perhaps just to see if they can get lucky and run into a high-payoff agreement. The consequence of this is very rare agreement in the first round for any proposer not offering at least 5. In this way, the first round of the PUG is almost entirely extraneous: first round offers do not lead to agreement, and also do not reveal very much. They are nonetheless impactful. One conjecture for the motivation behind this low-then-high type of strategy is an additional psychological incentive: lowballing permits proposers to feel like they attempted to bargain hawkishly, before ultimately conceding to a fairer solution. In the UG, sending a fair offer may be experienced like a concession, or a missed opportunity for more.

The non-negligible but small proportion of proposers who reduce their offers after rejection merit mention as well. This move is strange on the surface - if one intended to make a low offer in the ultimatum stage when the responder has more to lose by rejection, why offer more than that in the first stage? One reason

could be an intention to punish perceivedly greedy responders who reject prosocial initial offers. Supporting this hypothesis is that all but one subject who reduced their offer began with a first round offer of five or more.

5.9. Self-selection: Probability Boost Decision

Table 5 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 5: Probability Boost Decision

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).

5.9.1. Discussion

As a measure of detecting if subjects select into their most profitable games, the probability boost choice did not reveal subjects to be particularly well-calibrated, though median errors are not particularly costly. Hypothesis 4 is rejected.

6. General Discussion and Conclusion

In pursuit of the title question about whether bargainers should reveal their reserve values or not, this study finds that choosing explicit or implicit messaging (or both) may not matter, but using *some* form of messaging is very valuable. It is not clear why the different messaging approaches, which operate in fairly distinct ways, ultimately induce similar outcomes. A simple conjecture for the source of this lack of a difference is a ceiling effect: expected agreement rates for all messaging treatments are over 80%, with expected offers slightly over 50% of the pie.

Offers made by proposers are significantly and meaningfully larger in treatments with messaging. This is consistent with earlier findings that introducing communication into games increases cooperative behavior, at least for proposers (Andreoni and Rao [4], Roth [35], Zultan [38]), but unlike these studies which permit

largely unconstrained communication and attribute changes in behavior to prosocial channels, communication in this study is implemented coldly: messages take prespecified forms, and use of the strategy method means subjects cannot even know for sure the actual message received (though condition on each possibility). For this reason, increased offers appear more likely to be driven by impacts on strategic beliefs than changes in prosociality.

Explicit messaging through claims of specific minimum acceptable offers was revealed to increase offers. This contrasts with the finding of Rankin [32] in which subjects who made requests received lower offers on average than those who did not. There are multiple possible sources for this discrepancy. For one, Rankin [32] frames messages in the form of a request, which may carry different strategic or interpersonal connotations than a threat. Additionally, whether a responder makes a request in that study is an endogenous choice, where in the current study, subjects must send a message when in an explicit messaging treatment. For this reason, diminished offers in the former case may be a form of punishment from proposers for asking.

In order to precisely observe and identify the impacts of explicit and implicit messaging, this study focused on one-sided communication. But in myriad bargaining environments, communication is two-sided - one may argue that the proposer's offer in this setting is their explicit message, and choosing a value other than a responder's explicit message may be tantamount to an rejection, but nonetheless, it is treated and interpreted differently. It is not immediately apparent how extending communication to two sides may shift competitive balance. Additionally and similarly, while this study attempts to comment on endogenous strategy selection using the probability boost choice, it remains true that actions and payoffs under a forced bargaining structure may look different from actions and payoffs when the bargaining structure emerges organically from bargainers.

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 communicate during bargaining, it is likely better taken. For those designing bargaining institutions, for example, sellers of high-value items, enabling negotiation (contrasted with anti-haggling policy, perhaps) 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 of agreement, policies which enable messaging are more likely to facilitate agreement than policies which limit messaging.

7. Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the author used ChatGPT in order to aid in mathematical typesetting and the creation of code used to generate graphs. After using this tool/service, the author reviewed and

edited the content as needed and takes full responsibility for the content of the published article.

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Appendix A Model and Proofs

In order to motivate the hypotheses of Section 4, a simple model is constructed in which responders' preferences to accept or reject final offers depend on their types. Propositions 1, 2, and 3 generate the basic 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 $t \in T = \{0, 1, \ldots, 10\}$ prefers to reject offers below a certain threshold t, to accept at or above an offer of t, and more earnings to less when accepting. These responder actions in response to offers can be generated by the utility function

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

where ε is small.

Let $a(t, x)$ be a type t responder's acceptance strategy given an offer x; by intent, these preferences imply

$$a(t, x) = \mathbf{1}\{x \geq t\} \tag{1}$$

is a sequentially rational responder's strategy when no further action will follow.

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: for responder types $t < 10$, the proposer always makes a final/largest offer of t to induce the responder to accept, which the responder does. For type 10 responders, the proposer may make any offer as their equilibrium payoff is always 0 in this case.

Under incomplete information, proposer strategies now have to anticipate a distribution of responder types. Let $f(t)$ be the probability mass function defining a common knowledge prior distribution of types. To avoid trivial cases, let $f(t) > 0$ for at least one $t > 0$ and $f(t) > 0$ for at least one $t < 10$. Let $\mu(t)$ denote a proposer's belief of the probability that a responder is of type t, which will later be conditioned on messages.

Consider first the basic ultimatum game. In this setting, responder strategies only indicate (potentially mixed) acceptance or rejection in response to proposer offers. Proposer actions are offers $x \in \{0, 1, \ldots, 10\}$. Beliefs $\mu(t)$ cannot update and are therefore simply the prior $f(t)$. Thus, the UG under incomplete information is easily solved by backwards induction. Equation 1 uniquely defines sequentially rational behavior for each type of responder in this game, and so the proposer's problem is to maximize their expected payoff given these responder acceptance strategies and prior ($\mu(t) = f(t)$).

$$\max_{x \in \{0,\ldots,10\}} (10 - x) \sum_{t=0}^{x} f(t) \tag{2}$$

Let x^* be a solution to this problem. While x^* need not be unique, hereafter it is assumed to be. This assumption is valid for the experimental data in this study, and is generally the case for other ultimatum game experiments, where half-pie offers are often payoff-maximizing for proposers (Camerer [11]). x^*, μ, and the responder strategies defined by Equation (1) form the unique PBE of the ultimatum game with this form of incomplete information.

A.2 Extending to Games with Messaging

Next consider the UGM under incomplete information about responder MAOs. Intuition suggests that messages sent by responders are cheap talk which should not affect outcomes, since they are costless to send[8] Proposition 1 confirms this intuition.

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) In any PBE in which the proposer uses a pure strategy, there is at most one equilibrium-path offer that yields a strictly positive payoff to the proposer, and this offer must be prior-maximizing. If multiple offers can be sustained on the equilibrium path, any additional such offers are accepted with probability zero and therefore yield zero payoff.

Proof. (i) Suppose all types of responders send $m = 10$, and always accept offers if and only if those offers are greater than or equal to their type. As noted earlier, this acceptance strategy satisfies sequential rationality.

Denote the proposer's beliefs over responder types given a message m with $\mu(t|m)$. Since all types send $m = 10$, on the equilibrium path it must be the case that

$$\mu(t|10) = f(t)$$

by Bayes' rule (there is no updating). Off of the equilibrium path, the proposer adopts the belief

[8] 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 [17].

$$\mu(t \mid m \neq 10) = \mathbf{1}\{t = 0\}$$

so any message other than 10 is presumed by the proposer to be sent by a responder of type 0. The proposer's optimal offer given such a belief is 0.

Given beliefs $\mu(\cdot \mid m)$ and the specified responder final-stage strategy, the proposer chooses an offer $x \in \{0, \ldots, 10\}$ to maximize their expected payoff:

$$\max_{x \in \{0,\ldots,10\}} (10 - x) \sum_{t=0}^{x} \mu(t \mid m).$$

Thus after observing $m = 10$ (the on-path message for all responder types), the proposer solves

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

The solution to this problem is x^* by definition. Given this proposer strategy, no responder type can profitably deviate, since any deviation from $m = 10$ results in an offer of 0 rather than x^*, which is weakly worse for all types. Because all types of players best respond given their opponents' strategies and beliefs, all strategies are sequentially rational, and beliefs are accurate and satisfy Bayes' rule where applicable, this is a PBE.

(ii) Begin with the following lemma:

Lemma 1: Suppose the proposer uses a pure strategy. Then in any PBE, there exists at most one offer which is sent with positive probability and is accepted with positive probability.

Proof of Lemma: Suppose for a contradiction there exists a PBE in which the proposer uses a pure strategy and sends two distinct offers $x_1 > x_2$ both with positive probability.

Let $X : M \to \{0, 1, \ldots, 10\}$ denote the proposer's offer strategy in response to message m. Since the proposer's strategy is pure, there exist disjoint nonempty sets of messages $M_1, M_2 \subseteq M$ such that $X(m) = x_1$ for $m \in M_1$ and $X(m) = x_2$ for $m \in M_2$. Note that messages in M_1 and M_2 must both be sent with positive probability in order to induce x_1 and x_2 to be offered with positive probability.

Consider how different types of responders best respond to such a proposer strategy. If $t \leq x_2$, a sequentially rational responder accepts both offers, though strictly prefers to induce x_1. If $x_2 < t \leq x_1$, then a sequentially rational responder best responds by accepting x_1 and rejecting x_2, and still strictly prefers to induce x_1. Thus, any message $m \in M_2$ can only be sent by types $t > x_1$ in equilibrium.

Now consider proposer beliefs. By the above argument, a proposer with correct beliefs must assign

$$\mu(t|m) = 0 \quad \forall \quad m \in M_2, t < x_1$$

That is, types which are willing to accept x_1 never send messages to induce x_2. But because by assumption there exists an $m \in M_2$ sent with positive probability since x_2 must be offered with positive probability, there must exist types $t > x_1$ which reject both x_1 and x_2 and are therefore able to send $m \in M_2$ from indifference. But this means that if a proposer observes $m \in M_2$, the probability that $t > x_1$ is 1. The proposer's problem given a message $m \in M_2$ then is

$$\max_{x \in \{0,\ldots,10\}} (10 - x) \sum_{t=0}^{x} \mu(t \mid m \in M_2)$$

but

$$\mu(t \mid m \in M_2) = 0 \quad \forall t \leq x_1$$

so this can be rewritten

$$\max_{x \in \{0,\ldots,10\}} (10 - x) \sum_{t=x_1+1}^{x} \mu(t \mid m \in M_2)$$

There are two cases to consider. First, suppose there is positive probability that a responder of type $x_1 < t < 10$ sends a message in m_2. If this is the case, then the proposer can profitably deviate from $x_2 < x_1$ to some $x_2 \geq x_1 + 1$ that is accepted by at least one type in the posterior support, contradicting that $x_2 < x_1$ can be a PBE. Second, consider the case that the only type which sends messages in M_2 is type 10. In this case, while there is no profitable deviation for the proposer by changing x_2, x_2 is only ever sent to type 10 and it is never accepted. Thus, at most one offer can be sent with positive probability and accepted with positive probability. This proves the lemma.

By Lemma 1, in any pure-strategy PBE there is at most one equilibrium-path offer that is both sent with positive probability and accepted with positive probability. If no such offer exists, the claim is immediate. Otherwise, let $\hat{x}$ denote this unique offer. It remains to show that $\hat{x} = x^*$.

Let $M' \subseteq M$ denote the set of on-path messages. In order to include the degenerate cases where only type 10 sends the on-path-but-never-accepted messages, partition M' into the set of on-path messages which induce $\hat{x}$ and those which do not.

$$M^+ := \{m \in M' : X(m) = \hat{x}\}$$

and

$$M^0 := M' \setminus M^+.$$

Now fix any alternative offer $y \in \{0, \ldots, 10\}$. Since $\hat{x}$ is part of a PBE, by sequentially rationality $\hat{x}$ must satisfy that for every $m \in M^+$

$$(10 - \hat{x}) \sum_{t=0}^{\hat{x}} \mu(t \mid m) \geq (10 - y) \sum_{t=0}^{y} \mu(t \mid m)$$

This expression holds for every $m \in M^0$ as well, since payoffs are necessarily zero for any offer in this set. Thus, the expression applies to the entirety of M'.

$$(10 - \hat{x}) \sum_{t=0}^{\hat{x}} \mu(t \mid m) \geq (10 - y) \sum_{t=0}^{y} \mu(t \mid m) \tag{3}$$

Let $\Pr(m)$ denote the (unconditional) equilibrium probability of the message m being sent by a responder. Then taking expectations of the payoffs in inequality 3 over messages yields

$$\sum_{m \in M'} \Pr(m)(10 - \hat{x}) \sum_{t=0}^{\hat{x}} \mu(t \mid m) \;\geq\; \sum_{m \in M'} \Pr(m)(10 - y) \sum_{t=0}^{y} \mu(t \mid m).$$

Rearranging, this becomes

$$(10 - \hat{x}) \sum_{t=0}^{\hat{x}} \sum_{m \in M'} \Pr(m)\mu(t \mid m) \;\geq\; (10 - y) \sum_{t=0}^{y} \sum_{m \in M'} \Pr(m)\mu(t \mid m).$$

By Bayes' rule, for each type t,

$$f(t) = \sum_{m \in M'} \Pr(m)\mu(t \mid m).$$

So

$$(10 - \hat{x}) \sum_{t=0}^{\hat{x}} f(t) \;\geq\; (10 - y) \sum_{t=0}^{y} f(t)$$

And since this was true for every alternative offer y, $\hat{x}$ solves

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

This is exactly definition of x^*. Therefore, in any pure-strategy PBE, the unique equilibrium-path offer that yields strictly positive payoff to the proposer must be the prior-maximizing offer.

□

Proposition 2 verifies that in the penultimatum game, equilibrium outcomes are unchanged by introducing the first round

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. A pure proposer strategy in the penultimatum game can be represented by a first round offer x and a second round offer x' conditional on first round rejection. Consider the following three cases:

Case 1: $x' < x$. In this case, the proposer reduces their offer after the first round is rejected. Consider a responder of type t. Responders with types $t \leq x$ clearly best respond by accepting in round 1, since even if $x' > t$, $x' < x$. Responders with type $t > x$ best respond by accepting no offers. Thus, if $x' < x$, the proposer's payoff is

$$(10 - x) \sum_{t=0}^{x} f(t)$$

. The value of x which maximizes this payoff is x^* by definition.

Case 2: $x' > x$. In this case, the proposer increases their offer after the first round is rejected. Consider a responder of type t. Responders with types $t \leq x$ best respond by rejecting the first round offer and accepting the second round offer, since even if $x > t$, all responders will to accept x' gain by waiting. Responders with type $t > x'$ best respond again by accepting no offers. This means that no responders accept in round 1, and the game reduces to the ultimatum game of round 2. Again by definition, the proposer's expected payoff maximizing offer in this second round is $x' = x^*$.

Case 3: $x' = x$. Responders of types $t \leq x = x'$ best respond by accepting at least one offer, indifferently between the first and second. If $t > x = x'$, the responder rejects in both round. Thus, regardless of how types willing to accept either offer distribute their offers, the proposer maximizes the same expression as the previous two cases, yielding x^* as the optimal offer.

The intuition behind these cases is constant: in a pure strategy equilibrium, responders can select the better of the two offers to take, and therefore the game reduces to the one-shot case.

□

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 final 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 C.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.

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.

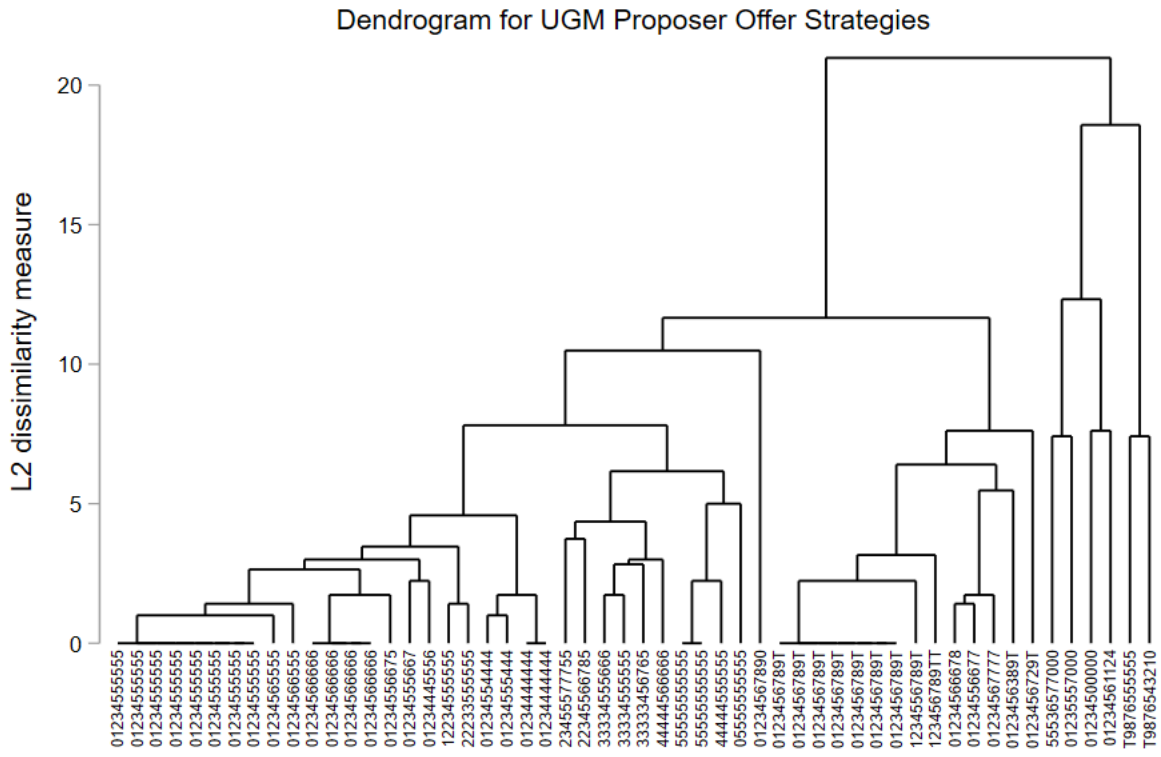

Figure C.1: All Proposer Offer Strategies

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 6: Regression results for Game Expected Payoffs on Probability Boost Choice

Appendix E Interface Screenshots/ Instructions

E.1 Part 1: Practice

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.

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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.

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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:

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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:

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E.4 Probability Boost Choice and Results