Communication architecture affects gender differences in negotiation

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Abstract

Women tend to face worse outcomes than men in negotiations. Prior work documenting the gender earnings gap in negotiations has primarily focused on hypothetical, face-to-face negotiations in contextualized environments. Given the ubiquity of various methods of communication in everyday life that reveal versus obscure gender, such as chat, phone calls, and video calls in the workplace, we examine the extent to which a gender gap in negotiation outcomes varies across settings in which gender is obscured versus revealed. Using context-free, incentivized experiments, we test how the architecture of different virtual communications affects the presence and extent of gender differences in negotiation outcomes. Experimental subjects negotiate over a context-free good in one of five communication modes that mimic naturalistic settings. When the architecture reveals gender (i.e., through video, image, or voice), women earn 6.2% less than men. However, when the architecture obscures gender (i.e., in anonymous messaging or via altered voice), there is no gender earnings gap. We discuss potential mechanisms and implications for efficiency.

JEL Codes: J16, C78, C91

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1 Introduction

Gender disparities in outcomes reliably emerge in negotiation settings. A wealth of existing research shows that in situations where bargaining is necessary, men's outcomes exceed those of women (Blau and Kahn, 2017; Card et al., 2016; Chen et al., 2013; Goldsmith-Pinkham and Shue, 2023; Hegewisch and Mariano, 2020; Kricheli-Katz and Regev, 2016; Leigh and Desai, 2023; Sin et al., 2022). Because bargaining is a ubiquitous feature of pricing in online (e.g., Facebook Marketplace) and highly consequential markets (e.g., housing) for goods and services, and remains prominent in large swaths of the world, it is essential to understand the factors embedded in negotiation settings that lead gender differences in outcomes to arise.

Many studies that have found gender differences in negotiation outcomes (e.g. Mazei et al., 2015; Stuhlmacher and Linnabery, 2013, among others) were conducted face-to-face.[1] There are, however, many forms of acceptable communication that are increasingly prevalent and are also used for negotiations—messaging apps, email, voice calls, and video calls. Notably, these communication methods vary along an important dimension: while some reveal gender, others obscure it. For example, while a communicating partner's gender is likely obvious in a video call, it may not be when receiving a text message from someone not yet known. While these alternative forms of communication are prevalent, little is known of their effects in negotiation and related gender disparities in outcomes. This paper uses controlled economic experiments to examine whether, and to what extent, the communication architecture in a negotiation—and specifically, whether the architecture reveals or obscures gender—differentially affects outcomes for men and women.

Each type of communication architecture brings with it different aspects that might affect

[1] Multiple sources of gender disparities have been documented in the literature, some of which relate to gender differences in negotiation: the willingness to ask (Babcock and Laschever, 2007; Roussille, 2022), the propensity to enter negotiations (Bowles et al., 2007; Exley et al., 2020; Leibbrandt and List, 2015) or tournaments (Miller et al., 2024), the choice to accept tasks with low promotability (Babcock et al., 2017, 2022), and the decision to self-promote (Exley and Kessler, 2022). Additional factors that might contribute to the gender gap in earnings include differences in competitive preferences (Buser et al., 2014; Gneezy et al., 2003; Niederle and Vesterlund, 2007; Small et al., 2007), negotiation skills (Ashraf et al., 2020), discrimination (Castillo et al., 2013), information asymmetry (Busse et al., 2017) and barriers faced by women in the academies (Card et al., 2022, 2023).

the negotiation process and outcomes (e.g., psychological distance, information richness, verbal and non-verbal social cues; see also Stuhlmacher et al. (2007)). Notably, all trends point to a greater likelihood that the use of virtual communication for negotiation will increase in frequency. Thus, it is important to examine not only whether extant findings on gender differences in negotiation extend to these communication architectures, which may or may not reveal gender, but also how different architectures might attenuate or exacerbate gender differences.

To understand how communication architecture affects negotiation, we use neutrally-framed, incentivized experiments. While some treatments obscure gender, others reveal it. Participants are assigned the role of buyer or seller and must agree upon the division of a randomly-sized monetary surplus, determined by private valuation and private cost, through unstructured negotiation of a trading price. The setting is a two-sided, private-information negotiation with a deadline and costs for delay. Our focus is on natural forms of communication that reveal or obscure gender by design. Six treatments are implemented that vary the manner in which participants can communicate to discuss the division of the surplus. There are four treatments that reveal gender. In the Video treatment, communication is similar to that in previous literature utilizing face-to-face communication, allowing for both visual and audio cues (like Zoom or Skype). Notably, while this treatment mimics the basic features of face-to-face communication, it is conducted in a fully virtual environment. Two voice-based treatments—Voice+Chat and Voice which allow for or do not allow for simultaneous chat, respectively—resemble telephone/voice communication, offering audio but not visual cues. Another treatment relies on written chat only, with gender revealed via a photo of the negotiating partner (Chat+Photo). There are two treatments that obscure gender. One treatment (Chat) is similar to the Chat+Photo treatment, but without any photo of the negotiating partner. Another treatment leverages voice-based technology, but with voices altered (Voice Altered) such that the partner's gender cannot easily be inferred. We further leverage survey data, the content of the negotiation dialogue, and external evaluation of the dialogue to examine the gender gap in earnings and interaction with communication architecture.

Several features of the experimental design help to isolate the direct effects of communication architecture on earnings and the gender gap. The negotiation is over the price of a

neutral, context-free good, thus removing any confounds that emerge when negotiating over stereotypically "masculine" or "feminine" goods (Bear and Babcock, 2012). Relatedly, gender is never explicitly mentioned during the study; gender was inferred based on self-report by participants.[2] Participants have a fixed period of time to negotiate, with costs incurred for delay and impasse. This ensures that impasse, a frequent underlying cause of gender disparities (Dannals et al., 2021; Hernandez-Arenaz and Iriberri, 2023), is less likely to occur and that any reported differences are less likely to be endogenous to participants' agreement. By exogenously assigning the communication architecture, the design precludes participants selecting into different methods of communication, which is likely in everyday settings. In particular, while some may prefer to negotiate via video chat (e.g., Zoom, WhatsApp Video), others might feel more comfortable to do so over the phone or by texting.

We have two key findings. First, women earn less than men on average, yet this does not hold for all communication methods. When the communication architecture reveals gender (e.g., video, audio, photo), women earn 6.2% less than men. Yet, when the communication architecture obscures gender (i.e., communication happens via anonymous written chat or via altered voice), the earnings of men and women are equivalent, as men's earnings decline to parity with women's. We cannot reject that the reduction in women's earnings across all architectures that reveal gender is the same. Second, despite the symmetric nature of the negotiation task in which neither buyers nor sellers have an advantage, buyers earn more of the surplus than sellers.[3] The gender gap in earnings when gender is revealed is most prominent in mixed-sex pairings.[4]

To further understand these findings, we analyze strategic behavior revealed during the negotiation dialogue and the impact of communication architecture that reveals gender on

[2]Participants self-reported sex, and we used this information in an aim to recruit an equal balance of those identifying as men and women within each session. In open-ended comments, no participants mentioned that they identified as non-binary.

[3]In the context of negotiations, buyers outperform sellers (Bazerman et al., 1985; Eliashberg et al., 1986; Huber and Neale, 1986; Neale and Northcraft, 1986), and employers outperform employees (Dittrich et al., 2014). Neale et al. (1987) eliminate the buyer-seller discrepancy when buyer and seller roles were given nonsensical names. They argue that, among other reasons, the buyer-seller discrepancy may result from the fact that people are more familiar with the buyer role. Buyers assess value through what they forgo, i.e., their expenditures (Carmon and Ariely, 2000) and focus more heavily on preventing losses (Monga et al., 2005; Appelt et al., 2009). One contribution of this research is to document this framing effect across different communication architectures.

[4]Differential effects by mixed-sex and same-sex pairings have been found by Hernández-Arenaz and Iriberri (2018) and D'Exelle et al. (2023).

how one communicates and is perceived. The architecture affects disclosure of private value or cost, a seemingly disadvantageous behavior, and whether such information is revealed truthfully. Architecture that reveals gender works to men's advantage, as it is more likely that women tell the truth compared to men, men's lies are larger, and thus men earn more of the bargaining surplus. Communication architecture that obscures gender affects what women say in the negotiation in such a way that a woman is more likely to be perceived as a man. Yet men do not change their manner of speaking as a function of communication architecture. In such settings, gender parity of earnings is achieved, albeit at a lower level. We conclude that earnings are largely determined by the structure of the negotiation environment, rather than changes in negotiation strategies induced by the communication architecture.

The role of communication in negotiation is critical. Virtual communication, as opposed to that which occurs face-to-face, could promote the flow of more relevant information if individuals rely less on social context (Sproull and Kiesler, 1986) and possibly focus on more fundamental features of the negotiation. Under some communication architecture, gender roles should fade because the social context is muted (Stuhlmacher and Linnabery, 2013). Previous research has posited, but not tested, that the communication setting might impact negotiation outcomes (McGinn and Croson, 2004; Nadler and Shestowsky, 2006), and meta-analysis suggests that it might differ for male and female negotiators (Stuhlmacher et al., 2007). Our study provides evidence that the architecture of many negotiation settings, because of their gender-revealing structures, can have differential effects on negotiation outcomes.

Individuals may be averse to negotiating face-to-face, but not in some or all virtual settings. Thus mandating the negotiation setting may not be welfare enhancing.[5] Face-to-face negotiations, by their nature, reveal gender, and this may play an important role in producing disparate outcomes for male and female negotiators (e.g. Sproull and Kiesler, 1986; Stuhlmacher and Linnabery, 2013).[6] Prior work has explored the role of communication in negotiations and games (e.g. Chen and Chen, 2012; Mazei et al., 2015; Huang and Low,

[5]Mandating negotiation itself does not necessarily make women better off (Exley et al., 2020).

[6]Research on negotiations among children aged between 4 and 9 shows that gender differences in negotiation emerge among older, but not younger, children (Arnold and McAuliffe, 2021), suggesting that the salience of gender differences in communication might give rise to such differences.

2022), but has not examined how different communication architecture affects negotiations and gender differences in outcomes. We add to this literature by examining a range of communication methods that reveal or obscure gender and their impacts on the negotiation dialogue and heterogeneity in earnings.

More broadly, our findings echo earlier work that removing knowledge of gender can narrow gender gaps in hiring - for example, in orchestra auditions (Goldin and Rouse, 2000) and blinded resumes (Behaghel et al., 2015; Åslund and Skans, 2012). In the context of ultimatum games, certainty (vs. uncertainty) about partner gender has been shown to affect negotiation outcomes, with women receiving lower offers when their gender is known (Eckel and Grossman, 2001; Solnick, 2001).

These findings suggest that richer, virtual negotiation environments that allow for communication between players and focus on the negotiation task at hand can mitigate observed gender gaps in negotiation outcomes. In our study, it is worth noting that some forms of communication (e.g., those involving chat) introduce a potential problem: lower efficiency. In architectures that do not allow for typical verbal communication, negotiations took longer and thus negotiators incurred costs of delay. Our experimental design provides the appropriate counterfactuals to illustrate these trade-offs. Such an approach could be used in other contexts to empirically test the effects of communication architecture that might affect outcomes.

The paper is organized as follows. Section 2 describes the study design and procedures. Section 3 reports the results across communication architecture and the gender gap in earnings. Section 4 discusses possible explanations, and Section 5 presents mediation analysis. Section 6 concludes.

2 Study design

The objective of our study is to examine how communication architecture affects the gender gap in earnings. The guiding premise for the experimental design is that communication architecture can reveal or obscure gender by design, thus making gender more or less salient. Given previous research on gender differences in bargaining (Arnold and McAuliffe, 2021;

Bear and Babcock, 2012; Huang and Low, 2022; Sproull and Kiesler, 1986; Stuhlmacher and Linnabery, 2013), if the architecture reveals gender, we expect women will earn less than men.

2.1 Negotiation task

To test the differential effects of communication architecture on earnings, we sought a setting that resembled how actual negotiations occur and where there was room for negotiation, namely a task in which participants must split monetary gains. In this setting, there is common knowledge that gains from trade are strictly positive, and negotiations would not necessarily resolve quickly or result in impasse.[7] It is well known in two-sided, private information bargaining that there is a multiplicity of equilibria that may favor one side or the other of the bargaining pair (Fudenberg and Tirole, 1991, chpt 10). This is an interesting setting for us because most actual negotiations entail private information on reservation values. We did not want either side of the negotiation to have an advantage a priori. Such a setting, however, does not provide clear predictions on the earnings distribution of the gains from trade among the negotiating partners. Unstructured bargaining is natural in actual negotiations, and it does not limit which side proposes first or the number of offer rounds. The negotiation is allowed to unfold organically, and one can observe the effects of architecture on outcomes and the negotiation process.

Given these requirements, the negotiation setting for our study is bilateral, two-sided, private information with unstructured bargaining and a deadline. The "buyer" and "seller" negotiate the division of a positive trading surplus with monetary incentives.[8] The size of the trading surplus is random and determined by the difference between the buyer's value and the seller's cost, both of which are drawn from common-knowledge distributions. Each player knows their own value or cost, but this is unknown to the other player. The trading surplus shrinks with agreement delay, and there is a deadline to complete negotiation after which payoffs for both players are zero.

[7] The likelihood of impasse is related to the potential size of the trading surplus and depends on whether the surplus is certain or uncertain (Crawford, 1982; Cramton, 1992). The surplus in our setting is uncertain and the potential size is fixed.

[8] The negotiation task is based loosely on Babcock et al. (1995), in which two players ("seller" and "buyer") negotiate over the price of a fictitious good.

Buyers and sellers have no strategic advantage in our negotiation setting, so we do not expect the earnings of buyers and sellers to be different. Information on values and costs are private and drawn from known distributions, and bargaining is unstructured. There is neither a predetermined order for making offers nor a limit on the number of rounds, either of which could favor one of the negotiating parties in receiving a larger share of the surplus (i.e., Rubinstein (1982); Stahl (1972)).

Previous research using unstructured communication and private information usually finds there are fewer disagreements than predicted by theory and efficiency is improved (Radner and Schotter, 1989; Valley et al., 2002; Camerer et al., 2019). The values and costs of buyers and sellers are private, although they might choose to disclose them in a truthful or deceitful manner or not at all. Disclosure in theory makes the revealing side worse off (Ausubel et al., 2002; Fudenberg and Tirole, 1983). Nonetheless, the two parties may prefer to be truthful about their valuations and opt to split the difference of the pie equally (for example, see Keniston et al., 2021).

2.2 Experiment

Participants are randomly assigned to the role of buyer or seller and keep the same role for all four rounds of negotiation. Each negotiation is with a new, randomly-matched partner of the opposite role. In each negotiation round, the buyer is assigned an integer-valued private value, drawn randomly from the range [45, 46, 47, ..., 55], and the seller is assigned an integer-valued private cost, drawn randomly from the range [10, 11, 12, ..., 20].[9] Both the buyer and the seller know that only they can observe their respective values or costs, but the distributions from which the private values and costs are drawn are common knowledge. For each negotiation round, a new value or cost is randomly drawn and made known to the participant prior to the start of the negotiation.

In each round, the buyer and seller negotiate over the trading price of a fictitious good, which determined the profits of each player. The buyer's profit is equal to the private assigned

[9] Of the 924 values randomly drawn from the interval [45, 55] for buyers, the mean value is 49.9 (median 50), and of the 924 costs randomly drawn for sellers from the interval [10, 20], the mean value is 15.2 (median 15). We compare the distributions of the difference between the assigned value or cost from the median for both buyers and sellers and cannot reject that the distributions are the same (Chi-square test p-value = 0.371).

value minus the agreed-upon trading price; the seller's profit is equal to the agreed-upon trading price minus the private cost. Participants are given five minutes to negotiate with their partners. Once they agree on a trading price, their negotiation is complete. If five minutes pass without agreement, then both earn a profit of zero. To reduce the likelihood of impasse and introduce costs of delay, buyers' private values are reduced by 1 and sellers' private costs are increased by 1 every 20 seconds beginning at the 3-minute mark until the end of the negotiation.

At any time, one of the players can choose to submit a trading price. If the other player agrees with the price and submits the same number, the negotiation is complete. In addition, once a new offer is made, that replaces any previously-submitted trading prices. The only method by which a negotiation can be considered complete is that both the buyer and seller need to submit the same price, one following the other.

At the end of the study, one of the four negotiations is chosen for payment by drawing a number between 1 and 4. The number chosen corresponds to the negotiation that is payoff-relevant for all players in the session. All participants are informed of these procedures prior to starting the negotiations.

2.3 Communication treatments

Our focus is to use methods of communication that are commonly used in naturally-occurring environments and reveal or obscure gender by design. Participants complete the four negotiations using one of six methods. Gender is revealed by seeing a photo or video of one's partner or hearing their voice. Gender is obscured by not seeing one's partner or by altering each partner's voice. The communication method is kept constant within a session, and no participant completes more than one session. All communication methods follow the same negotiation rules from Section 2.2. The only difference between treatments is the way in which participants communicate during the negotiation. The experimental treatments, along with their natural communication method analogs, are summarized in Table 1 and described below.[10]

[10]The instructions for the Chat, Video and Voice Altered treatments are included in Appendix B. The Chat+Photo instructions are identical to the Chat instructions but with the addition of the following sentence: "You will see the photo of your partner on the screen during the negotiation, and your partner will see your

Table 1: Experimental Treatments

	Treatment	**Natural communication method analog**
Gender revealed	**Chat+Photo:** written unstructured chat plus photo of partner	message app with photo
	Voice: audio only, normal voice	phone call
	Voice+Chat: audio only, normal voice, written unstructured chat	phone call with messaging
	Video: virtual face-to-face, written unstructured chat	Zoom/Skype with messaging
Gender obscured	**Chat:** written unstructured chat	message app
	Voice Altered: audio only, altered voice	phone call (voice modified)

At no time was gender mentioned. Participants could discern the gender of their partner only via their own inferences through communication. All treatments are virtual and vary only visual and communication mode.

2.3.1 Treatments that reveal gender

Chat+Photo: Participants can freely communicate with their negotiation partner through written, unstructured chat messages. They can provide as much or as little information to the other player as they wish. During the negotiation, participants see a photograph of their partner that was taken before the experiment began. This treatment is like communicating by messaging app with a photo icon.

Voice: Participants can freely communicate with the other player by voice (Skype without video). Participants can speak to their partner but cannot see each other's faces. Participants use headsets with microphones to talk to their partners. The function to send a written message is turned off. This treatment is like communicating by phone.

Voice+Chat: Participants are given identical instructions to those in the Voice sessions. The function to send a written message is turned on.[11] This treatment is like communicating by phone with the ability to also send messages.

photo. Besides this photo, no other identifying information will be available for the seller/buyer, unless you choose to disclose it." The Voice+Chat and Voice treatment instructions are similar to the Video instructions but with audio only, (i.e., no webcam). In the Voice treatment, the message function was disabled. The Voice Altered treatment instructions have more differences so are included in the Appendix.

[11] Although participants had the option to use the message function, few did, and no negotiations used it exclusively. Of all the lines of dialogue, 7.6% were generated by use of the message function, and 90% of this was generated by one participant with a faulty microphone.

Video: Participants are given identical instructions to those in the Voice+Chat sessions. However, they are told that they will be able to freely communicate with the other player through a video call (Skype). Participants can speak to and see their partners. Participants use headsets with microphones to talk to their partners, and a web cam is used to provide the video feed. The function to send a written message is turned on.[12] This treatment is like communicating over Skype or Zoom with the camera turned on. The Video treatment is used for a face-to-face comparison instead of in-person face-to-face communication to minimize additional changes to the communication environment.

2.3.2 Treatments that obscure gender

Chat: Participants are given identical instructions to those in the Chat+Photo sessions. There is no photo of one's partner. This treatment is like communicating by a standard messaging app.

Voice Altered: Participants are given identical instructions to those in the Voice sessions. The only difference is that each participant's voice is altered with a voice-modification software (VoiceMod). All participants' voices are altered to a higher pitch than their natural voice.[13] Care is taken to modify male and females voice such that, after modification, their voices have similar pitches, on average. This was done to make both male and female voices sound indistinguishable, thus making it difficult to discern the gender of one's partner.[14] This treatment is like communicating by phone but with an altered voice.

2.4 Post-experiment survey

After the four negotiations are complete and before payoffs are determined, each participant completes a demographic survey and answers questions aimed at assessing the participant's

[12] Although participants had the option to use the message function, almost no one did, and no negotiations used it exclusively. Of all the lines of dialogue, 0.1% were generated by use of the message function.

[13] We could find no real-time voice modification software that adequately transforms voices into those that sound "gender neutral." We tested "robotic" voices as well as voices that merely transform voice pitches to a gender-ambiguous range, but neither concealed gender. Another alternative could have been to transform voice to text, then use a standard AI/machine voice to read the text back, but this would have precluded natural, back-and-forth communication in real time. Instead, we opted to raise the voice pitch of all participants to a similar (high-pitched) level to better obscure natural voices. This approach allows for natural communication - similar to that in the Voice treatment - but with all voices at higher pitches.

[14] The voice modification software was installed on the computers in the experimental lab in advance. Men and women were seated at computers that were preset to modify a male or female voice, respectively.

attitudes toward and reactions to the negotiation. The participant is asked their sex, i.e., male or female.[15] The response to this question is used to classify participants as male/man and female/woman and as our measure of gender. Participants were asked to rate their first and last negotiation in terms of how they felt along the following dimensions: confidence, relaxed, comfortable, distressed, nervous, and threatened. They were also asked to indicate whether they believe (or remember) that their partners were male or female, or they did not recall, for each of the four negotiations.

2.5 Implementation

The original set of experiments was planned in 2014. Treatments were randomized at the session level. The original set of treatments was conducted at the Interdisciplinary Center for Economic Science (ICES) Lab at George Mason University in 2015-16 with undergraduate students.[16] The original planned set included the following treatments: Chat+Photo, Video, and Chat. The Voice+Chat and Voice sessions were added shortly after. A follow-up set of experiments was conducted at the Economic Research Lab (ERL) at Texas A&M University in April 2024 with undergraduate students.[17] The follow-up set included the following treatments: additional Voice sessions and a new treatment Voice Altered. Although we were concerned about potential population differences between the original and follow-up sets, we found that the populations were remarkably comparable. We find no differences in our main outcome variables in the two sets of Voice sessions which were common between the two samples.[18] Therefore, in what follows, we integrate the follow-up set with the original set of data for subsequent analyses. The analysis adjusts for multiple hypotheses testing (Westfall and Young, 1993) and includes permutation tests (Young, 2019).

[15]Specifically, we asked "What is your sex?," and the only options were "male" and "female." These are the same question and responses that the U.S. Census Bureau uses in its American Community Survey. A participant can respond either "male" or "female" based on how they currently identify their sex. To maintain consistency with the literature, we use the more capacious term "gender" rather than "sex" throughout this paper.

[16]Institutional Review Board (IRB) approval is from George Mason University (802943-1). The data were collected prior to the research emphasis on pre-registration and pre-analysis plans so are not pre-registered.

[17]This set of experiments based on two treatments was pre-registered at the AEA RCT Registry: https://www.socialscienceregistry.org/trials/13334. Appendix C includes preregistered analysis.

[18]We regress a dummy variable for whether the guess of the partner's sex is correct on a dummy variable for the follow-up experiment (p-value = 0.406), and we regress earnings per negotiation on the same dummy (p-value = 0.531). Standard errors are clustered by participant.

There were 462 individuals who participated over 35 sessions, resulting in 924 bilateral negotiations.[19] The Chat+Photo sessions had 68 participants in total, Voice had 144, Voice+Chat had 60, Video had 60, Chat had 66, and Voice Altered had 64. Half of the participants were women, and there is gender balance in role assignment within each treatment.[20] Each session lasted between 45-55 minutes, and average participant earnings were $16.78 (s.d. $5.72), which does not include the participation fee ($5 at GMU, $10 at TAMU).

3 Results

3.1 Treatment validation

Four of the six treatments were designed to reveal the gender of each bargaining partner, and two were designed to obscure gender. Grouping of treatments into those that reveal and those that obscure gender is confirmed in the post-experiment questionnaire in which participants were asked to recall the gender of their bargaining partner in each of the four negotiations.

In the treatments in which gender is revealed by design (Chat+Photo, Voice, Voice+Chat, Video), 73.6% of participants correctly report the gender of their partner in all four negotiations, 88.1% correctly report the gender in three or more negotiations, and 1.6% fail to report the correct gender of any partner (Figure A.1). In contrast, when gender is obscured (Chat, Voice Altered), 16.4% correctly state the gender of all four partners, and 12.9% fail to report the correct gender of any partner.[21] In pairwise comparisons of the distributions of number of correct reports of partner's gender, treatments that reveal gender by design (Chat+Photo, Voice, Voice+Chat, Video) are most similar and treatments that obscure gender by design (Chat, Voice Altered) are most similar (Table A.3).

[19] Table A.1 summarizes data collection details across treatments. The original set of experiments included 338 individuals, 27 sessions and 676 bilateral negotiations. The follow-up set included 124 individuals, 8 sessions and 248 negotiations.

[20] Women comprised 47% of subjects in the Video treatment, 53% in Voice+Chat, 51% in Voice, 50% in Voice Altered, 50% in Chat+Photo, and 53% in Chat. We cannot reject equal distribution of men and women assigned to the role of buyer or seller for each treatment (chi test of equal distribution p-values: 0.459 (Chat), 1.00 (Chat+Photo), 0.301 (Voice+Chat), 0.317 (Voice), 0.121 (Video), 1.00 (Voice Altered).

[21] In Voice Altered, 28.1% correctly state the gender of all four partners, and 4.7% fail to report the correct gender of any partner. In Chat, 1.9% correctly state the gender of all four partners, and 23.1% fail to report the correct gender of any partner. Not correctly reporting the gender of any partner in Chat is higher than what it would be if participants guessed randomly (6.25%). This suggests that participants thought they could guess correctly but were wrong more often than chance.

Participants express more uncertainty, and are more likely to be wrong, about their partner's gender in treatments that obscure gender. For each guess, a participant could choose male, female, or indicate that they don't know. Among each participant's four guesses, in the Chat and Voice Altered treatments, respectively, the average proportions of guesses that are incorrect are 40% and 19% and that are indicated as don't know are 19% and 15% (Figure A.2). In the Gender Revealed treatments, the proportion of guesses that are incorrect is 6% and that are indicated as don't know is 5%.

These results are further confirmed in regression analysis that shows the probability of guessing the partner's gender correctly is 40-58 percentage points larger in treatments in which gender is revealed (Table A.2). Men and women are no more likely to guess correctly, nor are participants more likely to guess correctly if their partner is a woman.[22] The treatments are balanced (Table A.2) on covariates and pairings of mixed- and same-sex pairings.

Taken together, these findings confirm that the communication architecture used in our treatments did reveal and obscure gender as we expected. Participants were much more likely to be aware of their partner's gender during the negotiation in treatments that revealed gender (Chat+Photo, Voice, Voice+Chat, Video), and this awareness was similar across each of these treatments. Participants were far less aware of their partner's gender during the negotiation in treatments that obscured gender. Gender was more ambiguous in Chat than in Voice Altered.

3.2 Negotiation efficiency

Almost all negotiations ended in agreement. Table 2 shows that, of the 924 negotiations, fifteen (1.6%) resulted in an impasse in which neither the buyer nor the seller realized a positive profit.[23] We exclude these fifteen negotiations in our analysis; however, all results hold if they are instead included.

Negotiations that did not end in an impasse (909) took, on average, 96.4 seconds to

[22] We regress a dummy for correct guess on a dummy for a female participant (p-value = 0.757), dummy for a female partner (p-value = 0.120), and dummy for Gender Revealed (p-value = 0.000) and an interaction of Gender Revealed and female partner (p-value = 0.208).

[23] This high agreement rate contrasts with the 23% of failed negotiations documented in previous studies examining communication in bargaining (Chen and Chen, 2012). Differences relative to prior work may have resulted from the presence of strong financial incentives to reach an agreement, the explicit costs of delay, gender balance of our sample, cultural differences, or a combination of all of these factors.

Table 2: Negotiation agreement, length, efficiency, and earnings

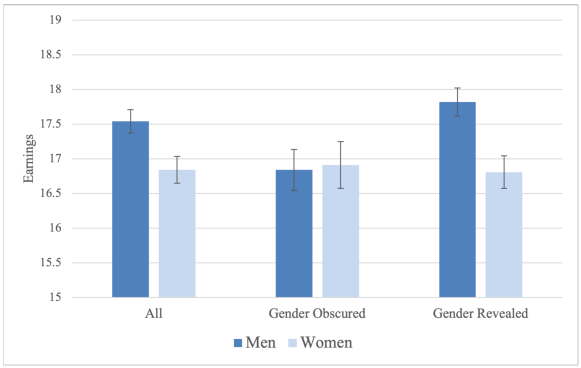
	Number of negotiations	Number of impasses	Negotiation length (seconds)	% inefficient (> 3 min)	Average number of words	Average earnings
Video	120	0	76.7	2.5	162.2	$17.57
Voice	288	6	83.0	4.5	133.6	$17.40
Voice Altered	128	2	93.1	4.7	134.2	$17.36
Voice+Chat	120	2	94.3	9.2	115.8	$17.06
Chat+Photo	136	4	118.1	16.2	43.6	$17.09
Chat	132	1	126.6	18.9	43.2	$16.41
Overall	924	15	96.4	8.7	106.7	$17.18

Note: Negotiation length and average earnings exclude the 15 negotiations that ended in an impasse. All other columns use the data from all 924 negotiations.

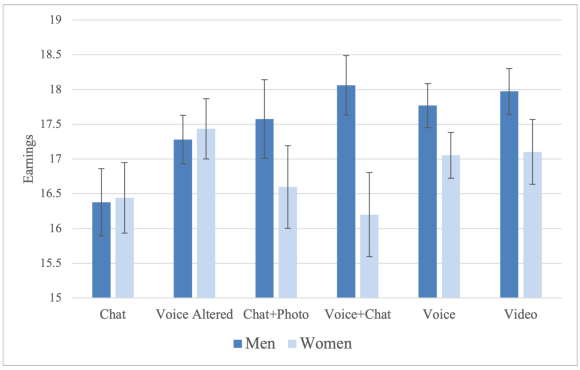
reach an agreement, though the timing varied across treatments. In the Video treatment, negotiations took 76.7 seconds; in the Voice treatment, they took 83.0 seconds; in the Voice Altered treatment, they took 93.1 seconds; and in the Voice+Chat treatment, they took 94.3 seconds. The Chat and Chat+Photo treatments took similar amounts of time: 126.6 and 118.1 seconds, respectively. The negotiations with audio (i.e., Video, Voice Altered, Voice+Chat, and Voice) were completed significantly more quickly than those in which only chat was allowed.[24]

Of the negotiations that ended in agreement, the majority (91.3%) ended before buyers and sellers incurred costs of delay (i.e., at the three-minute mark), taking an average of 86 seconds to complete. The remaining 8.7% of negotiations took an average of 223 seconds to complete. The Chat and Chat+Photo treatments were more likely than the other treatments to exceed three minutes, at which point the bargaining surplus was reduced in an efficiency loss for both bargaining partners. In the Chat treatment, therefore, 18.9% of negotiations were inefficient, which is reflected in average earnings of $16.41 compared to $17.57 in the Video treatment.

[24] A linear regression of time to complete the negotiation is run on treatment dummies (Chat is omitted) with standard errors clustered by participant. The null hypothesis that Chat+Photo is different from Chat is rejected (p-value = 0.377). The null hypothesis that Voice, Voice Altered and Video are equal is rejected (F-test p-value = 0.0243). Participants used written messages 7.6% of the time in Voice+Chat, and 90% of those were by a participant with a faulty microphone.



(a) All, gender obscured/revealed



(b) Treatments

Figure 1: Gender gap in earnings

Notes: Error bars are standard errors of the mean. Panel (a) shows the gender gap in earnings. All is the overall sample, Gender Obscured are the treatments that obscure gender (Chat, Voice Altered), Gender Revealed pools treatments that reveal gender (Chat+Photo, Voice, Voice+Chat, Video). Panel (b) shows the gender gap in earnings for each treatment separately. The gender gap in earnings is tested by OLS regressions of earnings on a dummy variable for female with standard errors clustered by participant (Table A.4).

3.3 Gender gap in earnings and treatment effects

The gender gap in earnings is shown in Figure 1. Panel (a) shows that, in the overall sample, women earn 5.1% less than men ($17.60 vs. $16.71). This earnings gap is significant (difference in means p-value = 0.027) and is verified in an OLS regression of earnings on gender controlling for role assignment and round fixed effects (Table 3, Column 1). Note that here and throughout the analyses, to adjust for multiple-hypothesis testing, we also report p-values based on the Westfall and Young (1993) permutation as programmed in Jones et al. (2019)[25] and, as recommended by Young (2019), permutation p-values which are randomization inference p-values testing the sharp null of no treatment effects.

We further examine the earnings gap for communication architecture that reveals gender compared to architecture that obscures gender. Gender of bargaining partners is revealed by design either visually (Chat+Photo, Video) or by voice (Voice, Voice+Chat, Video). Gender is obscured in Chat and Voice Altered. We explore whether there are differential treatment effects of the communication architectures that reveal gender or obscure gender by design

[25]This procedure aims to adjust for the familywise error rate (i.e., probability of making a type I error) and uses bootstrapping to allow for dependence among outcomes. This correction is typically considered more conservative than the Benjamini-Hochberg False Discovery Rate. However, it is less conservative than a Bonferroni correction that assumes outcomes are uncorrelated.

on earnings. Column 2 in Table 3 reports the results of an OLS regression of earnings on treatments, controlling for role assignment and round fixed effects. The omitted treatment is Chat. All treatments have a positive sign on earnings relative to Chat.

The bottom panel of Column 2 tests the null hypothesis that all treatments in which gender is revealed by design have the same coefficient. This cannot be rejected (p-value = 0.7934). To focus analysis on communication architecture that reveals or obscures gender by design, and to increase power, we pool Chat+Photo, Voice, Voice+Chat and Video into one group we call Gender Revealed and the Chat and Voice Altered treatments into another group we call Gender Obscured for further analysis.[26] The pooled treatment effect of Gender Revealed on earnings is reported in Column 3. Participants in Gender Revealed treatments earn \$0.43 more than those in the Gender Obscured treatments, but this is imprecisely estimated.

Given the positive effect of the Gender Revealed treatments and the overall gender gap in earnings, we next examine whether the gender gap in earnings is larger when gender is revealed than when gender is obscured. We first examine this separately for each treatment. Panel (b) in Figure 1 shows average earnings separately for men and women by treatment. There is no gender gap in earnings in treatments that obscure gender, with both men and women earning \$16.40 in Chat and \$17.30 in Voice Altered. In treatments that reveal gender by design, there is a gender gap with men earning \$0.72-\$1.85 more than women. The gap represents 4-11% higher earnings, however, it is imprecisely estimated in each treatment separately (Table A.4). We test the hypothesis that the gender gap in Gender Revealed treatments is the same, and we cannot reject it (p-value = 0.7608), nor can we reject the hypothesis that the gender gap is the same in Gender Obscured treatments (p-value = 0.8601) (Table A.4).

Next, we examine the gender gap in earnings in the pooled treatments where the communication architecture reveals or obscures gender. There is a significant gender gap in earnings (Figure 1, Panel (a)), with women making 6.2% less than men (\$17.88 vs. \$16.78, difference in means p-value = 0.014). Yet, when the architecture obscures gender, there is no significant

[26] Section 3.1 provides evidence that this pooling is valid in terms of treatment validity. Participants are much more likely to correctly guess the gender of their negotiation partner in Gender Revealed treatments.

Table 3: Gender gap in earnings and treatment effects

	(1) Gender gap	(2) Unconstrained treatment effects	(3) Constrained treatment effects	(4) Heterogeneous treatment effects
	Earnings	Earnings	Earnings	Earnings
Gender Revealed (GR)			0.43	1.00**
			(0.33)	(0.40)
permutation p-value				< 0.0169 >
Westfall-Young p-value				< 0.0310 >
Female (F)	-0.65**			0.16
	(0.32)			(0.54)
Westfall-Young p-value				< 0.7690 >
Female × Gender Revealed (F×GR)				-1.12*
				(0.66)
permutation p-value				< 0.0981 >
Westfall-Young p-value				< 0.1490 >
Chat+Photo (T2)		0.67		
		(0.67)		
Voice+Chat (T3)		0.65		
		(0.64)		
Voice (T4)		0.99*		
		(0.51)		
Video (T5)		1.15**		
		(0.55)		
Voice Altered (T6)		0.94*		
		(0.54)		
Seller	-2.01***	-2.03***	-2.03***	-2.01***
	(0.32)	(0.32)	(0.32)	(0.31)
Constant	18.40***	17.31***	17.78***	17.68***
	(0.34)	(0.52)	(0.40)	(0.42)
Observations	1,818	1,818	1,818	1,818
R-squared	0.04	0.04	0.04	0.04
H0: T2=T3=T4=T5, p-value		[0.7934]		
H0: T2=T3=T4=T5=0, perm p-value		< 0.3936 >		
H0: GR=0, perm p-value			< 0.2068 >	
H0: F+F×GR=0, p-value				[0.0123]
H0: GR=F×GR=0, perm p-value				< 0.0458 >

Note: Ordinary least square regressions are reported with earnings as the dependent variable. All regressions include dummy variables for round number. Gender Revealed indicates treatments that reveal gender. The omitted treatments then obscure gender (Chat, Voice Altered). Female indicates a female participant. Standard errors are clustered by participant and reported in parentheses. P-values are in square brackets ([]). Permutation and Westfall-Young (Westfall and Young, 1993) p-values are in angle brackets (<>). Westfall-Young p-values adjust for multiple hypothesis testing. Permutation p-values are randomization inference p-values testing the sharp null of no treatment effects (based on Young, 2019). *** p<0.01, ** p<0.05, * p<0.10

gender gap in earnings, due to a decline in men's earnings such that both men and women earn about $16.40.

Column 4 of Table 3 confirms that communication architecture that reveals gender by design leads to a significant gender gap in earnings. These results hold when adjusting for multiple hypothesis testing (Westfall and Young, 1993) and with permutation tests. The bottom panel of Column 4 reports joint hypothesis tests that confirm that the gender gap in Gender Revealed treatments is significant (p-value = 0.0123). Permutation tests confirm that the treatment effect of Gender Known and its interaction with being female are jointly significantly different from zero.

Despite the symmetric nature of the bargaining environment for buyers and sellers, buyers consistently earned more than sellers.[27] We had no a priori reason to believe that there would be earnings differences by role because neither the buyer nor the seller have an advantage in the negotiation. Table 3 shows that sellers consistently earn about $2 less across all specifications.

It is possible that the gender pairing of the negotiation partners may affect earnings. In particular, earnings could be a function of whether a given participant is negotiating with someone of the same or different gender. We test for this possibility by replicating the analysis in Column 4 of Table 3, for mixed-sex and same-sex pairings. When gender is obscured, there is no significant difference in earnings of men and women in same- and mixed-sex pairings (Figure A.3, Table A.5). However, when communication architecture reveals gender by design, there is a significant gender gap in earnings in mixed-sex pairings. Women earn 10% less than men (p-value = 0.000).

Taken together, our findings demonstrate that when the communication architecture reveals gender—either by photo, voice, or video—women receive a smaller share of the trading surplus than men do. However, when gender is obscured (i.e., through anonymous chat or altered voice), there is no gender gap in earnings.

[27] This is broadly consistent with prior research on buyer-seller discrepancies (e.g. Bazerman et al., 1985; Eliashberg et al., 1986; Huber and Neale, 1986; Neale and Northcraft, 1986) and with the possibility that cultural factors determine buyer-seller differences in negotiation, given that the opposite effects of role inequity are found in matrilineal societies (Andersen et al., 2018).

4 Understanding the gender gap in earnings

The findings show that being a woman has a detrimental effect on earnings when gender is revealed. So does role assignment; those assigned to the role of seller earn substantially less than those assigned to the role of buyer. Past literature on negotiation and psychology point to several possible mechanisms, suggesting that differences in the bargaining environment could affect an overall difference in negotiation outcomes. First, because gender cues ought to be more salient in situations with limited cognitive resources (Eagly and Karau, 2002; Kruglanski and Freund, 1983), differences in time pressure brought about by the communication architecture could partially drive the gender gap in earnings. Second, the relative salience of gender resulting from the communication architecture could undermine women's confidence during negotiation (Exley and Nielsen, 2023; Farber and Rickenberg, 1999; Stuhlmacher et al., 2007). Third, tough and firm communication tends to outperform warm and friendly communication in bargaining contexts (Jeong et al., 2019). Finally, if the communication architecture itself fosters or inhibits strategic behavior of women to a greater extent than men, we might expect that there are differences in non-strategic behavior between men and women.

We explore potential sources of the gender gap in earnings as suggested by these mechanisms. A formal mediation analysis of these sources and others is presented in Section 5.

4.1 Time pressure

Lower earnings for female negotiators could arise due to feeling rushed and wanting to swiftly conclude the negotiation or because of gender cues that become more salient under time pressure. In a number of domains, women fare worse in high time-pressure environments.[28] Also, if communication architecture that reveals gender and makes it salient creates additional time pressure, then we may expect gender differences in time taken as a function of the communication architecture.

We examine differences in the length of a negotiation by the gender composition of the

[28]These include tournaments (Shurchkov, 2012), chess (Dilmaghani, 2020), tests (De Paola and Gioia, 2016; Montolio and Taberner, 2021), and cognitive tasks (Voyer, 2011).

bargaining pair and communication architecture. If women, or men, feel especially rushed with an opposite-gender partner, negotiations in mixed-gender pairings should complete more quickly. We do not find significant effects of mixed-gender pairing or when interacted with communication architecture that reveals gender (Table A.6). Thus, we do not find evidence that men and women experienced differential time pressure.

4.2 Confidence

Gender differences in confidence could also underlie gender gaps in earnings.[29] After all negotiations were complete, participants were asked to rate, on a 7-point Likert scale, how confident they felt during their first and last negotiations.[30] We acknowledge that this is an imperfect measure of confidence, as it was asked after all negotiations were complete and may merely reflect ex post consistency with outcomes. However, as we show in Section 4.4, these self-reports of confidence are corroborated by external evaluators. Using these self-reports, we find a negative effect of being female and being assigned to the role of seller on confidence (Table A.7). In particular, compared to men, women reported that they were about 16% less confident; and compared to buyers, sellers reported that they were about 8% less confident. Effects are similar in same- and mixed-sex pairings. These effects hold whether or not the communication architecture reveals or obscures gender. Thus, confidence may play a role in the earnings gap.

4.3 Strategic behavior

Differences in the extent to which actors engage in strategic versus non-strategic behavior may contribute to gender differences in negotiation outcomes. In general, communication that reveals private information is non-strategic.[31] Relatedly, making a first offer may be disadvantageous, as it reveals information to the second-mover that can be leveraged against

[29] Gender gaps in the propensity to negotiate pay are partially explained by male-female differences in confidence (Biasi and Sarsons, 2022). Trends are similar for the propensity to enter competitions (Niederle and Vesterlund, 2007), with self-confidence playing a large role (van Veldhuizen, 2022).

[30] 1 indicated "not at all" and 7 indicated "extremely." Participants were also asked to rate these negotiations on other dimensions (i.e., relaxed, comfortable, distressed, nervous, and threatened). We focus on confidence, as these other dimensions are highly correlated with confidence.

[31] Disclosure, in general, is not strategic (Ausubel et al., 2002; Fudenberg and Tirole, 1983). Revealing one's preferences or reservation value in a negotiation is costly, although less so among experienced negotiators (Murnighan et al., 1999).

the party that made the offer.

Yet some types of communication may be strategically advantageous, i.e., being deceptive. Although there are many ways one can deceive, the most common forms of deception in negotiations are informational or emotional deception (Gaspar et al., 2019). In addition to paltering—the use of truthful but misleading statements (Rogers et al., 2017)—lying about reservation prices is so ubiquitous that professional negotiators barely consider it to be a form a deception (Shell, 1991). Communication architecture can affect the extent to which people use deception (Conrads and Lotz, 2015), and face-to-face interaction tends to promote more honest communication (Van Zant and Kray, 2014; Conrads and Lotz, 2015). The propensity to tell the truth or lie may also differ by role and gender.[32]

We examine whether there are gender differences in strategic behavior during the negotiation along these dimensions, and whether such differences are a function of communication architecture that reveals gender. The negotiation dialogue is not rich enough to produce reliable machine learning or sentiment analysis. We hand-code the data for strategic and non-strategic behavior (i.e., first offers, revealing value/cost).[33] Both the act of making the first offer as well as the size of the first offer could disadvantage the party that proposes it, as doing so sets the earnings bounds for a negotiation. Revealing a high willingness to pay or a lower willingness to accept could result in lower earnings. Not surprisingly, given that earnings for buyers (sellers) are determined by the difference between the trading price and the buyer's (seller's) value, sellers make higher first offers than buyers ($35.42 v. $26.98). For both sellers and buyers, there are no gender differences in the size of first offers.[34] Table 4, Column 1, shows that there are no gender differences in the probability of making the first offer in the negotiation.[35]

[32]In ultimatum games, proposers (i.e., those who move first) are more likely than responders are to lie, and they lie to a greater extent when they have more incentives to do so (Boles et al., 2000). While communicating first may be non-strategic, it can be effective if the communication is deceptive. There is also evidence that women are perceived to be more likely to be misled in negotiations (Kray et al., 2014).

[33]Negotiation dialogue is converted into text form. Written negotiations are already in text, and verbal communication recordings are transcribed by Rev, a professional transcription service, and Turboscribe.ai, an AI translation service. First offers and amount offered are tagged via a search of first occurrence for each negotiation. Suggesting to reveal value/cost, revealing value/cost, and revealing value/cost truthfully is coded by research assistants who read through each negotiation dialogue.

[34]For buyers, first offers by men are $26.43 and by women are $27.51 (difference in means p-value = 0.1839). For sellers, first offers by men are $36.12 and by women are $34.77 (difference in means p-value = 0.1365).

[35]A first offer is made in all negotiations, so a treatment dummy for Gender Revealed is suppressed.

Table 4: Strategic behavior

	(1) Make first offer	(2) Suggest reveal value/cost	(3) Reveal value/cost	(4) Reveal value/cost truthfully	(5) Size of lie
Gender Revealed (GR)		0.04	0.02	0.04	-0.14
		(0.04)	(0.05)	(0.08)	(0.84)
Westfall-Young p-value		< 0.624 >	< 0.914 >	< 0.787 >	< 0.915 >
Female (F)	0.03	0.01	-0.06	0.17*	-1.12
	(0.04)	(0.04)	(0.06)	(0.10)	(0.85)
Westfall-Young p-value	< 0.595 >	< 0.819 >	< 0.585 >	< 0.173 >	< 0.299 >
Female × Gender Revealed (F×GR)	-0.05	-0.03	-0.01	-0.00	0.30
	(0.04)	(0.06)	(0.08)	(0.12)	(0.94)
Westfall-Young p-value	< 0.365 >	< 0.763 >	< 0.914 >	< 0.984 >	< 0.912 >
Seller	0.03	0.01	0.01	0.01	-0.35
	(0.03)	(0.03)	(0.04)	(0.06)	(0.41)
Constant	0.49***	0.10***	0.31***	0.55***	1.75*
	(0.03)	(0.03)	(0.05)	(0.08)	(0.98)
Observations	1,676	1,676	1,676	621	621
R-squared	0.00	0.01	0.02	0.04	0.02
Gender gap in GR	-0.03	-0.02	-0.08	0.17	-0.82
H0: F+F×GR=0, p-value	[0.3482]	[0.5353]	[0.0857]	[0.0124]	[0.0612]

Note: Each observation is a participant's decision in a negotiation. Missing observations are due to corrupted audio recordings. Ordinary least squares regressions are reported. Dependent variables are 0-1 on whether or not the subject made the first offer (Column 1), suggested to reveal value/cost (Column 2), revealed their value/cost (Column 3), and conditional on revealing their value/cost, did so truthfully (Column 4). In Column 5, the dependent variable is the difference between the revealed value/cost and the participant's assigned value/cost, conditional on revealing their value/cost. Gender Revealed pools treatments that reveal gender. The omitted treatments obscure gender (Chat, Voice Altered). Female indicates a female participant. Regressions include dummy variables for round number. Standard errors are clustered by participant and reported in parentheses. P-values are in square brackets ([]). Westfall-Young (Westfall and Young, 1993) p-values are in angle brackets (<>). Westfall-Young p-values adjust for multiple hypothesis testing. *** p<0.01, ** p<0.05, * p<0.10

Because earnings are determined by the difference between the trading price and one's randomly assigned private value, revealing one's private value or cost yields no advantage to the party that chooses to reveal. We examine whether participants suggest to reveal value or cost, whether they in fact reveal the value or cost, whether they reveal the value or cost truthfully given they choose to reveal and the difference between the revealed and assigned value or cost.

Table 4 reports OLS regression results of each behavior on gender, the Gender Revealed treatments, and their interaction.[36] Column 2 shows that participants suggest to reveal

[36]Table A.8 replicates Table 4 by each communication architecture separately.

private values or costs 10% of the time. There are no significant gender or treatment effects. Column 3 shows that participants reveal private values or costs 31% of the time. The bottom panel shows there is a marginally significant gender gap when gender is revealed: Women are 8 percentage points less likely than men to reveal the value or cost. Column 4 reports the effect of gender and treatment on revealing the value or cost truthfully, conditional on revealing. There is a gender gap in telling the truth in the Gender Revealed treatments with women being 17 percentage points more likely than men to reveal their private value or cost truthfully. Column 5 reports the difference between the reported and assigned value or cost, i.e., size of the lie, conditional on revealing. There is a gender gap in the size of this difference in Gender Revealed treatments with women's reports being \$0.82 lower than men's. In other words, the size of men's lies are twice as large as those of women's.

Although men and women are equally likely to make the first offer and to suggest the revelation of private value or cost during the negotiation, men are slightly more likely than women to reveal their value or cost, and when they do, they are far more likely to lie about it and their lies are bigger. These strategic behaviors may contribute to the gender gap in earnings in the Gender Revealed treatments.

4.4 External perception of dialogue

Communication architecture may affect the manner in which people speak, i.e., what they say, how they say it, and how they are perceived. In all treatments, written and spoken dialogue was recorded; text-based chat was captured in the Chat and Chat+Photo treatments and audio recordings were captured in the Voice, Voice+Chat, Voice Altered and Video treatments and transcribed into text by professional services.

To understand how the architecture affected communication and how it is perceived, we develop various measures from external ratings of the negotiation dialogue. Individual raters (undergraduate students at Texas A&M) not involved in the experiment were hired to rate the dialogue along several dimensions. Raters viewed the entire written dialogue of a given negotiation and were asked to rate one side of the negotiation (i.e., either the buyer's text or the seller's text) along one of four dimensions: (1) whether or not they believed that the person who generated that side of the dialogue was male or female, and how (2) confident,

(3) competitive, and (4) cooperative the person was. In the latter three dimensions, raters indicated agreement using a scale of 1 ("Not at all") to 10 ("Extremely"). Importantly, raters were fully blind to the experimental design, the gender of both partners in the negotiation pair, and the treatment from which the dialogue was drawn. Each rater evaluated twelve different negotiations along just one of the four dimensions and always rated either the buyer or the seller side of the negotiation. This procedure kept the task simple for the rater, ensured that the rater never rated both sides of the same negotiation, and provided independent ratings for each negotiation and role.

We hired 1,713 individuals to rate the negotiations. They were paid a flat fee of $5 to complete all the ratings plus a bonus of $3 if their rating was close to the other raters for a given negotiation.[37] Ratings took about 10 minutes to complete, and each side of each negotiation was rated by 3-4 individuals. Average ratings are used in the analysis.

Table 5 reports OLS regressions of average ratings for the negotiation dialogues. Each observation represents the average response or rating for one side of the negotiation dialogue (buyer or seller) for all negotiations. The response or rating is regressed on a dummy variable that indicates whether the negotiator who generated the text is a woman, a dummy variable for the negotiation having been generated in a Gender Revealed treatment, and their interaction.

Column 1 of Table 5 examines whether independent raters could, based on text alone, guess whether that text came from a male or female negotiator. For male negotiators, whether the communication architecture reveals or obscures gender, raters correctly guessed their gender from the text 61% of the time. This is significantly different from chance.[38] For female negotiators, raters were less able to correctly guess the gender compared to men. They guess correctly 51% of the time when gender is revealed and 46% of the time when gender is obscured. In other words, when gender is obscured, the dialogue of men and women are perceived similarly and more likely to be generated by a man (61% of the time for male

[37] Specifically, if the response for one randomly-chosen negotiation out of the twelve was within one point of the average choice of two other raters who also rated the same negotiation, the bonus was awarded.

[38] The hypothesis that the probability of guessing a man's gender correctly is different from 0.5 is rejected when gender is obscured (p-value = 0.0000) and revealed (p-value = 0.0000). The hypothesis that the probability of guessing a woman's gender correctly is different from 0.5 is not rejected when gender is obscured (p-value = 0.1492), nor when gender is revealed (p-value = 0.6988).

Table 5: External ratings of negotiations

VARIABLES	(1) Guess correct gender	(2) Confident	(3) Cooperative	(4) Competitive
Gender Known	-0.02	-0.24	0.18	-0.26
	(0.03)	(0.15)	(0.16)	(0.17)
Westfall-Young p-value	< 0.507 >	< 0.178 >	< 0.464 >	< 0.130 >
Female	-0.15***	-0.31*	0.06	-0.51***
	(0.03)	(0.18)	(0.19)	(0.19)
Westfall-Young p-value	< 0.000 >	< 0.178 >	< 0.864 >	< 0.022 >
Female × Gender Known	0.06	0.27	-0.09	0.48**
	(0.04)	(0.22)	(0.23)	(0.23)
Westfall-Young p-value	< 0.232 >	< 0.209 >	< 0.864 >	< 0.085 >
Constant	0.61***	5.74***	6.27***	4.93***
	(0.03)	(0.12)	(0.12)	(0.13)
Observations	1,664	1,664	1,664	1,664
R-squared	0.03	0.00	0.00	0.00

Note: Ordinary least squares regressions are reported. The dependent variables are: average of whether or not the guess of the gender of the person generating the negotiation dialogue is correct, i.e., 1 if correct, 0 otherwise (Column 1), average rating of confidence of the dialogue (Column 2), average rating of cooperativeness of dialogue (Column 3) and average rating of competitiveness of dialogue (Column 4). Each observation is the average rating for one side of a negotiation dialogue, either the buyer or the seller. Missing observations are due to corrupted audio recordings. Gender Revealed pools treatments that reveal gender. The omitted treatment obscures gender (Chat, Voice Altered). Female indicates a female participant's dialogue is evaluated. Standard errors are clustered by participant and reported in parentheses. Westfall-Young (Westfall and Young, 1993) p-values in angle brackets (<>). Westfall-Young p-values adjust for multiple hypothesis testing within a regression. *** p<0.01, ** p<0.05, * p<0.10

negotiators and 54% of the time for female negotiators). However, when gender is revealed, the dialogue of men and women are more likely perceived as generated by their respective genders.[39]

Table 5 also shows evidence that female negotiators come across differently than male negotiators along some dimensions. Female negotiators appear less confident to external raters independent of communication architecture (Column 2), thus confirming self-reports of confidence in Section 4.2. Neither male nor female negotiators appear more cooperative (Column 3). Female negotiators appear less competitive when gender is obscured and as competitive as male negotiators when gender is revealed (Column 4).

In sum, the gender gap in earnings across communication architectures that reveal or ob-

[39]Male negotiators tend to speak similarly across communication architecture, with raters being able to correctly guess their gender 54-63% of the time. Female negotiators change the manner in which they speak more, with raters being able to correctly guess their gender 38-57% of the time (Table A.9).

scure gender by design may be driven by several factors that manifest during the negotiation. First, women report lower confidence than men, which may affect negotiation outcomes. Second, there are differences in strategic behavior. Men and women are equally likely to suggest that both sides reveal their value or cost. Men are more likely to comply when the communication architecture reveals gender. Whereas half of such revelations by men are a lie, women are far more likely to tell the truth. Men's lies are twice as large as women's. Finally, although women change the manner in which they communicate across architectures, men do not. It is more likely a woman comes across as a man than as a woman when the architecture obscures gender than when it reveals gender.

5 Mediation analysis

We conduct a mediation analysis to understand how factors identified in Sections 3 and 4 might drive gender differences in earnings when communication architecture reveals gender and the negative impact on earnings of assignment to the role of seller. The mediation is conducted in three steps (following the procedure in Heckman et al., 2013).

In the first step, we re-examine, separately for men and women, the effect of the Gender Revealed treatments and assignment to the role of seller on earnings. Table 6, Columns 1-2, shows that the treatment effect of Gender Revealed on men's earnings is \$0.99, while there is no treatment effect of Gender Revealed on women's earnings. In addition, there is a negative effect of \$1.47 and \$2.53 on earnings of assignment to the role of seller for men and women, respectively.

In the second step, we examine the effects of the Gender Revealed treatments and assignment to the role of seller on the aforementioned candidate mediators. These mediators come from actions taken during the negotiation, a participant's perceptions of the negotiation, and independent raters' assessments of the negotiation (see Section 4 for descriptions). For actions during the negotiation, we include whether or not the participant makes the first offer, whether or not the participant suggests that their partner reveals their private value or cost, and whether the participant reveals the value or cost truthfully and the size of the lie. For perceptions, we include the average confidence the participant reported during the

Table 6: Treatment and mediator effects on earnings

	(1) Earnings Women	(2) Earnings Men	(3) Earnings Women	(4) Earnings Men
Gender Revealed	-0.13	0.99**	-0.13	0.78
	(0.53)	(0.40)	(0.53)	(0.48)
Seller	-2.53***	-1.47***	-2.22***	-1.28***
	(0.48)	(0.41)	(0.49)	(0.37)
Make first offer			-0.06	-0.07
			(0.40)	(0.35)
Suggest reveal value/cost			0.45	0.12
			(0.48)	(0.41)
Reveal value/cost truthfully			-0.83*	-1.83***
			(0.48)	(0.40)
Size of lie			0.19	0.21***
			(0.16)	(0.07)
Confidence			0.56***	0.74***
			(0.19)	(0.21)
Guess correct (part)			0.42	0.44
			(0.55)	(0.44)
Prob guess correct (rater)			0.39	-0.44
			(0.67)	(0.51)
Constant	18.23***	17.30***	15.10***	13.61***
	(0.66)	(0.47)	(1.24)	(1.23)
Observations	924	894	924	894
R-squared	0.05	0.03	0.07	0.10

Notes: Ordinary least squares regressions are reported. Dependent variable is earnings. Negotiations that resulted in an impasse (n = 15) are excluded. Regressions include dummy variables for round number. Gender Revealed pools treatments that reveal gender. Missing covariate data are replaced with a zero and a dummy variable is included that indicates missingness. Standard errors clustered by participant in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

first and last negotiation and whether or not the participant correctly guessed the partner's gender. For external assessment of the negotiation, we include the average probability that the external raters guessed the negotiator's gender correctly.[40]

Table 7 reports these results. Panel A shows that, for women, communication architecture that reveals gender increases the probability of guessing one's partner's gender correctly. It also shows that assignment to the role of the seller reduces confidence. Panel B shows that, for men, communication architecture that reveals gender also increases the probability of guessing one's partner's gender correctly. There are no effects of the assignment to the role of seller.

In the last step, we examine the effects of the Gender Revealed treatments and assignment to the role of a seller on earnings for men and women, controlling for the mediators. The results appear in Columns 3-4 of Table 6.[41]

For women, the direct effect of assignment to the role of a seller has a smaller effect on earnings than when mediators are not included (-2.22 vs. -2.53). This result is expected because being a seller reduces confidence for women, and confidence increases earnings. Thus, some of the direct negative effect of role assignment on earnings is accounted for through its effect on confidence. Also, increased confidence and revealing value or cost truthfully directly affects earnings.

For men, the direct effect of the Gender Revealed treatments on earnings is smaller (0.78 vs. 0.99) as is the effect of assignment to the role of a seller (-1.28 vs. -1.47) than when mediators are excluded. The probability of correctly guessing the gender of one's partner has no significant direct effect on earnings, even though it was affected by the Gender Revealed

[40] Some mediator variables for behavior during the negotiation are missing because of corrupted audio recordings. The analysis presented in Table 6 replaces this missing data with zeros and includes a dummy variable to indicate whether it was missing. All steps of the mediation analysis are repeated using the restricted sample that have complete data for all mediators. Our main results are confirmed in this restricted sample (see Tables A.10 and A.11).

[41] We also check that the included mediators are not capturing the effect of omitted mediators. If omitted mediators (e.g., other aspects of the negotiation) are correlated with the included mediators, results of the mediation analysis would be biased. To evaluate whether omitted mediators affect our estimates for included mediators, Heckman et al. (2013) suggest testing whether the relationship between the included covariates changes between the treatment and control group. When we test if the coefficients on covariates, including mediators and controls, are significantly different for those in the Gender Revealed treatments and those in the Gender Obscured treatments, we cannot reject the hypothesis that parameters are the same in both groups for earnings (F-test p-value = 0.3731 for women and 0.2006 for men). Thus, we do not find evidence of an omitted mediator problem.

Table 7: Treatment effect on mediators

Panel A: Women

	(1) Make first offer	(2) Suggest reveal value/cost	(3) Reveal value/cost truthfully	(4) Size of lie	(5) Confidence	(6) Guess correct (part)	(7) Prob guess correct (rater)
Gender Revealed	-0.05	0.01	0.01	0.06	-0.07	0.32***	0.04
	(0.04)	(0.04)	(0.05)	(0.16)	(0.19)	(0.05)	(0.03)
Seller	0.05	0.01	-0.01	-0.04	-0.55***	-0.02	-0.00
	(0.04)	(0.04)	(0.04)	(0.17)	(0.16)	(0.03)	(0.03)
Constant	0.48***	0.11***	0.18***	0.17	4.90***	0.60***	0.50***
	(0.05)	(0.04)	(0.05)	(0.15)	(0.18)	(0.05)	(0.03)
Observations	852	852	852	852	924	868	834
R-squared	0.01	0.01	0.01	0.00	0.05	0.14	0.01

Panel B: Men

	(1) Make first offer	(2) Suggest reveal value/cost	(3) Reveal value/cost truthfully	(4) Size of lie	(5) Confidence	(6) Guess correct (part)	(7) Prob guess correct (rater)
Gender Revealed	0.06	0.04	0.03	-0.04	0.09	0.38***	-0.02
	(0.04)	(0.04)	(0.04)	(0.35)	(0.18)	(0.04)	(0.03)
Seller	0.02	0.02	0.03	-0.14	-0.22	0.05	-0.02
	(0.04)	(0.04)	(0.04)	(0.27)	(0.16)	(0.03)	(0.03)
Constant	0.49***	0.11***	0.17***	0.52	5.36***	0.51***	0.61***
	(0.05)	(0.04)	(0.05)	(0.42)	(0.17)	(0.05)	(0.04)
Observations	824	824	824	824	894	840	802
R-squared	0.01	0.01	0.01	0.01	0.01	0.19	0.00

Notes: Ordinary least squares regressions are reported. Dependent variables are 0-1, unless noted otherwise, on whether or not the subject made the first offer (Column 1), suggested to reveal value/cost (Column 2), revealed their value/cost truthfully (Column 3), difference between revealed and assigned value/cost (Column 4), average confidence for first and last negotiation on 1-7 Likert scale (Column 5), participant correctly guessed the gender of their negotiation partner (Column 6) and average of correct guesses of external rater of participant's gender for that negotiation (Column 7). Negotiations that resulted in an impasse (n = 15) are excluded. Regressions include dummy variables for round number. Gender Revealed pools treatments that reveal gender. Missing observations are due to corrupted audio recordings. Standard errors clustered by participant in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

treatments. Revealing the value or cost truthfully significantly decreases earnings by $1.83, and the size of the lie and confidence increases earnings.

We next decompose the mediating effects on earnings separately for men and women. Figure 2 depicts the proportion of the effect of the Gender Revealed treatments and the effect of assignment to the role of a seller that is mediated by each of the candidate mediators.[42] Non-significant treatment effects on earnings and mediators that are not significantly affected

[42]The proportion of the effect of treatment or role assignment on earnings explained by each mediator is calculated following the approach in Heckman et al. (2013). Specifically, the effect of the treatment on the mediator from Table 7 is multiplied by the effect of the mediator on earnings in Columns 3-4 in Table 6. This product is divided by the total effect of the treatment on earnings from Columns 1-2 in Table 6.

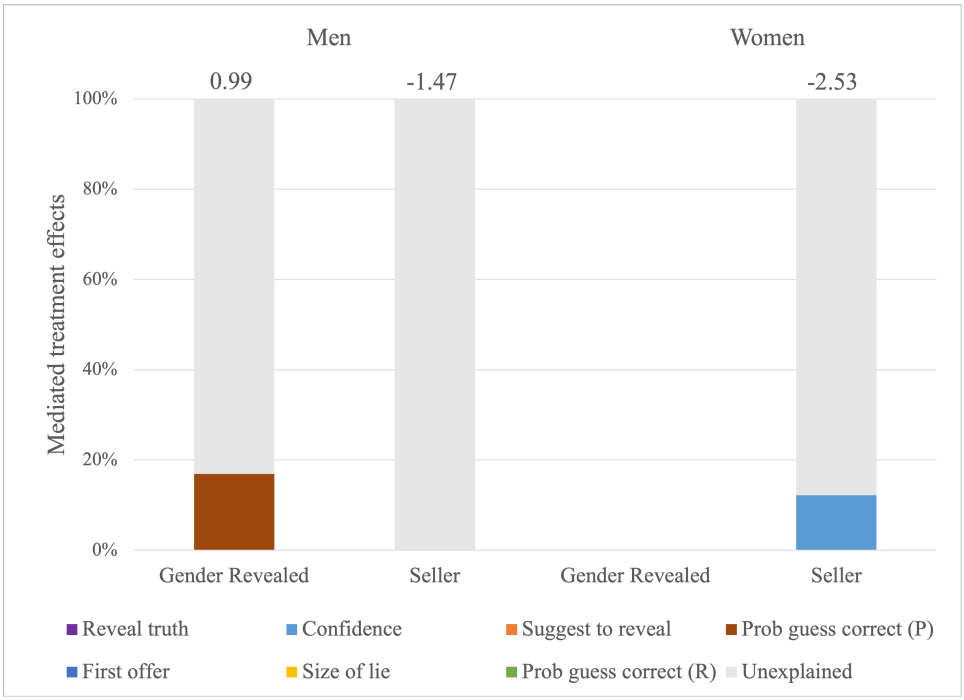


Figure 2: Mediation analysis

Notes: The figure visualizes the proportion of the Gender Revealed treatment effect and Seller role assignment effect on earnings that can be explained by each mediator. Men and women are presented separately. The number at the top of each bar displays the size of the treatment effect on earnings. Positive sign in the decomposition means that the mediator is in the same direction as the treatment.

by treatment are not included in the decomposition. The size of the treatment effect on earnings is listed above each bar.

For women, assignment to the role of a seller decreased earnings. Confidence was the only mediator significantly affected by role assignment, and being assigned the role of seller reduced confidence. The proportion of the effect of assignment to the role of seller on earnings that is mediated by confidence is 12%, with the remainder (88%) unexplained.

For men, there were significant effects of the Gender Revealed treatments and assignment to the role of a seller on earnings. No mediators were significantly affected by assignment to the role of seller, so these do not explain the negative effect of being a seller on earnings for men. The Gender Revealed treatments significantly increased earnings for men. Guessing the gender of one's negotiation partner correctly has positive effects on earnings. That mediator explains 17% of the positive effects of the Gender Revealed treatments on earnings, leaving

83% unexplained.

The mediation analysis sheds some light on what drives the treatment effects on earnings. Assignment to the role of a seller has a direct negative effect on earnings for both men and women. The effect for women is partially explained by a decline in confidence in the role of a seller but is unexplained by any of the candidate mediators for men. Communication architecture that reveals gender increases the earnings of men, but not for women. This effect for men is partially explained by correctly guessing the gender of one's partner. Overall, the positive effect of the Gender Revealed treatments for men and the negative effect of role assignment for men and women on earnings are largely unexplained by our mediators (ranging from 83-100%).

In sum, these findings suggest that the most important elements that determine earnings are the structure of the environment—communication architecture that reveals or obscures gender—and the bargaining position (i.e., role) that is assigned. Although correctly guessing the gender of one's partner and confidence play a role, they explain a relatively small portion of the communication architecture and role assignment effects on earnings.

6 Conclusion

Compared to men, women earn less, occupy fewer leadership positions, and have been found to fare worse in negotiations. Many negotiations occur face-to-face, revealing gender and other social cues. Yet, there are myriad alternative options to communicate, discuss, and make requests—text messages, email, phone calls, and video calls. All of these methods, to varying degrees, are acceptable forms for conversing, sharing information, and reaching consensus. The communication architecture across these methods differs, by design, in whether or not gender is revealed via auditory or visual cues. Despite the ubiquity of these methods, little is known about how they affect negotiations and the extent to which they attenuate or exacerbate gender differences in negotiation outcomes.

We use economic experiments with monetary incentives to examine the effects of communication architecture on negotiation outcomes and gender differences in earnings in an environment where negotiation is required. Our design focuses on the effect of architec-

ture itself on negotiation, apart from factors such as choice of communication medium and entering a negotiation. Our unstructured negotiation environment is neutrally framed and incentive-compatible. A buyer and a seller negotiate the split of a trading surplus that is randomly determined by a private value for the buyer and a private cost for the seller, drawn from known distributions. Both parties can freely communicate with each other to come to an agreement. We implement six treatments that vary whether the architecture reveals or obscures gender and the manner in which communication occurs (written, verbal). Thus, the negotiation fundamentals are identical across treatments, but the method in which participants can negotiate varies.

Consistent with previous research, we find that women do get a smaller share of the trading surplus than men; however, this depends on whether the communication architecture reveals or obscures gender. Women earn less than men in the treatments in which gender is revealed by the architectural design, but when communication is done solely via written chat (without either partner explicitly knowing the gender of the other) or using an altered voice, the earnings of men and women are indistinguishable. While it might be tempting to suggest the use of written chat as a way of achieving gender parity in earnings, this comes at an efficiency cost in our setting. These negotiations take longer to complete and costs of delay erode the bargaining surplus and final earnings.

Looking at how the negotiation unfolds, we find that communication architecture affects bargaining strategies and how the negotiator is perceived. Negotiators disclose their private value or cost to their partner 31% of the time. However, such disclosure is not necessarily veracious. Men are more likely to disclose, lie to their advantage and tell larger lies than women when gender is revealed, contributing to the gender gap in earnings. Women change how they negotiate under different architectures so that they "sound" more like a man when gender is obscured —which might arise due to stereotype threat (Kray and Thompson, 2004). In this instance, negotiators play their cards closer to the vest and men and women leave the negotiation with equal, albeit lower, earnings.

While bargaining strategies and perceptions play a role in explaining the effects of communication architecture on earnings, the proportion of the effect mediated by these mechanisms is small. The structure of the architecture itself is the main driver of gender differences in

earnings. This conclusion also carries over to role assignment effects. Being assigned the role of seller is seemingly perceived as disadvantaged. Assuming the role of a seller (vs. a buyer) lowers women's self-reported confidence and yields notable effects on earnings, although confidence mediates a small portion of the total effects.

Women have been found reluctant to enter negotiations, and when they do negotiate, they garner worse outcomes. Our results suggest that, while women may not want to enter negotiations that are face-to-face—and when their gender is salient—they may not be as reluctant if the communication architecture obscures their characteristics. When gender is taken off the table (e.g., in written chat or altered voice), women receive the same share of the trading surplus as men. It is, therefore, not the case that women will always do worse than men in zero-sum negotiations. Recent propositions about gender differences in negotiation have posited that differences in outcomes arise due to the salience of gender (Bowles et al., 2022), and that equalizing outcomes may require "fixing the institution" (Recalde and Vesterlund, 2022). We find that communication architecture interacts in important ways to equalize the outcomes of women and men in bargaining. Perhaps negotiations would be more appealing to women if the structure of the negotiation environment were crafted to remove salient gender cues.

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APPENDICES INTENDED FOR ONLINE PUBLICATION

A Figures and Tables

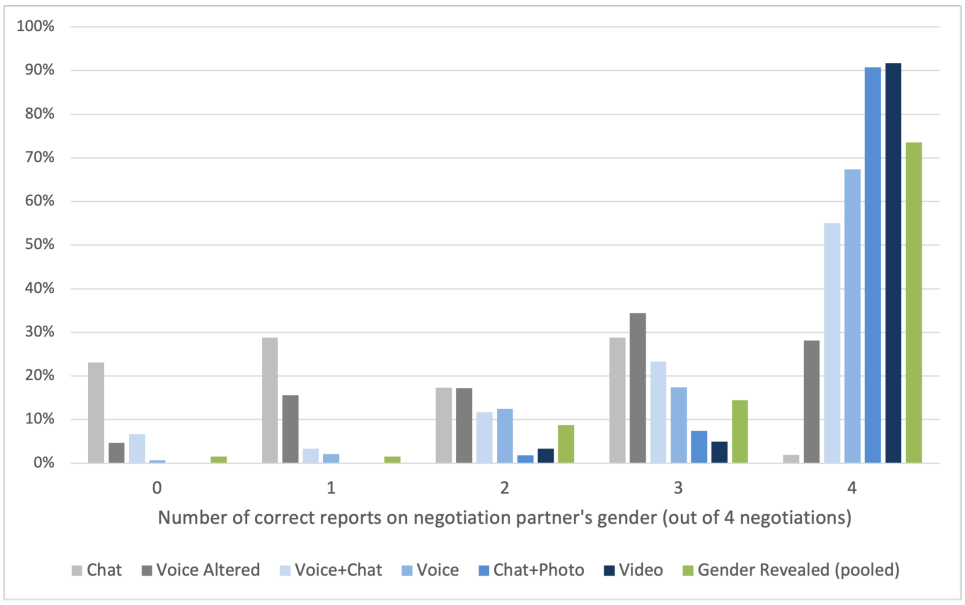


Figure A.1: Distribution of number of correct reports on partner's gender out of 4 negotiations

Notes: In two sessions, participants were not asked to guess the gender of their partner (one session in Chat and one in Chat+Photo). The figure is based on the 35 sessions in which this was asked.

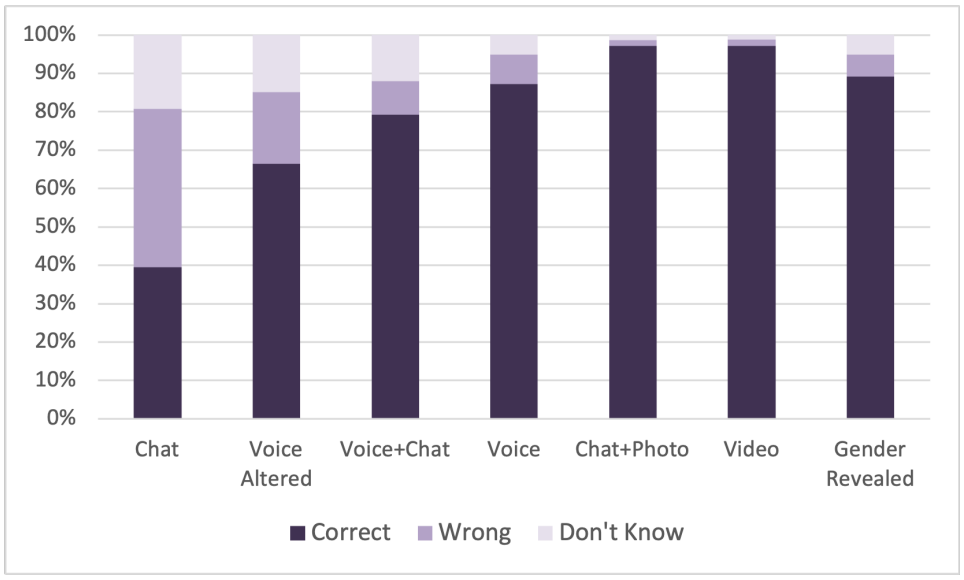


Figure A.2: Percent correct, wrong and don't know guesses of partner's gender out of 4 negotiations

Notes: In two sessions, participants were not asked to guess the gender of their partner (one session in Chat and one in Chat+Photo). The figure is based on the 35 sessions in which this was asked.

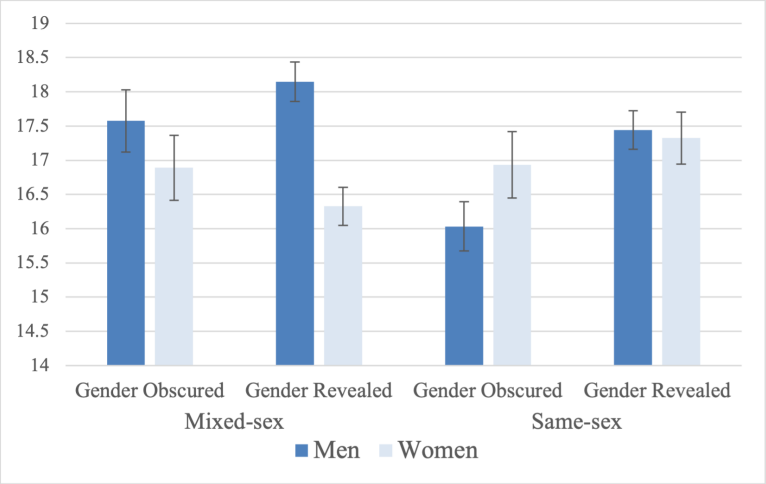


Figure A.3: Gender gap in earnings - mixed- and same-sex pairings

Notes: Error bars are standard errors of the mean. Gender Revealed pools treatments that reveal gender (Chat+Photo, Voice+Chat, Voice, Video), and Gender Obscured pools treatments that obscure gender (Chat, Voice Altered). The gender gap in earnings is tested by OLS regressions of earnings on a dummy variable for female, a dummy for treatment, and an interaction term. Standard errors are clustered by participant. The p-values associated with the gender gap are: Mixed-sex Gender Obscured (p-value = 0.270), Mixed-sex Gender Revealed (p-value = 0.000), Same-sex Gender Obscured (p-value = 0.195), Same-sex Gender Revealed (p-value = 0.823).

Table A.1: Experiment treatments and sessions

Treatment	# participants/session	# sessions	# participants	Where
Chat	10, 14	5	66	GMU
Chat+Photo	12, 14	5	68	GMU
Voice+Chat	12	5	60	GMU
Voice	12, 16	7, 4	84, 60	GMU, TAMU
Video	12	5	60	GMU
Voice Altered	16	4	64	TAMU
Total		35	462	

Notes: GMU is George Mason University, TAMU is Texas A&M University. Numbers listed in row for Voice treatment are for GMU first, then TAMU.

Table A.2: Guess of partner gender and Balance across treatments

	(1) Correct guess partner gender	(2) Mixed gender pairing	(3) Mixed gender pairing	(4) Female participant	(5) Female participant
Chat + Photo	0.58***	-0.09**		-0.03	
	(0.04)	(0.04)		(0.09)	
Voice + Chat	0.40***	-0.04		0.00	
	(0.06)	(0.03)		(0.09)	
Voice	0.48***	-0.02		-0.02	
	(0.04)	(0.03)		(0.07)	
Video	0.58***	-0.01		-0.06	
	(0.04)	(0.04)		(0.09)	
Voice Altered	0.27***	-0.11***		-0.03	
	(0.06)	(0.04)		(0.09)	
Gender Revealed			0.02		-0.01
			(0.02)		(0.05)
Constant	0.39***	0.56***	0.51***	0.53***	0.52***
	(0.04)	(0.03)	(0.02)	(0.06)	(0.04)
Observations	1,736	1,848	1,848	1,848	1,848
R-squared	0.20	0.01	0.00	0.00	0.00
H0: T2=T3=T4=T5=T6=0, p-value	[0.0000]	[0.0074]		[0.9801]	

Notes: Ordinary least squares regressions reported. Dependent variables are equal to 1 if criteria is met and 0 otherwise: correctly guessing the negotiation partner's gender (Column 1), whether the negotiation is a mixed gender pairing (Columns 2 and 3) and whether the participant is female (Columns 4 and 5). Standard errors are clustered by participant and reported in parentheses. Gender Revealed pools treatments that reveal gender. The omitted treatments obscure gender (Chat, Voice Altered). Missing observations for correct guess are because this was not asked in two sessions. P-values in square brackets ([]). *** p<0.01, ** p<0.05, * p<0.10.

Table A.3: Pairwise distribution comparisons of number of correct partner gender guesses

	Chat	Voice-alt	Voice+Chat	Voice	Chat+Photo	Video
Chat						
Voice-Altered	22.13					
Voice+Chat	43.99	12.43				
Voice	94.48	35.38	8.26			
Chat+Photo	85.89	47.63	18.91	11.71		
Video	91.42	52.35	21.39	13.36	0.51	

Notes: Table reports Pearson Chi2 test statistic. DOF = 4, expect for Video and Chat+Photo (DOF=2).

Table A.4: Gender gap in earnings by treatment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Pooled	Chat	Voice Altered	Chat +Photo	Voice +Chat	Voice	Video
Female	0.23	0.24	0.16	-0.90	-1.66*	-0.57	-1.19
	(0.83)	(0.84)	(0.64)	(0.99)	(0.90)	(0.56)	(0.76)
Chat+Photo (T2)	1.27						
	(0.90)						
Voice+Chat (T3)	1.61**						
	(0.65)						
Voice (T4)	1.40**						
	(0.63)						
Video (T5)	1.87***						
	(0.60)						
Voice Altered (T6)	0.99						
	(0.61)						
Female × T2	-1.18						
	(1.32)						
Female × T3	-1.80						
	(1.23)						
Female × T4	-0.79						
	(1.00)						
Female × T5	-1.51						
	(1.09)						
Female × T6	-0.08						
	(1.06)						
Seller	-2.02***	-2.09**	-0.27	-4.96***	-1.40	-1.82***	-1.58**
	(0.32)	(0.86)	(0.63)	(0.99)	(0.94)	(0.56)	(0.73)
Constant	17.18***	17.08***	17.59***	20.04***	18.22***	18.66***	18.43***
	(0.57)	(0.95)	(0.67)	(1.09)	(0.84)	(0.67)	(0.72)
Observations	1,818	262	252	264	236	564	240
R-squared	0.04	0.04	0.00	0.15	0.04	0.03	0.05
H0: T2=T3=T4=T5, p-value	[0.7966]						
H0: T2F=T3F=T4F=T5F, p-value	[0.7608]						
H0: F=T6F, p-value	[0.8601]						

Note: Ordinary least square regressions are reported with earnings as the dependent variable. All regressions include dummy variables for round number. Female indicates a female participant. In column (1), dummy variables for each treatment are included. The omitted treatment is Chat. In columns (2)-(7), each treatment is run separately. Standard errors are clustered by participant and reported in parentheses. P-values are in square brackets ([]). *** p<0.01, ** p<0.05, * p<0.10

Table A.5: Earnings by gender pairing

VARIABLES	(1) All	(2) Mixed sex	(3) Same sex	(4) Same sex Men	(5) Same Sex Women
Female (F)	0.16	-0.53	0.90		
	(0.54)	(0.68)	(0.69)		
Westfall-Young p-value	< 0.7690 >	< 0.4630 >	< 0.3110 >		
Gender Revealed (GR)	1.00**	0.59	1.40***	1.43***	0.35
	(0.40)	(0.53)	(0.51)	(0.49)	(0.72)
permutation p-value	< 0.0169 >	< 0.2394 >	< 0.0018 >		
Westfall-Young p-value	< 0.0310 >	< 0.4630 >	< 0.0210 >		
Female × Gender Revealed (F×GR)	-1.12*	-1.19	-1.02		
	(0.66)	(0.81)	(0.87)		
permutation p-value	< 0.0981 >	< 0.1382 >	< 0.2397 >		
Westfall-Young p-value	< 0.1490 >	< 0.2950 >	< 0.3110 >		
Seller	-2.01***	-1.82***	-2.16***	-0.67	-3.56***
	(0.31)	(0.38)	(0.43)	(0.49)	(0.68)
Constant	17.68***	18.21***	17.08***	16.33***	18.68***
	(0.42)	(0.59)	(0.55)	(0.55)	(0.92)
Observations	1,818	948	870	420	450
R-squared	0.04	0.05	0.04	0.02	0.08
H0: F+F×GR=0, p-value	[0.0123]	[0.0002]	[0.8226]		
H0: GR=F×GR=0, perm p-value	< 0.0458 >	< 0.3251 >	< 0.0135 >		

Notes: Ordinary least squares regressions reported. Dependent variable is earnings. All regressions include dummy variables for round number. Gender Revealed pools treatments that reveal gender. The omitted treatments obscure gender (Chat, Voice Altered). Female indicates a female participant. Standard errors are clustered by participant and reported in parentheses. P-values are in square brackets ([]). Permutation and Westfall-Young (Westfall and Young, 1993) p-values are in angle brackets (<>). Westfall-Young p-values adjust for multiple hypothesis testing within a regression. Permutation p-values are randomization inference p-values testing the sharp null of no treatment effects (based on Young, 2019). *** p<0.01, ** p<0.05, * p<0.10.

Table A.6: Time to complete negotiation by pair gender composition (in seconds)

VARIABLES	(1) Negotiation length	(2) Negotiation length
Mixed gender pairing	-5.04	-2.69
	(3.45)	(6.29)
Westfall-Young p-value	< 0.151 >	< 0.809 >
Gender Revealed		-17.53**
		(6.93)
Westfall-Young p-value		< 0.038 >
Mixed gender × Gender Revealed		-2.93
		(7.44)
Westfall-Young p-value		< 0.809 >
Constant	110.49***	122.85***
	(3.88)	(6.70)
Observations	909	909
R-squared	0.02	0.04

Notes: Ordinary least squares regressions reported. Dependent variable is negotiation length in seconds. Negotiations that ended in impasse are not included (n = 15). Gender Revealed pools treatments that reveal gender. The omitted treatment obscures gender (Chat, Voice Altered). Mixed gender pairing indicates the negotiators were opposite gender. Round fixed effects are included. Standard errors clustered by participant in parentheses. Westfall-Young (Westfall and Young, 1993) p-values in angle brackets (<>). Westfall-Young p-values adjust for multiple hypothesis testing. *** p<0.01, ** p<0.05, * p<0.10.

Table A.7: Confidence of participant during negotiations (7-point Likert scale)

VARIABLES	(1) All	(2) All	(3) Mixed sex	(4) Same sex
Female	-0.81***	-0.75***	-0.91***	-0.55*
	(0.11)	(0.23)	(0.30)	(0.31)
Westfall-Young p-value		< 0.005 >	< 0.005 >	< 0.160 >
Gender Revealed		0.14	-0.02	0.32
		(0.18)	(0.21)	(0.27)
Westfall-Young p-value		< 0.624 >	< 0.908 >	< 0.355 >
Female × Gender Revealed		-0.08	0.18	-0.37
		(0.26)	(0.35)	(0.37)
Westfall-Young p-value		< 0.749 >	< 0.809 >	< 0.355 >
Seller	-0.39***	-0.39***	-0.48***	-0.29*
	(0.11)	(0.11)	(0.15)	(0.16)
Constant	4.92***	4.82***	4.98***	4.64***
	(0.11)	(0.17)	(0.21)	(0.26)
Observations	867	867	439	428
R-squared	0.19	0.19	0.19	0.20

Notes: Ordinary least squares regressions reported with confidence of first and last negotiation (scaled 1 to 7) as dependent variable. Two sessions are excluded because participants were only asked about first negotiation. Regressions include dummies for last negotiation. Gender Revealed pools treatments that reveal gender. The omitted treatment obscures gender (Chat, Voice Altered). Female indicates a female participant. Standard errors clustered by participant in parentheses. Westfall-Young (Westfall and Young, 1993) p-values in angle brackets (<>). Westfall-Young p-values adjust for multiple hypothesis testing. *** p<0.01, ** p<0.05, * p<0.10.

Table A.8: Strategic behavior by treatment

	(1) Make first offer	(2) Suggest reveal value/cost	(3) Reveal value/cost	(4) Reveal value/cost truthfully	Size of lie
Chat+Photo		-0.02	-0.08	0.10	-1.53
		(0.03)	(0.08)	(0.18)	(2.39)
Voice+Chat		0.09	-0.01	0.37**	-2.82
		(0.06)	(0.09)	(0.18)	(2.27)
Voice		0.17***	0.23***	0.23**	-1.92
		(0.04)	(0.07)	(0.11)	(2.29)
Video		0.27***	0.44***	0.19*	-2.18
		(0.07)	(0.08)	(0.12)	(2.25)
Voice Altered		0.18***	0.29***	0.25**	-2.69
		(0.06)	(0.08)	(0.12)	(2.28)
Female	0.08	0.01	-0.08	0.07	-2.17
	(0.06)	(0.04)	(0.07)	(0.16)	(2.36)
Female × Chat+Photo	-0.10	-0.01	-0.03	0.41	-0.51
	(0.08)	(0.05)	(0.09)	(0.26)	(2.55)
Female × Voice+Chat	-0.07	0.06	0.15	-0.13	3.09
	(0.08)	(0.09)	(0.12)	(0.26)	(2.79)
Female × Voice	-0.10*	-0.06	-0.00	0.03	1.29
	(0.06)	(0.07)	(0.10)	(0.19)	(2.44)
Female × Video	-0.15	-0.06	0.03	0.25	1.13
	(0.09)	(0.10)	(0.12)	(0.20)	(2.42)
Female × Voice Altered	-0.11	0.01	0.06	0.12	1.56
	(0.07)	(0.08)	(0.11)	(0.20)	(2.42)
Seller	0.03	0.01	0.01	0.02	-0.32
	(0.03)	(0.03)	(0.03)	(0.05)	(0.39)
Constant	0.49***	0.01	0.16**	0.38***	3.63
	(0.03)	(0.03)	(0.06)	(0.10)	(2.41)
Observations	1,676	1,676	1,676	621	621
R-squared	0.00	0.06	0.15	0.08	0.05

Note: Each observation is a participant's decision in a negotiation. Missing observations are due to corrupted audio recordings. Ordinary least squares regressions are reported. Dependent variables are 0-1 on whether or not the subject made the first offer (Column 1), suggested to reveal value/cost (Column 2), revealed their value/cost (Column 3) and, conditional on revealing their value/cost, did so truthfully (Column 4). Dependent variable for Column 5 is, conditional on revealing their value/cost, the difference between the revealed value/cost and the participant's assigned value/cost. Dummy variables for each treatment are included: Chat+Photo, Voice+Chat, Voice, Video, Voice Altered. The omitted treatment is Chat. Female indicates a female participant. Regressions include dummy variables for round number. Standard errors are clustered by participant and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.10

Table A.9: External ratings - Percent of correct gender guesses

Treatment	Male negotiator	Female negotiator
Chat	62.3	42.3
Chat+Photo	63.2	38.2
Video	55.3	55.6
Voice Altered	60.7	51.6
Voice+Chat	54.5	57.5
Voice	60.2	53.1

Notes: Table reports the average percent of times external raters correctly guessed the gender of the person who produced negotiation the text generated by male and female negotiators.

Table A.10: Treatment and mediator effects on earnings (Restricted sample)

	(1) Earnings Women	(2) Earnings Men	(3) Earnings Women	(4) Earnings Men
Gender Revealed	0.12	0.92**	-0.04	0.56
	(0.51)	(0.42)	(0.52)	(0.45)
Seller	-2.26***	-1.27***	-2.02***	-1.20***
	(0.51)	(0.43)	(0.52)	(0.39)
Make first offer			-0.20	-0.22
			(0.41)	(0.34)
Suggest reveal value/cost			0.52	-0.05
			(0.48)	(0.42)
Reveal value/cost truthfully			-0.87*	-1.87***
			(0.48)	(0.42)
Lie size			0.19	0.23**
			(0.16)	(0.10)
Confidence			0.48**	0.77***
			(0.20)	(0.18)
Guess correct (part)			0.30	0.62
			(0.60)	(0.47)
Prob guess correct (rater)			0.52	-0.60
			(0.68)	(0.50)
Constant	17.77***	17.29***	15.23***	13.70***
	(0.64)	(0.48)	(1.30)	(1.12)
Observations	778	748	778	748
R-squared	0.04	0.03	0.06	0.10

Notes: Ordinary least squares regressions reported. Dependent variable is earnings. Negotiations that resulted in an impasse (n = 15) are excluded. Gender Revealed pools treatments that reveal gender. Regressions include dummy variables for round number. Data restricted to sample that has complete data across all variables. Standard errors clustered by participant in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

Table A.11: Treatment effect on mediators (Restricted sample)

Panel A: Women

	(1) Make first offer	(2) Suggest reveal value/cost	(3) Reveal value/cost truthfully	(4) Size of lie	(5) Confidence	(6) Guess correct (part)	(7) Prob guess correct (rater)
Gender Revealed	-0.05	-0.00	0.00	0.06	0.05	0.34***	0.03
	(0.05)	(0.04)	(0.05)	(0.17)	(0.20)	(0.05)	(0.03)
Seller	0.07	0.01	-0.01	-0.04	-0.47***	-0.02	0.02
	(0.04)	(0.04)	(0.05)	(0.19)	(0.18)	(0.04)	(0.03)
Constant	0.46***	0.13***	0.21***	0.19	4.74***	0.60***	0.51***
	(0.06)	(0.04)	(0.05)	(0.16)	(0.18)	(0.05)	(0.03)
Observations	778	778	778	778	778	778	778
R-squared	0.01	0.01	0.01	0.00	0.03	0.16	0.01

Panel B: Men

	(1) Make first offer	(2) Suggest reveal value/cost	(3) Reveal value/cost truthfully	(4) Size of lie	(5) Confidence	(6) Guess correct (part)	(7) Prob guess correct (rater)
Gender Revealed	0.05	0.03	0.01	0.21	0.11	0.41***	-0.01
	(0.04)	(0.04)	(0.05)	(0.22)	(0.18)	(0.04)	(0.03)
Seller	0.02	0.02	0.02	0.08	-0.13	0.06*	-0.02
	(0.04)	(0.04)	(0.04)	(0.23)	(0.16)	(0.03)	(0.03)
Constant	0.49***	0.13***	0.19***	0.15	5.31***	0.52***	0.61***
	(0.05)	(0.04)	(0.05)	(0.22)	(0.17)	(0.05)	(0.04)
Observations	748	748	748	748	748	748	748
R-squared	0.00	0.01	0.01	0.01	0.01	0.25	0.00

Notes: Ordinary least squares regressions are reported. Dependent variables are 0-1, unless noted otherwise, on whether or not the subject made the first offer (Column 1), suggested to reveal value/cost (Column 2), revealed their value/cost (Column 3) lied about value/cost (Column 4), average confidence for first and last negotiation on 1-7 Likert scale (Column 5), participant correctly guessed the gender of their negotiation partner (Column 6) and average of correct guesses of external rater of participant's gender for that negotiation (Column 7). Negotiations that resulted in an impasse (n = 15) are excluded. Gender Revealed pools treatments that reveal gender. Regressions include dummy variables for round number. Data restricted to sample that has complete data across all variables. Standard errors clustered by participant in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

B Participant Instructions

Instructions – Chat Treatment

Welcome and thank you for participating in today's economic experiment. You have earned $5 just for showing up on time. This is yours to keep. In addition, depending upon the decisions you make, the decisions others make, and random chance, you can earn more money.

The Task

You will be asked to complete 4 negotiations. Each time, you will be matched randomly with another participant in this room. You will never negotiate with a participant more than once. At the end of the study, **one of the four** negotiations will be chosen for payment by drawing a number between 1 and 4. Everyone's payoffs will be determined by that negotiation alone.

Each negotiation will involve one *buyer* and one *seller*. You will be randomly assigned to the role of buyer or seller, which will be your role for all four rounds of negotiation.

If you are assigned to the role of buyer, you will be given a **private value** at the beginning of each of the four negotiation rounds. Your private value will be drawn randomly from the numbers between 45 and 55, inclusive. That is, before each round, the private value you are assigned is just as likely to be 45 as it is to be 46, 47, 48, . . . , 55. The seller will never know which private value you were assigned.

If you are assigned to the role of seller, you will be given a **private cost** at the beginning of each of the four negotiation rounds. Your private cost will be drawn randomly from the numbers between 10 and 20, inclusive. That is, before each round, the private cost you are assigned is just as likely to be 10 as it is to be 11, 12, 13, . . . , 20. The buyer will never know which private cost you were assigned.

In each negotiation round, the buyer and the seller will negotiate a **trading price**. The trading price the buyer and the seller agree upon determines profits.

The buyer's profit is equal to **the assigned private value − the trading price.**

The seller's profit is equal to the **trading price − the assigned private cost.**

As you can see, buyers make a higher profit when they buy at a low price, and sellers make a higher profit when they sell at a high price. The buyer and seller will be paid their profits in dollars. This means that if the buyer's profit is 20, the buyer earns $20, and if the seller's profit is 30, the seller earns $30.

Let's go through a couple examples to see how profits are calculated.

Example 1: Suppose the buyer's assigned private value is 49 and the seller's assigned private cost is 11. Then suppose that the buyer and seller negotiate and agree on a trading price of 35. The buyer's profit will be the difference between the private value assigned to the buyer and the price they agreed upon, so buyer's profit = 49-35 = 14. The seller's profit will be the difference between the price they agreed upon and the private cost assigned to the seller, so seller's profit = 35-11 = 24.

Example 2: Suppose the buyer's assigned private value is 52 and the seller's assigned private cost is 15. Then suppose that the buyer and seller negotiate and agree on a trading price of 30. The buyer's profit will be the difference between the private value assigned to the buyer and the price they agreed upon, so buyer's profit = 52-30 = 22. The seller's profit will be the difference between the price they agreed upon and the private cost assigned to the seller, so seller's profit = 30-15 = 15.

Time to Negotiate

In each round, you will have a total of **5 minutes** to negotiate the trading price. If the buyer and the seller do not agree upon a price during this five-minute period, each of you will earn zero. After the first *3 minutes* have passed, the buyer's private value will be reduced every 20 seconds by a magnitude of 1 until the full five minutes have passed. Similarly, the seller's private cost will be increased every 20 seconds by a magnitude of 1 starting at 3 minutes of negotiation.

For example, suppose you are assigned to the role of buyer and your private value is 36. If you have reached the three-minute mark without agreeing upon a price, your private value

will be reduced by one to 35. After 3 minutes and 20 seconds your private value will be reduced to 34. After 3 minutes and 40 seconds your private value will be reduced to 33. At 4 minutes, your private value will be 32, and so on. If 5 minutes is reached without an agreement, you will earn zero.

Suppose instead you are assigned to the role of seller and your private cost is 11. If you have reached the three-minute mark without agreeing upon a price, your private cost will be increased by one to 12. After 3 minutes and 20 seconds your private cost will be increased to 13. After 3 minutes and 40 seconds, your private cost will be increased to 14. At 4 minutes, your private cost will be 15, and so on. If 5 minutes is reached without an agreement, you will earn zero.

In each round, you will be randomly matched with a new partner in the other role and will never negotiate with the same partner twice. Also, a new value will be drawn for the buyer, and a new cost will be drawn for the seller. You will always know your value or your cost before you start the negotiation.

Communication

You will be able to freely communicate with the seller/buyer through written, unstructured chat messages. You are welcome to provide as much or as little information you would like to the seller/buyer. Also, at any time, you can choose to submit to your partner a trading price you would be willing to accept. Your partner will see the price you submit. If the buyer submits a price to the seller and the seller then submits the same price, then the negotiation is complete, and the trading price is the price that each player submitted. The same occurs if the seller submits the price and the buyer submits the same price. Once a new price is submitted, the old offer price no longer applies.

For example, if the seller submits an asking price of 40, and then submits an asking price of 41, and the buyer then responds with an asking price of 40, the negotiation will continue. It will also continue if neither the buyer nor the seller has submitted a price. Negotiations can only come to an end after each party has submitted the same price, one following the other.

Remember, since after three minutes there are costs to delaying negotiation, it is in your best interests to find an agreement sooner rather than later.

No identifying information will be available for the seller/buyer, unless you choose to disclose it.

The picture below shows the screen that the buyer sees during the negotiation. The seller's screen is similar. On the screen, the buyer can see the time remaining for the negotiation, the current value, and the potential profit from accepting the seller's current price offer. In addition, the buyer can offer a potential trading price by typing in the price in the box in the upper-right hand side of the screen and clicking Submit Offer. Finally, the buyer can type in chat messages in the bottom part of the screen.

Are there any questions before we begin?

Instructions – Video Treatment

Welcome and thank you for participating in today's economic experiment. You have earned $5 just for showing up on time. This is yours to keep. In addition, depending upon the decisions you make, the decisions others make, and random chance, you can earn more money.

The Task

You will be asked to complete 4 negotiations. Each time, you will be matched randomly with another participant in this room. You will never negotiate with a participant more than once. At the end of the study, **one of the four** negotiations will be chosen for payment by drawing a number between 1 and 4. Everyone's payoffs will be determined by that negotiation alone.

Each negotiation will involve one *buyer* and one *seller*. You will be randomly assigned to the role of buyer or seller, which will be your role for all four rounds of negotiation.

If you are assigned to the role of buyer, you will be given a **private value** at the beginning of each of the four negotiation rounds. Your private value will be drawn randomly from the numbers between 45 and 55, inclusive. That is, before each round, the private value you are assigned is just as likely to be 45 as it is to be 46, 47, 48, . . . , 55. The seller will never know which private value you were assigned.

If you are assigned to the role of seller, you will be given a **private cost** at the beginning of each of the four negotiation rounds. Your private cost will be drawn randomly from the numbers between 10 and 20, inclusive. That is, before each round, the private cost you are assigned is just as likely to be 10 as it is to be 11, 12, 13, . . . , 20. The buyer will never know which private cost you were assigned.

In each negotiation round, the buyer and the seller will negotiate a **trading price**. The trading price the buyer and the seller agree upon determines profits.

The buyer's profit is equal to **the assigned private value – the trading price**.

The seller's profit is equal to **the trading price – the assigned private cost**.

As you can see, buyers make a higher profit when they buy at a low price, and sellers make a higher profit when they sell at a high price. The buyer and seller will be paid their profits in dollars. This means that if the buyer's profit is 20, the buyer earns $20, and if the seller's profit is 30, the seller earns $30.

Let's go through a couple examples to see how profits are calculated.

Example 1: Suppose the buyer's assigned private value is 49 and the seller's assigned private cost is 11. Then suppose that the buyer and seller negotiate and agree on a trading price of 35. The buyer's profit will be the difference between the private value assigned to the buyer and the price they agreed upon, so buyer's profit = 49-35 = 14. The seller's profit will be the difference between the price they agreed upon and the private cost assigned to the seller, so seller's profit = 35-11 = 24.

Example 2: Suppose the buyer's assigned private value is 52 and the seller's assigned private cost is 15. Then suppose that the buyer and seller negotiate and agree on a trading price of 30. The buyer's profit will be the difference between the private value assigned to the buyer and the price they agreed upon, so buyer's profit = 52-30 = 22. The seller's profit will be the difference between the price they agreed upon and the private cost assigned to the seller, so seller's profit = 30-15 = 15.

Time to Negotiate

In each round, you will have a total of **5 minutes** to negotiate the trading price. If the buyer and the seller do not agree upon a price during this five-minute period, each of you will earn zero. After the first 3 *minutes* have passed, the buyer's private value will be reduced every 20 seconds by a magnitude of 1 until the full five minutes have passed. Similarly, the seller's private cost will be increased every 20 seconds by a magnitude of 1 starting at 3 minutes of negotiation.

For example, suppose you are assigned to the role of buyer and your private value is 36. If you have reached the three-minute mark without agreeing upon a price, your private value will be reduced by one to 35. After 3 minutes and 20 seconds your private value will be reduced to 34. After 3 minutes and 40 seconds your private value will be reduced to 33.

At 4 minutes, your private value will be 32, and so on. If 5 minutes is reached without an agreement, you will earn zero.

Suppose instead you are assigned to the role of seller and your private cost is 11. If you have reached the three-minute mark without agreeing upon a price, your private cost will be increased by one to 12. After 3 minutes and 20 seconds your private cost will be increased to 13. After 3 minutes and 40 seconds, your private cost will be increased to 14. At 4 minutes, your private cost will be 15, and so on. If 5 minutes is reached without an agreement, you will earn zero.

In each round, you will be randomly matched with a new partner in the other role and will never negotiate with the same partner twice. Also, a new value will be drawn for the buyer, and a new cost will be drawn for the seller. You will always know your value or your cost before you start the negotiation.

Communication

You will be able to freely communicate with the seller/buyer through unstructured video chat (Skype). You are welcome to provide as much or as little information you would like to the seller/buyer. Also, at any time, you can choose to submit to your partner a trading price you would be willing to accept. Your partner will see the price you submit. If the buyer submits a price to the seller and the seller then submits the same price, then the negotiation is complete, and the trading price is the price that each player submitted. The same occurs if the seller submits the price and the buyer submits the same price. Once a new price is submitted, the old offer price no longer applies.

For example, if the seller submits an asking price of 40, and then submits an asking price of 41, and the buyer then responds with an asking price of 40, the negotiation will continue. It will also continue if neither the buyer nor the seller has submitted a price. Negotiations can only come to an end after each party has submitted the same price, one following the other.

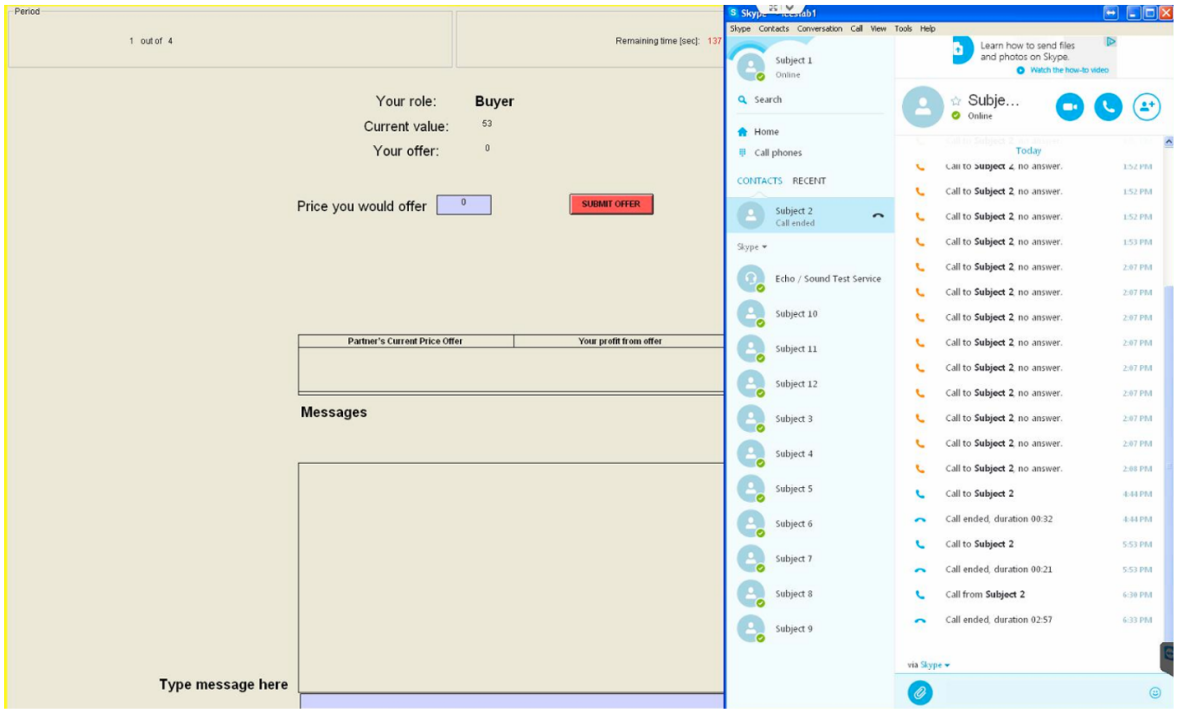
Remember, since after three minutes there are costs to delaying negotiation, it is in your best interests to find an agreement sooner rather than later.

You will see your partner on the screen during the negotiation, and your partner will see you. Otherwise, no other identifying information will be available for the seller/buyer, unless you choose to disclose it.

The picture below shows the screen that the buyer sees during the negotiation. The seller's screen is similar. The left side is the decision screen, and the right side is the Skype screen where the buyer and seller can video chat.

You should only type into and click on the decision screen on the left side. **Do not type into or click on the Skype screen.** That screen will be controlled remotely by the experimenters to connect you with your partner for each negotiation.

Let's look at the decision screen on the left side. Here, the buyer can see the time remaining for the negotiation, the current value, and the potential profit from accepting the seller's current price offer. In addition, the buyer can offer a potential trading price by typing in the price in the box in the upper part of the screen and clicking Submit Offer. Finally, the buyer can type in chat messages in the bottom part of the screen.



Each round will proceed in the following way. Before the negotiation starts and you learn

your value/cost, you will see a wait screen on the left side. At that time, you will see the right side of your screen change as we remotely connect you via Skype with your partner for that round. **Please do not use the keyboard or click on anything in the Skype screen or decision screen during this time.**

You will see the call to your partner being placed, the call being accepted, the video of your partner show up and then the video and audio being muted. Everyone's video/audio will be muted until we have everyone connected to their partner. Once that is done, we will unmute the video/audio and the left side of the screen will change to the decision screen you see above.

Once you see the decision screen, you may use the keyboard and mouse, the five minutes will start, and you will be able to see and hear your partner. You can then negotiate with your partner via video chat and use the left side of the screen to input trading price offers to your partner. **Do not click on anything inside the Skype screen (including on/off buttons).**

Once the negotiation is complete, you will see a wait screen on the left side. Do not click the mouse or touch the keyboard during the wait screen. On the right side, the screen will change again. You will see the Skype call with your partner end, and the screen will change back to one similar to that in the picture above. At that point, you will wait until everyone has completed that round of negotiation. Once everyone is done, the left side of the screen will show the profit for that round. You will click okay, and the next round will begin.

Remember that anytime you see a wait screen, do not click the mouse or touch the keyboard.

Are there any questions before we begin?

Instructions – Voice Altered Treatment

Instructions

Welcome and thank you for participating in today's economic experiment. You have earned $10 just for showing up on time. This is yours to keep. In addition, depending upon the decisions you make, the decisions others make, and random chance, you can earn more money.

The Task

You will be asked to complete 4 negotiations. Each time, you will be matched randomly with another participant in this room. You will never negotiate with a participant more than once. At the end of the study, **one of the four** negotiations will be randomly chosen for payment. Everyone's payoffs will be determined by that negotiation alone.

Each negotiation will involve one buyer and one seller. You will be randomly assigned to the role of buyer or seller, which will be your role for all four rounds of negotiation.

If you are assigned to the role of buyer, you will be given a **private value** at the beginning of each of the four negotiation rounds. Your private value will be drawn randomly from the numbers between 45 and 55, inclusive. That is, before each round, the private value you are assigned is just as likely to be 45 as it is to be 46, 47, 48, . . . , 55. The seller will never know which private value you were assigned.

If you are assigned to the role of seller, you will be given a **private cost** at the beginning of each of the four negotiation rounds. Your private cost will be drawn randomly from the numbers between 10 and 20, inclusive. That is, before each round, the private cost you are assigned is just as likely to be 10 as it is to be 11, 12, 13, . . . , 20. The buyer will never know which private cost you were assigned.

In each negotiation round, the buyer and the seller will negotiate a **trading price**. The trading price the buyer and the seller agree upon determines profits.

The buyer's profit is equal to **the assigned private value – the trading price**.

The seller's profit is equal to the **trading price − the assigned private cost**.

As you can see, buyers make a higher profit when they buy at a low price, and sellers make a higher profit when they sell at a high price. The buyer and seller will be paid their profits in dollars. This means that if the buyer's profit is 20, the buyer earns $20, and if the seller's profit is 30, the seller earns $30.

Let's go through a couple examples to see how profits are calculated.

Example 1: Suppose the buyer's assigned private value is 49 and the seller's assigned private cost is 11. Then suppose that the buyer and seller negotiate and agree on a trading price of 35. The buyer's profit will be the difference between the private value assigned to the buyer and the price they agreed upon, so buyer's profit = 49-35 = 14. The seller's profit will be the difference between the price they agreed upon and the private cost assigned to the seller, so seller's profit = 35-11 = 24.

Example 2: Suppose the buyer's assigned private value is 52 and the seller's assigned private cost is 15. Then suppose that the buyer and seller negotiate and agree on a trading price of 30. The buyer's profit will be the difference between the private value assigned to the buyer and the price they agreed upon, so buyer's profit = 52-30 = 22. The seller's profit will be the difference between the price they agreed upon and the private cost assigned to the seller, so seller's profit = 30-15 = 15.

Time to Negotiate

In each round, you will have a total of **5 minutes** to negotiate the trading price. If the buyer and the seller do not agree upon a price during this five-minute period, each of you will earn zero. After the first 3 minutes have passed, the buyer's private value will be reduced every 20 seconds by a magnitude of 1 until the full five minutes have passed. Similarly, the seller's private cost will be increased every 20 seconds by a magnitude of 1 starting at 3 minutes of negotiation.

For example, suppose you are assigned to the role of buyer and your private value is 46. If you have reached the three-minute mark without agreeing upon a price, your private value will be reduced by one to 45. After 3 minutes and 20 seconds your private value will be

reduced to 44. After 3 minutes and 40 seconds your private value will be reduced to 43. At 4 minutes, your private value will be 42, and so on. If 5 minutes is reached without an agreement, you will earn zero.

Suppose instead you are assigned to the role of seller and your private cost is 11. If you have reached the three-minute mark without agreeing upon a price, your private cost will be increased by one to 12. After 3 minutes and 20 seconds your private cost will be increased to 13. After 3 minutes and 40 seconds, your private cost will be increased to 14. At 4 minutes, your private cost will be 15, and so on. If 5 minutes is reached without an agreement, you will earn zero.

In each round, you will be randomly matched with a new partner in the other role and will never negotiate with the same partner twice. Also, a new value will be drawn for the buyer, and a new cost will be drawn for the seller. You will always know your value or your cost before you start the negotiation.

Communication

You will be able to freely communicate with the seller/buyer through unstructured audio chat (Zoom). Note that you will be communicating with your partner via voice modification. Your voice will be obscured, and the pitch of your voice will be shifted. You are welcome to provide as much or as little information you would like to the seller/buyer. Also, at any time, you can choose to submit to your partner a trading price you would be willing to accept. Your partner will see the price you submit. If the buyer submits a price to the seller and the seller then submits the same price, then the negotiation is complete, and the trading price is the price that each player submitted. The same occurs if the seller submits the price and the buyer submits the same price. Once a new price is submitted, the old offer price no longer applies.

For example, if the seller submits an asking price of 40, and then submits an asking price of 41, and the buyer then responds with an asking price of 40, the negotiation will continue. It will also continue if neither the buyer nor the seller has submitted a price. Negotiations can only come to an end after each party has submitted the same price, one following the

other.

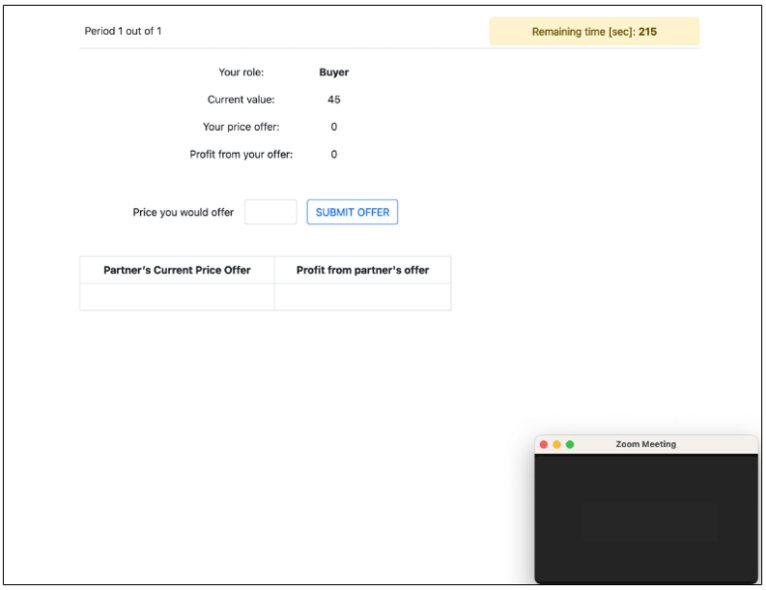
Remember, since after three minutes there are costs to delaying negotiation, it is in your best interests to find an agreement sooner rather than later.

You will see your partner's ID code on the Zoom screen during the negotiation, and your partner will see your ID code, but you will not see each other. Otherwise, no other identifying information will be available for the seller/buyer, unless you choose to disclose it.

The picture below shows the screen that the buyer sees during the negotiation. The seller's screen is similar. The main screen is the decision screen, and small window in the bottom right corner is the Zoom screen.

You should only click on and type into the main screen. **Do click on or type into the Zoom screen**. That screen will be controlled remotely by the experimenters to put you in and out of a breakout room with your partner for each negotiation round.

Let's look at the main screen. On the top of the screen, the buyer can see the round number and the time remaining for the negotiation. The next section shows the buyer's current value, current price offer and the profit from that offer. Below that, the buyer can offer a potential trading price to the seller by typing the price in the box and clicking Submit Offer. The bottom part of the screen shows the seller's current price offer and potential profit from accepting that offer.



Each round will proceed in the following way. Before the negotiation, you will see a wait screen on the main screen. At that time, you will see the Zoom window pop up and change as we remotely put you into a breakout room with your partner for that round. **Please do not use the keyboard or click on anything in the Zoom screen or main screen during this time.**

You will see yourself put into the room with your partner. Once everyone is in their respective rooms with their partners, the host will unmute everyone's microphone. Once all rooms are ready to go, the main screen will change to the decision screen you see above, and you will learn your value/cost.

Once you see the decision screen, use your mouse to click on the main screen. This will hide the Zoom screen. You can start negotiating at that time. The five minutes for negotiation will start, and you will be able to speak to and hear your partner.

Once the negotiation is complete, the main screen will change to a wait screen. Do not click the mouse or touch the keyboard during the wait screen. You will see the Zoom window pop up as you are moved back to the main room, and your microphone is muted. You will wait until everyone has completed that round of negotiation. Once everyone is done, the main screen will show the profit for that round. You will click okay button on the main screen,

and the next round will begin.

Remember to not click the Zoom screen. You can always access the main screen by clicking on it.

Are there any questions before we begin?

C Analysis of follow-up experiment data

This section presents the analysis of the follow-up experiment data as specified in the pre-analysis plan. This set of experiments based on two treatments was pre-registered at the AEA RCT Registry: https://www.socialscienceregistry.org/trials/13334. The analysis only includes the data collected in April 2024 for the Voice and Voice Altered treatments.

Table C.1: Gender gap in earnings and treatment effects

VARIABLES	(1) Gender Gap	(2) Treatment effects	(3) Heterogeneous treatment effects	(4) Mixed-sex pairings	(5) Same-sex pairings
Female	-0.21		0.15	-1.41	1.47*
	(0.53)		(0.64)	(0.85)	(0.88)
Westfall-Young p-value			< 0.927 >	< 0.215 >	< 0.260 >
Voice		-0.17	0.22	-0.78	0.88
		(0.54)	(0.64)	(0.94)	(0.74)
permutation p-value		< 0.7710 >	< 0.7462 >	< 0.4219 >	< 0.2216 >
Westfall-Young p-value			< 0.927 >	< 0.585 >	< 0.402 >
Female × Voice			-0.74	0.09	-1.09
			(1.07)	(1.22)	(1.59)
permutation p-value			< 0.5002 >	< 0.9412 >	< 0.4954 >
Westfall-Young p-value			< 0.842 >	< 0.950 >	< 0.492 >
Seller	-1.26**	-1.26**	-1.26**	-0.75	-1.81**
	(0.53)	(0.53)	(0.53)	(0.61)	(0.81)
Constant	18.05***	18.02***	17.95***	19.04***	17.02***
	(0.58)	(0.61)	(0.57)	(0.84)	(0.83)
Observations	490	490	490	252	238
R-squared	0.02	0.02	0.02	0.04	0.05
H0: F+F×Voice=0, p-value			[0.4960]	[0.1290]	[0.7741]

Note: Ordinary least square regressions are reported with earnings as the dependent variable. All regressions include dummy variables for round number. Voice indicates the Voice treatment. The omitted treatment is Voice Altered. Female indicates a female participant. Standard errors are clustered by participant and reported in parentheses. P-values are in square brackets ([]). Permutation and Westfall-Young (Westfall and Young, 1993) p-values are in angle brackets (<>). Westfall-Young p-values adjust for multiple hypothesis testing. Permutation p-values are randomization inference p-values testing the sharp null of no treatment effects (based on Young, 2019). *** p<0.01, ** p<0.05, * p<0.10

Table C.2: Confidence of participant during negotiations (7-point Likert scale)

VARIABLES	(1) All	(2) All	(3) Mixed sex	(4) Same sex
Female	-0.88***	-0.41	-0.90**	0.03
	(0.21)	(0.31)	(0.43)	(0.38)
Westfall-Young p-value		< 0.214 >	< 0.119 >	< 0.950 >
Voice		0.50*	0.35	0.59
		(0.28)	(0.34)	(0.38)
Westfall-Young p-value		< 0.164 >	< 0.469 >	< 0.226 >
Female × Voice		-0.98**	-0.60	-1.27**
		(0.41)	(0.57)	(0.55)
Westfall-Young p-value		< 0.054 >	< 0.469 >	< 0.063 >
Seller	-0.20	-0.20	-0.10	-0.30
	(0.21)	(0.20)	(0.29)	(0.28)
Constant	4.87***	4.64***	4.99***	4.32***
	(0.21)	(0.27)	(0.35)	(0.36)
Observations	248	248	120	128
R-squared	0.22	0.24	0.25	0.26

Notes: Ordinary least squares regressions reported with confidence of first and last negotiation (scaled 1 to 7) as dependent variable. Regressions include dummies for last negotiation. Voice indicates Voice treatment. The omitted treatment is Voice Altered. Female indicates a female participant. Standard errors clustered by participant in parentheses. Westfall-Young (Westfall and Young, 1993) p-values in angle brackets (<>). Westfall-Young p-values adjust for multiple hypothesis testing. *** p<0.01, ** p<0.05, * p<0.10.

Table C.3: Strategic behavior

	(1) Make first offer	(2) Suggest reveal value/cost	(3) Reveal value/cost	(4) Reveal value/cost truthfully	(5) Size of lie
Voice		0.01	0.09	0.02	0.67
		(0.08)	(0.09)	(0.12)	(0.62)
Westfall-Young p-value		< 0.979 >	< 0.615 >	< 0.827 >	< 0.456 >
Female	-0.08	0.02	-0.02	0.19*	-0.60
	(0.06)	(0.07)	(0.09)	(0.11)	(0.52)
Westfall-Young p-value	< 0.345 >	< 0.966 >	< 0.856 >	< 0.217 >	< 0.456 >
Female × Voice	-0.05	-0.01	-0.08	-0.18	-0.23
	(0.06)	(0.11)	(0.13)	(0.17)	(0.76)
Westfall-Young p-value	< 0.417 >	< 0.979 >	< 0.754 >	< 0.440 >	< 0.742 >
Seller	-0.02	0.05	0.02	-0.11	0.24
	(0.05)	(0.06)	(0.07)	(0.08)	(0.38)
Constant	0.56***	0.17**	0.41***	0.68***	0.56
	(0.06)	(0.06)	(0.08)	(0.10)	(0.54)
Observations	490	490	490	271	271
R-squared	0.01	0.01	0.04	0.04	0.05
Gender gap in Voice	-0.13	0.01	-0.10	0.01	-0.83
H0: F+F×Voice=0, p-value	[0.0151]	[0.8896]	[0.3490]	[0.9287]	[0.1410]

Note: Each observation is a participant's decision in a negotiation. Missing observations are due to corrupted audio recordings. Ordinary least squares regressions are reported. Dependent variables are 0-1 on whether or not the subject made the first offer (Column 1), suggested to reveal value/cost (Column 2), revealed their value/cost (Column 3), and conditional on revealing their value/cost, did so truthfully (Column 4). In Column 5, the dependent variable is the difference between the revealed value/cost and the participant's assigned value/cost, conditional on revealing their value/cost. Voice indicates the voice treatment. The omitted treatment is Voice Altered. Female indicates a female participant. Regressions include dummy variables for round number. Standard errors are clustered by participant and reported in parentheses. P-values are in square brackets ([]). Westfall-Young (Westfall and Young, 1993) p-values are in angle brackets (<>). Westfall-Young p-values adjust for multiple hypothesis testing. *** p<0.01, ** p<0.05, * p<0.10

Table C.4: External ratings of negotiations

VARIABLES	(1) Correct guess	(2) Confidence	(3) Cooperative	(4) Competitive
Voice	0.01	0.24	0.42	0.44
	(0.05)	(0.27)	(0.28)	(0.30)
Westfall-Young p-value	< 0.929 >	< 0.517 >	< 0.251 >	< 0.233 >
Female	-0.09*	-0.40	0.40	-0.63**
	(0.05)	(0.27)	(0.25)	(0.28)
Westfall-Young p-value	< 0.160 >	< 0.295 >	< 0.251 >	< 0.063 >
Female × Voice	-0.02	-0.11	-0.42	-0.15
	(0.07)	(0.38)	(0.38)	(0.40)
Westfall-Young p-value	< 0.929 >	< 0.761 >	< 0.274 >	< 0.711 >
Constant	0.61***	5.57***	6.27***	4.85***
	(0.04)	(0.19)	(0.18)	(0.21)
Observations	496	496	496	496
R-squared	0.02	0.02	0.01	0.04

Note: Ordinary least squares regressions are reported. The dependent variables are: average of whether or not the guess of the gender of the person generating the negotiation dialogue is correct, i.e., 1 if correct, 0 otherwise (Column 1), average rating of confidence of the dialogue (Column 2), average rating of cooperativeness of dialogue (Column 3) and average rating of competitiveness of dialogue (Column 4). Each observation is the average rating for one side of a negotiation dialogue, either the buyer or the seller. Voice indicates the Voice treatment. The omitted treatment is Voice Altered. Female indicates a female participant's dialogue is evaluated. Standard errors are clustered by participant and reported in parentheses. Westfall-Young (Westfall and Young, 1993) p-values in angle brackets (<>). Westfall-Young p-values adjust for multiple hypothesis testing within a regression. *** p<0.01, ** p<0.05, * p<0.10