"Communication in Bargaining Games with Unanimity" *

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Abstract

Communication has been shown to increase proposer power in multilateral bargaining settings that use majority voting rule via competition between non-proposers for a place in the coalition. In this paper we investigate whether communication affects bargaining outcomes and the bargaining process settings in which the competition effect is not present. We study committees that use unanimity rule to pass allocations. We find that in these settings, communication has the complete opposite effect compared with the majority settings: under unanimity, communication eliminates the inefficiencies that are present in settings without communication and it shifts bargaining outcomes towards egalitarian allocations with no proposer power. Communication logs provide insights regarding the topics subjects discuss and communication content correlates with bargaining outcomes.

1 Introduction

Communication is an integral part of bargaining processes. Formal bargaining is typically preceded by informal conversations between involved parties who attempt to influence bargaining results. For instance, in legislative policy-making, legislators spend a considerable amount of time and resources communicating with each other before bringing bills to the floor for a vote. Similarly, in arbitration cases and trade agreements, negotiations between conflicting parties are a vital part of the bargaining process. In many of these examples, bargainers communicate

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with each other despite the fact that they have commonly known unaligned preferences regarding bargaining outcomes and there is no incomplete information embedded in the environment.

Great strides have been made in the bargaining literature to better understand the effects of communication on bargaining outcomes and on the bargaining processes underlying these outcomes. Much of the work that analyzes the effects of communication in complete-information multilateral bargaining setups comes from experimental studies. Agranov and Tergiman (2014) were the first to introduce communication in multilateral bargaining and showed that this alone allows proposers to increase their shares to nearly theoretical levels. Work by Baransky and Kagel (2015) further confirmed these findings. Both of these studies focused on bargaining games that use a majority voting rule to pass proposed allocations.[1] A majority voting rule means that a proposer allocates positive shares only to a subset of committee members (the minimum winning coalition, i.e. those who are expected to support the proposed allocation) and appropriates the remaining funds. The introduction of communication under a majority voting rule allows the proposer to create an auction for a place in the coalition among non-proposers, which ultimately drives the shares of coalition partners down via a "competition effect." By exploiting this competition effect, the proposers are able to appropriate a higher share of resources in committees that allow negotiations between its members compared to those that restrict such negotiations.

In this paper we investigate whether communication in bargaining has a role that goes beyond allowing competition to flourish. We do this by studying multilateral bargaining with a different voting rule often used in real-life bargaining situations: the unanimity rule, which requires support of all committee members. By changing the voting rule from majority to unanimity, we completely remove the competition effect discussed above. Specifically, we run a series of laboratory experiments in which a five-member committee is charged with allocating a unit of resources between its members using a standard bargaining protocol *à la* Baron and Ferejohn (1989). At the beginning of the bargaining stage, one member of the committee is chosen at random to propose a budget allocation. All committee members observe this allocation and vote either to support or reject the proposed budget. If all members support the allocation, then the budget passes, the game ends and the committee dissolves. If the budget is rejected, then the committee goes into the next bargaining stage with the same bargaining protocol. Our treatments vary whether committee members can communicate with each other before the proposed allocation is submitted.[2]

Given that the "competition effect" is absent under a unanimity rule, one might expect that communication under such a voting rule might have no impact on proposer power. However, our results show that this is far from the case. In fact, adding communication under a unanimity rule has two strong effects. First, contrary to the competition effect observed in majority settings, proposers *lose* power and appropriate a smaller share of resources when members can

[1]Recently, communication has been also incorporated in the dynamic bargaining games that do not end once the resources are allocated (see Baron, Bowen and Nunnari (2017) and Agranov, Cotton and Tergiman (2017)).

[2]Our communication tool allows committee members to send any kind of text message to any subset of members in their group, including private messages to individual members and public messages that are delivered to all members of the group.

communicate with each other. Specifically, without communication, in the vast majority of passed proposals (more than 85%), the proposer appropriates a higher share than any other committee member, while more than 90% of all passed allocations in the treatment with communication are exact five-way equal splits. Second, communication improves efficiency both in terms of the likelihood of delays occurring and, consequently, the overall resources appropriated by bargainers. Committees that allow communication rarely experience delays in reaching decisions (less than 7% of the cases) and appropriate 99% of available resources. Without communication, delays are very common and occur in 44% of the cases and committees lose about 15% of available resources. This last result speaks to the debate regarding the disadvantages of the unanimity rule. (See the discussion in Buchanan and Tullock (1962) and Miller and Vanberg (2013)).

To investigate communication patterns that arise in committees that use the unanimity rule, we analyze communication logs. We have three main results in this respect. First, when unanimous support is required to pass proposals, subjects choose to communicate publicly by sending messages that are delivered to the entire committee. This is strikingly different from the overwhelmingly private chatting behavior observed under a majority rule setting, as documented by Agranov and Tergiman (2014). Second, public and private statements serve opposite purposes. When subjects choose to communicate privately via back-room channels, they lobby for themselves, in particular their place in the coalition and their share. When subjects choose to make public statements, these statements serve to promote equality and a more egalitarian distribution of resources between all members. The prevalence of public messages coupled with the content of these messages is the driving force behind the egalitarian allocations observed in committees that use a unanimity rule and permit communication between its members. Third, there is a strong correlation between the actions of proposers and the content of the deliberation process despite the cheap-talk nature of such communication. The proposed allocations are more likely to feature an equal split of resources between all committee members and a smaller proposer share when members discuss fairness. The opposite is true when members discuss self-interest.

Overall, the results documented in the current study and in Agranov and Tergiman (2014) show that the impact of communication on bargaining greatly depends on the voting rule in place. Under a majority rule, communication leads to higher proposer power via the competition effect. However, when the competition effect is removed, as is the case under unanimity rule, communication is detrimental to the proposer and completely removes proposer power.[3] Absent the competition effect, communication is used as a tool to promote and implement social norms via pressure for egalitarian allocation of resources. In committees that use unanimity rules and allow communication, these social norms become the dominant force determining bargaining outcomes, which are for the most part fully egalitarian and feature the highest efficiency levels. Given the presence of unanimity rules in real-life committees, these effects are

[3]Our results are in line with those documented in bilateral bargaining settings: Roth (1995) shows that in a two-player game, allowing face-to-face communication, leads to more equal shares of the bargainers. Unfortunately, there is no record of face-to-face communication between bargainers, which precludes a more thorough investigation of the content of communication and comparison with our current setup.

important elements to consider when thinking about the optimal amount of interaction between bargainers and, more generally, the transparency of the bargaining process.[4]

Our paper contributes to a large experimental body of literature that studies the complete information multilateral divide-a-dollar game. Much of this literature has adopted the stylized bargaining protocol of Baron and Ferejohn (1989) and has focused on analyzing the effects of various political institutions on the distribution of resources and bargaining efficiency. This literature is reviewed in Morton (2012) and in Palfrey (2013). Among other things, studies have analyzed the comparative static predictions of the Baron-Ferejohn model (McKelvey (1991) and Diermeir and Morton (2004)), the effects of amendment rules (Frechette, Kagel and Lehrer (2003)), of bargaining protocols (Frechette, Kagel and Morelli (2005)), of voting rules (Miller and Vanberg (2013)), of veto power (Kagel, Sung and Winter (2010)), and the more general determinants of voting behavior (Frechette and Vespa (2017)). The present paper is, to the best of our knowledge, the first to study multilateral bargaining in committees that use a unanimity rule and allow communication between group members.

The rest of the paper is structured as follows. The bargaining game and theoretical predictions are described in Section 2. The experimental design is presented in Section 3. Our experimental results are reported in Section 4. Finally, in Section 5 we offer some conclusions.

2 Setup and Theoretical Predictions

We consider a classic divide-a-dollar game in which a committee of $N \geq 3$ players decides how to allocate a fixed budget of $\$1$ among themselves using the q-voting rule, where $q \leq N$. The parameter q represents the degree of consensus required to reach the agreement with $q = N$ corresponding to the unanimity voting rule.

The committee uses the standard bargaining protocol of Baron and Ferejohn (1989), which is an N-person extension of the Rubinstein alternating offers bargaining game. At the beginning of the first bargaining stage, one group member is chosen at random to make a proposal. A proposal is a vector $(x_1^i, ..., x_N^i)$ that specifies the share of each group member (x_j^i indicates the share offered to member j by member i, $x_j^i \geq 0, \forall j$). Proposals have to satisfy the budget constraint $\sum_{j=1}^{N} x_j^i \leq 1$. The proposed allocation is observed by all group members and is immediately voted on. If q members support the proposal, then it is implemented and the committee adjourns. If it is rejected (gets fewer than q votes) then the budget shrinks by a factor of $(1 - \delta)$, the committee moves to the next bargaining stage and the process repeats itself (one group member is chosen at random to make a proposal, etc...) until a proposed distribution receives q votes. Committee members have preferences that depend only on their own share. The factor $(1 - \delta)$ represents the cost of delay in reaching an agreement and allows

[4]The Council of the European Union for example has to vote unanimously on any "sensitive" issues, such as the joining of new members or common security policies. In the United States, many private clubs admit new members only if they are accepted by unanimity. Also in the United States, the certificate of incorporation of a majority of companies requires action by written consent to be unanimous.

for efficiency comparisons between different final allocations.

It has been shown that Baron-Ferejohn games with q-voting rules admit plethora of subgame perfect equilibria. Thus, to gain some predictive power, most papers in this literature focus on the specific type of SPE, i.e., symmetric stationary subgame-perfect equilibria (SSSPE), in which players support a proposal when they are indifferent between accepting and rejecting it.[5] Then, for each q-voting rule and each discounting parameter δ, there exists a unique such SSSPE, in which players support a proposal when they are indifferent between accepting and rejecting it (equilibrium hereafter), in which all proposals pass right away without any delay. In this equilibrium, the proposer randomly selects $q < 1$ other committee members (the coalition partners) and offers them equal shares that make them exactly indifferent between accepting and rejecting the bill. The proposer appropriates the remainder of the budget. The committee members that are not invited into the coalition (if those exist) get zero shares. Non-proposers support any bill that gives them at least as much as their continuation value and reject any bill that gives them lower amount. Thus, in the equilibrium, all proposals pass without delay and the distribution of resources depends on the voting rule in place, q,

$$x_q^{\mathrm{P}} = 1 - (q-1) \cdot x_q^{\mathrm{NP}} \quad \text{and} \quad x_q^{\mathrm{NP}} = \frac{\delta}{N}$$

This equilibrium has been argued to be the most relevant theoretical benchmark for behavior in Baron-Ferejohn games for a variety of q-voting rules and different discounting parameters δ (see Frechette et al (2005), Miller and Vanberg (2013), and survey of Palfrey (2013)). We, therefore, focus on the same benchmark when analyzing results of our experiments without communication.

As we alluded in the introduction, in some treatments, we allow group members to engage in cheap-talk communication. The communication happens after the proposer is chosen and before he/she submits the proposed allocation. What happens when communication between bargainers is introduced? While the theoretical derivation of the full set of SSSPE in the game with communication is beyond the scope of the current paper, we note that the same equilibrium described above for the game without communication exists also in the game with communication. Intuitively, communication serves little purpose for the bargainers in this game since the game is one of complete information where the players' preferences and the structure of the game are common knowledge. Thus, one may argue that all players should be able to compute all continuation values from the outset of the game without the use of communication. Our experimental treatments will inspect this intuition.

[5] Specifically, stationarity here means that strategies used by proposer and non-proposers are independent of the history of play. Moreover, symmetry means that proposers treats all non-proposers the 'same' way (i.e., offer all non-proposers who are included in the coalition the same share) and non-proposers act the 'same' way irrespectively of which committee member is selected to be the proposer (i.e., use the same cutoff rule to decide whether to accept or reject the proposal).

3 Experimental Design

The experiments were conducted at the California Social Sciences Experimental Laboratory (CASSEL) at UCLA between February and April of 2013. A total of 155 subjects participated in six different experimental sessions. The subjects were recruited from the general undergraduate population of UCLA and no subject participated in more than one experimental session. All the interactions between participants were through computer terminals using the MULTISTAGE software.[6]

The experimental design is identical to that of Agranov and Tergiman (2014), save for the voting rule.[7] In particular, in all experiments, groups with five members ($N = 5$) bargained over a budget of 250 tokens. Bargaining was governed by the Baron-Ferejohn protocol described above with discount factor of $\delta = 0.8$, which means that following the rejection of a proposed allocation the budget shrank by 20%. Specifically, at the beginning of each bargaining session, one of the five members was randomly chosen to be the proposer. His/her assigned ID number was revealed to the entire group. The proposer proposed an allocation that was observed by all members of the group, with shares to each member clearly indicated. After that, all members of the group including the proposer voted to accept or reject the proposed allocation. If the allocation obtained the required number of votes $q = N = 5$ then it passed and the bargaining session was over. Otherwise, if one or more members of the committee rejected the proposal, the budget shrank by 20% and the bargaining continued with a random selection of a (possibly) new proposer from the same group. This process repeated itself until a proposer's allocation received all 5 votes.[8]

We conducted two treatments: a treatment without communication, which we refer to as the Unanimity Baseline treatment, and a treatment with communication, which we refer to as the Unanimity Chat treatment. For each treatment, we conducted three separate experimental sessions. Specifically, in the treatment without communication, after the proposer was selected, no communication between members of a group could happen, and the proposer was prompted to submit an allocation. In the treatment with communication, after the proposer was determined and his/her ID number revealed to the group members, but before the proposer submitted his/her proposal, members of the group could communicate with each other using a chat tool. This chat tool allowed subjects to send any message they wanted to any subset of members in their group. For instance, members could send private messages that would be delivered only to a particular member or to a subset of members, and they could also send public messages that would be observed by all members of the group. Subjects could only see the messages that were sent to them. If a message was sent to two or more individuals at

[6]This software was developed from the open source Multistage package and is available for download at http://software.ssel.caltech.edu/

[7]The sessions were also conducted around the same time, removing the possibility that a change in behavior across the Unanimity and Majority settings would be due to changes in the economic or social environments.

[8]The only difference between the current set of experimental sessions and those reported in Agranov and Tergiman (2014) is the voting rule used to pass the proposals. In the previous paper we analyzed bargaining with majority voting rule, in which at least three yes votes were required for the proposal to pass, i.e., $q = 3$.

the same time, those individuals observed who the other recipients were. The duration of the communication was in the hands of the proposer: the chat tool was disabled when the proposer submitted his/her proposal for a vote. Our software recorded all the messages sent by subjects during the communication stage.[9]

Each experimental session consisted of 15 bargaining games. Before the beginning of each bargaining game, subjects were randomly matched into groups of five and assigned an ID number. Random matching between bargaining games and random assignment of ID numbers was used to minimize repeated bargaining effects. At the end of the experiment, we summed up all the tokens earned by each subject in all bargaining games and converted them to US dollars using the rate of 50 tokens equals $1. Our experimental sessions lasted about an hour and subjects earned on average $20, including the show-up fee of $5. Complete instructions for the Unanimity Chat treatment are presented in Appendix A.

For the parameters used in our experiments, the unique symmetric stationary subgame perfect equilibrium predicts that the share of each coalition member in both treatments is $x^{\text{NP}}_{q=5} = 40$ tokens, while the proposer appropriates the remaining $x^{\text{P}}_{q=5} = 90$ tokens.

4 Results

We present our experimental results in the following order. We start by documenting how unrestricted communication affects bargaining outcomes (Section 4.1). Specifically, we evaluate bargaining outcomes through two lenses: (1) the frequency of delays and inefficient agreements, and (2) the distribution of resources among committee members. We then proceed to analyze the content of the communication between bargainers and their voting behavior (Section 4.2).

4.1 Bargaining Outcomes

4.1.1 Approach to Data Analysis

In the main text of the paper, we report data from the first bargaining game as well as from the last five games in each session. The data from the first game in each session is informative as it avoids interdependencies due to random rematching of the participants into groups throughout the session. The data from the last five games is used to compare bargaining outcomes between treatments after subjects have been able to familiarize themselves with the game and interface. This is the standard method in experimental economics given the abundance of evidence that subjects often learn the game by playing it, which results in much noisier data in the first few periods of the experiment. In Appendix C.3, we present a thorough analysis of the learning behavior over the course of our sessions.

[9]The communication protocol is identical to that of Agranov and Tergiman (2014).

To compare the average outcomes between two treatments and to contrast them with theoretical predictions, we use random effects GLS regressions with standard errors clustered at the session level. Clustering at the session level accounts for potential interdependencies between observations that come from random re-matching of subjects between matches in a session. Depending on the question under consideration, we use one of the two regression specifications described below to provide statistical statements:

1. The first regression specification is used to compare variable of interest, e.g. an indicator of whether the outcome is efficient or the share of the proposer, with the theoretical predictions. We do this by regressing variable of interest on a constant term. We report the p-value of a test where the null hypothesis is that the estimate equals the theoretically predicted one.

2. The second regression specification is used to compare variable of interest between two groups, e.g., two treatments. In this case, we regress the variable of interest on a dummy variable that indicates one of the groups and a constant. We report the p-value of a test where the null hypothesis is that there is no difference across the two groups.

4.1.2 Efficiency

Efficiency in our setup can be measured by both the probability of delays occurring and the proportion of initial pie realized. If a proposer is unable to gather the required number of votes, delays in implementing a budget occur. Because the budget shrinks by 20% before a new round of voting can take place, an inefficiency is created. Previous experimental studies have documented higher delays in bargaining situations in which unanimity (as opposed to a simple majority) is required to pass a proposal. (See Miller and Vanberg (2013).) This has served as support for the theoretical argument by Buchanan and Tullock (1962) that less-than-unanimity decision rules are more efficient.

Table 1: Efficiency and Delays

	Unanimity Baseline		Unanimity Chat	
	game 1	last 5 games	game 1	last 5 games
Probability of Delays	0.06 (0.06)	0.44*** (0.04)	0.13 (0.07)	0.07 (0.03)
Number of Bargaining Stages	1.17 (0.51)	3.14 (1.10)	1.12 (0.05)	1.06 (0.03)
Proportion of Initial Pie Realized	0.98 (0.02)	0.85*** (0.01)	0.97 (0.01)	0.99 (0.01)

Remarks: Probability of delays measures the likelihood that the first stage proposal was rejected. Number of bargaining stages and Proportion of initial pie realized report the average quantities across sessions and cluster-robust standard errors are in parentheses, where the observations are clustered at the session level. For the probability of delays (first row) and the proportion of initial pie realized (third row) we also report whether the observed quantity is significantly different from the theoretically predicted one with ***,** ,* indicating significance at the 1, 5 and 10% levels, respectively.

Table 1 reports efficiency measures in the unanimity setting both with and without communication. Interestingly, in the first game in both treatments, delays occur at very low rates (statistically no different than 0 with $p > 0.10$ in both treatments). However, over time, delays routinely occur in the unanimity setting without communication, consistent with the Buchanan and Tullock (1962) intuition. Indeed, by the end of our sessions in our Unanimity Baseline treatment, the fraction of delays is staggeringly high at 44% and bargainers loose 15% of their initial resources on average. Both these features are inconsistent with theoretical predictions according to which delays should never be observed on the equilibrium path, and, as a result, 100% of the initial pie is predicted to be appropriated by the bargainers.[10]

The introduction of communication dramatically improves efficiency both in terms of the likelihood of delays occurring and the overall resources appropriated by bargainers: fewer than 7% of groups that have access to communication in unanimity settings end up reaching the second bargaining stage. Consequently, with communication, groups appropriate 99% of available resources.[11] Statistical analyses confirm that in the last 5 games, delays are much more likely to occur when committee members do not have access to communication than when they do. Specifically, a regression analysis that compares the likelihood of delay in the Unanimity Baseline and Unanimity Chat treatments estimates the coefficient on the dummy variables indicating availability of communication at -0.371 with $p < 0.001$. A two-sided test of proportions performed at the session level (one observation per session) supports the same conclusion ($p = 0.0463$).

4.1.3 Proposed Budgets and Final Allocations

In the previous section, we have documented the positive effect that communication has on restoring efficiency in committees that use a unanimity voting rule. In this section, we focus on how the availability of communication affects the distribution of resources between committee members. In order to do so, we first abstract away from efficiency concerns and zoom in on first stage proposals. Then we combine both efficiency and the distribution of resources and look into the division of resources among allocations that passed.

Theoretically, both with and without communication, proposers should allocate 40 tokens to each of the four non-proposers and appropriate the remaining 90 tokens for themselves. Table 2 presents descriptive statistics of submitted, accepted and rejected proposals that occurred in the first bargaining stage as well as the final allocations irrespective of when they occurred. We report three statistics: (1) the average share of the proposer, (2) the average highest share of the coalition partners, and (3) the fraction of proposals in which all committee members get the exact same share each, which we refer to as "Equal Split." The first two statistics are

[10] Statistical analyses based on GLS regressions, in which observations are clustered at the session level, confirm that in the Unanimity Baseline treatment in the last 5 games the likelihood of delays is greater than the theoretically predicted level of 0% ($p = 0.008$) and that bargainers appropriate less than 100% of available resources ($p = 0.003$). In fact, the 95% confidence interval for probability of delays in the last 5 games of Baseline treatment is $(0.27, 0.60)$, while the 95% confidence interval for the the proportion of appropriated pie is $(0.82, 0.89)$. Neither confidence intervals do not include the point prediction identified by the theoretical analysis.

[11] We cannot reject the null hypothesis that probability of delays is equal to 0% as predicted by the theory and that bargainers appropriate 100% of available resources in Unanimity Chat treatment in the last 5 games ($p > 0.10$ in both tests).

accompanied by their corresponding robust standard errors, which are clustered at the session level.

Table 2: First-stage Proposals and Final Allocations in the Unanimity treatment.

	Baseline		Chat		Baseline vs Chat	
	game 1	last 5 games	game 1	last 5 games	game 1	last 5 games
FIRST STAGE						
Submitted Proposals						
Proposer's Share	57.4 (2.5)	68.2 (1.7)	54.1 (1.1)	50.8 (0.21)	$p = 0.235$	$p < 0.001$
Max Non-proposer's Share	46.2 (1.4)	46.0 (0.3)	49.0 (0.3)	49.9 (0.1)	$p = 0.085$	$p < 0.001$
Fraction of Equal Splits	43.8%	7.5%	80.0%	88.0%	$p < 0.001$	$p < 0.001$
Passed Proposals						
Proposer's Share	59.6 (0.4)	63.9 (2.9)	50.8 (0.7)	50.2 (0.1)	$p < 0.001$	$p = 0.003$
Max Non-proposer's Share	47.6 (0.1)	46.5 (0.7)	49.8 (0.1)	50.0 (0.0)	$p < 0.001$	$p = 0.003$
Fraction of Equal Splits	46.7%	13.3%	92.3%	94.3%	$p = 0.001$	$p < 0.001$
Rejected Proposals (for $n > 2$)						
Proposer's Share	n/a	73.7 (1.3)	n/a	59.2 (1.6)	n/a	$p < 0.001$
Max Non-proposer's Share	n/a	45.2 (0.2)	n/a	48.0 (0.3)	n/a	$p = 0.001$
Fraction of Equal Splits	n/a	0.0%	n/a	0.0%	n/a	n/a
FINAL ALLOCATIONS						
Proposer's Share	58.4 (1.5)	52.1 (2.8)	49.3 (1.3)	49.5 (0.4)	$p = 0.004$	$p = 0.357$
Max Non-proposer's Share	46.5 (1.1)	40.3 (0.2)	48.5 (0.6)	49.3 (0.3)	$p = 0.127$	$p < 0.001$
Fraction of Equal Splits	43.8%	28.8%	93.3%	94.7%	$p < 0.001$	$p < 0.001$

Remarks: We report the average share of the proposer and the highest share among coalition partners in tokens together with robust standard errors in parentheses, where observations are clustered at the session level. In Equal Split allocations all members of the committee receive the exact same number of tokens (in the first stage proposals this is exactly 50 tokens). "n/a" indicates that there are fewer than 3 observations in the category. The last two columns report statistical tests comparing variable of interest (proposer's share, highest share of non-proposer, or fraction of equal splits) between Unanimity Baseline and Unanimity Chat treatments. We report p-values for the estimated coefficient from the regression analysis (see details in Section 4.1).

We start our analysis with first stage proposals. In committees that do not have access to communication between members, proposers tend to appropriate a higher share of resources than coalition partners ($p < 0.001$ for both all submitted and all passed first-stage proposals in the last 5 games). However, proposers under-exploit their power relative to the equilibrium prediction: the average share of the proposer is between 64 and 68 tokens in the last 5 games depending on whether one considers all submitted first-stage proposals or only those that passed without delay. Regression analyses confirm that proposers' shares are significantly lower than those predicted by the theory in the last 5 games of the Unanimity Baseline treatment ($p = 0.006$ for all submitted and $p = 0.012$ for all passed proposals). Moreover, fewer than 15% of all submitted and passed proposals are exact equal splits. This echoes a well-known and robust finding in bargaining games with a majority voting rule, which establishes the failure of proposers to extract equilibrium rents absent communication. (See Frechette et al. (2003, 2005a, 2005b), Battaglini et al. (2012), Agranov and Tergiman (2014) and Baranski and Kagel (2015).)

The introduction of unrestricted communication steers final allocations in the direction of more egalitarian ones. In fact, it removes proposer power all together: In the Unanimity Chat, 94.3% of all allocations that pass without delay in the last 5 games are exact equal splits with all members earning 50 tokens. Given that delays are quite rare in the treatment with communication, this constitutes the vast majority of all passed allocations. Focusing on all submitted proposals in the first stage regardless of whether they passed or not shows the same pattern: in the last 5 games 88% are equal splits when communication is allowed and only 7.5% when communication is not allowed. Regression analysis confirms that a fraction of equal splits is significantly different between Unanimity Baseline and Unanimity Chat treatments in both all first-stage submitted proposals as well as in the all first-stage passed proposals irrespective of whether one focuses on the first game or the last 5 games in each experimental session. The exact p-values are reported in the last column of Table 2.

Rejected first-stage proposals, on the contrary, feature higher shares for proposers and are never equal splits, regardless of whether communication is allowed or not. Regression analysis confirms that proposers' shares are significantly lower in passed than in rejected first-stage proposals in the last 5 games of both Unanimity Baseline treatment and Unanimity Chat treatment with $p = 0.039$ and $p = 0.033$, respectively. The same pattern holds true even in the very first game of each experimental session: $p < 0.001$ in the Unanimity Baseline and $p = 0.045$ in the Unanimity Chat.

The voting patterns of non-proposers shed light on why some proposals are rejected and others are not. Table 3 presents results of regression analyses in which we investigate the determinants of supportive votes from non-proposers in both treatments. Specifically, we run PROBIT regressions in which we regress the vote of a non-proposer on a constant, the proposer's share, his own share, an indicator for the Chat treatment as well as interaction terms, while clustering observations by session. We present this analysis for the very first 5 games in each experimental session, the middle 5 games, and the last 5 games separately.[12] Results of the regressions reveal which factors impact voting behavior. Higher shares of proposers are associated with lower support from the non-proposers, particularly in the first and in the last 5 games. Further, by the end of the experiment, non-proposers tend to support proposals which give them higher shares.[13] In the last 5 games, other things equal, non-proposers are more likely to vote in favor of proposals in the Chat treatment compared with the Baseline treatment and subjects are less responsive to their own shares in the Chat treatment compared with the Baseline treatments (as shown by the interaction terms). However, as Table 3 clearly indicates,

[12] The reason we chose to present this regression analysis for the first 5 games rather than for the very first game is that there are very few negative votes in the first game in both treatments: only 3 out of 64 observations in the Baseline treatment and only 4 out of 60 observations in the Chat treatment. This is not enough variation to be able to identify the determinants of voting behavior in the first game.

[13] While the coefficient is negative in the first 5 games, the magnitude of those effect is rather small.

Table 3: Voting Behavior of Non-Proposers

	Dependent Variable: Support Proposal		
	first 5 games	middle 5 games	last 5 games
Proposer's share	$-0.03^{***}(0.01)$	-0.001 (0.008)	$-0.03^{***}(0.008)$
Own share	-0.007^{***} (0.0008)	$0.23^{***}(0.04)$	0.11^{***} (0.03)
Chat treatment indicator	$-46.28^{***}(2.24)$	-104.70 (64.04)	$18.46^{***}(4.21)$
Proposer's share × Chat treatment	$0.12^{***}(0.01)$	0.42 (0.29)	-0.24^{***} (0.07)
Own share × Chat treatment	$0.83^{***}(0.04)$	$1.66^{*}(0.99)$	-0.11^{***} (0.03)
Constant	$3.66^{***}(0.85)$	$-8.88^{***}(1.93)$	-2.01 (1.40)
# of observations	620	620	620
# of clusters	6	6	6
Log pseudolikelihood	-131.79	-162.06	-133.50

Remarks: We report the results of PROBIT regression in which we regress the votes of non-proposers (which takes value one if the non-proposer votes to support a proposal and zero otherwise) on the proposer's share, own share, treatment dummy as well as the interaction terms. The observations are clustered at the session level. We report estimated coefficients and robust standard errors in the parenthesis. *** denotes significance at 1% level, ** denotes significance at 5% level, and * denotes significance at 10% level.

the voting patterns of our experimental subjects evolve over time as voting behavior is quite different between the first 5 games and the remaining games. Once subjects gain experience in the game and converge to stable behavior, our data display voting patterns that are are largely consistent with the ones reported in the previous literature. (See Frechette et al. (2003, 2005a)).

Patterns observed in first-stage proposals translate directly into final allocations (see Table 2). The main observation is that the introduction of communication essentially eliminates proposer power altogether. This pattern is clearly seen in the comparison of the fraction of equal splits between Unanimity Baseline and Unanimity Chat treatments: while fewer than 30% of all final allocations in the Unanimity Baseline treatment are equal splits in the last 5 games, more than 90% of all final allocations in the last 5 games of Unanimity Chat treatment are the exact equal splits with no proposer power.[14] As we saw above, while in the Unanimity Baseline treatment proposers earn significantly higher shares than any other coalition partner, proposers' advantage is completely absent in the Unanimity Chat treatment ($p > 10\%$ in the last 5 games).

The seemingly close average shares of proposers in the Unanimity Baseline and Chat treatments in the last 5 games are the combination of two different effects. The low average share of the proposer in the Unanimity Baseline treatment is due to the high fraction of delays and the high discount factor (since the pie shrinks by 20% following each rejected proposal). The vast majority of proposals that pass, however, feature proposer power as proposers appropriate a higher share of resources than coalition partners. On the contrary, the low average share of the proposer in the Unanimity Chat treatment is due to the fact that the vast majority of all proposals are exact equal splits with no proposer power and that these pass.

[14]Similarly, in the first game, without communication, fewer then half of the final allocations are equal splits, versus over 90% when communication is allowed.

4.2 How are bargaining outcomes reached? Communication and bargaining behavior

In this section we are taking the first step in understanding how bargainers reached the outcomes summarized in the previous section. Why does the availability of communication increase efficiency and eliminate proposers' power in the Unanimity Chat compared to the Unanimity Baseline treatment?

To answer these questions, we analyze conversations between subjects that occurred before proposers submitted their proposals for a vote. The content of these conversations provides the insights into the dynamics that drive bargaining outcomes. We analyze the content of conversations and study how conversations relate to proposals and final allocations.

4.2.1 Content Analysis of Conversations

Communication protocols were analyzed by two students at UBC who were not privy to the goals of the current study. The students were given the complete transcripts of conversations along with pre-specified categories and were asked to determine which chat message fell into each category. (See Appendix B for the list of variables that the coders used.)

Table 11 documents the breakdown of all conversations that transpired in the first stage of the first and the last 5 games of the Unanimity Chat treatment. In this analysis, we treat the whole conversation that a group engaged in before a proposal was submitted as the unit of observation. All recorded conversations were classified by the coders into those that contain "relevant" messages and those comprised of all messages that are "irrelevant". Relevancy was broadly defined so that messages that were in any way related to the game were counted as relevant. Examples of commonly observed relevant messages include those that pertain to the structure of the game, proposals, consequences of rejecting a proposal, and players' strategies. Messages that did not contain any of the discussions pertaining to the game being played were coded as irrelevant. In addition, Table 11 documents how frequently communication did not take place before proposers submitted their allocation for voting.[15] We determined that a conversation was relevant if both coders agreed that it contained at least one relevant message. [16]

We first note that subjects used the messaging system very often. Indeed, in the last 5 games, in 84% (63 out of 75) of cases groups engaged in a conversation before the proposer submitted allocation for voting. Moreover, a vast majority of those conversations, 94% (59 out of 63), included discussions about the game being played. Irrelevant conversations were quite

[15]The full transcripts of the chats and their classification are available from the authors upon request.

[16]The level of inter-rater agreement is extremely high at 94.67%. While Cohen's kappa is particularly relevant in situations when there is no "objective" truth (for example, different individuals rating movies), we report it as well even though we believe that in these conversations there is an objective way to interpret them and that when there is disagreement, often it is clear which coder is mistaken. The value of Kappa is also very high at 0.825. There is also a very high degree of agreement at the individual subject level: 91.78% with a Kappa of 0.836.

Table 4: Descriptive Statistics of Group-level Conversations in the First Bargaining Stage of Unanimity Chat treatment.

	Unanimity Chat					
	game 1			last 5 games		
	relevant	irrelevant	no chat	relevant	irrelevant	no chat
Frequency of conversations	86%	7%	7%	79%	5%	16%
	$(n = 13)$	$(n = 1)$	$(n = 1)$	$(n = 59)$	$(n = 4)$	$(n = 12)$
Length of Chat (in seconds)	64.7	38.5	n/a	58.2	20.5	n/a

Notes: The first row reports the frequency of relevant, irrelevant and no chat in the first bargaining stage using one observation per group per match (the number of observations is listed underneath the fraction). Relevant conversations are defined as conversations that contain any mention of the game being played. We use a conservative measure of relevance and label a conversation as relevant only if both coders marked it as relevant. The third row reports the length of the chat in seconds.

rare and happened only in 4 groups in the last 5 games.[17] There were also 16% (12 out of 75) cases in which proposers submitted their allocation before any conversation took place. The proposals that were submitted absent any communication are quite similar to those submitted after relevant conversations: the vast majority of them (more than 80%) featured equal splits with each member receiving the exact same share of 50 tokens. Furthermore, more than 90% of the proposals submitted without any preceding chat passed right away just like proposals that were submitted after discussions of the game. Given the small number of conversations that contained only irrelevant messages or no messages at all, in the analysis that follows, we will focus on conversations that contained discussion coded as relevant.

Focusing on the conversations that contained relevant messages, we further classify messages according to their content. The vast majority of recorded messages fall into one of two categories: messages that relate to fairness of allocation, and messages that relate to self interest of a specific member. Most of the messages that were classified as "fairness" messages are similar to: "Equal is nice," "Let's just do 50 each," and "Just play fair." On the contrary, most of the messages that were classified as "self-interest" messages are similar to: "Give me [amount here] for an automatic yes," and "I'll vote yes for [amount here]." The frequencies of fairness and self-interest messages are very different: 80% of conversations in the last 5 games contain messages that lobby for fairness, while only 21% of conversations contain messages that lobby for self-interest. [18] Regression analysis confirms that the conversations in the Unanimity Chat treatment contain a significantly higher fraction of fairness messages than self-interest messages ($p < 0.001$).

To dig deeper into the content analysis, we zoom into the individual messages sent by

[17]Similar patterns are observed in the very first game: all but two groups discuss relevant to the game things, one group talks about irrelevant things, and one group proceeds to the bargaining stage without any discussions.

[18]There is also a very high degree of agreement at the individual subject level. We observe high agreement between coders regarding classification of messages into those related to fairness and those related to self-interest: 92.27% and 90.93%, respectively. The corresponding Kappa statistics are very high at 0.831 and fair at 0.438. A large fraction of the disagreements come from how each coder interpreted a message of just a single thing ("50") that was sent to everyone. One coder classified this message as fairness message, while another classified it as self-interest message.

Table 5: Frequency and content of individual messages in Unanimity Chat treatment

	Unanimity Chat			
	game 1		last 5 games	
	Non-Proposers	Proposers	Non-Proposers	Proposers
Total subjects	60	15	75	54
Nb (%) subjects who send relevant chats	34 (56.7%)	6 (40%)	61 (81.3%)	25 (46.3%)
Public Messages				
% who send public messages at least once	**100%**	**100%**	**96.7%**	**96%**
% who lobby for fairness	82.4%	66.7%	74.6%	58.3%
% who lobby for themselves	5.9%	0%	8.5%	29.2%
% who exclusively send public messages	**100%**	**100%**	**90.2%**	**96%**
Private Messages[a]				
% who send private messages at least once	**0%**	**0%**	**9.8%**	**4.0%***
% who exclusively send private messages	**0%**	**0%**	**4.0%**	**4.2%***

[a]We have few observations here, 6 at most, so we do not present the fraction of subjects who lobby for fairness or themselves

Notes: The content analysis pertains to those subjects who have sent at least one relevant message in the first stage of the first game or the last 5 games. Note that some categories have very few observations in them. In particular, * indicates the case in which we have one observation in a category (one subject).

our experimental subjects and further classify each message into those delivered to the entire group (Public messages) and those sent privately to a specific member of the group (Private messages). Table 5 summarizes the frequency of public and private messages as well as their content, treating messages from proposers and non-proposers separately. The content is broken down only for the subsample of subjects whose messages were classified as "relevant."

We start by noting that in both voting treatments non-proposers are more likely to use the messaging system than proposers: in the last 5 games, 81.3% of subjects at one point or another used the chat to discuss the game when they were non-proposers, while only 46.3% of subjects sent relevant messages when they were proposers in the Unanimity Chat treatments.[19]

Table 5 reveals interesting patterns characterizing the deliberation process in committees. First of all, almost all messages (whether sent by proposers or by non-proposers) are public and not private. Indeed, the fraction of subjects who sent a public message at least once during the last 5 games is significantly larger than the fraction of subjects who sent a private message at least once in the last 5 games ($p < 0.001$ for both groups). Similarly, over 90% of subjects exclusively used the public communication channel in the last 5 games, while just two non-proposers and one proposer exclusively used the private communication channel in the last 5

[19]Statistical tests show that in a conversation, the likelihood of proposers to engage in relevant conversation is significantly smaller than that of non-proposers during deliberation stage ($p < 0.001$).

games.[20]

The second important feature of the deliberation process is the observation that group members use public channels to lobby for fairness: non-proposers do so in over 70% of all cases in which they send public message, while proposers do so in more than half of the cases. Talking about self-interest using public messages is not common for non-proposers, though just under a third of proposers who use the chat feature do so.

4.2.2 Conversations and Bargaining Actions

Does the deliberation process matter in the sense that there is a relation between what people say in the negotiation stage and what they do in the game after? In this section we show that the answer is yes. Despite conversations being cheap talk, there is a strong relationship between the content of conversations and the type of proposals submitted, which, ultimately, determine final bargaining outcomes.

Table 6: Regressions of first-stage proposals in the last 5 games of Unanimity Chat treatment.

	Dependent variable	
	Equal split proposal	Share of the proposer
Group conversation contains		
messages about fairness	0.95 (0.63)	-1.54** (0.28)
messages about self-interest	-1.60*** (0.19)	3.62*(1.08)
Constant	0.99*** (0.16)	51.28*** (0.29)
# of observations	75	75
# of clusters	3	3
(pseudo) R-squared	0.170	0.170

Notes: The first column reports PROBIT regression in which the dependent variable is the dichotomous variable that takes value 1 if the proposer submitted an equal split proposal in which all group members get the same share of 50 tokens. The second column reports linear regression in which the dependent variable is the share of the proposer. In both regressions, standard errors are clustered at the session level. ***, **, and * indicate significance at 1, 5, and 10% level, respectively.

Since essentially all proposed allocations in the Unanimity Chat treatment are accepted right away (see discussion in Section 4.1.2), we focus on the correlation between the content of those chats that precede first-stage proposals.[21] Table 6 reports two regressions both analyzing features of the first-stage proposals submitted in the last 5 bargaining games. The dependent variable in the first regression is an indicator which takes value one if submitted allocation is an equal split and zero otherwise. The dependent variable in the second regression is the share of the proposer.

[20]Regression analysis confirms that the fraction of subjects who exclusively used public messages in the last 5 games is significantly higher than the fraction of subjects who exclusively used private messages with $p < 0.001$ for both non-proposers and proposers.

[21]In the last 5 bargaining games of the Unanimity Chat treatment, 93% of all first-stage submitted proposals are passed right away. Therefore, there is not enough data to analyze voting patterns of non-proposers.

In the first regression, we find that there is a positive and significant association between conversations pertaining to selfish motives and the probability of submitting an equal split proposal. At the same time, messages regarding fairness and equal splits display no such correlation, which perhaps is an indication that equal split proposals have no need to be explicitly talked about since by the end of the game they are the most commonly observed allocation which always pass. Turning to proposers' shares we see that both types of conversations are related to the shares appropriated by the proposers. As is the case in the first regression, conversations about self-interest are associated with higher proposers' shares. Interestingly, in this case, conversations about fairness are associated with lower proposer shares. This last effect is significant at the standard 5% significance level. However, given the results of the first regression, we see that while conversations about fairness are associated with lower proposer shares, they have no significant correlation with the likelihood of proposing equal shares for all members. While our current data and analyses presented above cannot establish causality between conversations and behavior of group members, they suggest that the deliberation process was taken seriously by our experimental subjects. Indeed, we find that there are important and significant correlations between what people say and what they do, despite communication being cheap talk. One interpretation of our results is that given that inefficient and costly delays are practically eliminated when group members chat, negotiations serve as a coordination device to select a specific allocation of resources (out of many possible) which will pass right away.[22]

5 Conclusion

Communication is an integral part of bargaining processes. In this paper, we have studied the effects of cheap-talk deliberation that occurs in unanimity settings, in which support of all committee members is required to pass the proposal. Absent such communication, committees that use unanimity voting rules suffer from inefficient delays, as proposals often fail to obtain unanimous support even after subjects gain experience with the game. Those proposals that do pass without delay, however, feature some proposer power, as proposers appropriate a higher share of resources than the non-proposers. The introduction of communication has important effects on bargaining outcomes. First, communication restores efficiency, as 99% of all proposed allocations pass without delay. Second, subjects mainly use a public communication channel in which they lobby for equal and fair allocation of resources. This has a strong effect on proposed allocations, as proposers give in to this pressure and divide resources equally among all committee members. As a result, communication essentially eliminates proposer power as over 90% of all passed proposals feature the exact equal split of the available budget.

[22]Given that the vast majority of all messages sent by both proposers and non-proposers are public messages talking about fairness, one may ask whether there is a relationship between who (proposer or a non-proposer) sent the first message about fairness to the public chat and the proposal type or the share of the proposer. Our data indicate that such a correlation is not significant at any standard significance levels, which suggests that who spoke about fairness first (proposer or non-proposer) is irrelevant and that what may matter instead is that there was a group discussion about fairness at all: there is a positive correlation between having a fairness discussion and the probability of proposing an equal split allocation and, also, a lower share for the proposer.

Our current results combined with previously obtained results in the majority settings (Agranov and Tergiman (2014), Baranski and Kagel (2015)) suggest that even within the class of divide-a-dollar bargaining games, communication can have very different effects on bargaining outcomes depending on the voting rule in place. In multilateral bargaining games that use a majority voting rule to reach agreements, communication has been shown to promote higher proposer power and fewer egalitarian allocations. On the contrary, in settings that use the unanimity voting rule and require unanimous support from all committee members to pass proposals, communication increases efficiency, leads to more egalitarian allocations and eliminates proposer power all together. In other words, communication can enhance competition in environments where it is salient, but can also enhance social norms and reduce proposer power in the absence of competition.

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ONLINE APPENDIX

A Instruction for the Unanimity Chat

This is an experiment in the economics of decision making. The instructions are simple, and if you follow them carefully and make good decisions you may earn a CONSIDERABLE AMOUNT OF MONEY which will be PAID TO YOU IN CASH at the end of the experiment. The currency in this experiment is called tokens. All payoffs are denominated in this currency. The total amount of tokens you earn in the experiment will be converted into US dollars using the rate 50 Tokens = $1. In addition, you will get a $5 participation fee if you complete the experiment.

In this experiment you will act as voters. You will distribute funds between yourself and others in a series of Periods. In each Period you will be randomly divided into groups of 5 members each. Each group will decide how to split a sum of money. Proposals will be voted up or down (accepted or rejected) by unanimity rule. That is, if 5 out 5 voters approve a proposal, it passes. In any Period you will not know the identity of the subjects you are matched with and your group-members will not know your identity. In each Period you will have to decide how to divide 250 tokens among the 5 voters in your group. One of the 5 voters in your group will be randomly chosen to make a proposal of how to split 250 tokens among the 5 voters (provisional budget proposal). Each voter has the same chance of being selected to make a proposal. Allocations to each member must be between 0 and 250 tokens. All allocations must add up to 250 tokens. After the selected proposer has made his/her allocation, this proposal will be posted on your computer screens with the proposed allocation to you and the other voters clearly indicated. You will then have to decide whether to accept or reject the proposed allocation.

If the proposal passes (gets all 5 votes), the proposed allocation is implemented and we will move on to the next Period. If the proposal is defeated (gets fewer than 5 votes), there will be a call for new proposals and the process will repeat itself. However, the amount of money to be divided will be reduced by 20% of the amount of money in the preceding Round and rounded to the nearest integer. Thus, if the proposal in Round 1 is rejected, the new proposal in Round 2 will involve splitting 200 tokens among the 5 voters. And if this new proposal is rejected in Round 2, then in round 3 you will be splitting 160 tokens. If the proposal in rejected in Round 3, then in Round 4 you will be splitting 128 tokens, etc? This process will repeat itself until a proposed allocation is passed (gets all 5 votes).

To summarize, the steps of the process will work as follows:

1. One voter is randomly selected to make a proposal of how to split 250 tokens.
2. A vote is held (each member of the group votes to accept or reject the proposal of the selected voter).

3. If all 5 voters accept it, then the proposal passes and the Period is over. If the proposal is rejected, then the money shrinks by 20%, we move on to the next Round of this Period and a new voter is chosen to propose the split (each of the 5 voters in a group has equal chance of being chosen). The process repeats itself until the proposal of the selected voter for that Round passes.

At the start of each Period, you will be randomly re-matched into groups of 5 voters each. Each member of the group is assigned an ID number (from 1 to 5), which is displayed on the top of the screen. Once the Period is over, you will be randomly re-matched to form new groups of 5 voters each and you will be assigned a (potentially) NEW ID. Please make sure you know your ID number when making your decisions. Since ID numbers will be randomly assigned prior to the start of each Period, all voters are likely to have their ID numbers vary between Periods, and, thus, it is impossible to identify subjects using their ID numbers.

In each round, after one voter is selected to propose a split but before he/she submits his/her proposal, members of a group will have the opportunity to communicate with each other using the chat box. The communication is structured as follows. On the top of the screen, each member of the group will be told her ID number. You will also know the ID number of the voter who is currently selected to make a proposal. Below you will see a box, in which you will see all messages sent to either all members of your group or to you personally. You will not see the chat messages that are sent privately to other members. In the box below that one, you can type your own message and send it either to the entire group or to particular members of the group. To select subjects that will receive your message, simply click on the buttons that correspond to the ID numbers of the subjects you wish to send this message to and hit SEND. You can send a message to all members of your group by clicking the SELECT ALL button.

The chat option will be available until the voter selected to make a proposal submits her proposal. At this moment the chat option will be disabled.

Remember that in each Period subjects are randomly matched into groups and ID numbers of the group-members are randomly assigned. Thus, your ID number is likely to vary from Period to Period, and, therefore, it is impossible to identify your group-members using your ID number.

At the conclusion of the experiment we will sum up all the tokens you earned in the experiment and convert this amount into US dollars using the conversion rate 50 tokens = $1. In addition, you will receive a $5 participation fee for completing the experiment.

You are not to reveal your (potential) earnings, nor are you to speak or communicate in any other way with any other subject while the experiment is in progress. This is important to the validity of the study and will be not tolerated.

We will now go slowly through one practice Period to familiarize you with the screen. After the practice Period is over, we will start the experiment, in which you will play 15 Periods for cash.

Review. Let's summarize the main points:

1. The experiment will consist of 15 Periods. There may be several Rounds in each Period.
2. Prior to each Period, you will be randomly divided into groups of 5 voters each. Each subject in a group will be assigned an ID number.
3. At the start of each Period, one subject in your group will be randomly selected to propose a split of 250 tokens between the five of you. Before he/she submits his/her proposal, members of the group can use the chat box to communicate with each other. You may send public messages that will be delivered to all members of your group as well private messages that will be delivered to members that you specify explicitly.
4. Proposals to each voter must be greater than or equal to 0 tokens.
5. If all 5 voters accept the proposal, the Period ends.
6. If one or more voters reject the proposal then a (potentially) new voter will be randomly selected to make a proposal in the next Round of that Period.
7. The amount of money to be divided shrinks by 20% following each rejection of a proposal in a given Period.

Are there any questions?

B Analysis of Chat Protocols

Below we list the various variables, together with a short explanation, that the coders used in interpreting subjects' statements.

1. "Ask Amount." This is the explicit amount that a non-proposer is requesting. You can also record here an amount that someone says he will accept in exchange for a vote.
2. "Own Vague." Responder just asking for tokens (unspecified amount).
3. "Ask Equal." Responder asking for equality.
4. "Social Vague." Responder asking proposer to be nice or fair or something like that.
5. "Responding." This is equal to 1 if this statement is in response to a question on type of split by the proposer. This is accompanied by a 1 in either AskAmount, OwnVauge, AskEqual or SocialVague.
6. "Proposer Direct." Dummy indicating that the proposer is trying to figure out how much someone wants.
7. "Proposer Own." Proposer is indicating that he/she will get a higher share than at least some others.
8. "Proposer Equal." Proposer is indicating that he/she intends to split equally.
9. "Unsure." Dont know where to put a 1 but could fit in one of these categories.
10. "Relevant." Anything you cant categorize but thats relevant: discussions about rules, anything that is related to the game.

C Additional Data Analysis

C.1 Efficiency

In Table 7 we present the 95% confidence intervals for the efficiency measures reported in Table 1 in the main text of the paper, where observations are clustered at the session level to account for the interdependencies of observations that come from the same session.

As we discuss in Section 4.1.2, there is no statistical differences between treatments in all three efficiency measures (probability of delays, number of bargaining stages, and the proportion of initial pie realized) in the very first game our subjects play. However, as subjects gain more experience with the game, the stark differences emerge. The most notable ones are the lower probability of delays occurring in the Chat compared with Baseline treatment, which results in the higher proportion of initial pie realized in the Chat than in the Baseline treatment.

Table 7: Efficiency and Delays (95% confidence intervals)

	Unanimity Baseline		Unanimity Chat	
	game 1	last 5 games	game 1	last 5 games
Probability of Delays	$(-0.22, 0.34)$	$(0.27, 0.60)$	$(-0.16, 0.43)$	$(0.05, 0.19)$
Number of Bargaining Stages	$(0.51, 1.82)$	$(-1.61, 7.89)$	$(0.89, 1.35)$	$(0.96, 1.17)$
Proportion of Initial Pie Realized	$(0.88, 1.08)$	$(0.82, 0.89)$	$(0.91, 1.03)$	$(0.96, 1.01)$

Remarks: We report the 95% confidence intervals of probability of delays which measures the likelihood that the first stage proposal was rejected, the number of bargaining stages and the proportion of initial pie realized, where the observations are clustered at the session level.

C.2 Proposed Budgets and Final Allocations

In Table 8 we report the 95% confidence intervals of first-stage submitted, passed and rejected proposals as well as the final allocations. Results reported in this table confirm what we report in Section 4.1.3. In particular, focusing on the proposals submitted in the last 5 games, we observe that in committees that do not have access to communication between members, proposers tend to appropriate a higher share of resources than coalition partners. At the same time, proposer under-exploit their power relative to the equilibrium predictions, according to which a proposer should appropriate 90 tokens. However, once committee members can chat with each other, we observe no differences between proposers' and non-proposers' shares. Final allocations display similar patterns, i.e., the availability of communication removes proposers' power all together.

C.3 Results over time

In this section, we replicate the main analysis of the data breaking all 15 bargaining games played within each experimental session into three time periods: the first five bargaining games, the second five bargaining games, and the last five bargaining games. The goal of this section is to document learning behavior of subjects as they gain experience with the game over the course of the experiment.

Table 9 depicts three measures of efficiency: the probability of observing delays in reaching agreements, the average number of bargaining stages prior to the agreements, and the percentage of pie that subjects realized as a result of the bargaining. All three efficiency measures are quite stable across the three time periods in both Unanimity Baseline and Unanimity Chat treatments. Indeed, delays are very likely and happen more than 30% of the time right from the beginning of the experiment in the Unanimity Baseline treatment, reaching 44% in the last five bargaining games. These delays are costly, since the budget available for division shrinks as subjects take longer to reach agreement. On the contrary, subjects learn to avoid costly delays when they communicate with each other in the Unanimity Chat treatment. While in the first 5 bargaining games delays happen 13% of the time, by the end of the experiment, the fraction of delays is not significantly different from theoretically predicted 0%. As a result of this learning, by the end of the experiment, subjects in the Unanimity Chat treatment appropriate more than

Table 8: First-stage Proposals and Final Allocations (95% confidence intervals)

	Baseline		Chat	
	game 1	last 5 games	game 1	last 5 games
FIRST STAGE				
Submitted Proposals				
Proposer's Share	$(46.8, 68.0)$	$(60.7, 75.6)$	$(49.5, 58.8)$	$(49.9, 51.7)$
Max Non-proposer's Share	$(40.1, 52.2)$	$(44.6, 47.3)$	$(47.7, 50.3)$	$(49.6, 50.1)$
Passed Proposals				
Proposer's Share	$(57.9, 61.3)$	$(51.4, 76.3)$	$(47.7, 53.9)$	$(49.7, 50.7)$
Max Non-proposer's Share	$(47.2, 48.0)$	$(43.4, 49.6)$	$(49.2, 50.5)$	$(49.9, 50.1)$
Rejected Proposals (for $n > 2$)				
Proposer's Share	n/a	$(68.3, 79.1)$	n/a	$(52.5, 65.9)$
Max Non-proposer's Share	n/a	$(44.4, 46.0)$	n/a	$(46.5, 49.5)$
FINAL ALLOCATIONS				
Proposer's Share	$(51.9, 64.9)$	$(40.0, 64.2)$	$(43.6, 55.1)$	$(48.0, 51.0)$
Max Non-proposer's Share	$(41.8, 51.2)$	$(39.2, 41.3)$	$(46.1, 50.9)$	$(48.2, 50.5)$

Remarks: We report the 95% confidence intervals for share of the proposer and the highest share among coalition partners in tokens, where observations are clustered at the session level. "n/a" indicates that there are fewer than 3 observations in the category.

99% of the budget. This learning takes time, however, as in the first five bargaining games subjects appropriate significantly less than 100% of available resources (97% to be exact).

Table 10 reports shares of the proposers and coalition partners in each time period in first-stage proposals as well as in the final allocations agreed upon. All main comparisons between treatments documented in the last 5 bargaining games hold true both in the first 5 bargaining games and in the second 5 bargaining games. Specifically, looking at the first-stage submitted proposals, we note that proposers request a higher share of resources in the Unanimity Baseline treatment compared with the Unanimity Chat treatment right from the start of the experiment. Indeed, in the first 5 bargaining games, shares requested by the proposers are higher in the Unanimity Baseline than in the Unanimity Chat treatment ($p = 0.001$). Furthermore, there are significantly more equal split coalition proposals in the Unanimity Chat treatment compared with the Unanimity Baseline treatment starting from the very first 5 bargaining games ($p < 0.001$). Both these patterns continue to hold throughout the experiment and remain intact not only for the first-stage submitted proposals but also for the final allocations. [23] Just like in the last 5 bargaining games, rejected proposals in the first 5 bargaining games feature significantly

[23]Considering all final allocations, we note that proposers' shares are significantly higher in the Unanimity Baseline treatment compared with the Unanimity Chat treatment in the first 5 bargaining games ($p = 0.003$). Moreover, final allocations are much more likely to be exact equal splits in the Unanimity Chat treatment than in the Unanimity Baseline treatment in the first 5 bargaining games ($p < 0.001$).

Table 9: Efficiency and Delays

	Unanimity Baseline		
	games 1-5	games 6-10	games 11-15
Probability of Delays	0.33*** (0.02)	0.39***(0.01)	0.44*** (0.07)
Nb of Bargaining Stages	1.45 (0.03)	3.34 (1.46)	3.14 (1.10)
% Pie Realized	0.91*** (0.01)	0.89*** (0.01)	0.85*** (0.01)
	Unanimity Chat		
	games 1-5	games 6-10	games 11-15
Probability. of Delays	0.13*** (0.01)	0.16*(0.04)	0.07 (0.03)
Nb. of Bargaining Stages	1.12 (0.01)	1.16 (0.04)	1.06 (0.03)
% Pie Realized	0.97*** (0.00)	0.97* (0.01)	0.99 (0.01)

Remarks: Probability of delays measures the likelihood that the first stage proposal was rejected. Number of bargaining stages and Proportion of initial pie realized report the average quantities across sessions and cluster-robust standard errors are in parentheses, where the observations are clustered at the session level. For the probability of delays and the proportion of initial pie realized we also report whether the observed quantity is significantly different from the theoretically predicted one with ***,** ,* indicating significance at the 1, 5 and 10% levels, respectively.

higher proposer shares than passed proposals ($p = 0.035$ in the Unanimity Baseline treatment, and $p = 0.079$ in the Unanimity Chat treatment).

Table 11 reports the breakdown of group-level conversations into three categories: relevant conversations (those that contain some discussion about the game, players' strategies, and/or payoffs), irrelevant conversations, and groups that refrained from talking in the three time periods defined above. Right from the beginning of the experiment, subjects mostly discuss things that are relevant to the game. Irrelevant conversations are quite rare both at the beginning of experimental sessions and at the end. There is some non-negligible fraction of groups that do not communicate with each other: this fraction starts at 7% in the first 5 bargaining games and reaches 16% by the end of the experiment in the last 5 bargaining games.

Table 12 depicts the frequency and content of individual messages sent by proposers and non-proposers in the Unanimity Chat treatment in each time period. The analysis of content of individual messages throughout the experiment reveals that subjects use the chats throughout the session in a consistent manner. Specifically, the main features of chat protocols are the same in each time period of the experiment: (a) most subjects send public messages that are delivered to the entire group throughout the session; (b) private messages are rare both at the beginning of the experiment and at the end; (c) public messages are used mostly to lobby for fairness and equality rather than lobby for one's own interests.

Table 10: First-stage Proposals and Final Allocations

	Baseline			Chat		
	games 1-5	games 6-10	games 11-15	games 1-5	games 6-10	games 11-15
FIRST STAGE						
Submitted Proposals						
Proposer's Share	67.9 (2.33)	68.25 (2.60)	68.2 (1.72)	52.9 (0.74)	51.0 (0.52)	50.8 (0.21)
Max Non-proposer's Share	45.4 (0.55)	45.5 (0.63)	46.0 (0.32)	49.3 (0.18)	49.8 (0.11)	49.9 (0.06)
Fraction of Equal Splits	21.3%	23.8	7.5%	85.3%	78.7%	88.0%
Passed Proposals						
Proposer's Share	61.4 (1.44)	62.2 (3.60)	63.9 (2.9)	50.2 (0.15)	50.1 (0.07)	50.2 (0.12)
Max Non-proposer's Share	47.2 (0.38)	47.0 (0.89)	46.5 (0.72)	50.0 (0.03)	50.0 (0.03)	50.0 (0.02)
Fraction of Equal Splits	31.5%	38.8%	13.3%	98.46%	93.7%	94.3%
Rejected Proposals (for $n > 2$)						
Proposer's Share	81.5 (5.18)	77.80 (1.23)	73.7 (1.25)	70.4 (5.86)	55.8 (4.85)	59.2 (1.56)
Max Non-proposer's Share	41.5 (1.20)	43.1 (0.58)	45.2 (0.18)	44.8 (1.37)	48.7 (1.15)	48.0 (0.35)
Fraction of Equal Splits	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
FINAL ALLOCATIONS						
Proposer's Share	55.1 (1.26)	55.0 (2.09)	52.1 (2.81)	48.8 (0.20)	47.9 (0.95)	49.5 (0.35)
Max Non-proposer's Share	43.2 (0.34)	42.1 (1.06)	40.3 (0.24)	48.7 (0.06)	48.4 (0.36)	49.3 (0.27)
Fraction of Equal Splits	36.3%	35.9%	28.8%	98.7%	93.3%	94.7%

Remarks: We report the average share of the proposer and the highest share among coalition partners in tokens together with robust standard errors in parentheses, where observations are clustered at the session level. In Equal Split allocations all members of the committee receive the exact same number of tokens (in the first stage proposals this is exactly 50 tokens).

Table 11: Frequency of Group-level Conversations in the First Bargaining Stage of Unanimity Chat treatment.

	games 1-5			games 6-10			games 11-15		
	relevant	irrelevant	no chat	relevant	irrelevant	no chat	relevant	irrelevant	no chat
Conversation	89%	4%	7%	77%	4%	19%	79%	5%	16%
	($n = 67$)	($n = 3$)	($n = 5$)	(n=58)	(n=3)	(n=14)	($n = 59$)	($n = 4$)	($n = 12$)
Chat Duration in sections	62.2	28.0	n/a	54.0	19.9	n/a	55.8	29.8	n/a

Notes: Relevant conversations are defined as conversations that contain any mention of the game being played. We use a conservative measure of relevance and label conversation as relevant only if both coders marked it as relevant.

Table 12: Frequency and content of individual messages in Unanimity Chat treatment

	games 1-5		games 6-10		games 11-15	
	Non-Proposer	Proposer	Non-Proposer	Proposer	Non-Proposer	Proposer
Total subjects	75	46	75	50	75	54
Nb (%) subj. relevant chats	66 (88.0%)	18 (39.2%)	65 (86.7%)	15 (30.0%)	61 (81.3%)	25 (46.3%)
Public Messages						
% send public messages	**98.5%**	**100.0%**	**96.9%**	**93.3%**	**96.7%**	**96.0%**
% lobby fairness	87.7%	83.3%	79.4%	57.1%	75.6%	58.3%
% lobby for self	6.2%	27.8%	11.1%	42.9%	8.5%	29.2%
% exclusively public	**98.5%**	**94.4%**	**84.6%**	**73.3%**	**90.2%**	**96.0%**
Private Messages[a]						
% send private messages	**1.5%**	**5.6%**	**15.4%**	**26.7%**	**9.8%**	**4.0%***
% exclusively private messages	**1.5%**	**0.0%**	**3.08%**	**6.7%**	**4.0%**	**4.2%***

[a]We generally have few observations here, so we do not present the fraction of subjects who lobby for fairness or themselves

Notes: The content analysis pertains to those subjects who have sent at least one relevant message in the first stage of the first, middle or last five games.