PUBLIC DELIBERATION, PRIVATE COMMUNICATION, AND COLLECTIVE CHOICE

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December 14, 2017‡

Abstract

Must deliberation be fully public to produce egalitarian and socially beneficial outcomes? We hypothesize that when discussion is fully public, considerations of fairness and common interest will be prevalent but less so when private communication is allowed. Consequently, we design an experiment to test whether private pre-deliberation communication undermines public deliberation. In our setting, proposal power is symmetric and group members vote on allocations of private benefits and public goods. Although we find that group members are more likely to refer to fairness when using a public communication channel and restrict more self-serving messages to the private communications channel (when allowed), subjects send messages that are largely instrumental and value-free. As a consequence, the privacy of communication channels has little effect on the incidence of majority tyranny. Regardless of the communication protocol, groups initially select egalitarian outcomes but over time form minimum winning coalitions that exploit the minority. (JEL Codes: D71, C92, H41)

‡ We thank Dimitri Landa, Rick Wilson, the Pitt Workshop on Experimental Research Design, and PEEL faculty and students for helpful comments and suggestions. Previous versions were presented at the 2017 NYU-CESS Experimental Political Science Conference, 2017 Public Choice Society Meeting, 2017 Social Dilemmas Workshop, the Experimental Public Choice Workshop at the Catholic University of Lille, and the 2017 European Political Science Association Conference in Milan, Italy.

I INTRODUCTION

Democracy, minimally conceived, is thought by many to be a process of collective decision making through majoritarian voting. By contrast, normative theorists have debated a fuller conception involving public, rational discourse, during which participants are expected to provide reasonable justifications for their positions (Cohen 1989; Gutmann and Thompson 1996; Habermas 1996; Thompson 2008; also see Landa and Meirowitz 2009, Mansbridge et al. 2010, and Landwehr 2010). Such deliberative decision-making processes are more likely to be viewed as legitimate and just, and there is evidence that they lead to more egalitarian outcomes and better revelation of information. In addition, it has been argued that deliberation helps move the participants' preferences closer to single-peakedness (Farrar et al. 2010; List et al. 2013) and makes them more willing to incorporate the knowledge, experiences and interests of others into their group's decision (Landwehr 2010).

What is often overlooked in discussions about deliberation is that, unlike deliberation in juries, experiments, and deliberative polls (e.g., Fishkin 1997; Luskin et al. 2002), in actual policy-making bodies extensive negotiation and private meetings usually precede public deliberation. Participants can exploit this pre-deliberation period to unite into like-minded factions for the purpose of coordinating their communication strategies and actions during the actual deliberation.

Little is known about the effects of such pre-deliberation coordination on the quality and outcomes of democratic deliberation. On one hand, laboratory experiments in the emerging literature on private versus public communication in legislative bargaining have shown that private communication promotes strategic play and greater inequality (Agranov and Tergiman 2015; Baron, Bowen and Nunnari 2016). On the other hand, researchers in the deliberative

democracy tradition suggest that pre-deliberation coordination can enable disadvantaged or minority participants to have their voices heard, which may lead to more egalitarian outcomes (Karpowitz, Raphael, and Hammond 2009; Karpowitz and Mendelberg 2014).

Our goal is to investigate whether allowing private communication diminishes the social benefits of public deliberation. In particular, we focus on the effects of private (pairwise) pre-deliberation communication on the outcomes of a public deliberation in a larger group. Specifically, we test whether allowing private communication leads to inegalitarian outcomes, minimal winning coalitions, and majority tyranny. We also investigate whether private pre-deliberation communication reduces appeals to fairness and the common good during the subsequent public deliberation.

Our approach is to use a controlled laboratory experiment. The primary advantage of this approach is that it enables us to control the participants' payoffs and to isolate the effects of private pre-deliberation communication while holding other features of the environment constant. This type of setting abstracts from several issues that are already studied in the literature, such as the effects of face-to-face communication, and the roles of racial and gender composition of the group (Karpowitz and Mendelberg 2014; Karpowitz, Mendelberg, and Shaker 2012; Mendelberg 2007). Although not deliberation in the proper sense of the term considered by philosophers and political theorists, such communication has been shown to affect the outcomes in allocation tasks (Simon and Sulkin 2002) and to enable participants to reach socially efficient outcomes under conditions that do not approximate the process of ideal deliberation (Austen-Smith and Feddersen 2006; Palfrey and Rosenthal 1991).[1]

This paper contributes to the empirical literature on deliberation by focusing on a key

[1] Bochet, Page, and Putterman (2006) find that in a public goods game, free-form chat preserving anonymity had almost the same effects as face-to-face communication.

feature of deliberative democracy—the public nature of discussion—and assessing whether the social benefits of deliberation are robust to introducing features of real-world political environments, namely the ability to engage in private, pre-meeting conversations. In particular, we test whether private communication might undermine the processes through which deliberation leads to outcomes that are most consistent with an idea of the common good.

While we are motivated by the desire to understand the mechanisms underlying deliberative democracy, our study falls squarely within the experimental political economy tradition and contributes, in particular, to the nascent literature seeking to understand the effects of private versus public communication in collective choice environments. This literature has been primarily concerned with legislative bargaining (Agranov and Tergiman 2014, 2015; Baranski and Kagel 2015; Baron, Bowen, and Nunnari 2016), and to some extent, jury and turnout decisions (Goeree and Yariv 2011; Palfrey and Pogorelskiy 2016). We contribute by taking this literature in a new direction by investigating the effect of private versus public communication with respect to voting, cooperation, and public goods (Dal Bo, Foster, and Putterman 2010; Hamman, Weber, and Woon 2011; Kroll, Cherry, and Shogren 2007; Walker et al. 2000). The public goods setting is important for at least two reasons. First, it features a tension between social efficiency and incentives for majority tyranny, as efficiency considerations are mostly absent in bargaining games.[2] Second, unlike legislative bargaining environments, there is no proposal power in our setting, which makes coalition formation challenging. We chose to make power diffuse and symmetric to reflect the notion that ideal versions of deliberative democracy are thought to be procedurally egalitarian.

[2] However, there is no tension between social efficiency and fairness, which are aligned in our setting. Experiments on that feature a trade-off between efficiency and equality tend to find that behavior reflects fairness considerations such as inequality aversion and therefore voting tends to produce relatively egalitarian outcomes (e.g., Bolton and Ockenfels 2003; Höchtl, Sausgruber, and Tyran 2012).

II THEORETICAL FRAMEWORK AND PREDICTIONS

We use a collective choice procedure in which groups of five players make proposals about how to allocate a fixed budget of 100 tokens between themselves and a public good. Each player privately decides on an allocation to propose, after which the whole group sees all of the proposals. The group members then engage in free-form communication. In our experiment, we hold constant a fully public communication stage just prior to voting and vary whether or not a pairwise communication stage precedes the public communication stage. Following the communication stage(s), the group simultaneously votes on the proposals using a majority vote procedure where each member casts a vote for one of the proposals. If a proposed allocation receives an absolute majority, it is adopted and the game ends. If no allocation receives a majority, the process repeats (proposals, discussion, then voting) until one proposal receives an absolute majority of votes or the group has taken five votes. If no proposal receives a majority in the fifth vote, the group decision is deemed a failure and the tokens for the round are forfeited.

A proposal is defined as an n-tuple $(x_{1,}^{i} \dots, x_{N}^{i})$ that specifies the number of tokens allocated to each group member, with x_j^i indicating the number of tokens that member *i* proposes to allocate to member *j*. The proposed allocations must satisfy a non-negativity constraint $x_j^i \geq 0, \forall j$, a group budget constraint $\sum_{j=1}^{N} x_j^i \leq 100$ and an individual budget constraint $x_j^i \leq 20$. The individual budget constraint makes the structure of our setting equivalent to a standard voluntary contribution environment where the constraint serves the same purpose as an individual endowment. Tokens not allocated to any of the group members are invested in a public good. The payoff to each player is given by the linear public goods function $U_i(X) = x_i + bG$, where x_i is the final allocation to player *i*, *b* is a multiplication factor, and $G = (100 -$

$\sum_{j=1}^{N} x_j$) is the amount of tokens invested in the public good.

This setup is intended to capture two essential aspects of deliberative democracy: deliberation as a public process and formal equality of participation. The deliberation stage operationalizes the public process aspect, and the simultaneous display of proposals and lack of formal agenda control operationalize the formal equality of participation. In addition, the linear public goods game captures the tension between maximizing group benefits versus individual benefits, also giving the participants an incentive to express their arguments in terms of the common good, another essential feature of democratic deliberation. Finally, since we are interested in deliberation in real-life policy-making bodies, we use a majority voting procedure.

Two kinds of proposed allocations are of particular interest. As in other linear public good games, *social efficiency* is achieved if all of the tokens are invested in the public good, i.e. $G = 100$, provided that $b > 1/5$. In this case the payoff to each player equals $u_i(x) = 100b$. This allocation not only maximizes the total payoffs for the group, but it is also fair and egalitarian since every member's payoff is the same.

Given that a proposal requires an absolute majority of votes, a minimum winning coalition of three players could make itself better off by imposing a *majority tyranny* allocation. If these three players are able to coordinate with each other, they could allocate the maximum allowable number of tokens (20) to each other, e.g. X^M=(20,20,20,0,0), and the rest to the public good. Each member of the majority would then achieve a higher payoff than in the full efficiency condition, given that $b < 1/3$. Their payoffs are then $u_i(x) = 20 + 40b$, while the other two members (the minority) would only receive $u_i(x) = 40b$.

In the experiment, we set $b = 1/4$ so that the payoff is 20 if there is no public good, the payoff from social efficiency is 25, and the payoff from majority tyranny is 30 for members of

the majority coalition and 10 for excluded minority members. Note that a player could earn a maximum of 40 points by allocating 20 tokens to him or herself while allocating 0 to four other group members (leaving 80 tokens for the public good), but such a proposal would be unlikely to receive a majority of votes.

Our setup with private communication prior to public discussion resembles Hoffmann and Plott's (1983) coalition formation experiment. Unlike our public goods setting, their experiment features a spatial voting game in which committees deliberated publicly in groups of five subjects. Deliberation was preceded by a forty-five minute pre-meeting communication period, during which committee members could privately contact each other via telephone. These pre-meeting discussions were completely voluntary, and the subjects were given no instructions as to what they were supposed to talk about other than a prohibition against threats, deals, and discussions of monetary amounts. After the pre-meeting period, the subjects were brought to a meeting room for a formal deliberation. The committees used either Robert's Rules of Order (1970), or a decision-making process with no formal procedures other than a requirement that a majority had to agree to the final choice. To our knowledge, none of the private and public conversations were recorded, so there is no transcript of the conversations or of committees' deliberations.

In our experiment, all pre-deliberation communication occurs anonymously via computerized chat windows, and the group members enter their initial proposals before communicating with each other. Communication via computerized chat means that we are able to record all public and private messages and that communication necessarily occurs via the content of such messages rather than tone or other non-verbal cues that would be present with face-to-face communication. Putting the proposals at the beginning of each round, prior to

communication, is analytically useful from a design perspective because it means that communication is likely revolve around coalition formation and coordination rather than to discussion about what kinds of proposal to make.

Our first prediction is that public deliberation should lead to relatively egalitarian outcomes and high levels of the public good. This is consistent with previous findings that public communication increases social efficiency in various public goods, common pool resource, and collective choice experiments (Hamman, Weber, and Woon 2011; Hoffman and Plott 1983; Isaac and Walker 1988; Ostrom, Garnder, and Walker 1992; Walker et al. 2000). For example, in Hamman, Weber, and Woon's (2011) linear public goods experiment with public communication, majority tyranny is rare: groups achieve social efficiency by electing prosocial dictators even though majority tyranny (dictators supported by a minimum winning coalition) would make the winning coalition better off. Similarly, in the spatial voting experiment of Hoffmann and Plott (1983), pre-debate communication results in the final committee choice by only a simple majority (three individuals) in 31 of their 36 experimental sessions.

Our second prediction is that private pre-deliberation communication should lead to a greater propensity to form minimum winning coalitions, to implement majority tyranny, and to underprovide the public good, even when it is followed by a public deliberation. These predictions are consistent with the effects of private versus public communication in legislative bargaining experiments. For example, in Agranov and Tergiman (2015), private pre-bargaining communication was found to promote formation of majority coalitions, strategic play, and greater inequality. Baron, Bowen and Nunnari (2016) demonstrate similar, but much more stark effects in a dynamic setting. Relatedly, in experiments on team reasoning (e.g. Cooper and Kagel 2005) and voter turnout (Palfrey and Pogorelskiy 2016), private communication promotes

coordination and strategic play at subsequent stages of the game.

We speculate that the mechanism by which public communication promotes more egalitarian outcomes and increases provision of the public good relates to the way the public discussion setting activates certain social norms about permissible speech. Roughly, our conjecture is that public deliberation favors arguments related to the public interest, and that purely self-interested arguments are taboo. Our conjecture is supported by Naurin (2007), who argues that two social norms are activated when political actors are exposed to a public audience. The first is the force-of-the-better-argument norm, which stipulates that, in public discussion, arguing (i.e. seeking transformation of preferences through rational arguments) should take the place of bargaining (i.e. seeking aggregation of preferences through the exchange of threats and promises). The second is a non-selfishness norm, which stipulates that the appropriate types of justification for public policy are public-regarding rather than self-regarding. The combined effect of these two norms is to impose social costs on actors who do not shift from self-interested bargaining to public-spirited arguing when previously closed doors are opened for a public audience.

Our third prediction is, therefore, that there will be a greater proportion of references to fairness and equality in the arguments during the public deliberation. Conversely, we expect a greater proportion of messages seeking minimum winning coalitions during the private communication stage. This prediction is consistent with Agranov and Tergiman (2014), who find that subjects use a public communications channel to send messages expressing a desire for fairness or to argue for equality, and restrict more self-serving messages to a private communications channel. The prediction is also consistent with literature on reasoning in enclaves, which shows that enclave members who have communicated among themselves are

less amenable to changing their views in a large group deliberation (Sunstein 2002), and literature on norms activation, which shows that, once people have committed themselves to a course of action, they are likely to act consistently at a subsequent stage (Kerr 1992). In our setting, this means that if subjects are successful in coordinating on a minimum winning coalition during the pre-deliberation communication stage, they are unlikely to change their minds during public deliberation. Such norm activation has been observed in group settings even without a strong in-group identification (Bicchieri 2002), which leads us to expect that it can arise in the lab. These theoretical considerations lead us to formulate the following hypotheses:

> H1: Public-only deliberation is more likely to produce winning allocations that are socially efficient than when private pre-deliberation communication is allowed.
>
> H2: Pre-deliberation private communication prior to public deliberation is more likely to produce winning allocations imposing majority tyranny than in public-only deliberation.
>
> H3: Pre-deliberation private communication will reduce appeals to the common good during the public deliberation.

III EXPERIMENTAL PROCEDURES

Our experiment was run at the **********. The subjects were recruited from the laboratory's undergraduate subject pool, and no subject participated in more than one experimental session. All interactions among the subjects occurred through computer terminals using the z-Tree software (Fischbacher 2007). A total of 110 subjects participated in ten sessions of the experiment (eight with 10 subjects and two with 15), and were compensated with a $5 show-up fee and their payoff from one randomly selected round of the experiment (with each point earned in that round worth 75 cents).[3] In two sessions, subjects participated in four rounds

[3] The random-lottery incentive system is a standard procedure meant to enhance the independence of decisions in multiple round experiments and guards against wealth effects (Stermer and Sugden 1991).

of the decision procedure; in the remaining eight sessions, subjects played eight rounds.[4]

We ran two treatments: a public deliberation treatment (*Public-Only*) and a private pre-deliberation communication treatment (*Private-Public*), described below. In both treatments we implemented the collective choice procedure described in Section 2. The average compensation was $23.08. The experimental sessions lasted under an hour, including time for obtaining consent, reading instructions, and paying the subjects. The details of the experimental sessions are summarized in Table 1, and the instructions for the subjects are included in the Appendix.

In each round of the experiment (referred to as a "decision" in the instructions), subjects were randomly assigned into groups of five and given a numeric identifier from 1 to 5 within each group. These group assignments and identifiers were randomly re-assigned in every round. Each group member was asked to enter a proposal for how to allocate a fixed budget of 100 tokens among the group members, with the restriction that they could not assign more than 20 tokens to any individual. The subjects were informed that unallocated tokens would be multiplied by a factor of 1.25 and divided equally among all members of the group.

In the *Public-Only* treatment, the five proposals were presented to the group along with a public chat window through which the group members could communicate with each other for up to 90 seconds. The subjects could indicate that they wanted to leave the chat before the 90 seconds were up, although they could still receive messages from other group members. If at least four members of the group indicated they wanted to leave the chat, the chat for that group was terminated, and the subjects moved to the next stage.

In the next stage, each subject cast one vote for an allocation and could choose to vote for any of the five proposals made by the group's members. The aggregate vote totals were then

[4] The first two sessions were pilot sessions, and we kept the number of rounds low to ensure that sessions would finish in around an hour if groups used the maximum number of votes to achieve their decisions. We then increased the number of rounds in later sessions when we saw that groups made their decisions relatively quickly.

displayed to the group; the results did not indicate how any specific member voted. If a proposal received an absolute majority, that proposal was implemented as the decision for that round. If the group failed to reach a majority, the process would start over: each member would be asked to enter a new proposal, the proposals would again be displayed along with a public chat window, and the group would vote again. After a successful majority vote, or after five attempts at a majority vote, the subjects were randomly regrouped for another round of the experiment. If the group failed to reach a majority decision, the tokens for that round were forfeited and the payoff for that round was recorded as zero for every group member.

In the *Private-Public* treatment, we added a private communication stage before the public discussion but after submitting the proposals. The subjects were allowed to communicate with other group members for up to 90 seconds in a pairwise fashion using individual chat windows. That is, each member had four separate chat windows on their screens, with each chat window corresponding to communication with one other group member (e.g., Player 1 had one window to communicate with Player 2, another to communicate with Player 3, etc.). We chose to allow for all possible pairwise communication so that message partners and coalitions would be endogenous (instead of having coalitions imposed by the experimenter). As with the public chat, the subjects could leave the chat before the 90 seconds were up, and if four group members decided to leave, the experiment moved to the next stage.

TABLE 1
Experimental design

Treatment	Communication technology	# of sessions	# of subjects	# of decisions
Public-Only	Public chat room	5	55	80
Private-Public	Pairwise chat, followed by a public chat room	5	55	80

IV RESULTS

We report the results of the experiment in the following order. First, we assess whether there is any effect of introducing the private communication channel before the public chat in terms of whether it changes the nature of proposals or final outcomes. To do so, we compare the proposals entered in the *Public-Only* and the *Private-Public* treatments as well as the winning proposals in both treatments. Second, we compare the volume and content of the chats in the two treatments. Third, we examine coalition and network formation.

Proposals

Table 2 shows our classification scheme for the proposals made by group members during the proposal stage of the experiment as well as the percentage of each type of proposal by treatment. We classify allocations as three distinct types: socially efficient, majority tyranny, or some other (non-efficient) equal split. We code a proposed allocation as *socially efficient* if all tokens are left unallocated, (0, 0, 0, 0, 0), with full provision of the public good, yielding a payoff of 25 tokens for all members of the group. We code a proposed allocation as *majority*

tyranny if the allocation gives 20 tokens to each of exactly three members of a minimal majority coalition, zero to the two members outside the majority coalition (and thus 40 to the public good), giving a payoff of 30 tokens for the majority coalition members and 10 for those outside the majority coalition. Lastly, we code a proposed allocation as an *equal split* if the proposal allocates the same nonzero amount to each group member.

Together, socially efficient and majority tyranny proposals account for a vast majority of proposals (87% in *Public-Only* and 93% in *Private-Public*), while a small remainder are for an equal split other than the socially efficient allocation, or for some other type of allocation. Overall, we do not find substantial differences in the types of proposals made in each treatment. About half of the proposals in both treatments (50% in the *Public-Only* and 53% in *Private-Public*) are for a socially efficient allocation (i.e. 0, 0, 0, 0, 0). Similarly, we find nearly equal proportion of majority tyranny proposals in both conditions (37% in *Public-Only* and 40% in *Private-Public*). These differences are not statistically significant at any conventional significance levels.

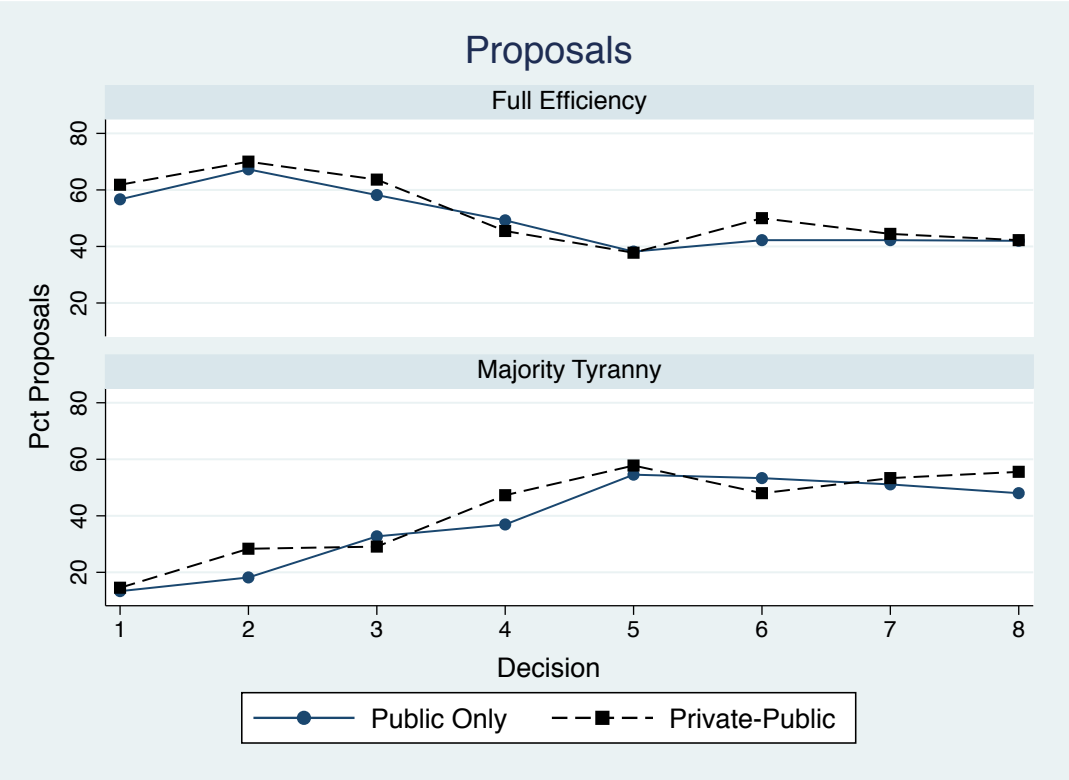
TABLE 2
Proposal types by treatment

Proposal type	Public-Only	Private-Public
Socially efficient	50%	53%
Majority tyranny	37%	40%
Equal split	5%	3%
Other	8%	4%
N	430	410

The pattern remains if we disaggregate the proposals by round, as shown in Figure 1. Figure 1 also shows an interesting trend with respect to the evolution of the types of proposals as subjects gain more experience with the game. In both treatments, fewer than 1 in 5 members, on

average, propose a majority tyranny allocation in the first round, and roughly 60% of proposals are for socially efficient allocations. Over the next four rounds, the proportion of majority tyranny proposals steadily increases while the proportion of socially efficient allocations steadily declines, stabilizing during the last three rounds. In other words, there seems to be an overall learning effect, where subjects learn to propose minimum winning coalitions, and once the pattern of forming these coalitions is established, the subjects continue the behavior.

FIGURE 1
Dynamics of full efficiency and majority tyranny proposals



Winning allocations

Figure 2 depicts the types of winning allocations by treatment. Out of 160 outcomes, there were only two proposals not classified as socially efficient or majority tyranny (one outcome in each treatment), so we omit these allocations from the figure. We observe a slight

increase in the percentage of majority tyranny allocations in the private communication treatment, and a slight increase of socially efficient allocations in the *Public-Only* treatment. In the *Private-Public* treatment, 51% of the winning allocations are majority tyranny allocations, while 48% are socially efficient. In the *Public-Only* treatment, about 40% of the winning allocations are majority tyranny allocations and about 59% are socially efficient. There is no statistically significant difference at any conventional significance level in a session level analysis where the sessions are appropriately treated as independent.

To summarize, we find that majority tyranny is a prevalent outcome with public-only communication and that allowing private communication does not lead to noticeable increases in minimum winning coalitions, majority tyranny, or underprovision of the public good. These findings contrast starkly with results in legislative bargaining experiments in which private communication has a marked effect, such as Agranov and Tergiman (2015) and Baron, Bowen, and Nunnari (2016), who find sizeable effects of private communication, and with voting in public goods games such as Hamman, Weber, and Woon (2011), who find that majority tyranny is exceedingly rare.

FIGURE 2
Proportion of social efficiency and majority tyranny winning allocations

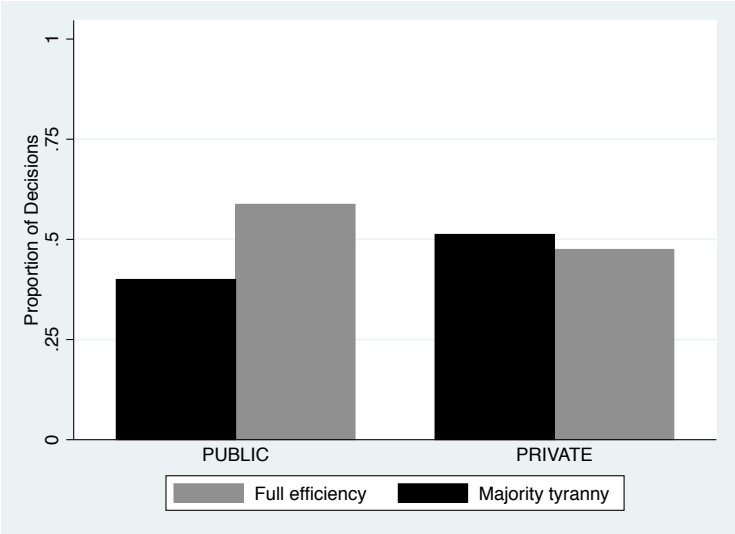
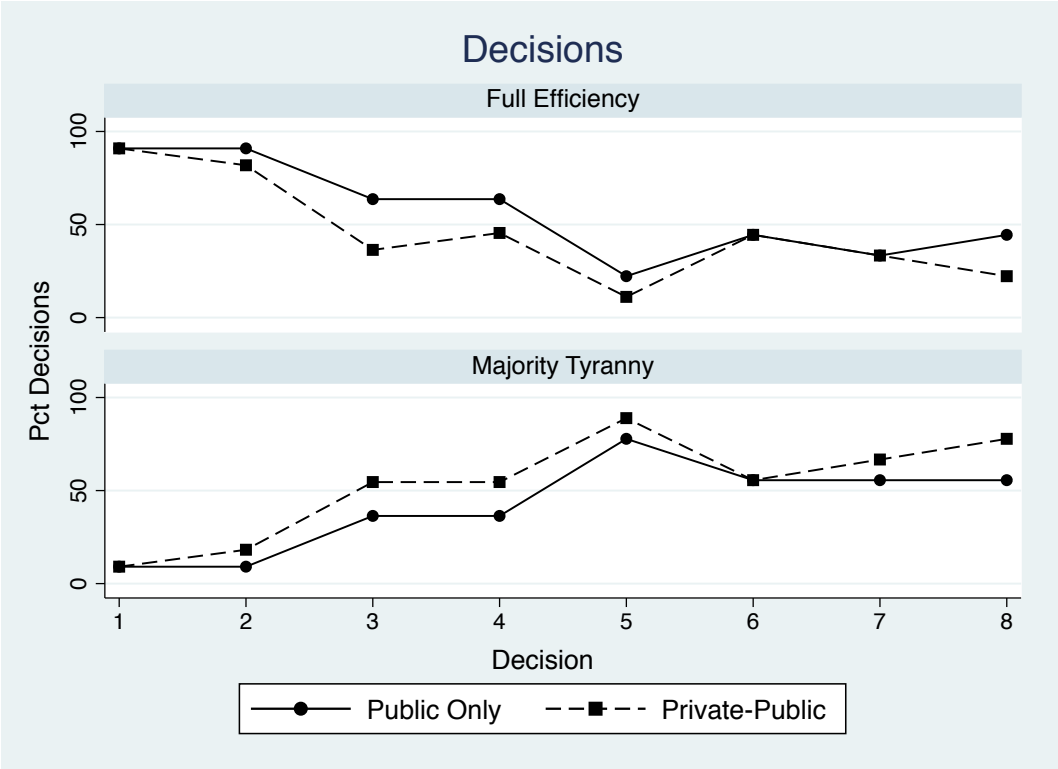


Figure 3 depicts the dynamics and evolution of winning allocations over the rounds of the experiment, which are similar to the trends in proposed allocations depicted in Figure 1. Strikingly, in both treatments *almost every group* chooses social efficiency (and, conversely, almost none choose majority tyranny) in the first round. After the second round, the proportion of majority tyranny allocations steadily increases while the proportion of socially efficient allocations steadily declines. This trend peaks by the fifth decision, then attenuates, with some divergence seen again in the last round. Again, there seems to be an overall learning effect, where subjects learn to propose minimum winning coalitions, and once the pattern of forming these coalitions is established, the subjects continue the behavior, despite some late attempts at reversing the trend.

FIGURE 3
Dynamics of full efficiency and majority tyranny winning allocations

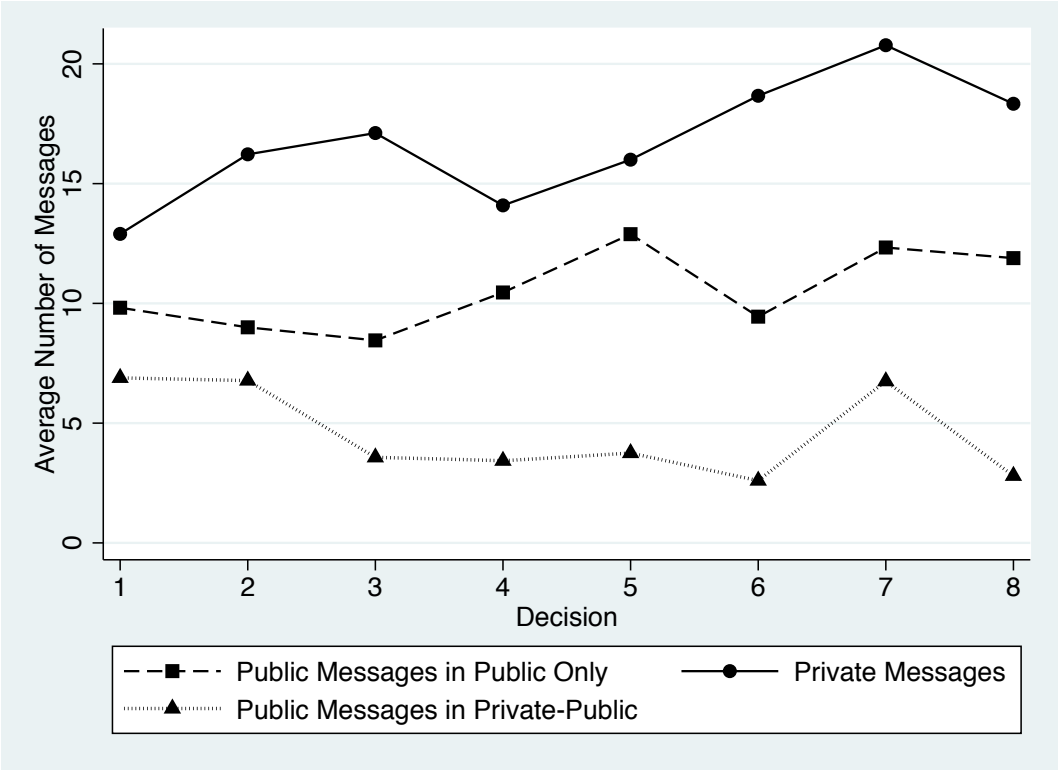


Public versus private messages

When we look at the overall volume of chat messages, we find that subjects in the *Private-Public* treatment substitute private for public messages over time. Figure 4 shows the average number of messages sent by each subject in each chat window over the course of the experiment by treatment and type of message (public or private). We divide by the number of chat windows to account for the greater number of opportunities to send the same message in the private chat stage (effectively meaning we divide the total number of private messages by 4). The total volume of all messages is relatively similar across treatments in the first round. However, after the first few rounds in the *Private-Public* treatment, the number of messages in the public chat steadily decreases, almost disappearing at the last round. Conversely, the volume in the private communication channel increases. In general, a vast majority of the

communication in the *Private-Public* treatment occurs through the private channels, suggesting that the private communication channel is used to coordinate voting behavior.

FIGURE 4
Public and private messages



In addition to the volume of the chat messages, we analyze the content of both the private and public chats using the coding scheme outlined in Table 4. As in Steiner et al. (2004)'s empirical study of parliamentary deliberation, we focus on *relevant* parts of public discourse, i.e. parts that contain a demand or a proposal on what a decision should or should not be made (Steiner et al. 2004, 55). Cursory visual inspection of the chat transcripts suggests that many messages are short and perfunctory. For example, many messages are simple *suggested votes* (e.g., "vote for proposal 1"), while others are simple acknowledgements or indications of

agreement (e.g., one member says "yeah" immediately after another suggests "vote for 1"). Some messages additionally suggested *majority* coalitions (e.g., "2 and 4 vote for 1"). We also noted that longer messages sometimes explicitly referenced *fairness* or *cooperation* and we code these messages accordingly.

TABLE 4
Description of coding scheme for messages

Type of message	Criteria	Example
Suggested vote	Message suggests a vote but does not explicitly seek a coalition	"Vote for 1." "Vote for mine."
Agreement	Message indicates assent	"yes"; "yeah"; "ok"
Majority	Message clearly seeks coalition with two other players, or states that players can get a higher payout of 30 by cooperating with the message sender	"2 and 4 vote for 1 for max payout."
Cooperation/efficiency	Message points out that cooperation gives higher benefit overall or lets subjects leave the experiment earlier	"Giving everyone 0 will earn 125 tokens, there's no way to earn more than that"; "the highest total money paid is in cooperation"; "we'll get to leave sooner if we can agree on something so just pick proposal 3 and we'll all benefit."
Fairness	Message references fairness or equality	"5 would be best for everyone"; "the proposal also gives something to 2 other players"; "proposal 5 will have a decent payoff for every member."
Other	Communication not included in other categories, e.g. greetings	"hi"; "hey guys"

Table 5 presents a summary of our content analysis of messages. Overall, the majority of messages are short and direct, pertaining to specific proposals and indications of agreement with those suggestions. In the *Public-Only* treatment, 67% of all messages are categorized as suggested votes or agreements, and in the *Private-Public* treatment, 87% of public messages and 77% of private messages fall in these categories. Group members thus appear to use the available free-form communication as a simple way to coordinate their actions and to form majority coalitions. In contrast to this direct, instrumental behavior, appeals to fairness, cooperation, or to any other principles or arguments of any kind are quite rare.

TABLE 5
Content analysis of messages

	Public-Only	**Private-Public**	
Message content		**Public Message**	**Private Message**
Suggested vote	45%	65%	46%
Agreement	22%	22%	31%
Majority	17%	5%	17%
Cooperation/efficiency	5%	6%	2%
Fairness	10%	2%	2%
Number of messages	537	181	960

Nevertheless, we find, consistent with H3 and Agranov and Tergiman (2014), that subjects are more likely to use the public communications channel to send messages expressing a desire for fairness or to argue for equality: 10% of the messages in the *Public-Only* treatment refer to fairness or equality, compared with only 2% in the private communication channel. Allowing private communication seems to have a dampening effect on arguments for fairness

and equality: in the *Private-Public* treatment, the proportion of public messages referring to fairness and equality is only 2%, the same percentage as in the private communications channel. Subjects in both treatments also use the public channel to communicate messages about social efficiency, such as pointing out that allocating all tokens to the public good would give the group the maximum number of tokens.

Contrary to H3 subjects did not restrict self-serving messages to the private communications channel. Indeed, 17% of messages in the *Public-Only* treatment refer to a majority coalition, compared with 10% of messages referring to fairness and equality. However, such messages are used more often in the private channel (17%) than in the public channel (5%) when both channels are available.

Coalition formation and types of subjects

What kind of minimum winning coalitions do group members propose and seek out? We find that in the absence of information about other subjects' previous behavior, the subjects gravitate towards using natural patterns of ID numbers: the coalitions proposer by players 1 and 2 tend to include the first three players (1, 2, and 3), and coalitions proposed by players 4 and 5 the last three players (3, 4, and 5). Proposals by player 3 sometimes include the first three and sometimes the last three players. Overall, coalitions with members 1-2-3 comprise 37% of all majority tyranny proposals and 40% of winning majority tyranny allocations in both treatments, and coalitions with members 3-4-5 comprise 30% of such proposals and 31% of winning allocations. Other coalitions include odd numbered member IDs (1-3-5), comprising 8% of proposals and 11% of winning allocations, and a coalition of the middle (2-3-4), comprising 10% of proposals and 7% of winning allocations. Player 3 is the most frequently sought after coalition

partner, and is included in 89% of winning majority tyranny allocations, compared to 47%-58% for the remaining players (with player 1 having a slight advantage over the others). Communication patterns in the private chats also reflect these coalition patterns: player 1 mostly communicates with players 2 and 3, player 2 with players 1 and 3 and so on. In addition, decision-level analysis of the data (Table 6) shows that a player is more likely to be included in the winning coalition if the player's proposal is of the majority tyranny type, if there are more majority tyranny proposals in the round, and, perhaps unsurprisingly, if the player is included in a larger proportion of majority tyranny proposals. Being the first to send a message does not necessarily result in the player's inclusion in the winning coalition. However, if the player's messages are reciprocated, they are more likely to be included in the winning coalition, but if a player sends too many messages, they are less likely to be included.

TABLE 6
Predictors of being included in the winning majority coalition

	(1)	(2)
Proposed majority tyranny	0.115**	0.135**
	(0.034)	(0.043)
Number majority tyranny proposals	0.150**	0.097**
	(0.014)	(0.018)
Pct of majority tyranny proposals including player	0.364**	0.245**
	(0.051)	(0.076)
Private-Public	0.058	
	(0.038)	
Messages sent		-0.095
		(0.031)**
First message		-0.005
		(0.017)
Reciprocated		0.162
		(0.040)**
Constant	-0.321**	-0.126
	(0.033)**	(0.33)**
R^2	0.30	0.36
N	650	400

* $p<0.05$; ** $p<0.01$, ordinary least squares

Proposal-level analysis of the data (Table 7) shows that if a proposal is mentioned more frequently, whether in the public or private chats, it is more likely to be adopted as the winning proposal, regardless of whether it is a full efficiency proposal or a majority tyranny proposal.

TABLE 7
Predictors of proposal being adopted

	Public treatment			Private-Public treatment		
	All proposals	FE proposal	MT proposal	All proposals	FE proposal	MT proposal
Percentage of public mentions	1.104**	1.071**	1.266**	0.479**	0.545**	0.494*
Percentage of private mentions				0.675**	0.520**	0.889**
Majority tyranny	0.043			0.068		
Full efficiency decision	0.038	-0.008	0.007	0.032	0.086**	0.026*
Constant	-0.070*	0.007	-0.096	-0.028	0.712	-0.154*
R^2	0.698	0.829	0.540	0.514	0.829	0.370
N	430	215	161	410	217	166

* $p<0.05$; ** $p<0.01$, ordinary least squares

Table 8 shows a classification of subject in terms of the types of proposals they make. About 25% of subjects are unconditional cooperators who always propose full efficiency allocations (FE), whereas about 6% of subjects always propose majority tyranny (MT) allocations. About 15% of subjects (FE to MT pure) start with proposing FE allocations, then

switch to proposing MT allocations and never switch back, and about 8% (FE to MT switchers) propose a FE allocation in the first period and a MT allocation in the last period, switching back or making other proposals in other periods. By contrast, very few subjects start with proposing MT allocations and then switch to making FE proposals. Rest of the subjects display various patterns of proposals, shown in the table. Another interesting observation is that every session has at least one subject who proposes MT in the first period except session 1, in which the winning allocations were almost always full efficiency.

TABLE 8
Types of subjects

Treatment/Type of subject	**Private-Public**	**Public**	**Total**
Always FE	23.64%	27.27%	25.45%
Always MT	9.09%	3.64%	6.36%
FE to MT (pure)	18.18%	10.91%	14.55%
FE to MT (switcher)	9.09%	7.27%	8.18%
MT to FE (pure)	1.82%	1.82%	1.82%
MT to FE (switcher)	0.00%	1.82%	0.91%
Other (mostly FE)	10.91%	9.09%	10.00%
Other (mostly MT)	12.73%	16.36%	14.55%
Sometimes FE (never MT)	9.09%	12.73%	10.91%
Sometimes MT (never FE)	3.64%	5.45%	4.55%
Total	55	55	110

Finally, we note something that we do *not* observe in the coalition formation process. Excluded members do not seem to take advantage of their private communication channel to engage in team reasoning in order to thwart the will of the majority. Such proposals are possible to construct in this environment because there is no majority rule core (i.e., no proposal is a Condorcet winner). For example, suppose that players 1, 2, and 3 form a coalition and attempt to coordinate on the majority tyranny proposal T = (20, 20, 20, 0, 0). The minority, players 4 and 5, could propose an allocation that gives only one member of the majority the full allocation of tokens while giving themselves somewhat less. They could propose U = (0, 0, 20, 15, 15). Player 3 would be even better off with a payoff of 32.5 under proposal U than the payoff of 30 from proposal T, while the minority members would improve their payoffs from 10 to 27.5. It is also feasible for members of the excluded minority to pick off a member of the majority coalition in this way, but they are clearly unable to generate new proposals that defeat existing majority tyranny allocations.

V CONCLUSION

We hypothesized that public discussion would produce socially beneficial outcomes through deliberative processes, and that private pre-play communication would undermine these beneficial effects of public communication. In general, we do not find this to be the case. In fact, we find that public deliberation in and of itself far from guarantees that collective choices will be socially efficient and egalitarian. Instead, majority tyranny emerges over time and becomes common with experience. Furthermore, there is little difference in the provision of public good or formation of minimum winning coalitions when subjects are allowed engage in private pre-deliberation communication and when such communication is not available. While subjects prefer to use the private communication channel for the purpose of coordinating minimum

winning coalitions, they do not shrink from sending messages seeking minimum winning coalitions if the public channel is the only communication technology available.

We do find some evidence that references to fairness and equality are more common in the public deliberation in the *Public Only* treatment (but not in the public channel in the *Private-Public* treatment), suggesting that the subjects do, to some extent, recognize a social norm stipulating that one should use arguments referring to the common good in a public communication setting, and that allowing private pre-deliberation communication undermines this norm. However, appeals to fairness principles or any principles whatsoever for justifying collective choices are rare. Instead, communication is used instrumentally to coordinate and form coalitions.

These results contrast with previous experimental findings comparing private and public communication. For example, Agranov and Tergiman's (2015) legislative bargaining experiment resulted in 87% majority coalitions and 12% universal coalitions in a private communication treatment, and 74% majority coalitions and 24% universal coalitions in a public communication treatment. Baron, Bowen and Nunnari (2016) found ever more dramatic differences in their dynamic bargaining game: when private communication was allowed, 51% of coalitions were majority coalitions vs. only 4%, in a public communication setting. The results are also qualitatively different from the finding of Dal Bo et al. (2010), who show that democratically chosen institutions increase cooperative outcomes.

What could account for our results? One possibility is that the simplicity of the payoff structure in our environment does not lend itself to argumentation or persuasion. Game theoretic models of deliberation typically posit that the primary strategic problem involves uncertainty about policy or preferences, and deliberation is therefore posed as a problem of strategic

communication or of information aggregation (e.g., Austen-Smith and Feddersen 2006). To the extent that our environment features any incomplete information, it is not in the monetary incentive structure, but rather in the heterogeneity of the behavioral types or social preferences of the participants. Consistent with the voluminous literature on social dilemmas, the behavior we observe may reflect the fact that some group members are selfish and some altruistic, while perhaps most are "conditional cooperators" (Ostrom 2000; Fischbacher and Gächter 2010).

If so, another feature of our environment is that it allows for a third channel of information transmission: subjects can clearly signal their types through the proposals that they make. Indeed, there seem to be participants who are conditional cooperators who initially make socially efficient proposals but then switch to majority tyranny when they observe that others propose majority tyranny. In this way, relevant information is transmitted through the players' proposals. Once it is clear that a majority of group members favor majority tyranny, coordinating on that outcome is not difficult. To isolate the effects of free-form communication, an alternative experimental design would make proposals exogenous rather than allow them to be endogenous. Overall, the dynamics we observe suggest that participants may come to see their collective decisions to be more about the formation of winning coalitions than about efficiency or the allocation of goods.

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Appendix: Experiment Instructions

General Information

This is an experiment on group decision-making. The ********** has provided funds for this research. You will be paid in cash for your participation at the end of the experiment along with the $5 participation payment. The exact payment you receive will depend on your decisions and the decisions of others during the experiment. You will be paid privately, meaning that no other participant will find out how much you earn.

Pay attention and follow the instructions closely, as we will explain how you will earn money and how your earnings will depend on the choices that you make. Each participant has a printed copy of these instructions, and you may refer to them at any time.

If you have any questions during the experiment, please raise your hand and wait for an experimenter to come to you. Please do not talk, exclaim, or try to communicate with other participants during the experiment, except when asked to do so via the computer interface. Participants intentionally violating the rules may be asked to leave the experiment and may not be paid.

Groups, Decisions, and Payoffs

In the experiment, you will be assigned to groups to make a series of decisions. Each group's decision is separate from the other's. Each decision requires a vote of a majority of your group's members and you will have up to 5 chances to vote to reach a majority. Before each decision, you will be randomly assigned to a group of 5 participants. Each group member is randomly assigned a unique number from 1 to 5. Some members of your group for one decision may or may not be the same as the members of your group for another decision, and the member number you are assigned for one decision may or may not be different from the number assigned to you for another decision. Your group's decision is also entirely separate from the other group's decision.

During today's session, you will make eight of these group decisions. At the end of the experiment, we will randomly select one decision to count for payment from the entire session. Each group decision is equally likely to be selected. Only the points you receive from the decision that counts will be used to calculate your payment, so you should think of each decision as separate from any other.

Payoffs during the experiment will be denominated in points. Points will be converted to cash at the rate of **75 cents per point**. At the end of the experiment, you will see the payoff for the decision that counts and your total earnings for the experiment (which includes the $5 participation fee).

Description of Decision Task

Your group has 100 tokens and your task is to decide how many tokens to allocate to each member of your group. You will make your group decision using a procedure that has several stages: proposals, chats, and voting.

1. Proposals

- Each member of the group separately makes a proposal for how to allocate the tokens.
- The proposal specifies a whole number of tokens between 0 and 20 for each member.
- Each token allocated to a member is worth 1 point.
- You can propose a different amount for each individual; the amounts do not have to be the same.
- The amounts you specify do not have to add up to 100.
- If a proposal is accepted by a majority of the group, the computer will compute a number of points equal to the number of unallocated tokens multiplied by 1.25, then divide the resulting number of points equally between all members of your group.
- Unallocated tokens will only be multiplied and distributed if a proposal receives a majority of votes.
- Any fractional points will be rounded to the nearest whole number.

To summarize, if a majority of your group votes in favor of a proposal, you will earn points from any tokens individually allocated to you from the proposal plus your share of the total points from unallocated tokens. What you earn from the proposal that passes can be summarized with the following formula:

Points Earned = Tokens Allocated to You + (1.25 x Unallocated Tokens ÷ 5)

2. Private Chat

- After all group members have submitted their proposals, the proposals will be displayed at the same time, with member 1's proposal marked as Proposal 1, member 2's proposal marked as Proposal 2, and so on. The set of proposals will be shown in a table with each row representing a specific proposal and each column representing the number of tokens that a specific group member would receive.

- You will have several chat windows through which you can communicate with other group members. Each chat window is a private chat between only you and one other member (for example, between you and person 1, or between you and person 2).

- You may enter any message you wish, with two restrictions. First, please do not enter any message that identifies or describes you in any way (e.g. age, race, appearance, etc). Second, please avoid using obscene, offensive, or inappropriate language.

- You will have up to 90 seconds to send messages to others in your group.

- If you want to end the discussion before the 90 seconds is up, you may click the "Leave Chat" button. If four members of your group click on the "Leave Chat" button, then the discussion period ends and your group will move to the next stage. Clicking on the button will announce to other members that you want to finish the chat, but you will continue to be able to send and receive messages until four members of your group click on "Leave Chat" (or until time is up).

3. Public Chat

- Following the private chat stage is a public chat stage. In the public chat stage, there will be one chat window through which you can communicate with your group members.

- Each message sent in the public chat will be seen by all group members.

- Again, you may enter any message you wish, with the restrictions that you are not to enter any message that identifies or describes you in any way and that you are to avoid using obscene, offensive, or inappropriate language.

- You will have up to 90 seconds to send messages to others in the public chat.

- If you want to end the discussion before the 90 seconds is up, you may click the "Leave Chat" button just like in the private chat. If four members of your group click on the "Leave Chat" button, then the discussion period ends and your group will move to the voting stage.

4. Voting

- A vote will determine whether your group adopts a proposal as the group's decision.

- Each group member will cast a vote for one of the five proposals.

- If a proposal receives a majority of votes (at least 3 votes), then the proposal wins and counts as the group's decision. At most one proposal can count as the group's decision.

- Even if two proposals are identical, they count as separate proposals in the voting stage. The votes for proposals that are the same will not be combined. For example, if Proposal 1 and Proposal 3 both give the same number of tokens to every member and each of these proposals receives 2 votes, then neither proposal receives a majority.

- If no proposal receives a majority, then you will repeat this process: everyone in the group will submit a new proposal, you will have another 90 seconds for private chat, another 90 seconds for public chat, then you will vote again.

- This process stops when a proposal receives a majority or when the group has taken 5 votes.

- If you have voted 5 times and no proposal receives a majority, then you will receive 0 points from the decision. In this case, the unallocated tokens are lost.

Are there any questions about the decision task? If you have a question, please raise your hand and wait for an experimenter to come to you.

Example Payoffs

Consider a few examples of what proposals might look like.

Example 1: Suppose the winning proposal allocates 20 tokens for each member of the group. In this case there are no unallocated tokens, so each member's payoff is 20 points.

Your (and everybody else's) payoff for this round will be: $20 + (1.25 \times 0 \div 5) = 20$ tokens

Example 2: Suppose the winning proposal allocates 0 tokens for each member of the group. In this case, there are 100 unallocated tokens. All 100 unallocated tokens are multiplied by 1.25 for a total of 125 points, then these points are divided equally among the members of the group so that each member will receive 25 points.

Example 3: Suppose that Players 1, 2, and 3 are allocated 20 tokens while Players 4 and 5 are allocated 0 tokens. In this case, there are 40 unallocated tokens. The 40 unallocated tokens are multiplied by 1.25 for a total of 50 points, then these points are divided equally so that every member receives 10 points from the unallocated tokens. Players 1, 2, and 3 will each receive points from their 20 allocated tokens plus the 10 points from unallocated tokens for a total of 30 points each. Players 4 and 5 will receive the 10 points from unallocated tokens.

Instruction Quiz

Before we begin the experiment we would like you to answer a few questions to make sure you understand how the group decision task works. You will receive immediate feedback once you answer all of the questions. We will then begin the experiment when everyone has answered these questions.

1. What is the **minimum** number of tokens you can propose to give to a group member?
   - 20
   - 10
   - 15
   - 0

2. What is the **maximum** number of tokens you can propose to give to a group member?
   - 15
   - 50
   - 20
   - 100

3. If a proposal receives a majority of votes and the allocated tokens add up to less than 100, what happens to the unallocated tokens?
   - No-one gets them.
   - Points are divided equally among the group members.
   - Multiplied by 1.25 and divided equally among all members.
   - Multiplied by 1.25 and divided equally among members voting for the proposal.

4. What is the maximum number of times the group can enter proposals, discuss them and vote on them?
   - 3
   - 1
   - 5
   - 4

5. What happens if, after 5 rounds of discussion and voting, none of the proposals gets a majority vote?
   - One is picked randomly.
   - Computer creates a new random proposal.
   - All tokens divided equally (i.e. everyone gets 20 tokens).
   - Nobody earns any points.

6. If the proposal that gets a majority vote gives 20 tokens to every member, how many points does each member earn?
   - 25
   - 10
   - 20
   - 15

7. If you are allocated 20 tokens and the total number of unallocated tokens is 80, how many points would you earn?
   - 20
   - 80
   - 40
   - 60

8. If you are member 1 of the group, and the proposal that gets a majority vote gives 16 tokens to members 1, 2 and 3 while giving four tokens to members 4 and 5, leaving 44 tokens unallocated, how many points would you earn?
   - o 15
   - o 27
   - o 24
   - 20

We are now ready to begin the experiment.

Just to remind you: If you have any questions during the experiment, please raise your hand and wait for an experimenter to come to you. Please do not talk, exclaim, or try to communicate with other participants during the experiment except through the chat interface.