Public Deliberation, Private Communication, and Collective Choice

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Abstract

Must deliberation be fully public to induce greater consideration of fairness and the common good in discussions of collective choice, thereby generating more egalitarian and socially beneficial outcomes? We identify the public nature of discussion as necessary to producing the benefits of deliberation and design an experiment to test whether private pre-deliberation communication might undermine public deliberation in a setting characterized by voting on allocations of private benefits and public goods. While we find that private communication increases majority tyranny—with outcomes less egalitarian, less socially efficient, and more favorable to a minimum winning coalition—precluding private communication in favor of fully public discussion does not entirely prevent it.

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1 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 suggestive 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; Goeree et al. 2011; List et al. 2013) and makes them more willing to incorporate the knowledge, experiences and interests of others into their 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), public deliberation in actual policy-making bodies is usually preceded by extensive negotiation and private meetings. Participants can exploit this period to unite into like-minded factions, parties, or enclaves 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. Previous research has shown that deliberation in homogeneous enclaves leads to more extreme opinions and polarization (Sunstein 2002, 2009; Benoît and Dubra 2015), and that experimental subjects use private communication channels to reach backroom deals while public communication channels are used to express preferences for fairness and equality (Agranov and Tergiman 2015). This suggests that pre-deliberation coordination may cement participants' preferences and make them less amenable to change. On the other hand, pre-deliberation coordination can enable disadvantaged or minority participants to get their voices heard, which might lead to more egalitarian outcomes (Karpowitz, Raphael, and Hammond, 2009 and Karpowitz and Mendelberg, 2014).

Our goal is to understand the effects of private communication (pre-deliberation) that takes place prior to public discussion (deliberation), which may be strong enough to overcome the socially beneficial effects of subsequent 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 less egalitarian outcomes, minimal winning coalitions, and majority tyranny. In addition, we investigate whether private communication reduces appeals to common good during the deliberation.

Our approach is to use a controlled laboratory experiment with anonymous communication. The primary advantage of our approach is that it enables us to control the participants' payoffs and to isolate the effects of private pre-deliberation communication. 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, 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 by focusing on a key 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 (Landa and Meirowitz 2009). We also contribute to the growing empirical and experimental literature on communication and collective choice, including legislative bargaining (Agranov and Tergiman 2014; Baranski and Kagel 2015) and voting on public goods (Hamman, Weber, and Woon 2011; Walker et al. 2000).

[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.

Our paper is structured as follows. Section 2 discusses the theory and predictions, Section 3 presents the experimental design, and the experimental results are discussed in Section 4. Finally, Section 5 concludes with final remarks.

2 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 a default set of payoffs are implemented.

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, *full 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 is not only socially efficient, maximizing 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 the majority and 10 for the minority. 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.

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 helps us to attribute any effect of private communication to coalition formation, coordination, and persuasion rather than to differences in proposals.

Our first prediction is that public deliberation leads to more egalitarian outcomes, increased provision of the public good, and more references to fairness or the common good in the arguments during the deliberation. This prediction is consistent with public goods experiments that allow for communication (Bochet, Page, and Putterman 2006; Hamman, Weber, and Woon 2011; Isaac and Walker 1988), and similar effects are observed in common pool resource experiments in which communication lessens withdrawals from the common pool (Ostrom 1994; Walker et al. 2000), as well as in multilateral bargaining experiments using a majority rule, in which multilateral bargaining results in non-equilibrium outcomes (see e.g. Agranov and Tergiman 2014).

We speculate that the mechanism by which this happens operates in a way that different discussion settings will activate different social norms. 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 arguing (i.e. seeking transformation of preferences through rational arguments) is preferred to 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.

However, these two norms may be overshadowed by another group norm activated when there is a private pre-deliberation communication stage, which stipulates that, once people have committed themselves to a course of action, they are expected and likely to act consistently (Kerr 1992). In our setting, this means that if subjects are able to coordinate on a minimum winning coalition (imposing majority tyranny) during the pre-deliberation communication stage, they are unlikely to change their minds during the public deliberation. Such norm activation has been observed in group settings even without a strong in-group identification norms (Bicchieri 2002). In addition, literature on enclave deliberation shows that enclaves are less amenable to large group deliberation. This is, according to one argument, due to enclaves developing internal argument pools – norms that govern what counts as a persuasive argument in that social group (Sunstein 2002).

Based on these considerations, our prediction is that pre-deliberation communication results in the formation of minimum winning coalitions, majority tyranny, and underprovision of the public good relative to environments which only allow fully public communication. Our prediction is consistent with evidence from previous collective choice experiments with communication. For example, in Hamman, Weber, and Woon (2011), who use a linear public goods environment like ours but only allow 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) is feasible. In the spatial voting experiment of Hoffmann and Plott (1983), pre-debate communication resulted in the final committee choice by only a simple majority (three individuals) in 31 of their 36 experimental sessions. In Agranov and Tergiman (2014), subjects used a public communications channel to send messages express a desire for fairness or to argue for equality, and restricted more self-serving messages to a private communications channel, and in Agranov and Tergiman (2015), non-transparent pre-bargaining backroom deals were found to promote coordination, strategic play, and greater inequality. Relatedly, in signaling games, private communication in teams of players has been shown to promote coordination and strategic play at subsequent stages of the game (Cooper and Kagel 2005). 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.

3 Experimental Procedures

Our experiment was run at the Pittsburgh Experimental Economics Laboratory (PEEL) at the University of Pittsburgh. 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 65 subjects participated in six sessions of the experiment (five with 10 subjects and one 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).[2] In two sessions, subjects participated in four rounds the decision procedure; in the remaining four sessions,

[2] 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).

subjects played eight rounds.[3]

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 $22.48. 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 for each round of the experiment 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 then 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 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

[3] 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.

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	3	35	48
Private-Public	Pairwise chat, followed by a public chat room	3	30	40

4 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

We first classify proposals as one of several possible types of allocation of interest: socially efficient, majority tyranny, or some other (non-efficient) equal split. Table 2 shows our classification of all proposals made by group members during the proposal stage of the experiment. Together, socially efficient and majority tyranny proposals account for a sizeable proportion of proposals (85% and 93%, respectively) while a much smaller remainder of proposals were for an equal split other than the socially efficient allocation or for some other type of allocation.

We code an allocation as *socially efficient* if all tokens are left unallocated, (0, 0, 0, 0, 0), with full provision of the public good and yielding a payoff of 25 tokens for all members of the group. Almost half of the proposals entered in both treatments (47% in the *Public-Only* and 44% in *Private-Public*) were for socially efficient allocations. Aggregating across all decisions within treatment, we cannot reject the equality of the proportions of socially efficient outcomes (p = 0.49, two-tailed), and similar results obtain if we conduct regression analysis that accounts for a time trend and dependence of decisions within session (p = 0.69).

We code a *majority tyranny* allocation as an allocation that 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. Somewhat surprisingly, we find a substantial proportion of majority tyranny proposals in both conditions (38% in *Public-Only* and 49% in *Private-Public*). The difference is statistically significant using a simple difference-in-proportions test (p = 0.01), but not if we estimate a regression model that accounts for a time trend and dependence within session (p = 0.17).

Table 2. Proposal types by treatment

Proposal type	Public-Only	Private-Public
Fully efficient	47%	44%
Majority tyranny	37%	49%
Equal split	6%	2%
Other	9%	5%
N	255	210

Overall, we do not find substantial differences in the types of proposals made in each treatment. This pattern remains if we disaggregate the proposals by round, as shown in Figure 1, which 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 while roughly half of proposals are fully efficient allocations. Over the next four rounds, the proportion of majority tyranny proposals steadily increases while the proportion of socially efficient allocations steadily declines. The trend lines for each of the two treatments are very similar, with only slight divergence in the very last period. 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.

Winning allocations

Figure 2 depicts the types of winning allocations by treatment. Out of 88 outcomes, there were only two proposals not classified as fully efficient or majority tyranny (one outcome in each treatment), so we omit these proposals from the figure. Consistent with hypotheses H1 and H2, we find that allowing private communication leads to an increase in minimum winning coalitions, majority tyranny, and underprovision of the public good. While we observe a significant number of majority tyranny allocations in the public deliberation treatment, 58% of the final allocations in the *Public-Only* treatment are fully efficient, compared with only 33% in the *Private-Public* treatment. Conversely, in the *Private-Public* treatment, 65% of the winning allocations are majority tyranny allocations compared with only 40% in the *Public-Only* treatment. Using a Pearson chi-squared test of the independence of the overall distributions of proposals, independence can be rejected at the 0.10 significance level ($p = 0.053$). Similar results obtain if we compare the proportions of each proposal type. The difference in proportions of fully efficient outcomes is significant using a simple difference in proportions test ($p = 0.01$, two-tailed) and in a regression analysis with a time trend and standard errors clustered by session ($p = 0.03$, one-tailed). For majority tyranny outcomes, the differences are also significant using a difference in proportions test ($p = 0.01$, one tailed) and regression analysis ($p = 0.02$, one-tailed).

Figure 1. Dynamics of full efficiency and majority tyranny proposals

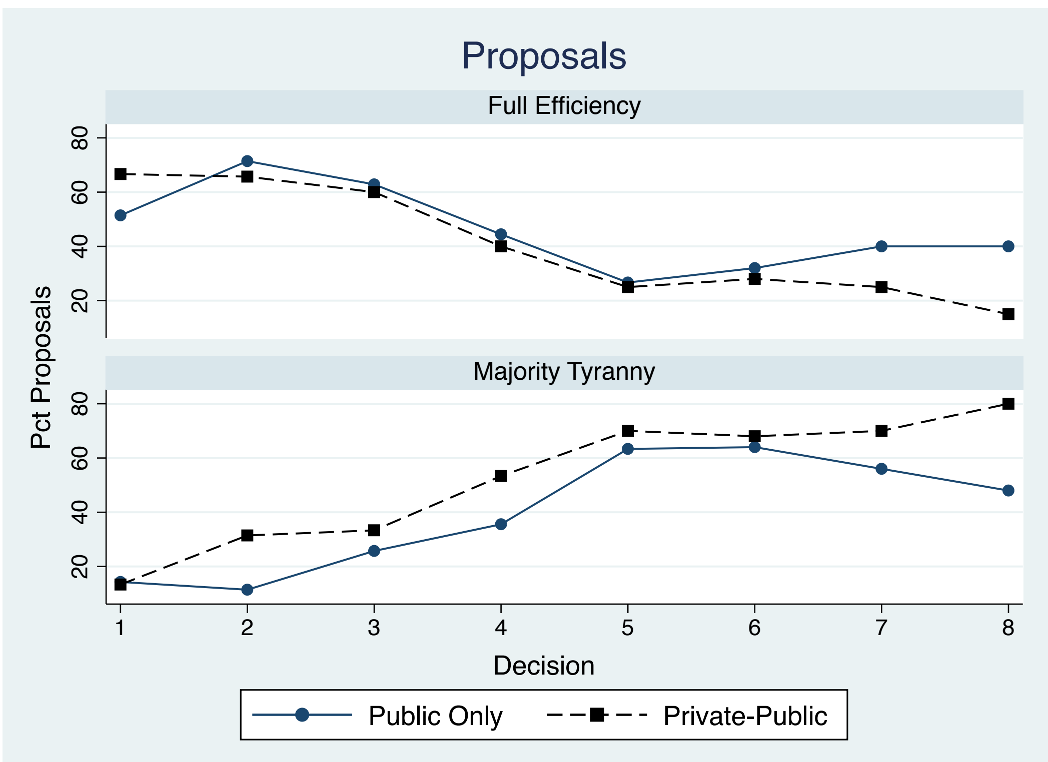


Figure 2. Proportion of full efficiency and majority tyranny winning allocations

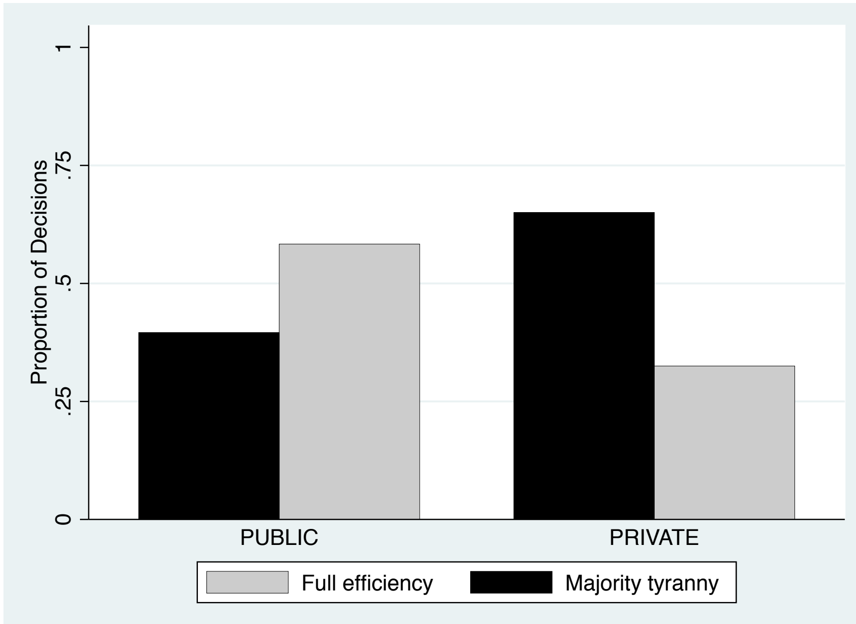
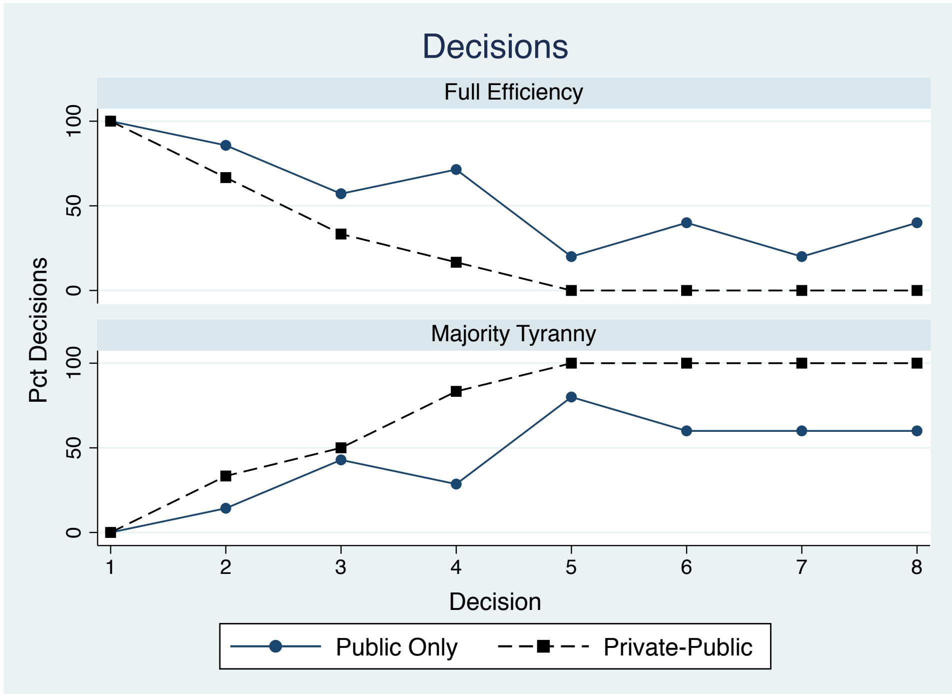


Figure 3 depicts the dynamics and evolution of winning allocations over the rounds of the experiment. Similar to the trends in the distributions of proposals made by all subjects, we see a decrease over time in the proportion of fully efficient outcomes and a corresponding increase in majority tyranny outcomes. Strikingly, in both treatments *every single group* chooses full efficiency (and thus *no group* chooses majority tyranny) in the first round. By the fifth decision, however, 100% of groups in the *Private-Public* treatment achieve majority tyranny, which persists for the remainder of the experiment. In contrast, while majority tyranny outcomes also increase at the beginning of the *Public-Only* treatment, they end up hovering just above 50% from the fifth round through the end of the experiment. The treatment effect thus appears to emerge over time. While outcomes completely converge on majority tyranny when the communication technology allows private messages, fully public discussion without private messages successfully impedes, but does not entirely eliminate, it.

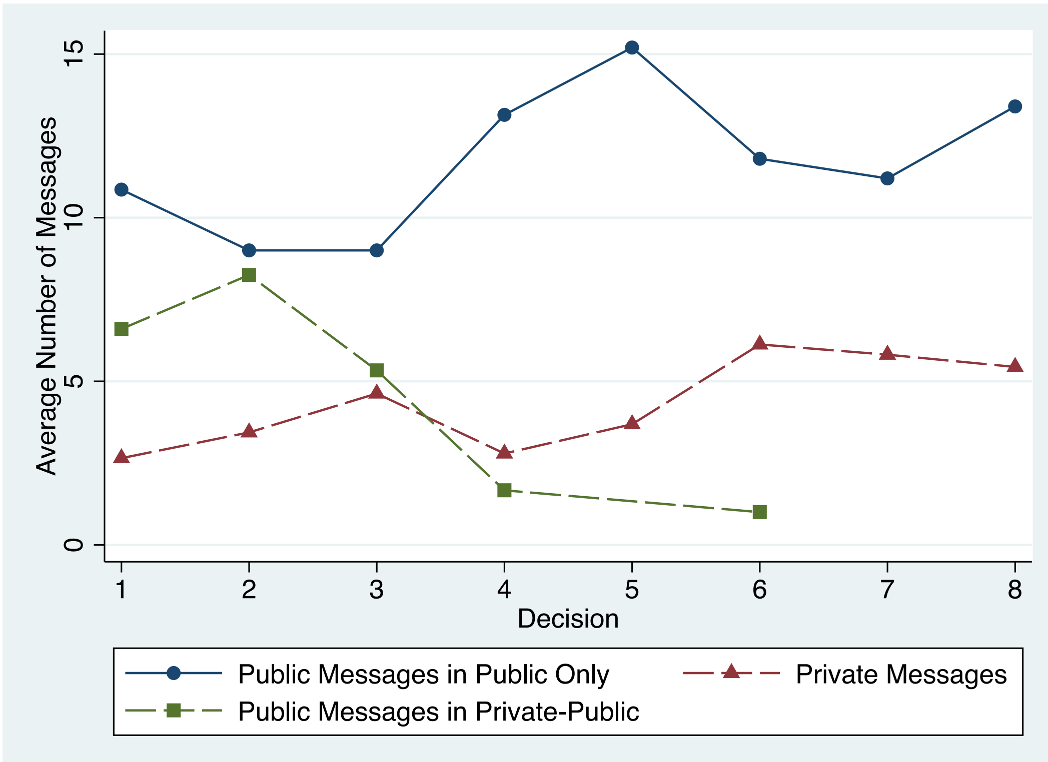
Figure 3. Dynamics of full efficiency and majority tyranny winning allocations



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. However, after the first two rounds in the *Private-Public* treatment, the number of messages in the public chat decreases dramatically, disappearing completely after the 6th 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 may be mostly 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") or signals of *vote intention* (e.g., "I am voting for 4"), 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 intention	Message indicates how the sender is going to vote	"I am voting for 1."
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. We find significant differences between the treatments in the content of the messages in the public channel, but also surprising similarities. Consistent with H3, subjects were more likely to use the public communications channel to send messages expressing a desire for fairness or to argue for equality, although the overall number of such messages is extremely small. In addition, we found that the subjects used the public channel to communicate that the full efficiency solution would give the group the maximum number of tokens or that coordinating on the full efficiency solution would let the subjects leave the experiment earlier.

Contrary to H3, however, subjects did not restrict self-serving messages exclusively to the private communications channel. Indeed, 12% of messages in the

Public-Only treatment suggest majority coalitions. However, we do see that such messages are used more often in the private channel (17%) than in the public channel (6%) when both are available in the *Private-Public* treatment, which is consistent with our argument that the appropriate social norm is to have such discussions in private rather than in public. Subjects seemed to use the public chat to try coordinate on majority tyranny allocations in the *Public-Only* treatment in the way that subjects use the private chat in the *Private-Public* treatment, albeit less effectively in the former than in the latter. In sum, while we find difference in messages referring to the public good or equality between the treatments, such messages were rare and often crowded out by messages seeking a minimum winning coalition.

Two results from our content analysis provide clues as to why *Public-Only* may be less effective at allowing majority coalitions to form. First, we see a smaller proportion of messages in the *Public-Only* treatment urging others to vote in a certain way (18%) than in the *Private-Public* treatment (31% of private messages and 38% of public messages). Second, we also see a greater proportion of private messages indicating assent (27%) than the public messages in either treatment (13% in *Public-Only* and 14% in *Private-Public).* These differences between private and public messages suggest that private messages are used more effectively to identify, coordinate, and build coalitions.

Table 5. Content analysis of messages

Message content	Public-Only	Private-Public	
		Public Message	Private Message
Suggested vote	18%	38%	31%
Agreement	13%	14%	27%
Majority	12%	6%	17%
Cooperation/efficiency	4%	8%	1%
Fairness	6%	0%	1%
Number of messages	552	88	586

Coalition formation

What kind of minimum winning coalitions do group members propose and seek out? Since we randomly assign each player's ID number before each round, subjects have no information about other subjects' previous behavior. Lacking such information, we find that subjects tend to propose coalitions based on natural patterns of subject ID numbers. Table 6 summarizes the coalition partners across all proposals in terms of the percentage of proposals that include each group member (in the columns) broken down by the proposer's ID number (in the rows). Table 7 summarizes the coalition partners for the winning majority tyranny allocations. While all coalitions naturally include the proposer, the coalitions proposer by players 1 and 2 tend to include the first three player numbers (1, 2, and 3), and coalitions proposed by players 4 and 5 tend to include the last three players (3, 4, and 5). Proposals by player 3 are consistent with sometimes including the first three and sometimes the last three. Overall, coalitions with members 1-2-3 comprise 37% of all majority tyranny proposals and 40% of winning majority tyranny allocations in both treatments. 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.

We can also analyze attempted coalition formation by examining the choice of message partners in the private chats. Table 8 shows the frequency of speaker-listener dyads by group member ID in the private chats. The patterns in Table 8 are similar to the patterns we see in Tables 6 and 7. Subjects communicated with potential coalition partners in a way that reflected the coalitions in the proposals. For example, player 1 mostly communicated with players 2 and 3, and player 2 mostly communicated with 1 and 3. Players 4 and 5 sent messages to each other and to player 3, while player 3 communicated equally with all other group members.

It is interesting that Player 3 is the most frequently sought after coalition partner by virtue of the nature of these focal coalitions (1-2-3, 3-4-5, 1-3-5, and 2-3-4) even though all group members are formally equal. Indeed, player 3 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). If all coalitions were equally likely, the probably of being randomly included in a coalition would be 60%.

Table 6. Proposed coalitions, all majority tyranny proposals

	Includes 1	Includes 2	Includes 3	Includes 4	Includes 5
Proposed by 1	100%	80%	98%	8%	15%
Proposed by 2	84%	100%	89%	16%	11%
Proposed by 3	51%	64%	100%	49%	36%
Proposed by 4	23%	25%	75%	100%	78%
Proposed by 5	23%	15%	83%	80%	100%
All proposals	56%	56%	89%	51%	48%

Table 7. Coalition members, winning majority tyranny allocations

	Includes 1	Includes 2	Includes 3	Includes 4	Includes 5
Proposed by 1	100%	82%	100%	0%	18%
Proposed by 2	90%	100%	70%	20%	20%
Proposed by 3	50%	38%	100%	50%	63%
Proposed by 4	11%	33%	78%	100%	78%
Proposed by 5	14%	0%	100%	86%	100%
All winning allocations	58%	56%	89%	47%	51%

Table 8. Dyads in private chats

	Listener 1	Listener 2	Listener 3	Listener 4	Listener 5
Speaker 1	--	57	47	9	24
Speaker 2	62	--	49	13	4
Speaker 3	33	25	--	22	31
Speaker 4	9	13	40	--	45
Speaker 5	16	4	44	39	--

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. For example, 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. Members of the excluded minority seem to be unable to generate new proposals that defeat existing majority tyranny allocations.

5 Conclusion

Our experimental setting is a far cry from the rich discourse of real deliberation. Not only do we abstract away from the complex policy information, but the computerized communication technology also strips away nuances of expression and intent that may be conveyed through non-verbal communication. Indeed, we observe chat messages that are short, direct, and devoid of the kind of principled argumentation expected by deliberative theorists. We trade the complexity of real environments for experimental control, which helps to better understand, analytically, the mechanisms by which deliberation produces good outcomes.

We argued that the public nature of discussion is critical to producing socially beneficial outcomes through deliberative processes, and our experimental results indeed suggest that allowing private communication can undermine public deliberation. Compared with a purely public communication technology, private messages prior to the public discussion in a collective choice task leads to an increase in the formation of minimum winning coalitions, majority tyranny, and the underprovision of public goods. However, public deliberation does not itself deter subjects from seeking minimum winning coalitions. While references to fairness and equality are present in the public deliberation, they are far less common than messages seeking to build such coalitions. Our analysis of proposals and messages suggests that private communication promotes majority tyranny by helping group members seek out and form coalition—that is, by *facilitating coordination.*

The results stand in contrast to experimental findings about the benefits of voting and delegation in the provision of public goods (Hamman, Weber, and Woon 2011), where majority tyranny outcomes are rare, and instead bear a greater resemblance to the experimental findings on majoritarian bargaining where private communication generates outcomes that are less egalitarian and closer to equilibrium predictions (Agranov and Tergiman 2014, 2015, Baranksi and Kagel 2015). Although we also find that private communication increases inequality, we believe it does so through a different mechanism. In a legislative bargaining environment, proposal power is temporarily concentrated in a single group member and private communication generates competition between potential members of the majority that drives the "price" of their votes down to equilibrium continuation values. In other words, communication facilitates greater price competition in legislative bargaining environments whereas in our public goods setting where there is formal equality of proposal power, communication facilitates coordination.

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Instructions

General Information

This is an experiment on group decision-making. The University of Pittsburgh 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 x 0 ÷ 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?
   - o 20
   - o 10
   - o 15
   - o 0

2. What is the **maximum** number of tokens you can propose to give to a group member?
   - o 15
   - o 50
   - o 20
   - o 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?
   - o No-one gets them.
   - o Points are divided equally among the group members.
   - o Multiplied by 1.25 and divided equally among all members.
   - o 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?
   - o 3
   - o 1
   - o 5
   - o 4

5. What happens if, after 5 rounds of discussion and voting, none of the proposals gets a majority vote?
   - o One is picked randomly.
   - o Computer creates a new random proposal.
   - o All tokens divided equally (i.e. everyone gets 20 tokens).
   - o 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?
   - o 25
   - o 10
   - o 20
   - o 15

7. If you are allocated 20 tokens and the total number of unallocated tokens is 80, how many points would you earn?
   - o 20
   - o 80
   - o 40
   - o 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?
   - 15
   - 27
   - 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.