Essays on Deliberation and Voting in Small-Groups

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Abstract

This dissertation examines how characteristics of process design for decision-making influence deliberation and voting in small groups. Decisions in small groups are made in numerous democratic and organizational contexts, such as citizen panels or committees. A well-designed process increases trust and the legitimacy of voting decisions, even if they do not represent dissenting opinions. Deliberative processes aim to aggregate opinions and attitudes on a specific topic in a fair and informed manner. However, certain conditions, such as group composition or voting rules, produce different outcomes. Voting rules influence not only how preferences for a decision are aggregated, but also, for example, the visibility of minorities. Majority rules can have a marginalizing effect, while structured systems, such as the median rule, can reduce conformity and avoid groupthink. The choice of how to design certain elements can be crucial for a decision-making process, because herd behavior and the formation of echo chambers can lead to polarization and reinforce more extreme positions. The design of such processes is therefore central to the quality of collective decisions and forms the basis for implementing adaptive mechanisms. This dissertation examines how the characteristics of process design influence collective decisions in small groups. It considers (1) the composition of groups (homogeneous or heterogeneous in elections), (2) voting rules, (3) group size, and (4) a behavioral intervention to promote constructive discussion in polarized spaces. The results offer valuable insights for institutional designers who develop inclusive participation processes and for organizations seeking to promote effective group decision-making.

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List of Abbreviations

AIC	Akaike Information Criterion
ANOVA	Analysis of Variance
ASI	Ambivalent Sexism Inventory
CI	Confidence Interval
ES	Experiential Scale
III	Implementation Intentions Intervention
IRB	Institutional Review Board
IT	Information Technology
KIT	Karlsruhe Institute of Technology
LLM	Large Language Models
LM	Like-Minded
LMGE	Like-Minded, Generous
LMGEM	Like-Minded, Generous, Median
LMGEU	Like-Minded, Generous, Unanimity
LMGM	Like-Minded, Median
LMGU	Like-Minded, Unanimity
LMS	Like-Minded, Selfish
LMSM	Like-Minded, Selfish, Median
LMSU	Like-Minded, Selfish, Unanimity
MCII	Mental Contrasting with Implementation Intentions

MM	Mixed-Minded
MMF	Mixed-Minded, Fair
MMGE	Mixed-Minded, Generous
MMM	Mixed-Minded, Median
MMS	Mixed-Minded, Selfish
MMU	Mixed-Minded, Unanimity
NA	Not Applicable
ORSEE	Online Recruitment System for Economic Experiments
RA	Refugee Attitude (Scale)
REI	Rational–Experiential Inventory
RS	Rational Scale
SD	Standard Deviation
SC	Social Comparison (Scale)
SMD	Standardized Mean Difference
SN	Social Norms
SPNE	Subgame Perfect Nash Equilibrium

Chapter 1

Introduction

1.1 Introduction

1.1.1 General Introduction

Small groups make important decisions in many democratic and organizational settings. They range from citizen panels to committees and work teams. In policy-making and citizen involvement, small groups play a crucial role as benchmarks for representative decision-making (e.g., in jury-based decision-making or assemblies). An effective procedure enhances trust and legitimacy in a democratic institution. Fairness perceptions increase acceptance of outcomes, even among those who disagree with the decision. Jury verdicts in the U.S. have wide acceptance, not because of the verdict outcome, which can be biased, but because citizens accept the fairness of the procedure. In firms and business-related functions, a well-designed process directly influences innovation, well-being, and growth. In the current debate of growing polarization of views, understanding how deliberation affects voting decisions is of rising interest. Deliberation itself has promising implications for voting procedures. These group settings aim to aggregate preferences in a way that is fair, informed, and accepted. Yet procedure and context place constraints on how groups reason and vote. Deliberation can support learning and moderation, but it can also foster divergence under some conditions. The design of deliberative procedures matters. Understanding how design implications shape the process of small-group decision-making helps inform both stakeholders for democratic innovation and organizational practice.

Procedures are not neutral to the behavior of participants. Voting rules not only aggregate preferences, but they also determine how much weight voices have. Moreover, they influence whose preferences are reflected, and this has implications for deliberation processes. Hence, the quality of decisions can be influenced by the rule imposed. Depending on the aggregation rule, participants are encouraged or discouraged from sharing information. For example, imposing the majority rule risks marginalizing minorities or simply

silencing argumentation. Structured rules, such as the median rule, can reduce conformity pressure and group thinking. Unstructured rules are prone to immediate outcomes that influence the sustainability of the collective decision-making. Beyond immediate outcomes, procedures shape how participants view each other. They influence whether they trust the process and whether they are willing to engage in future citizen or other panels.

The dissertation studies how features of process design shape collective decisions. I focus on three aspects of group decision-making. First, the composition of the group in like-minded and mixed-minded settings. Second, the rule by which votes are turned into outcomes. Third, the use of a simple behavioral intervention to prepare participants for a constructive exchange. Across four empirical projects, I use controlled experiments to examine how these levers affect group outcomes and individual preferences. These findings can help institutional designers who seek to build inclusive and participatory processes, organizational stakeholders aiming to foster effective small-group decision-making, and scholars interested in empirical research on this question.

The broader debate on the effects of process design in deliberation in the literature is ongoing. Some studies find that deliberation promotes informed judgment and cooperation (Dryzek and List, 2003; List et al., 2013; Fishkin, 2019). Others highlight that, in some contexts, the exchange of arguments can shift preferences toward extremes and fuel polarization (Sunstein, 2002; Schkade et al., 2010). Online discourse and social media are often named as drivers for dynamic distortions (Bail et al., 2018; Wilson et al., 2020; Levy, 2021; Dalton, 2021; Rhodes, 2022; Orhan, 2022). This variation in findings raises my main question: Under what circumstances do small group procedures lead to consensus-driven behavior, and under what circumstances do they foster division of attitudes? While we know that deliberation can both integrate and divide, we lack systematic evidence on the procedural conditions that push outcomes to extremes or decrease deliberation quality. This dissertation directly addresses that gap.

The dissertation addresses this question with four projects. Chapter 2 studies like-mindedness and shows that group decisions in a donation allocation task moderate rather than polarize. Chapter 3 varies group size and reexamines rule sensitivity in five-member groups relative to three-member groups. Chapter 4 tests equilibrium predictions in a sequential voting game under mean and symmetric median rules. Chapter 5 explores intervening on self-reflection based on mental contrasting with implementation intentions (MCII) in a polarized setting. The common aim is to link the theory of aggregation to observed behavior in small groups.

1.1.2   Motivation

The motivation is both empirical and design-oriented. On the empirical side, there is a need for clean evidence on how composition and rules shape what groups decide. Theories

of aggregation explain why the median rule has appealing properties on single-peaked domains (Moulin, 1980). Strategic models also show when the mean and median rules differ in incentives. But these predictions require assumptions that may not hold in practice. Group interaction introduces social norms, status, and persuasion. Participation is sometimes costly and uneven. As a result, behavior can depart from the predictions even in simple environments.

On the design side, institutions must trade off accuracy, inclusion, and ease of use. Majority-based rules, veto-based rules, and median-based rules offer different balances. In settings with single-peaked preferences, the median rule can support transparent outcomes that are robust to misreporting in the sense of strategy-proofness under the direct revelation benchmark (Moulin, 1980). In other environments, persuasion and coordination can dominate. Unanimity may invite conformity and delay, while a majority can move fast at the expense of consensus (Guarnaschelli et al., 2000; Sorkin et al., 1998). Group size interacts with these tensions. Larger groups have more information to pool, yet they also bring more complexity in coordination and communication. The wisdom of crowds literature documents both gains from aggregation and losses from herding and confidence-based distortions (Lorenz et al., 2011; Becker et al., 2017; Jayles et al., 2017; Fujisaki et al., 2018).

The projects in this dissertation are built to speak to these trade-offs. Chapter 2 holds rules constant and varies like-mindedness to test whether enclave-style composition pushes outcomes to extremes. The results suggest that ad hoc groups, even when like-minded, do not move to extremes in this task and context. Chapter 3 scales the small group from three to five and asks whether rule sensitivity becomes more pronounced. In this setting, composition again dominates outcomes, while unanimity increases message volume in mixed-minded groups. Chapter 4 turns to a sequential voting game with complete information. By selecting peak profiles and participation costs that align mean and symmetric median equilibria, the design isolates framing from strategy. The study tests whether participants recognize and play the predicted outcomes and examines participation by extremeness (Osborne and Rubinstein, 1994; Puppe and Rollmann, 2021; Sauermann, 2023). Chapter 5 moves to intervention. Mental contrasting with implementation intentions (MCII) aims to prepare participants for the demands of deliberation. Prior work shows effects of the method on individual goal pursuit and some group contexts (Gollwitzer and Sheeran, 2006; Oettingen et al., 2010; Oettingen, 2012; Kappes et al., 2012; Kirk et al., 2013). The study places MCII before a unanimous group decision on a morally salient issue and examines engagement and preference change.

Together, the projects seek a measured answer. Design matters. Composition and simple features of the communication environment can dominate rule effects. Strategic structure matters as well, but recognition of equilibrium depends on how the task is framed and how costly participation is. Interventions can modestly improve engagement without

necessarily moving outcomes. The practical implication is to tailor small group procedures to the context. Use rules that fit the distribution of preferences. Make composition and process explicit. Support participants with light preparation when topics are charged.

1.1.3   Background Literature

Deliberation, polarization, and composition.   Theoretical and empirical work points at two forces in deliberation. One force is informational. Exchange can reduce information asymmetries and support mutual learning, which leads to more informed and moderate judgments (Cason and Mui, 1997; Dryzek and List, 2003; Fishkin, 2019; List et al., 2013; Grönlund et al., 2015). A second force is social. Like-minded groups can build echo chambers. This privileges confidence and status, and crowds out dissent and supports silencing. These dynamics can lead to "following the herd" behavior and push outcomes toward extremes (Sunstein, 2002; Luhan et al., 2009; Schkade et al., 2010). Foremost, the recent literature links these dynamics to online settings (Bail et al., 2018; Wilson et al., 2020; Dalton, 2021; Levy, 2021; Rhodes, 2022; Orhan, 2022). Mixed-minded composition and clear procedures help to counteract dominance and to widen the space for reasoned exchange (Lindell et al., 2017; Strandberg et al., 2019).

Group Size and the Wisdom of Crowds.   Aggregation can improve accuracy, but the gains depend on independence, task structure, and networked communication (Becker et al., 2017; Jayles et al., 2017). Herding and reduced diversity can undermine the crowd advantage (Lorenz et al., 2011; Fujisaki et al., 2018). These mechanisms imply that scaling up a small group has both promise and risk. The design of the exchange and the rule of aggregation shape which effect dominates.

Voting Rules and Strategic Behavior.   On single-peaked domains, the median rule enjoys strategy proofness in the direct revelation sense (Moulin, 1980). In practice, the mapping from preferences to reports runs through communication and voting. Laboratory studies document rule sensitivity and coordination costs, especially under unanimity and in larger groups (Sorkin et al., 1998; Guarnaschelli et al., 2000). Work on redistribution and allocation tasks reveals that central tendencies can prevail even in small groups, although sincere voting is not universal and extreme reports can emerge under mean aggregation (Puppe and Rollmann, 2021; Sauermann, 2023).

Behavioral Interventions for Collective Tasks.   Mental contrasting and if-then planning, an intervention that supports goal pursuit, links desired outcomes to obstacles and helps individuals form a concrete plan (Gollwitzer and Sheeran, 2006; Oettingen et al., 2010; Oettingen, 2012). Evidence outside policy making shows robust effects in health, work, and learning (Kappes et al., 2012). In a group context, there is early work

on negotiation that suggests performance gains (Kirk et al., 2013). Bringing MCII into participatory settings raises a question. Can a brief exercise before discussion support engagement and quality without steering the outcome? The project in Chapter 5 explores this question in a morally salient domain.

1.1.4 Structure of the Thesis

The dissertation consists of four empirical chapters that share a common design logic.

- **Chapter 2: Like-mindedness and deliberation.** A three-round donation allocation task with like-minded and mixed-minded triads under unanimity and median rules. Group outcomes moderate rather than polarize in this context.

- **Chapter 3: Group size and rule sensitivity.** The design extends to five member groups. Composition again drives outcomes. Unanimity increases message volume in larger mixed-minded groups.

- **Chapter 4: Mean versus median in a sequential game.** A laboratory test of subgame perfect equilibria under mean and symmetric median rules with aligned peak profiles and costs. The study examines recognition of the predicted outcomes and participation by extremeness.

- **Chapter 5: MCII before deliberation.** A polarized donation setting under unanimity with a standard MCII exercise and a predefined wish variant. The study measures engagement, sentiment, and preference change.
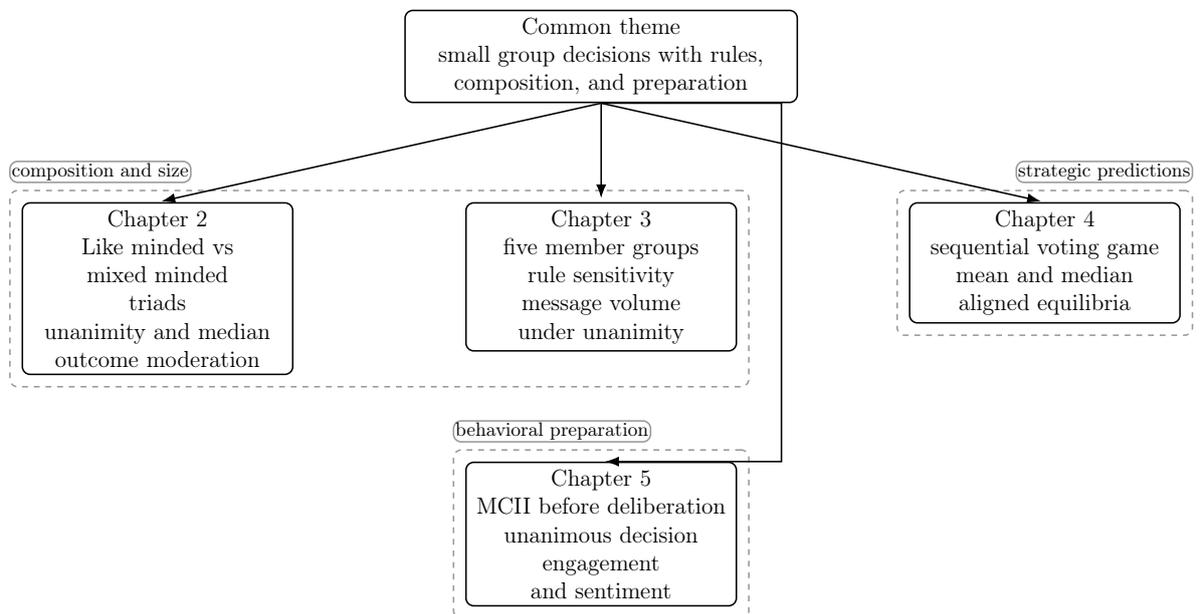
Figure 1.1: Projects vary in group composition, size, aggregation rules, preparation, and context.

Chapter 2

Like-Mindedness in Deliberation and Voting

Deliberation in decision-making is often proposed as a cure to mitigate polarization in democratic processes. However, empirical evidence remains mixed, with some studies suggesting that deliberation among like-minded individuals can drive vote shifts toward extremes. We use a three-round group dictator game to examine how group composition influences deliberative outcomes systematically. Our design allows us to compare deliberation within like-minded and mixed-minded groups while also manipulating the voting rule (median vs. unanimity) to assess its impact on decision-making. Contrary to expectations of polarization, we find that deliberation moderates votes across all conditions. This effect is strongest for selfish participants in mixed-minded groups, but also like-minded selfish groups behave significantly less extreme than individuals. On the other hand, the moderating effect of deliberation does not persist when subjects revert to individual decision-making. Regardless of the voting rule, groups tend to converge on unanimous decisions, suggesting norm-driven behavior in deliberative and participatory settings.

2.1   Introduction

Among other current distortions of democratic procedures, polarization is an important challenge in society. The urge raises questions about how to develop deliberative processes for public participation and discourse. Not only as a potential cure to polarization, but also to understand under which conditions it strengthens the dynamics of polarizing attitude shifts. While polarization, defined as ideological and affective, has been widely studied (Wilson et al., 2020; Dalton, 2021; Orhan, 2022), scholars are undecided about its clear origins in deliberation. Political polarization has seemingly intensified in recent years, boosted by social media and discourses held online (Bail et al., 2018; Levy, 2021; Rhodes, 2022). Some research suggests that deliberation fosters informed decision-making and mitigates polarization (Barabas, 2004; Fishkin, 2019; Luskin et al., 2022), while others argue that in some conditions and contexts it leads to biases and extreme voting shifts (Sunstein, 2002; Schkade et al., 2010). Interestingly, like-mindedness is a predominant distortion in the debate. Hence, we ask: Do like-minded groups move towards extremes, or does deliberation promote moderation?

To address this, we conducted a pre-registered experiment testing how like-mindedness affects deliberation and decision-making. The study builds on the experimental group polarization literature (Cason and Mui, 1997; Luhan et al., 2009), which concluded in conflicting evidence on whether deliberation fosters pro-social, moderating behavior or the opposite. We formulated two competing hypotheses: (1) like-minded groups amplify polarization, leading to more extreme allocations in group decision-making, and (2) deliberation moderates allocation decisions.

To test these hypotheses, we used the task of a modified three-round group dictator game. Unlike previous studies, our design incorporates immigration as a politically salient issue by directing allocations to a refugee organization in the neighborhood of the participants. Participants are grouped based on collected initial votings to form three-member like-minded and mixed-minded groups, and we manipulate the voting rule (median vs. unanimity) to examine its impact on deliberation and voting.

Our findings provide no evidence of polarization. Like-minded groups do not shift toward extreme allocations; instead, we observe moderation across all conditions. Interestingly, like-minded selfish groups retain fewer resources compared to individual decisions, while selfish participants in mixed-minded groups tend to withhold even more. A similar but opposite trend occurs for generous participants. The voting rule does not significantly alter these shifts. Groups reach unanimous decisions regardless of the imposed decision rule. Analysis of the second individual round provided evidence that no learning occurred. Participants moved back to their initial individual votes.

These results suggest that deliberation neither polarizes nor alters individual votings significantly. Instead, other social dynamics, such as potentially social norms in ad-

hoc group building (Strandberg et al., 2019), influence group decision-making, fostering moderation rather than extremism.

Our study contributes to the academic debate on deliberative democracy by highlighting the role of group composition and allocation rules in impacting collective decisions. Exploring and integrating like-mindedness, deliberation, and voting in a lab-controlled experiment, we contribute to the understanding of group voting. Future research could further investigate social and cognitive mechanisms such as norms, strategic signaling, and (perceived fairness) expectations, which may influence the observed moderation across groups.

This chapter is structured as follows. Section 2.2 provides the theoretical motivation and background. We provide reviews of the relevant literature on deliberation, polarization, and voting rules in collective decision-making. Section 2.3 describes the study design, including treatment conditions and procedural details in the lab. Section 2.4 presents the empirical findings, including statistical analysis of voting behavior and group dynamics. Section 2.5 discusses the results in the context of our theoretical framework and existing confirmatory studies. Finally, Section 2.6 concludes with implications for deliberative democratic literature and directions for future research.

2.2 Theoretical Motivation and Background

This study investigates how process design features of voting, namely deliberation, group composition, and decision rule, impact collective decisions and voting. While deliberation is widely regarded as a normative ideal in democratic theory (Estlund and Landemore, 2018), empirical findings vary on whether it leads to moderation or polarization. Most existing empirical research focuses on attitude change, often measured at the individual level. Yet when deliberation is linked to binding group decisions, features such as like-mindedness and voting rules in groups could become an influential consideration when designing such processes.

We focus on two mechanisms central to the deliberation-polarization debate. First, we vary group composition by forming like-minded and mixed-minded groups. The grouping logic is based on participants' initial allocation choices in the frame of a (group) dictator game task. This allows us to test how initial like-mindedness amplifies or diminishes polarization tendencies during deliberation and voting. Second, we vary the voting rules under which votes are aggregated. The median rule allows for majoritarian outcomes without requiring consensus. Unanimity imposes a collective veto, potentially increasing conformity or fostering mutual learning. Regardless, participants have the option to opt out of the group decision task if required.

By developing corresponding treatments, we examine how group composition and rules in decision-making shape allocation decisions in a morally salient context. This approach

allows us to measure decisions in a controlled setting with a real-world application.

2.2.1   Deliberation as a Mechanism for Preference Change and Aggregation

Deliberation, unlike group discussion, is often framed in normative theory as a means of improving collective judgment and enhancing proximity to epistemic truth (Estlund and Landemore, 2018). It has the potential to reduce information asymmetries through mutual learning. If well-designed, deliberative procedures can help participants to reveal preferences and attitudes, leading to more informed judgments on policy questions (Grönlund et al., 2015; Bächtiger et al., 2018; Luskin et al., 2022).

Deliberation is both an intersubjective and internal process (Grönlund et al., 2015). Intersubjectivity involves mutual communication on shared concerns (Bächtiger et al., 2018; Niemeyer et al., 2024), while internal reasoning has an impact on the reflection of information. This can lead to attitudinal change. Ideally, this process reduces information asymmetries and updates individual attitudes to more informed judgment for aggregation. Heterogeneity and inclusion of minor views in attitudes are crucial for a deliberation process (see e.g., Thompson, 2008; Grönlund et al., 2015; Fishkin, 2019), while others enrich argumentation.

From a Habermasian perspective (1990; 1993), the goal is to facilitate an "ideal speech situation" that leads to consensus, even without voting. There is a transformation of mutual preferences in the process. Barabas (2004) also emphasizes consensus and enlightenment as deliberative aims. In his view, the goal is not uniform agreement but mutual understanding amid diverging interests. His findings suggest that inclusive and open-minded settings allow participants to learn, moderate, and update attitudes.

Ultimately, scholars have argued for relaxing the requirement of consensus as a means for impactful deliberation (List et al., 2013; Jezierska, 2019; Luskin et al., 2022). List (2018) proposes a mixed model of deliberation that integrates deliberation with voting, requiring "substantive, balanced, and civil discussion" (after Fishkin and Luskin, 2005; List et al., 2013). This model contrasts with "original" deliberation, that do not require voting to conclude aggregation. In addition, enhancing voting with deliberation provides possible solutions to impossibility results of social choice. Deliberation can help mitigate aggregation issues like the voting paradox (Arrow et al., 1964; List et al., 2013; Perote-Peña and Piggins, 2015; List, 2018). It is argued that deliberation, as it fosters altering preferences towards single-peaked preferences, makes majority-rule outcomes more stable (List et al., 2013). Thus, deliberation narrows the preference space and increases acceptance of majority outcomes (Dryzek and List, 2003).

2.2.2 Group Composition and the Dynamics of Like-Mindedness

Predominantly, the literature discusses the issue of like-mindedness (Grönlund et al., 2015) and bubble discussions in social media (Seargeant and Tagg, 2019). Hence, the question arises whether like-minded deliberation produces extremes in policy decision-making. This issue often turns on group composition, specifically, the degree of initial preference similarity among participants. Like-minded groups may facilitate mutual understanding, but they also risk reinforcing biases and even reducing the low levels of diversity of perspectives (Sunstein, 2002; Mendelberg, 2002).

Polarization generally refers to the divergence of opinions towards two extremes of a spectrum of attitudes or preferences (Bail et al., 2018; Baron et al., 2021; Orhan, 2022; Broockman et al., 2023). Scholars distinguish more specifically between idea-based polarization (disagreement on policy content) and identity-based polarization (division based on group identity) (Abramowitz and Saunders, 2008; Bernaerts et al., 2023). Involving citizens in deliberative decision-making is seen as a potential risk for polarization (Vinokur and Burnstein, 1978; Carpini et al., 2004).

However, scholars provide very opposing views on deliberation in voting and its properties resulting from empirical research: some regard deliberation as a cure, i.e., for polarization (Dryzek and List, 2003; Grönlund et al., 2015; Fishkin et al., 2021; Levendusky and Stecula, 2021; Niemeyer et al., 2024), while others identify deliberation itself as a cause of polarization (Sunstein, 2002; Mendelberg, 2002). Sunstein argues that deliberation can push attitudes toward pre-existing group inclinations towards the extreme edges. Empirical evidence supports this in contexts such as jury decisions, where group verdicts tend to be more extreme than individual judgments (Schkade et al., 2007, 2010). The issue is known as enclave deliberation (Sunstein, 2002; Grönlund et al., 2015). The mechanism behind the issue of like-mindedness is the development of echo chambers. Echo chambers are leading to groupthink, where shared identity and argumentation patterns crowd out dissenting views (Mendelberg, 2002; Sunstein, 2009). This creates conditions for information cascades and conformity pressures, undermining epistemic quality (Grönlund et al., 2015).

A recent extension of this dynamic is the phenomenon of curated polarization or partisan curation bubbles. This is polarization that arises not solely through face-to-face exchange of arguments but through the sharing of ideologically proximate content, i.e., in social media. As Green et al. (2025) show, social media users often consume political information not directly from partisan sources or the press, but through like-minded users who selectively share narratives and information. A property is the alignment of the identities and corresponding attitudes that creates the bubble. Opinion bubbles change platforms into ideologically homogeneous content systems. This remains even when the underlying media sources are cross-cutting or moderate in general. For deliberation, this

shift is crucial: participants may enter group deliberation settings already cognitively embedded in different informational realities. This might narrow the space for mutual understanding or limit the persuasiveness of counterarguments. As a result, it fosters misaligned priors. In this way, curated polarization could lead to a pre-deliberative asymmetry. Deliberation is biased not only content-wise, but also in what is considered credible or legitimate (Green et al., 2025).

Recent work highlights how individual information exposure, especially avoidance, can drive polarization. Offer et al.(2024) show that individuals often avoid confronting unfairness by deliberately choosing not to gain information that would display inequality. In a modified Ultimatum Game, over half of the participants chose not to learn whether they had received an unfair offer; among these, only 6% rejected the offer, compared to 39% rejection among those who sought the information. The authors interpret this pattern as "sorting behavior" (Offer et al., 2024). Revealed unfairness triggered punishment, while deliberate ignorance shielded individuals from the moral cost of inaction. This mechanism resonates with models of enclave deliberation and information avoidance. Individuals may self-select into information asymmetry that amplifies existing preferences or reduces cognitive dissonance. A common pattern of polarization dynamics.

Another related distortion in dynamics is the "risky shift". Here, group decisions become riskier than the average individual preference (Kogan and Wallach, 1967; Vidmar, 1970). Vidmar (1970) finds that mixed groups (of risk preferences) tend to shift more toward risk than like-minded ones, potentially due to the spread of responsibility. However, findings remain unclear. Some studies find no risk shift when groups engage in non-task-related discussions beforehand (Pruitt and Teger, 1969).

Theories of social comparison and persuasive argumentation offer further explanations to group dynamics related to compositions (Asch, 1955; Isenberg, 1986; Sunstein, 2002; Grönlund et al., 2015). Participants may adapt their views to align with perceived majorities for social acceptance (Isenberg, 1986; Lindell et al., 2017). Dominant participants persuade others, enhancing potential biases, and often suppress misalignment. In enclave deliberation, where opposing viewpoints are absent, such mechanisms are more likely to produce path-dependent and extreme shifts in attitudes (Landemore and Mercier, 2012).

2.2.3   Voting Rules as Structural Constraints on Deliberation

Deliberation rarely takes place in isolation. When groups must make binding decisions, formal rules for aggregating preferences, such as unanimity or median, form the structure of deliberation. While much of the literature focuses on theory, few studies empirically test how different rules shape group decisions in deliberative settings.

In the deliberative model, proximity to unanimity is a desirable property (Habermas, 1990; Calhoun, 1993; Mendelberg, 2002; List, 2018). Habermas (2022, p. 152) later

clarified that consensus is an ideal, not a necessary result. Rather, participants should regard disagreements as part of reasoned discourse.

The mixed model, which combines deliberation and voting, allows for structured aggregation of preferences (List, 2018). Mendelberg (2002) outlines the requirements for applying unanimity in deliberation. While unanimity fosters mutual understanding (Dryzek, 1990), it also induces conformity, especially in like-minded groups where minority voices may be suppressed (Mansbridge, 1983; Bächtiger et al., 2018). Evidence on its effects is mixed and context-dependent (Falk and Falk, 1981; Kaplan and Miller, 1987; Cason and Mui, 1997).

Unanimity is associated with longer deliberations and a higher likelihood of tie outcomes (Davis et al., 1975; Mendelberg, 2002). While often contrasted with majority rule, we propose an alternative: the median rule. Theoretically, it incentivizes truthful preference reporting under single-peaked preferences (Moulin, 1980; Puppe and Rollmann, 2021). In an empirical field study, Puppe and Rollmann (2021) found that although truthtelling was not universal, many participants identified their best responses when provided with full information.

Unlike unanimity, the median rule does not require persuasion. However, it offers room for mutual understanding that could result in identifying the median voter. Yet, empirical evidence on the median rule in deliberative contexts remains limited. Our study aims to address this gap by comparing deliberation outcomes under unanimity and median decision rules.

In practice, the unanimity rule, common in jury deliberations and intergovernmental bodies such as the EU, requires full agreement and grants veto power to individual members. It can foster cohesion and mutual learning, complementing deliberation. However, it facilitates logrolling in parliamentary decision-making with multidimensional interests (Dougherty and Edward, 2011; Aksoy, 2012). Voting rules such as unanimity not only impose strict outcomes but also influence strategic behavior. This leads to party cohesion in legislative assemblies (Carey, 2007). The median rule, by contrast, reflects majoritarian compromise. It minimizes the need for persuasion while centering group outcomes around the median voter. In practice, it is used in committee decisions and budget allocations (Banks and Duggan, 2006). All together, the rules demand consensus versus (majoritarian-accepted) compromise. Hence, we conclude that these two rules drive different deliberative dynamics.

2.2.4   Research Gap and Contribution

While previous studies have explored how deliberation affects individual attitudes, much less is known about how the exchange of arguments translates into voting outcomes. Moreover, under different rule-constrained voting procedures. In particular, few stud-

ies consider the joint effects of group composition and aggregation rules in real-stakes decision-making.

Our study addresses this gap by experimentally manipulating both group composition (like-minded vs. mixed-minded) and decision rule (median vs. unanimity) in a three-round group dictator game (Cason and Mui, 1997; Luhan et al., 2009). By framing the allocation around a politically salient recipient, a refugee support organization, we observe how deliberative dynamics or distortions show in a context with real distributive consequences.

This design allows us to explore how like-mindedness and voting rules interact in both group-level allocations and post-deliberation individual decision-making. In doing so, we bridge the literatures on deliberative democracy, group polarization, and procedural design.

While some scholars argue that like-minded deliberation fosters polarization and group-think (Sunstein, 2002, 2007), others find that deliberation can moderate attitudes, even in like-minded groups (Fishkin and Luskin, 2005; List et al., 2013; Grönlund et al., 2015; Lindell et al., 2017; Luskin et al., 2022). Yet, few studies examine whether such attitudinal effects translate into actual voting. Our experiment contributes to this literature by shifting the focus from opinion change into ballots under varying rule constraints.

We define like-mindedness in groups based on initial individual allocation decisions in our task. We are using this information as an attitudinal proxy. This approach avoids reliance on self-reported attitudes. Our study thus provides insights into understanding the conditions under which group composition and rules impact deliberation and voting at the group and individual levels.

2.3   Experimental Design and Procedure

2.3.1   General Design

The study is designed around a group dictator game to examine group allocation decisions under deliberation. This task design allows us to isolate fairness-related voting without the strategic incentives typically found in bargaining or public goods games. This task is especially suited to studying normative decision-making in groups, as it avoids the confounds of reciprocity or punishment. It offers an attitude-related context due to the external recipient in which to compare voting rules and deliberative dynamics. Previous applications, such as Cason and Mui (1997) and Luhan et al. (2009), show that group discussion and voting procedures can significantly shape allocation behavior and polarization, which provides the methodological appropriateness of this approach for our research questions. We conducted a laboratory experiment using a three-round group dictator game to examine how group composition and aggregation rules affect deliberative alloca-

tion decisions in the lab. The experiment was pre-registered, IRB ethics approved, and conducted across 18 lab sessions. Among these, 216 participants were randomly assigned to three-person deliberative groups. All sessions were conducted at the university lab using oTree, with participants randomly assigned via *Hroot* (Bock et al., 2014) and *ORSEE* (Greiner, 2004).

Participants received an endowment of 10 points (each worth €0.50) and made three sequential decisions about how much of their endowment to retain versus donate to a real-world refugee aid organization. The three rounds were structured as follows:

- **Round 1 (Individual decision):** Participants made an initial decision on how many points to keep.

- **Round 2 (Group deliberation and decision):** Participants were assigned to a group and deliberated their preferences via an anonymous chat interface before voting under either a median or unanimity rule.

- **Round 3 (Post-deliberation individual decision):** Participants made a second individual withdrawal decision, allowing us to track any individual voting change.
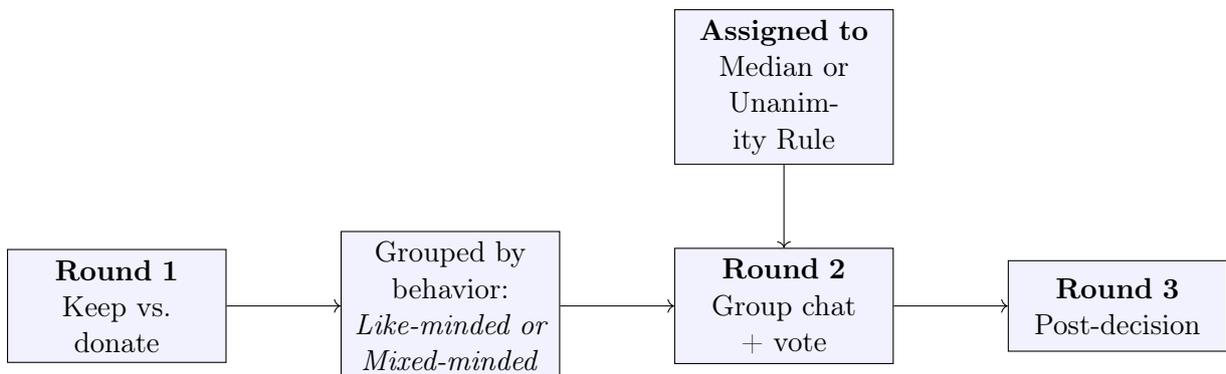
Figure 2.1: Timeline. Participants made an individual choice (Round 1), were grouped by allocation behavior and randomization, deliberated and voted - voting rule by session(Round 2), and finally made a post-deliberation decision (Round 3).

2.3.2 Group Composition and Like-Mindedness Assignment

Group composition was based on participants' Round 1 individual allocation behavior. We grouped individual decisions into three behavioral types: *selfish* (0–4 points donated), *fair* (5 points), and *generous* (6–10 points). These thresholds were pre-defined to ensure variance in allocation attitudes. Participants were then randomly assigned to either like-minded groups (all members from the same decision category) or mixed-minded groups (members from different categories).

We chose behavioral like-mindedness over self-reported political or ideological attitudes to avoid priming effects and social desirability bias (Nederhof, 1985). Instead, we used participants' individual allocation decisions as a task-specific measure of fairness orientation. Before data collection, we considered 5 points to represent a fair split between self and other. After observing the data, we found that the median individual allocation in Round 1 was 6 points. Based on this, we defined the fairness benchmark ex-post as 6 points and relabeled participants accordingly: those donating less than 6 were classified as *selfish*, those donating exactly 6 as *fair*, and those donating more than 6 as *generous*. This classification ensured meaningful differences in group composition based on actual withdrawal.

For a validation of this grouping logic using decision data (see Appendix B.1).

2.3.3   Recipient Organization and Framing

The recipient of all donations was *Lernfreundehaus*, a local refugee education and integration program. The organization was selected because it is politically salient, yet in the direct environment of the participants. The organization helps children doing homework or assists with daily tasks, sports, and food.

Participants were presented with a short neutral description of the organization at the introduction page, before any decision-making (see Appendix A.2). Participants were informed that all decisions would be made in real donations by the researchers at the end of the study.

2.3.4   Control Variables and Measurement Instruments

To account for heterogeneity in attitudes and dispositions, participants completed a short survey following Round 3. We included validated scales for:

- **Refugee and immigration attitudes:** Adapted from Kotzur et al. (2022) (see Appendix C.4).

- **The social comparison scale:** Adapted from Schneider and Schupp (2011) (see Appendix C.3).

- **The social-norm espousal scale:** Adapted from Bizer et al. (2014) (see Appendix C.2).

- **Socio-demographics:** Age, gender, education level, and occupation.

These scales were used for additional control variables in statistical models but were not part of the group logic mechanism.

2.3.5 Procedure and Ethical Oversight

All participants gave informed consent to participate. The study was approved by the university's institutional review board (IRB). Participants received earnings based on their decisions. Group earnings were calculated in real time, and donations were confirmed to participants after the study. Total payments (including donations) were processed through the lab's digital payout system.

Each session lasted approximately 30–40 minutes. No deception was used. Participants could ask clarification questions at any time, and a full debriefing was provided at the end of the experiment.

2.4 Findings

This section reports the empirical results of our study. We begin by describing the sample and treatment distribution. We then examine the effects of our two main manipulations, group composition (like-minded vs. mixed-minded) and voting rule (median vs. unanimity), on group decisions and individual decision-making. Finally, we explore interaction patterns, voting changes across rounds, and deliberation dynamics. Our analysis focuses on testing whether like-minded groups exhibit polarization, whether decision rules shape outcomes, and how group composition and voting impact individual decisions.

2.4.1 Data and Summary Statistics

The experiment was conducted over 18 sessions with 216 participants. Subjects were randomly assigned to groups of three and engaged in a decision-making task. The voting rule was assigned at the session level and balanced across the sample to ensure comparability across treatments.

Demographics and Sample Characteristics Table 2.1 summarizes the data of our demographic survey and group variability in the data. The participants had an average age of 24 years (SD = 4.32), and 40% identified as female. The sample consisted primarily of students, with 62% not holding a formal degree and 35% having completed at least a bachelor's degree. A small proportion (2%) were either employed or are PhD students. The slight gender imbalance observed in the sample is a well-documented characteristic of the universities' participant pool.

Group Composition Participants were assigned to one of two group structures:

- *Like-minded groups* (39% of participants) participated with members with similar retention voting patterns.

Table 2.1: Summary Statistics

Variable	Mean	SD
Demographics		
Age (years)	24.00	4.32
Female (dummy)	0.40	0.49
Bachelor or Higher (dummy)	0.36	0.48
Group Composition		
Like-minded (dummy)	0.39	0.49
Mixed-minded (dummy)	0.61	0.49
Treatment Conditions		
LMGEU	0.10	0.30
LMSU	0.11	0.31
MMU	0.28	0.45
LMGEM	0.07	0.25
LMSM	0.11	0.31
MMM	0.33	0.47

Notes: $N = 216$ for all variables, except group composition (Like-minded $N = 84$, Mixed-minded $N = 132$). - Dummy variables equal 1 if the condition is met and 0 otherwise. - *Treatment groups:* - LMGU: Like-minded, generous, unanimity rule - LMGM: Like-minded, generous, median rule - LMSU: Like-minded, selfish, unanimity rule - LMSM: Like-minded, selfish, median rule - MMU: Mixed-minded, unanimity rule - MMM: Mixed-minded, median rule

- *Mixed-minded groups* (61% of participants) participated with members with varying retention voting patterns. Participants in these groups were classified into one of three types:

  - *Selfish*: Retained more than six points.

  - *Fair*: Retained exactly six points.

  - *Generous*: Retained fewer than six points.

All possible combinations of these three types were feasible in mixed-minded groups.

Treatment Conditions and Voting Rules Participants were assigned to the following treatment conditions based on group composition (like-minded vs. mixed-minded) and the assigned voting rule (unanimity vs. median). The treatment groups are defined as follows: *Like-minded groups:*

- LMGEU – Generous, unanimity rule

- LMGEM – Generous, median rule

- LMSU – Selfish, unanimity rule

- LMSM – Selfish, median rule

Mixed-minded groups:

- MMU – Mixed-minded, unanimity rule

- MMM – Mixed-minded, median rule

Additionally, within mixed-minded groups, participants were classified based on their type classification:

- MMGE – Generous participant in a mixed-minded group

- MMS – Selfish participant in a mixed-minded group

- MMF – Fair participant in a mixed-minded group

Sample Composition 39% of participants engaged in like-minded deliberation and voting, while 61% participated in mixed-minded groups. The classification was determined based on voting in the first individual decision round. The voting rules were randomly assigned at the session level to ensure balance across conditions.

2.4.2   Validation of Behavioral Grouping

To assess the validity of our grouping logic, we analyzed the relationship between participants' initial decisions and their self-reported answers to the questionnaires. Before data collection, we considered 5 points as a normative fairness benchmark, which is an even split of the 10-point endowment. After observing the data, we found that the median allocation in Round 1 was 6 points. Based on this ex post central tendency, we relabeled group membership as follows: participants donating fewer than 6 points were classified as *selfish*, those donating exactly 6 as *fair*, and those donating more than 6 as *generous*.

We then tested whether initial decisions were associated with our controls. As shown in the Appendix (see Appendix B.1), votings on allocations were positively associated with corrected scores on the Social Comparison Scale ($r = .15$, $p = .029$), suggesting that participants who more frequently compare themselves to others tended to retain slightly more for themselves. More notably, decisions were negatively correlated with attitudes on refugees ($r = -.17$, $p = .010$), concluding that participants who reported greater willingness to interact with or live alongside refugees donated more. No significant correlations were found for the cognitive or affective subscales of refugee attitudes. These findings support the interpretation of Round 1 decisions as a meaningful proxy for like-mindedness to our grouping logic.

2.4.3   Effects of Group Composition and Voting Rules

In the following, we assess the impact of group composition on deliberation and voting, as well as the effect of the voting rule on the process and outcome. We begin by analyzing the impact of the unanimity and median rules on voting behavior and outcomes. We then examine the effect of like-mindedness on voting outcomes and individual decision-making. Finally, we analyze the deliberation data to understand the effects of the treatment on the deliberation process.

The Effect of Manipulating Voting Rules

Figure 2.2 presents the distribution of group withdrawal, i.e., the amount of retained points, votes across the voting rule treatments. In our study, 111 participants voted under the median rule, and 105 participants voted under the unanimity rule. Our sample is balanced across the voting rule treatment.

Sessions using the unanimity rule yielded a mean voting outcome of 5.3, whereas the median rule led to a mean voting outcome of 5.7. However, this difference is not statistically significant (Mann-Whitney U test: $p > 0.1$, $N = 216$).

A deeper analysis of voting behavior reveals that among the 37 groups that deliberated under the median rule, 29 reached unanimous votes. Additionally, 12 groups reached a

unanimous agreement on the median of their initial individual votes.

Further, when analyzing differences across group compositions, we find that in like-minded selfish groups (LMS), withdrawal votes significantly differ between the two voting rules. Figure 2.2b shows that the mean vote in the median condition is 7.6 compared to 6.8 in the unanimity condition. This difference is statistically significant (Mann-Whitney U test: $p < 0.05$, $N = 48$). However, for other group compositions, we do not find significant differences between the voting rules.
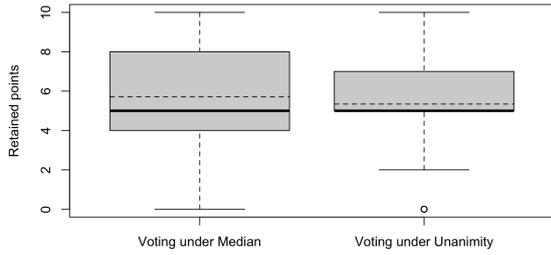
(a) Withdrawal Group Decisions by Voting Rule.
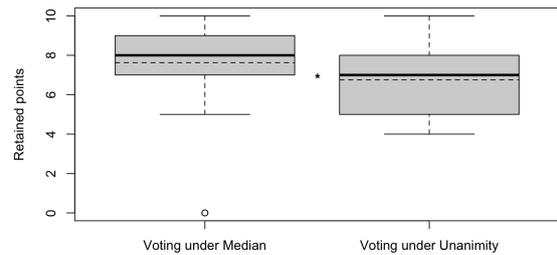
(b) Withdrawal LMS Group Decisions by Voting Rule.
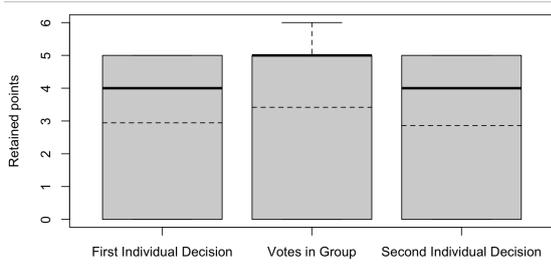
(c) Withdrawal Decisions in Like-Minded Generous Groups.
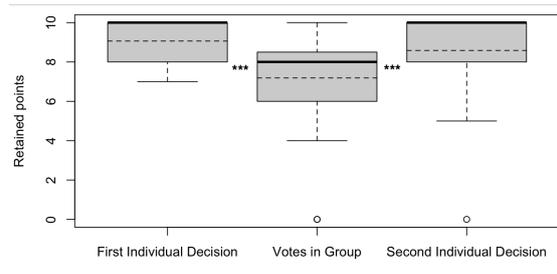
(d) Withdrawal Decisions in Like-Minded Selfish Groups.
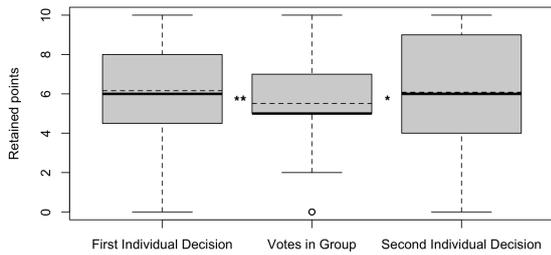
(e) Withdrawal Decisions in Mixed-Minded Groups.
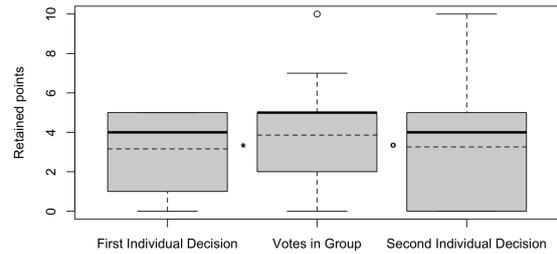
(f) Withdrawal Decisions of Generous Participants in MM Groups.
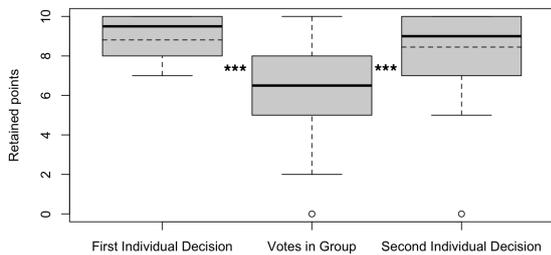
(g) Withdrawal Decisions of Selfish Participants in MM Groups.
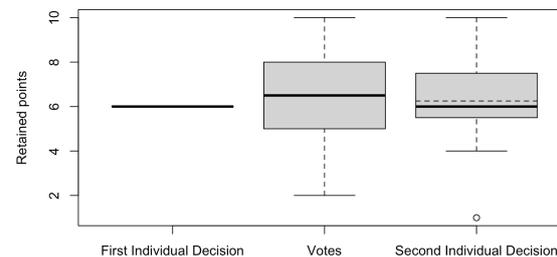
(h) Withdrawal Decisions of Fair Participants in MM Groups.

Figure 2.2: Distribution of withdrawal decisions by voting rule, group type, and participant type across rounds. Figures (a) and (b) compare median and unanimity voting rules. Figures (c) and (d) show like-minded groups. Figures (e), (f), (g), and (h) display withdrawal decisions in mixed-minded groups, distinguishing between participant types. Dotted lines indicate mean values. Statistical significance of differences is noted in each figure. A complete overview of exact p-values from all Wilcoxon signed-rank and rank-sum tests is provided in the Appendix (see Appendix B.3) in the robustness subsection for transparency and reproducibility.

The Evolution of Withdrawal Decisions Across Rounds

The density shifts of withdrawal decisions across rounds are illustrated in Figure 2.3. The x-axis represents withdrawal decisions at different stages: (a) individual decisions in Round 1 (R1), (b) group votes in Round 2 (R2), (c) individual payoffs resulting from group votes in R2, and (d) individual decisions in Round 3 (R3). The y-axis indicates group composition, distinguishing between mixed-minded, like-minded selfish, and like-minded generous groups.
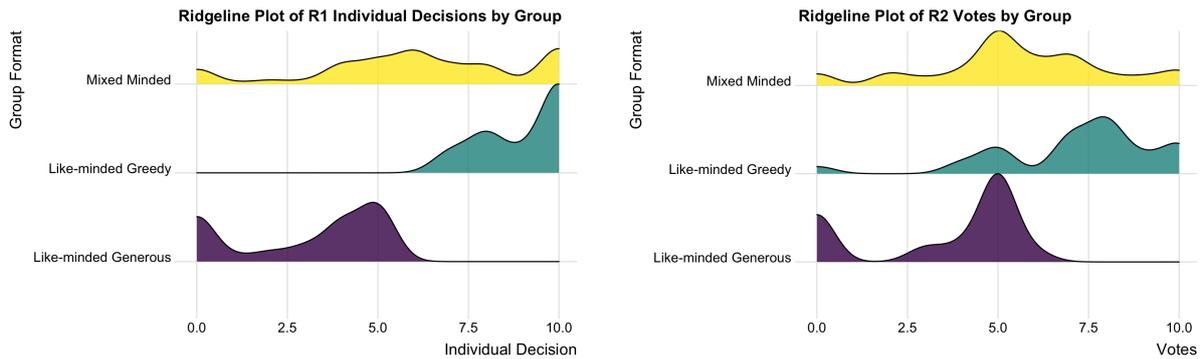
(a) Density distribution of individual decisions in Round 1.

(b) Density distribution of group votes in Round 2.
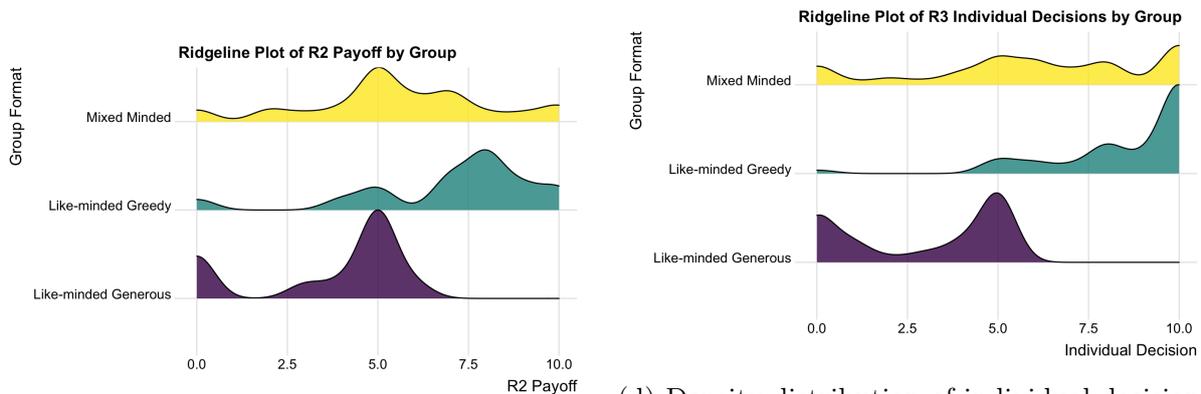
(c) Density distribution of payoffs in Round 2.

(d) Density distribution of individual decisions in Round 3.

Figure 2.3: Density distributions of individual decisions, group votes, and payoffs across rounds. (a) Individual decisions in Round 1 before deliberation. (b) Group votes in Round 2. (c) Payoff distributions in Round 2 based on group voting. (d) Individual decisions in Round 3 after deliberation. Group compositions are categorized as like-minded or mixed-minded.

Across all treatments, we observe a moderation of votes for retention in Round 2 voting behavior toward a central fairness benchmark of 5 points. However, this shift does not persist in Round 3 individual decisions, suggesting that there is no long-term effect or learning.

For like-minded generous groups (LMG), the mean withdrawal shifts from R1 (2.94) to R2 (3.42) and then returns to R3 (2.86) (see Table 3.2). There are no significant

differences across rounds (Wilcoxon signed-rank test: $p > 0.1$, $N = 36$), though the small sample size should be noted. While like-minded groups show signs of moderation in their joint decisions, these changes do not carry over into individual decision-making. This suggests that conformity within the group may shape temporary consensus, without altering underlying votes (see Figure 2.2c).

In like-minded selfish groups (LMS), the shift is more pronounced. The mean withdrawal changes from R1 (9.04) to R2 (7.19) and then to R3 (8.58). The differences between R1 and R2, as well as between R3 and R2, are highly significant (Wilcoxon signed-rank test: $p < 0.001$, $N = 48$). However, no significant differences are found between R1 and R3, suggesting that the group moderation effect is only temporary (see Figure 2.2d).

For mixed-minded groups, a similar trend is observed. The mean withdrawal shifts from R1 (6.16) to R2 (5.51) and then to R3 (6.08) (see Table 3.2). The changes from R1 to R2 are statistically significant (Wilcoxon signed-rank test: $p < 0.01$, $N = 132$), and the differences between R2 and R3 are also significant but weaker ($p < 0.05$). The data indicate a pattern of norm convergence during group deliberation in mixed-minded groups, followed by a reversion to prior individual votes. This suggests that participants temporarily align with group norms without lasting attitude change (see Figure 2.2e).

A closer analysis of participant types in mixed-minded groups reveals that generous members (MMG) moderate their voting behavior in R2, shifting from R1 (3.16) to R2 (3.86) and then to R3 (3.26) (see Figure 2.2f). The difference between R1 and R2 is significant ($p < 0.05$, $N = 50$), while R2 to R3 is only weakly significant ($p < 0.1$). In contrast, selfish members (MMS) show a strong moderation effect, shifting from R1 (8.81) to R2 (6.52) ($p < 0.001$, $N = 58$), but reverting to R3 (8.45) (see Figure 2.2g). Fair participants (MMF) remain stable in their voting across rounds (R1 = 6, R2 = 6.5, R3 = 6.25) with no significant changes ($p > 0.1$, $N = 24$) (see Figure 2.2h).

Table 2.2: Overview of Withdrawal Decisions Across Treatments and Rounds

Category	N	Withdrawal Mean	SD	Min	Max	p50 - Median
Individual Decisions						
Individual - R1	216	6.3	3.2	0	10	6
Individual - R3	216	6.1	3.4	0	10	6
Group Vote Breakdown (R2)						
Group Vote - All	216	5.5	2.7	0	10	5
Group Vote - Unanimity (U)	105	5.3	2.7	0	10	5
Group Vote - Median (M)	111	5.7	2.7	0	10	5
Group Outcome Breakdown (R2)						
Group Outcome - All	216	5.5	2.7	0	10	5
Group Outcome - Unanimity (U)	105	5.3	2.7	0	10	5
Group Outcome - Median (M)	111	5.7	2.7	0	10	5
Group Composition Breakdown (R2)						
Like-minded (LM)	84	5.6	3.0	0	10	5
Mixed-minded (MM)	132	5.5	2.5	0	10	5
Breakdown by Group Type and Voting Rule (R2)						
LMGE - Unanimity (U)	21	3.3	2.2	0	5	5
LMS - Unanimity (U)	24	6.8	1.9	4	10	7
MM - Unanimity (U)	60	5.5	2.7	0	10	6
LMGE - Median (M)	15	3.6	2.3	0	6	5
LMS - Median (M)	24	7.6	2.7	0	10	8
MM - Median (M)	72	5.5	2.4	0	10	5

Notes: This table displays individual and group-level withdrawal decisions across all treatments and rounds. R1 and R3 refer to individual decision rounds, while R2 corresponds to the group voting round. "Unanimity (U)" and "Median (M)" refer to the voting rules applied in the group decision-making process. "LMG" = Like-minded Generous, "LMS" = Like-minded Selfish, "MM" = Mixed-minded. A detailed definition of the abbreviations can be found in Section 2.4.1.

Robustness Check: Exact *p*-Values

We conducted Wilcoxon signed-rank and rank-sum tests using exact *p*-values. These findings confirm our significance analysis. Table B.3 in Appendix (see Appendix B.3) summarizes the exact *p*-values for all models discussed, including effects of the voting rule, changes across rounds, and within-group dynamics by the categorization of the participants. These robustness checks support the conclusion that group deliberation and voting lead to statistically significant but temporary preference shifts, especially in like-minded selfish and mixed-minded groups.

Effect of Participant Type and Group Composition

Tables 2.3 - Table 2.6 present the results of the regression analysis. Given the characteristics of withdrawal decisions, we employ a Tobit regression. We model with the

independent variable left-bounded at zero. We apply censoring, as our data contains no values below the threshold. The analysis explores the joint effect of participant type (categorization by first decision) and group composition on voting behavior and withdrawal outcome.

We first examine how selfish behavior interacts with like-minded and mixed-minded settings. Table 2.5 presents estimates for (a) the additional effect of a selfish participant in a like-minded group and (b) the additional effect of a selfish participant in a mixed-minded group. Both types are significantly impacting group voting, but as expected in opposite directions.

The positive interaction estimate of 2.2 (p < 0.01) for *Selfish × Like-minded* suggests that selfish participants in like-minded selfish groups are likely to participate in selfish voting behavior. Conversely, the negative interaction estimate of -2.2 (p < 0.01) for *Selfish × Mixed-minded* indicates that selfish participants in mixed-minded groups moderate their behavior. They are more proximate to fair-minded participants. This suggests that deliberation in mixed-minded groups tempers selfishness. We conclude that the selfishness level in our design depends on the group composition, but moderation is generally found.

Table 2.3: Effect of Selfish Participants on Voting and Group Outcomes

Dependent variable	Vote	Outcome
Selfish × Like-minded	2.19** (0.72)	1.86* (0.74)
Selfish × Mixed-minded	-2.19** (0.72)	-1.86* (0.74)
Like-minded	-1.53** (0.53)	-1.33* (0.54)
Mixed-minded	1.53** (0.53)	1.33* (0.54)
Selfish	1.90*** (0.45)	1.88*** (0.46)
Constant	4.61*** (0.30)	4.60*** (0.30)
Controls	No	No
Observations	216	216

Notes: Tobit regressions with left-censoring at 0. Standard errors in parentheses. Selfish participants show significantly higher support and payoff in like-minded groups (interaction $p = 0.0025/0.0119$) and significantly lower support in mixed-minded groups ($p = 0.0025/0.0119$). Main effects: Selfish ($p < 0.0001$), Like-minded ($p = 0.0036/0.0132$), Mixed-minded ($p = 0.0036/0.0132$).
† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 2.6 reports on the interaction effects of generous participants in like-minded and mixed-minded groups. The results reveal a reversed pattern compared to selfish participants.

Table 2.7 explores the effect of fair participants in mixed-minded groups. The results show no statistically significant effect. Including fair participants not significantly changing voting behavior.

Table 2.4: Effect of Generous Participants on Voting and Group Outcomes

Dependent variable	Vote	Outcome
Generous × Like-minded	-1.25 (0.69)	-0.85 (0.71)
Generous × Mixed-minded	1.25 (0.69)	0.85 (0.71)
Like-minded	0.66 (0.44)	0.50 (0.45)
Mixed-minded	-0.66 (0.44)	-0.50 (0.45)
Generous	-2.81*** (0.44)	-2.87*** (0.45)
Constant	6.50*** (0.27)	6.52*** (0.27)
Controls	No	No
Observations	216	216

Notes: Tobit regressions with left-censoring at 0. Standard errors in parentheses. Generous participants are significantly less supportive of the proposal and allocate lower payoffs overall ($p < 0.001$). The interaction term with like-minded groups is marginally significant ($p = 0.072/0.229$), suggesting reduced effectiveness of generosity in homogeneous settings. No significant interaction is observed for mixed-minded groups ($p = 0.072/0.229$).
† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Control Variables and Additional Effects

Table 2.6 introduces additional control variables, including gender, refugee attitudes, and social norms. As expected, the inclusion of the generous type remains a strong predictor of lower withdrawal votes (-2.2, $p < 0.01$). However, the effect of the selfish type is mitigated when controls are introduced.

A significant gender effect is found. Female participants withdrew significantly less than male participants (-1.1, $p < 0.05$). Refugee attitudes exhibit a weak significant effect on voting. This suggests that attitudes toward refugees may influence decision-making in group settings. However, social norms do not emerge as a significant moderator.

Robustness: Power and Effect Size

To assess the robustness of the effects identified in our censored regression models, we computed effect sizes (Cohen's f^2) and post hoc statistical power for all predictors across treatments (see Appendix B.4). While several predictors showed statistically significant effects (e.g., the negative impact of generosity on support for the proposal, and the strong positive effect of greedy behavior in mixed-minded groups), only a subset reached conventionally acceptable power levels ($> .80$). For example, the effect of generosity in both vote and outcome models was consistently large ($f^2 \approx .13–.20$) and well-powered (power $\approx .84–1.00$), indicating that these are likely not false positives. In contrast, several main effects and interactions, such as social norm endorsement or social comparison, exhibited low power despite moderate coefficients, suggesting underpowered tests and insufficient

Table 2.5: Effect of Fair Participants on Voting and Group Outcomes in Mixed-Minded Groups

Dependent variable	Vote	Outcome
Fair	0.25 (0.51)	0.26 (0.51)
Constant	5.36*** (0.28)	5.35*** (0.29)
Controls	No	No
Observations	132	132

Notes: Tobit regressions limited to mixed-minded groups. Standard errors in parentheses. The coefficient for *fair* participants is small and statistically insignificant ($p = 0.623/0.611$), suggesting no meaningful effect on voting or group outcomes relative to selfish and generous types.
† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

evidence to conclude null effects. Interaction effects involving greediness, particularly in mixed-minded groups, yielded large effect sizes ($f^2 > .30$) with power $> .95$. These results support the presence of meaningful heterogeneity in data across group compositions but also highlight compositions where the study is perceived as underpowered to detect smaller effects.

To improve the transparency and interpretability of our regression results, we report 95% confidence intervals (CIs) for relevant predictors across models (see Appendix B.5). The most robust effect is observed for generosity, which significantly reduces support for redistribution in mixed-minded groups (Estimate = –2.27, CI = [–3.36, –1.18]). Selfishness, by contrast, has context-dependent effects: it increases retention in like-minded groups (Estimate = 2.19, CI = [0.77, 3.60]) and decreases it in mixed-minded groups (Estimate = –2.19, CI = [–3.60, –0.77]). Female participants also show lower support (Estimate = –1.08, CI = [–1.93, –0.23]). Other effects, such as the generosity–mixed-minded interaction (CI = [–0.11, 2.61]), are reported as zero, indicating statistical uncertainty.

Clustering and Randomization Robustness

Given the nested data structure, we assessed the extent to which group- or session-level clustering might bias inference. While randomization occurred at the group level, both for group composition and the assigned voting rule (median vs. unanimity), our primary analyses were conducted at the individual level.

To quantify potential intra-cluster dependence, we computed intra-class correlation coefficients (ICCs) for the Round 2 group decision outcome. Group-level clustering yielded a moderate ICC of 0.285, while session-level clustering was lower at 0.107. These values suggest non-negligible dependence within groups, but limited session effects.

We replicated all models with cluster-robust standard errors to account for group-level

Table 2.6: Effect of Selfish and Generous Participants on Voting and Group Outcomes in Mixed-Minded Groups

Dependent Variable	With Controls		Without Controls	
	Vote	Outcome	Vote	Outcome
Selfish	0.52 (0.48)	0.51 (0.49)	0.88† (0.48)	0.87† (0.49)
Generous	-2.17*** (0.55)	-2.20*** (0.56)	-2.27*** (0.56)	-2.27*** (0.57)
Female	-1.08* (0.44)	-1.07* (0.44)	–	–
Bachelor	-0.47 (0.43)	-0.53 (0.44)	–	–
Refugee Attitude	-0.65† (0.37)	-0.59 (0.38)	–	–
Social Norm	0.70 (0.77)	0.72 (0.78)	–	–
Social Comparison	0.70 (0.52)	0.63 (0.53)	–	–
Constant	4.51 (2.85)	4.52 (2.90)	5.62*** (0.37)	5.62*** (0.38)
Controls	Yes	Yes	No	No
Observations	132	132	132	132

Notes: Tobit regressions in mixed-minded groups. Standard errors in parentheses. Reference group: fair participants. Selfish participants show marginally higher support for proposals when controls are excluded ($p = 0.066/0.076$), while generous participants consistently show significantly lower support and group allocations ($p < 0.001$). Controls include gender, education, refugee attitudes, social norms, and social comparison.
† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

clustering (see Appendix B.6). The coefficient estimates and significance levels remained substantively unchanged, resulting in our main findings not being artifacts of clustering. We conclude that the group-level randomization was implemented effectively and that clustering does not invalidate the reported effects.

Deliberation Analysis

Next, we report on the analysis of deliberation data across treatments. Figure 2.4 presents the deliberation duration, message frequency, and sentiment analysis.

Panel (a) shows the deliberation duration by voting rule. Groups under the median rule deliberated for an average of 4.8 minutes, while groups under the unanimity rule deliberated for an average of 5.2 minutes. Hence, we find no significant difference.

Panel (b) presents the deliberation time across group compositions. A pairwise comparison using Dunn's test finds a weak, significant difference, where like-minded generous groups (LMG) deliberate for a shorter duration (mean: 3.9 minutes) compared to like-minded selfish (LMS) and mixed-minded (MM) groups (mean: 5.2 minutes). However, the median deliberation time differs between LMS (3.9 minutes) and MM (4.52 minutes).
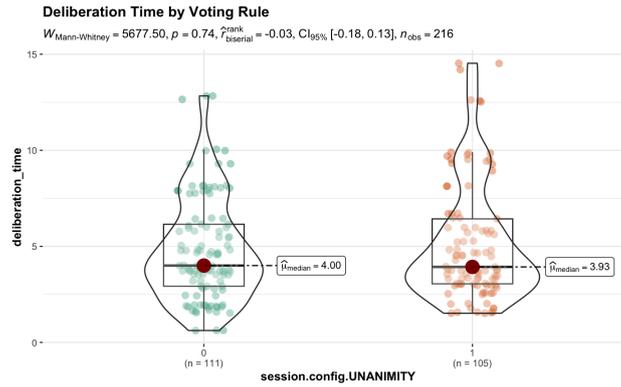
(a) Deliberation Time by Voting Rule.
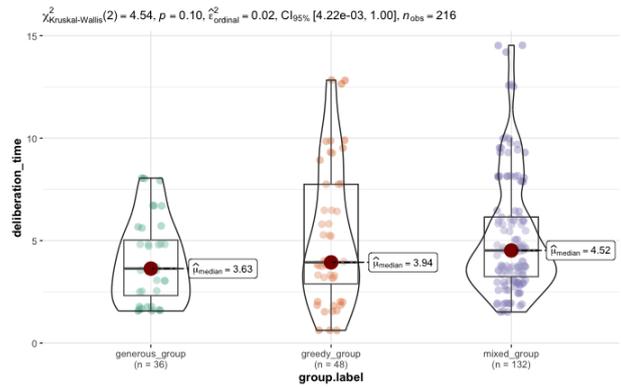
(b) Deliberation Time by Group Composition.
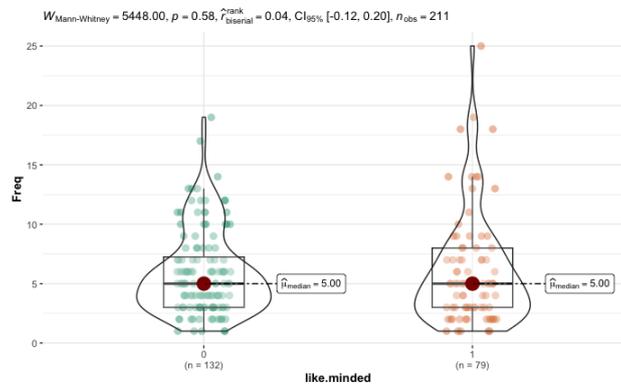
(c) Message Frequencies by Group Treatment.
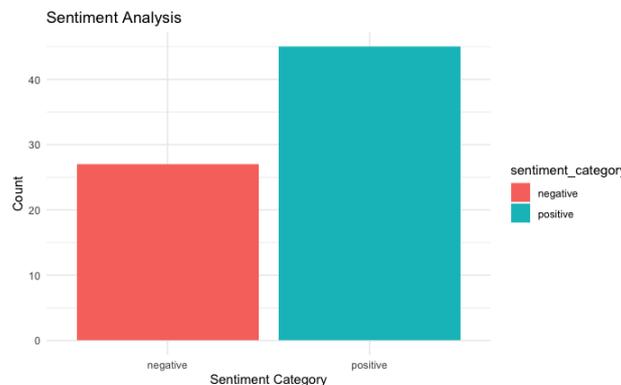
(d) Message Sentiment in Deliberation.

Figure 2.4: Deliberation time, message frequency, and sentiment in deliberation. (a) Deliberation time by voting rule. The x-axis denotes the dummy variable for the unanimity rule (1 = unanimity rule). (b) Deliberation time by group composition. There is a weakly significant difference between group types. (c) Message frequencies by group treatment. No significant difference is observed. (d) Overall message sentiment in deliberation.

Panel (c) presents the message frequencies by group treatment. The number of messages exchanged does not significantly differ across treatments, suggesting that group format did not influence communication intensity.

Panel (d) shows a sentiment analysis using the Bing lexicon. Deliberation chat messages contained more positive sentiment (41 instances) than negative sentiment (27 instances). This suggests that overall, the group discussions were more positively framed.

We also conducted a qualitative content analysis following Luhan et al. (2009). Table 2.7 summarizes the most frequent arguments used in group discussions. Arguments classified as "keep more for ourselves" and "keep less for ourselves" were common, but fairness arguments appeared most frequently.

Table 2.7: Analysis of Group Chats

Argument	Number of Arguments	Number of Groups
Keep more for ourselves	28	19
Keep less for ourselves	29	21
Be fair and...	35	21
...retain more	–	8
...retain less	–	1
...retain fair	–	12

Notes: Categorization adapted from Luhan et al. (2009) with additional coding.

2.5 Discussion

We discuss how like-mindedness (and mixed-mindedness) affect deliberation and voting decisions and outcomes. Voting behavior and outcomes in the group round are more moderated compared to individual decision-making. A qualitative content analysis provides insights into this pattern. Some participants avoided revealing their initial votes in deliberation. In many instances, first-proposers dominate the discourse. It seems that their proposal is perceived as uncontroversial, especially if it is a fair split distribution of the allocation, regardless of their initial decisions. Where deliberation occurred, arguments remained cautious and modest, as confirmed by sentiment analysis. Selfish members pledged for higher retention but still often proposed lower allocations than they would individually. Generous and fair members disclosed more information about their voting behavior. Less likely, selfish participants revealed their voting behavior truthfully, while generous participants emphasized fairness and mutual benefits in general.

These patterns emerge in both like-minded and mixed-minded groups. In like-minded selfish and like-minded generous groups, voting decisions are moderated. A possible limitation is that participants were unaware of the group composition logic. While delibera-

tion should enable preference discovery, in like-minded selfish groups, significant moderation of stated votes suggests norm-driven behavior (Kimbrough and Vostroknutov, 2016). Kimbrough and Vostroknutov (2016) argue that the disclosure of pro-social attitudes is driven by social norms in the lab. This aligns with Smith's (2010) concept of the impartial spectator. In this very introductory literature, it is said that groups enforce fairness norms. This remains true in anonymous settings. Hence, deliberation fosters group coherence by positioning participants as both decision-makers and observers of others' arguments. This dual role of the participants of such settings could explain short deliberation times, low engagement rates, and an overall positive sentiment. Consequently, voting decisions may reflect a preference for social appropriateness rather than mutual exchange and learning.

This aligns with findings by Cason and Mui (1997), who show that generous members are drivers in mixed-minded group decisions. In our study, mixed-minded groups without generous participants exhibited a strong influence of selfish members on voting behavior. However, adding a single generous participant nullified this effect. Social comparison theory offers a potential explanation: individuals adapt their voting to align with assumed norms rather than persuade the other group member to vote more selfishly. This is in line with findings of Santoro and Brookman (2022) who elaborated that besides huge effects of moderation in deliberation, long-term effects remain unclear.

Deliberation and group decision-making do not significantly impact second-round individual decisions. The absence of a shift between first (R1) and second (R3) individual decisions suggests a rejection of persuasive argument theory in this context. If we had detected persuasion, the data would show much more alignment between voting in R2 and R3. Instead, we find no significant differences between individual rounds (R1 and R3). One possible explanation for limited long-term persuasion effects is provided by the nature of ad-hoc group formations (even anonymous). Grönlund et al. (2015) emphasize that ad-hoc group formation can reduce engagement due to individual uncertainty. Reputation concerns affect exchange and the extent to which individuals go into heavier debates (Schkade et al., 2010). However, amplification effects may be mitigated by additional information or moderators.

Another surprising finding is the high number of unanimous votes in median-rule groups. Bartling et al. (2015) suggest that this could be explained by responsibility and pivotality aversion. The participants seem not to engage in finding the median voter or engage in argumentations based on their votes. Hence, more acceptable results seem to be the main driver of discourse.

A final consideration is the potential impact of the take-frame in the study design. The take-frame could accelerate the norm-driven voting, we found in our data. However, Dreber et al. (2013) find no evidence that framing destabilizes preferences. Future research could focus on different contexts when applying the take-frame to measure truth-telling or the revealing of preferences.

2.5.1 Contribution Overview

We empirically contribute to the current debate on like-mindedness and polarization. First, we challenge the widely held belief that like-minded group deliberation leads to more extreme outcomes. Contrary to this belief, we find that deliberation, whether among like-minded or mixed-minded members of a group, led to moderation of outcomes in a politically driven context. However, we align with some scholars that these findings are not long-term stable. We report that no learning took place, but rather a discourse on the disclosure of social norms.

Second, our design allowed us to test two different voting rules, namely median and unanimity, which have theoretically different properties for deliberation and voting. While in the mean the outcomes are insignificantly different, we find only in like-minded selfish groups a difference between voting rules. This suggests that voting rules have only a nuanced impact on deliberation and voting.

Third, we contribute to a well-researched literature on group behavior that focuses on norm-driven acceptance rather than individuality and learning starting from own preferences. Even though not necessary in the median treatment, groups mostly voted unanimously. This highlights that convergence is higher valued than utility maximization in broader terms. Finally, our design confirms Cason and Mui's (1997) findings even in like-minded settings. Groups moderate, however, it is not long-lasting on an individual level. Participants return in the third round to their initial voting behavior. We conclude that no real persuasion from group decision-making was found.

2.5.2 Future Implications for Research

The moderation, while no learning, demands a further understanding of the underlying mechanisms of the group round. Are participants genuinely persuaded by arguments, influenced by social cues, or merely avoiding conflict? Further research could use mixed methods and politically different contexts to answer these questions. Predominantly, the fact that no learning occurs raises an important question for the deliberation literature. If moderation is a desirable property to depolarize participants, this effect should persist for a relevant time. Hence, designing a deliberative process that fosters this remains a challenge. A potential avenue for research could be the effect of repetition. Sequential or repeated deliberation rounds in the process of voting, debubbeling by presenting counter-narratives (potentially with the help of Large Language Models (LLM), or providing participants with moderation and constant information could be promising design elements to shift the focus off norms.

Participants' tendency to unanimously vote, despite the implemented rule, requires further consideration. Morals and pivotality aversion are important biases we found in our design, yet not fully understand. When designing participatory involvement projects,

it should be clear that some contexts and formats might accelerate these dynamics. This is especially relevant for participatory processes where anonymity and responsibility diffusion may drive voting behavior more than the implemented allocation rules. We need to understand what participants need to state possible concerns and help them overcome these.

Finally, Chapter Three will extend this analysis by exploring the impact of group size. Addressing the diffusion of responsibility, we would like to contrast our findings on the allocation rules by increasing the number of group members to five. We would like to understand whether the discussed dynamics of moderation prevail.

2.6   Conclusion

This study investigates the effect of like-minded group composition on polarization in deliberative decision-making. Furthermore, we study the effects of voting rules, unanimity, and the median on deliberation and outcomes. Using a computer-based experiment in the lab, we test whether like-minded group deliberation and voting foster outcomes to become more extreme. In a three-round dictator game, we compare like-minded and mixed-minded groups, as well as individual and group decisions. The take-frame and a refugee project as the recipient were introduced to increase preference variance and relevance for practice.

We find no evidence in our modified group dictator game task that like-minded group deliberation shifts withdrawal decisions toward extremes. Instead, both like-minded selfish (retaining more than 6 points) and like-minded generous (retaining fewer than 6 points) groups moderate their votes toward fairness (5 points). Individual and group decisions differ across treatments. Selfish and generous members in mixed-minded groups moderate their withdrawal votes. Notably, generous participants strongly drive voting outcomes in mixed-minded groups. However, we find no significant shift between the first and second individual decision rounds across treatments.

Voting rules do not significantly impact voting behavior or outcomes across group compositions in the mean. However, we find an effect of rules in like-minded selfish groups. Based on our findings, we reject the hypothesis that like-minded group deliberation moves voting to extremes under different rules. Instead, group voting moderation suggests arguments for norm-driven behavior. Potentially, driven by pivotality and responsibility biases. Future research could particularly focus on norms in ad-hoc group building in deliberation to overcome some of the detected biases.

Chapter 3

Group Size in Deliberation and Voting

We further investigate the effect of group size. Based on Chapter 2, we use our modified group dictator game to explore the effect of like-mindedness and mixed-mindedness in deliberation and voting. Hence, we increase the number of participants to five members per group. We deploy our computer-based experiment in the lab to contrast the findings of five-group deliberation and voting with the findings from the three-group experiment. Furthermore, we also manipulate voting rules. Ultimately, we have the same conditions to achieve comparability of our results. While voting rules have no significant effect on outcomes, the unanimity rule significantly increased message volume in mixed-minded groups. Comparing voting outcomes of mixed-minded groups with three or five participants, we find that selfish participants are more likely to drive group outcomes towards their preferences. Sentiment analysis reveals that larger groups used more positively coded language than three-member groups in the chat. We conclude that rising complexity, because of the rising number of members, drives participants into more conforming behavior. This raises the question if scalability is potentially a pathway out of norm-driven deliberation. Moreover, it calls for an even more profound understanding of dynamics in small groups.

3.1   Introduction

In democratic societies, small groups are prevalent in making consequential decisions. In practice, not only aggregating individual preferences through voting are a part of participation. But civic participation in general is seen as a pathway out of some of the distortions we are currently facing in democratic societies. They range from civic deliberation panels to digital juries and teams (Stein et al., 2023). Time constraints, rules, and polarizing attitudes on policies are a current challenge in designing those procedures. Understanding how the conditions under which small groups arrive at outcomes affect deliberation thus becomes a central concern in both democratic theory and behavioral research.

This study focuses on group size. First, we are interested in how an increased group size of five affects decision-making in our modified group dictator game. Second, we take the comparability of our results as a reason to contrast some of the results with findings from Chapter 2. As we hypothesize that rules become more important in larger group settings, prior research elaborates on that. Voting rules shape strategic incentives (Sorkin et al., 1998; Guarnaschelli et al., 2000). Heterogeneity of attitudes, status, communication hierarchies, and norms can significantly influence whether institutional rules foster cooperation or conflict (Ohtsubo and Masuchi, 2004; Becker et al., 2017).

Recent findings in the literature on deliberation and mixed-methods (List, 2018) are not only interested in the consequences of giving citizens the means to participate in policy decision-making. The process gains more attention as distortions might arise and harm the benefits of involvement (Sunstein, 2002). In mixed-minded groups, where participants share a diverse set of attitudes, deliberation and the exchange of arguments can promote more informed judgment, or exactly the opposite. Polarization as a result of deliberation is prevalent and a negative consequence of involvement (Lorenz et al., 2011; Fujisaki et al., 2018).

Another string of research is the "wisdom of crowds" literature. It suggests potential benefits from aggregation with a growing number of participants. However, how this logic applies to deliberative aggregation mechanisms in a controlled setting is understudied.

This study builds on the experimental design discussed in Chapter 2, which analyzed how like and mixed-mindedness within three-member groups affect dictator decisions with deliberation. Analyzing three-member group dictator decisions, we concluded that norms and perception impact the deliberative process. The present chapter expands the research agenda of the previous chapter by including one additional dimension: group size. First, we analyze the impact of deliberative voting and rules on the outcome in five-member groups. Second, compare the relevant data of three- and five-member groups. The goal is to explore the potential rule sensitivity in larger groups and to find robustness for our results.

We focus on the same small-group setting in which participants decide individually and in groups on allocations in a three-round dictator game. By keeping the main design stable (like-mindedness vs. mixed-mindedness and median vs. unanimity rule), we isolate the impact of group size on voting outcome, sentiment of deliberation, and engagement volume. Furthermore, we analyze the impact of the deliberative process on individual learning on preferences by reassessing individual dictator decisions in the third round.

We confirm that group composition (mindedness and size) has the strongest impact on withdrawal decisions in our modified dictator game. Like-minded generous members, which is the only like-minded composition we were able to detect in our sample, vote significantly lower for retention as three-member groups. There was no significant effect of voting rules manipulation on voting outcomes. However, the voting rule has an impact on deliberation data. We found that in a larger-sized mixed-minded group, the unanimity rule significantly increased the number of messages. Moreover, deliberation times did not vary across treatments. Sentiments were found to be more positive than in smaller groups, which corresponds to the explanation of norm-adapted behavior in ad-hoc small group deliberation.

This chapter is structured as follows. Section 3.2 reviews the ideas of wisdom of the crowd to understand the impact of scalability in the aggregation of preferences. Section 3.3 presents the experimental design and procedures. Section 3.4 reports the results of our analysis, including treatment effects on voting outcomes and the analysis of deliberation data. Section 3.5 discusses the implications and limitations of our findings for practice and further research. Section 3.6 concludes.

3.2 Background Literature

This study contributes to a more robust agenda of understanding the impact of group composition and voting rules on deliberation, voting, and individual preferences. We start with the literature on the wisdom of the crowds to point out the question of group size in aggregation and bridge it to the deliberative discourse research. While the literature focuses on the benefits of scaling judgments for aggregation, we are interested in how to incorporate this into a mixed model of deliberative decision-making. Hence, we begin on (1) the influence of group size and social dynamics on collective accuracy, and (2) the sensitivity of outcomes to different voting rules.

3.2.1 Wisdom of the Crowds in Allocation

By referring to the wisdom of the crowds, the literature suggests that the aggregate of judgements of independent individuals outperforms even the most informed and skilled individual judgement. This domain reaches a broad interdisciplinary literature from policy

deliberation to forecasting in politics (Hertwig, 2012; Davis-Stober et al., 2014). However, recent findings point out the definition of the institutional framework that is built upon group size, preference diversity, social biases, and rules that impact the accuracy of large group decisions and its accuracy. Contrary to the belief that larger groups are always "better", decision accuracy in less salient contexts is often maximized by moderate-sized groups. For example, Kao and Couzin (2014) shows that smaller group sizes lead to balance in attitude diversity and its coordination in complex decision-making environments. Relatedly, Lee and Shi (2010) argues that if the issue is salient, it is simply the averaging of individual estimates that outperforms even deliberation in a simple estimation task.

However, deliberation offers a misinformed preference building to be corrected. In this circumstance, deliberation outperforms larger crowds when judgments are aggregated after deliberation, where learning occurred. Navajas et al. (2018) finds evidence for this. In this project, consensus decisions that result from small-group deliberation yielded higher levels of accuracy than unstructured averaging of larger crowds. Hence, we underscore the importance of the quality of deliberation in this context. We find further support by Becker et al. (2017) and Jayles et al. (2017), who highlight that appropriately moderated social exchange enhances group accuracy. In particular, Becker et al. (2017) shows that network dynamics play a crucial role in this discussion. The structure of the communication network shapes how information spreads. Ultimately, these social signals affect the collective accuracy of group judgements. However, the findings are very mixed and demand informed design considerations of deliberative involvement. Decision-making with a deliberative phase can lead to biased behavior caused by herding effects and the reduction of diversity of arguments and corresponding attitudes, diminishing the improvement of accuracy (Lorenz et al., 2011; Frey and Van de Rijt, 2021). Inference and learning from exchange among group members has been shown to counteract the effect of accuracy (Fujisaki et al., 2018). In contrast, over-reliance on confidence or other personal traits creates significant distortions in group decisions (Koriat, 2012; Muchnik et al., 2013).

Hence, the group size and its optimality properties for accuracy appear to be task-dependent. Galesic et al. (2015) shows that moderate-sized groups can outperform both individuals and large crowds across various decision contexts. This is especially true when tasks are cognitively demanding and involve a broad information source line. Similarly, Mannes et al. (2014) argues that giving participants the possibility to select groups with more informed members outperforms randomized crowds in performance tasks. Finally, we acknowledge that the wisdom of crowds remains a robust finding in the literature. However, it depends crucially on the context and group size, decision space, and procedural design considerations. Structured sufficiently small groups with an independently distributed set of preferences and learning capacity showed outperformance over crowd wisdom. However, an adequate set of rules and potential moderating factors is important to unlock collective intelligence.

3.2.2 Voting Rule Sensitivity in Larger Groups

A body of empirical work links voting rule sensitivity to a variation of group decision outcomes. Studies reveal how the salience of the context and the group composition impact the accuracy or shifts in outcomes of collective procedures.

Work by Guarnaschelli et al. (2000) showed how voting rule treatments, specifically, majority versus unanimity, and group size, affect error rates and strategic considerations in decision-making tasks of participants. Their studies on pre-voting deliberation with groups of three and six jurors deciding on conviction or acquittal of an accused showed that unanimity rules lead to higher error rates. This remains particularly true in larger groups. These findings show that larger groups impose higher strategic complexity in coordination of unanimous voting and thus increase costs.

Sorkin et al. (1998) similarly varied group size and voting rules in a signal detection task. They observed that more demanding rules (e.g., unanimity) could improve accuracy in some settings but imposed heavier cognitive and coordination burdens. The relationship between rule stringency and decision quality was found to be non-linear. This finding supports the trade-off between rule efficiency and deliberative rigor. Moreover, Stasson et al. (1991) compared problem-solving performance under majority, unanimity, and no-consensus conditions. Their findings indicate that unanimity rules often produce stagnation, while majority rules promote decisiveness. This was found even occasionally at the expense of accuracy. Group composition is a further challenge in the design of these processes. Ohtsubo and Masuchi (2004) examined the effects of status differentials and group size. The result indicates that in larger groups, dominant individuals disproportionately dominate the process of exchange. Interestingly, no rules were installed, yet accuracy decreased. Ambrus et al. (2015) provided no specific ruling to deliberate. They allowed five-person groups to decide based on internal reflection in an informal exchange setting. They found that mean and median aggregation mechanisms were both sensitive to the position and variance of non-central members (which is expected for the mean rule, but surprising for the median). Hence, they provide evidence for the impact of within-group attitude distribution on collective outcomes.

Jury experiments provide insights into the importance of rule sensitivity. Davis et al. (1997) compared juries of six and twelve individuals using majority and median-based aggregation rules. Larger juries tended to deviate more from individual preferences but often yielded more moderate verdicts. This illustrates the interaction between group size and aggregation. Focusing specifically on unanimity rules, Fabrizi et al. (2022) showed that requiring unanimous decisions in ambiguous contexts reduces Type I errors. Yet it may suppress the expression of informative dissent.

More recent work further elaborates on this understanding of rules in decision contexts. Baillon et al. (2016) used three-member groups to test majority and unanimity

rules under biases such as the Allais paradox. Their findings highlight how rules interact with communication to shape judgment aggregation outcomes. Lastly, Tsuruta and Inukai (2018) compared outcomes under unanimity rules and multilateral bargaining in small groups. Their results underscore the importance of individual patience and median positioning in determining outcomes. This reveals that even formally egalitarian rules are prone to strategic manipulation.

3.3   Experimental Design and Procedure

We want to shed light on how group composition and voting rules affect collective decision-making through voting in a modified group dictator game. Extending the project in Chapter 2, we look at five member groups to isolate the effect of increasing the number of participants on deliberation and voting outcomes. We use our modified group dictator game that uses three rounds to first detect individual preferences, second, to form groups based on individual preferences, and randomize into like-minded and mixed-minded groups. Third, we reassess individual preferences and survey control data. The design allows us to perform a comparable analysis of group size on deliberation and voting.

3.3.1   General Design

We modified a group dictator game based on the established designs to measure polarization (Cason and Mui, 1997; Luhan et al., 2009). To investigate the effect of group size and how five-member groups form decisions while deliberating, we manipulate group composition and voting rules, namely the median and unanimity rules. Furthermore, we varied the recipient to a local refugee organization to provide a salient real-life application for deliberation and allocation. No deception took place as a requirement of the university's lab.

The participants were endowed with 10 points (0.50 € per point) per round. They made sequential decisions on how much to retain in each of the three rounds. In the first round, participants decide individually about their allocation of the 10 points between them and the refugee organization. Based on this private information, we labeled the participants into preference types (*selfish*, *generous*, *fair*) and randomly assigned them to five-member groups. Depending on the session variability of preferences, we randomly grouped them into either like-minded or mixed-minded groups. In the second round, group members engaged in deliberation via a digital chat anonymously. We manipulate the voting rule on the session level into the median or unanimity rule. Based on the rule, participants need to align their preferences under the unanimity rule, but not necessarily under the median condition. Here, participants could potentially stay if not convinced by their initial preference, because the median is counted as the winner of the voting

procedure. In the third round, participants once again provide information on their individual preferences on allocating 10 points between them and the refugee organization.

After the last decision, participants are asked to provide survey information on a five-point Likert scale (see Appendix C.1). Control variables included demographic characteristics (gender, occupation, and education) and validated scales assessing refugee attitudes, social comparison, and social norms (Schneider and Schupp, 2011; Kotzur et al., 2022; Bizer et al., 2014).

3.3.2 Deliberation and Voting

In the group decision stage (Round 2), participants deliberated for up to 15 minutes before casting their votes. Two voting rules were implemented:

- **Median rule**: Each member submitted a preferred withdrawal amount (0-10 points). The median decision is the middle point of the five participants, which is counted as the winner of the election.

- **Unanimity rule**: The members need to unanimously decide on the withdrawal amount. The unanimous decision is the one all five members agree on.

A detailed list of instructions is provided in the Appendix (see Appendix A). All instructions were reapplied for the five-member group sessions, but we adapted the information on group size accordingly.

3.3.3 Procedure

The study is a lab experiment, following approval by the institutional ethics board (IBR). All participants gave informed consent before the experiment started. Recruitment was facilitated via *ORSEE* (Greiner, 2004).

A total of 65 participants were assigned across 4 sessions, with each session consisting of multiple five-member groups. Due to the low participation rates, we do not have balanced numbers of participants for all conditions. However, we could sufficiently randomize the voting rules on the session level. Sessions lasted approximately 30-40 minutes. Payment was completed by the lab's internal digital service. Donations were transferred to *Lernfreundehaus*, a local organization supporting refugees.

3.4 Findings

This section provides an overview of the collected data and findings from the analysis.

3.4.1   Data and Summary Statistics

We were able to collect data from four sessions with a moderate number of 65 participants. Our participants were randomly assigned, and the architecture of the lab ensured anonymous participation. The aggregation rule was manipulated at the session level.

Fairness Benchmark and Relabeling   Ex ante, we defined the retention decision as fair around the global benchmark of five points on a 10-points scale. After analyzing the initial 65 individual decisions on allocation, we reassessed the fairness benchmark using the median of these decisions, which corresponded to seven points. We then relabeled the participants as *selfish* (keeping more than 7 points for themselves), *generous* (keeping less than seven points for themselves), *fair* (keeping exactly seven points for themselves). This adaption ensures that our analysis captures fairness perceptions that are endogenous to the sample.

Demographics and Sample Characteristics   Table 3.1 presents descriptive statistics for the sample. A total of 65 participants were assigned to either like-minded or mixed groups of five. The average age across the entire sample was 24 years. In terms of gender composition, 20 participants identified as female and 45 as male. The like-minded groups (n=20) had a slightly older average age of 27 years and included 8 women and 12 men. In contrast, the mixed groups (n=45) had a younger average age of 22 years, with 12 women and 33 men. The observed gender imbalance, with a predominance of male participants, is consistent with the demographic profile of the university participant pool.

Group Composition   Participants were assigned to one of two group compositions based on their preferences:

- *Like-minded groups* (31 percent of participants) were assigned to members with similar generous preferences on withdrawal decisions.

- *Mixed-minded groups* (69 percent of participants) were randomly assigned to mixed-preference groups on withdrawal decisions.

Treatment Conditions and Voting Rules   Due to the 2x2 between-subjects design, participants were assigned to one of four treatment conditions based on group composition (like-minded vs. mixed-minded) and the voting rule used for collective decision-making (unanimity vs. median).

Table 3.1: Summary Statistics

Variable	Mean	SD
Demographics		
Age (years)	24.00	4.32
Female (dummy)	0.34	0.47
Bachelor or Higher (dummy)	0.35	0.48
Group Composition		
Like-minded (dummy)	0.31	0.47
Mixed-minded (dummy)	0.69	0.47
Treatment Conditions		
LMGU	0.15	0.36
LMGM	0.15	0.36
MMU	0.23	0.42
MMM	0.46	0.50

Notes: $N = 65$ for all variables. - Dummy variables equal 1 if the condition is met and 0 otherwise. - *Treatment groups:* - LMGU: Like-minded generous, unanimity rule ($n = 10$) - LMGM: Like-minded generous, median rule ($n = 10$) - MMU: Mixed-minded, unanimity rule ($n = 15$) - MMM: Mixed-minded, median rule ($n = 30$)

The treatment groups are defined as follows: *Like-minded groups:*

- LMGU – Like-minded generous, unanimity rule

- LMGM – Like-minded generous, median rule

Mixed-minded groups:

- MMU – Mixed-minded, unanimity rule

- MMM – Mixed-minded, median rule

Sample Composition 31 percent of participants engaged in like-minded group deliberation and voting, while 69 percent participated in mixed-minded groups. Group composition was determined based on participants' initial individual decisions in the first round. Voting rules were randomly assigned at the session level to ensure balance across treatment conditions. However, due to recruitment issues, we do not find a balanced sample on the voting rules.

3.4.2 Treatment Effects

This section analyzes how the treatments impact group decision-making and deliberation. We begin with the analysis of the effect of the voting rule on the five-member group

decision-making. Then, we follow up on the question of how group composition (like-minded vs. mixed-minded) impacts group outcomes and individual post-deliberation decisions. Finally, we analyze the deliberation transcripts to assess how the treatments affected the nature and quality of the deliberation process.

The Effect of Voting Rules

Figure 3.2 shows the distribution of group-level withdrawal decisions, i.e., the number of retained points, across the two voting rule treatments among five-member groups. Our sample included 40 participants under the median rule and 25 participants under the unanimity rule, indicating a slight imbalance in sample size across treatments.

The average group outcome under the median rule was 5.7 points, compared to 5.4 points under the unanimity rule. However, this difference in means is not statistically significant (Mann-Whitney U test: $p > 0.1$, $N = 65$). The distributions across rules were also similar in terms of standard deviation and median, with both conditions centering around a median value of 7.

When disaggregating by group composition, we observe a pronounced divergence in withdrawal behavior. Specifically, like-minded (LM) groups, involving only generous participants, reached expectably lower group withdrawal decisions (mean = 1.8), consistent with a norm of self-restraint. In contrast, mixed-minded (MM) groups, involving selfish, fair (median preference), and generous participants, showed significantly higher withdrawal levels (mean = 7.3). These differences indicate that group composition strongly influences group outcomes around the median. Importantly, the observed behavioral divergence appears to stem less from the voting rule itself and more from the heterogeneity in participants' allocation preferences. This suggests that group composition dominates voting rules in our decision-making task.

(a) Mixed-Minded Voting by Group Size.

(b) Like-Minded Generous Voting by Group Size.
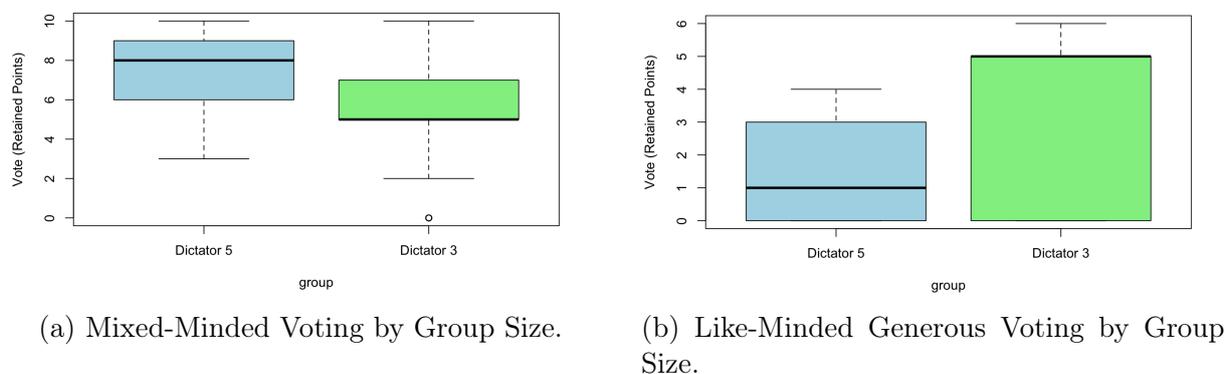
Figure 3.1: Voting by Group Size
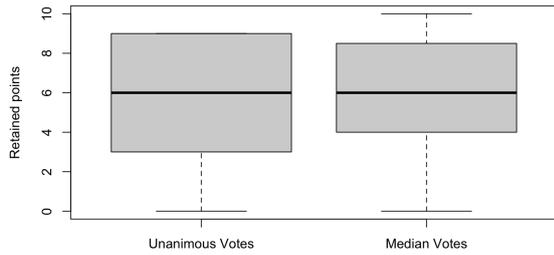
(a) Withdrawal Group Decisions by Voting Rule.
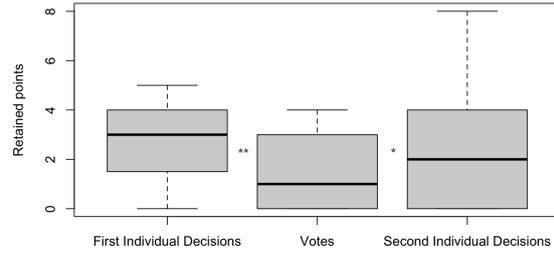
(b) Withdrawal Decisions in Like-Minded Generous Groups.
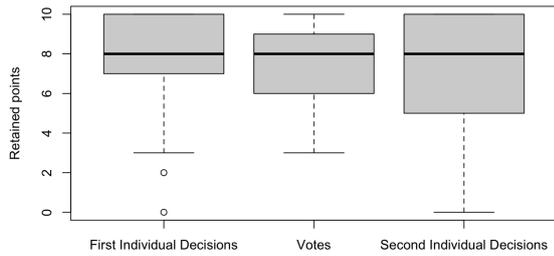
(c) Withdrawal Decisions of Generous Participants in MM Groups.
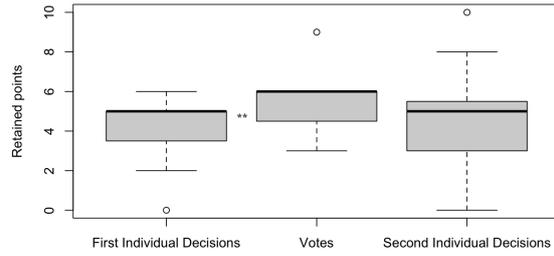
(d) Withdrawal Decisions of Generous Participants in MM Groups.
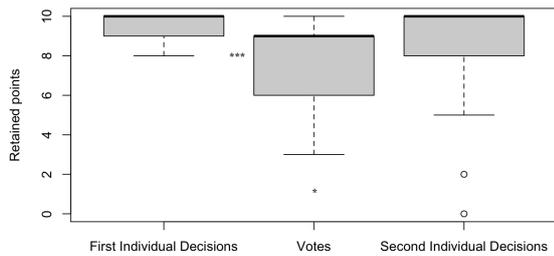
(e) Withdrawal Decisions of Selfish Participants in MM Groups.
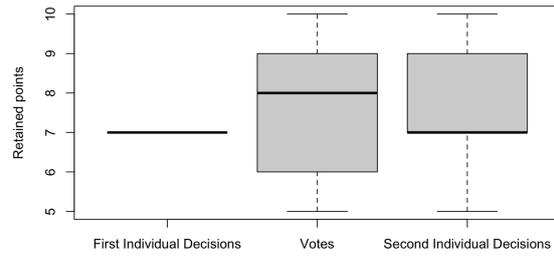
(f) Withdrawal Decisions of Fair Participants in MM Groups.

Figure 3.2: Distribution of withdrawal decisions by voting rule, group type, and participant type across rounds. Figure (a) compares median and unanimity voting rules. Figure (b) shows a like-minded group. Figures (c), (d), (e), and (f) display withdrawal decisions in mixed-minded groups, distinguishing between participant types. Dotted lines indicate mean values. Statistical significance of differences is noted in each figure.

The Evolution of Withdrawal Decisions Across Rounds

Table 3.2 and Figure 3.2 provide an overview of how withdrawal decisions evolved across individual and group decision-making phases. The comparison is based on the modified three-round group dictator game: initial individual decisions (R1), group decisions (R2), and follow-up individual decisions (R3). While aggregate patterns suggest relative stability, mean withdrawal values of 6.1, 5.6, and 5.8 for R1, R2, and R3. The breakdown by group composition and participant type reveals heterogeneity.

Panel (a) of Figure 3.2 shows that, at the aggregate level, the voting outcomes did not differ significantly between the median and unanimity voting rules. This aligns with

the summary statistics in Table 3.2, where the mean withdrawal under the median rule is 5.7 and 5.4 under unanimity. These results suggest that the voting rule show no effect on voting outcomes. This pattern is similar to voting in three-member groups.

More pronounced patterns emerge when accounting for group composition. As shown in panel (b), like-minded generous (LM) groups show a high level of retention in voting behavior. Average group-level withdrawals of 1.8 points were substantially lower than in like-minded generous three-member groups. The boxplot highlights a significantly lower median in R2, which remains low in R3, indicating that generous norms not only shaped collective decisions but also persisted individually even after deliberation. The differences between R1 and R2, and between R1 and R3, are statistically significant, underscoring the robustness of this decisive shift.

In contrast, mixed-minded (MM) groups involving participants who are typed as selfish, fair, and generous showed higher withdrawal behavior in their voting. Panel (c) captures the aggregate pattern, while panels (d), (e), and (f) distinguish between generous, selfish, and fair MM participants, respectively. Notably, in panel (d), generous participants initially favored lower withdrawals, but this tendency weakened post-deliberation. Conversely, as seen in panel (e), selfish participants not only supported higher withdrawal levels in R1 but maintained or increased them in R2 and R3, with significance stars indicating persistent deviations. These results indicate that selfish preferences were driven through deliberation and persisted afterward. Panel (f) reveals that fair participants demonstrated relative stability, yet also trended toward the group median post-vote.

Taken together, the data suggest that group composition, particularly the presence of selfish participants, played a decisive role in shaping both collective and post-deliberation individual decisions. While the formal decision rule (median vs. unanimity) had limited impact, mixed-mindedness led to asymmetries.

Table 3.2: Overview of Withdrawal Decisions Across Treatments and Rounds

Category	N	Withdrawal Mean	SD	Min	Max	p50 - Median
Individual Decisions						
Individual - R1	65	6.1	3.2	0	10	7
Individual - R3	65	5.8	3.7	0	10	6
Group Vote Breakdown (R2)						
Group Vote - All	65	5.6	3.3	0	10	6
Group Vote - Unanimity (U)	25	5.4	3.6	0	9	6
Group Vote - Median (M)	40	5.7	3.2	0	10	6
Group Outcome Breakdown (R2)						
Group Outcome - All	65	5.6	3.2	0	10	6
Group Outcome - Unanimity (U)	25	5.4	3.6	0	9	6
Group Outcome - Median (M)	40	5.8	3.1	0	10	5.5
Group Composition Vote Breakdown (R2)						
Like-minded (LM)	20	1.8	1.8	0	4	1.5
Mixed-minded (MM)	45	7.3	2.0	4	10	8

Notes: This table shows individual and group-level withdrawal decisions across all treatments and rounds. R1 and R3 refer to individual decision rounds, while R2 corresponds to the group voting round. "Unanimity (U)" and "Median (M)" refer to the voting rules applied in the group decision-making process. "LMG" = Like-minded Generous, "MM" = Mixed-minded.

The Effect of Group Size and Composition

To analyze the effect of group size and group composition on allocation voting and decisions, we compared voting behavior between three-member and five-member groups. The analysis draws on the dataset established in Chapter 2, expanding it with additional observations from five-member groups in an otherwise procedurally identical decision task.

Given the non-normal distribution of votes in both samples, as confirmed by Shapiro-Wilk tests (three-member mixed-minded groups: $p < 0.001$, $n = 132$; five-member mixed-minded groups: $p < 0.001$, $n = 45$), we employed a non-parametric approach. Specifically, we used the Wilcoxon rank sum test with continuity correction to compare votes across group sizes within group compositions.

For mixed-minded participants, the analysis reveals a statistically significant difference in votes retained between three-member and five-member groups ($p < 0.001$, $n = 177$). As illustrated in Figure 3.1a, participants in five-member mixed-minded groups tended to retain a higher number of points than three-member groups.

The same statistical approach was applied to like-minded, generous groups. Again, Shapiro-Wilk tests confirmed deviations from normality, and a Wilcoxon rank sum test was conducted. The test also revealed a significant difference in retained votes across group sizes for these participants ($p < 0.001$; see Figure 3.1b).

These findings suggest an influence of group size on redistribution preferences. Notably, while we have complete data for like-minded generous groups in both conditions, data for like-minded selfish groups are only available for the three-member setting, which limits direct comparability across like-minded group compositions.

We estimate a series of Tobit models with left-censoring at zero, due to the nature of our data, to understand how types, group size, and composition jointly impact voting and outcomes. We define our dependent variable, vote, that is subject to left-censoring at zero, because no retention of fewer than 0 points is possible. First, we estimate a model limited to mixed-minded groups with participants assigned to one of three types: generous, selfish, or fair. Type reflects the logic of our grouping that classifies participants based on their initial decision in the first round dictator game. The model includes group size and its interaction with participants' type. A second specification adds control variables.

In a third model, we include the full dataset and examine whether group size interacts with group composition, distinguishing between like-minded and mixed-minded groups. Table 3.3 reports the coefficients and standard errors of the main specifications. Model comparison using the Akaike Information Criterion (AIC) suggests that adding attitudinal controls, e.g., (RA_mean) does not substantially improve model fit compared to the baseline specification. Among the mixed-minded models, the specification that includes attitudinal controls (RA_mean) achieves the best fit (AIC = 773.35, $N = 177$). When considering all groups, the model that incorporates group composition (like-mindedness) yields the lowest AIC overall (AIC = 1043.93, $N = 233$), though this reflects its broader coverage rather than superior fit per observation.

Figure 3.3 shows the predicted vote retention for participants in mixed-minded groups, based on their initial strategy type (selfish, fair, or generous) and the group size (three vs. five members). The predictions are derived from the Tobit model with an interaction between type and group size and include controls.

We predicted values using the model estimates while holding continuous variables at their mean. Since the Tobit model accounts for censoring at zero, the predicted votes represent expected outcomes that correct for the lower bound of the voting scale. As shown in the figure, the model produces different vote predictions depending on participants' initial decisions and group size.

The figure reveals distinct voting patterns across strategy types and group sizes. For participants labeled as *selfish* or *fair*, predicted vote retention is similar in three-person groups, averaging around 6.5 points. In five-person groups, however, both types are predicted to retain more, with selfish types reaching the highest prediction for votes of over 8 points.

By contrast, participants labeled as *generous* are predicted to retain fewer points overall, as expected. In three-member groups, their predicted vote is approximately 3.6, while in five-person groups, it increases to about 5.4.

Table 3.3: Tobit Estimates: Effects of Strategy Type, Group Size, and Composition on Vote Retention

Dependent variable:	Mixed-minded only			All groups
	Vote	+ SN control	+ RA control	Vote
Greedy	−0.60 (1.82)	−0.66 (1.82)	−0.52 (1.81)	—
Generous	−3.63† (1.98)	−3.65† (1.98)	−3.40† (1.98)	—
Group size	0.58 (0.42)	0.59 (0.42)	0.59 (0.42)	0.96*** (0.22)
SN_mean	—	0.45 (0.59)	—	—
RA_mean	—	—	−0.33 (0.27)	—
Greedy × Group size	0.20 (0.50)	0.22 (0.50)	0.16 (0.49)	—
Generous × Group size	0.28 (0.55)	0.29 (0.55)	0.22 (0.55)	—
Like-minded	—	—	—	3.98* (1.67)
Group size × Like-minded	—	—	—	−2.12*** (0.45)
Constant	4.75** (1.54)	3.39 (2.37)	6.00** (1.85)	2.57** (0.81)
Observations	177	177	177	233
AIC	774.16	775.59	773.35	1043.93

Notes: Tobit regressions with left-censoring at zero. Standard errors in parentheses. † $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. *Vote* is the number of points retained by the participant in the group decision. *RA_mean* captures the Refugee Attitudes Scale (higher indicates more positive attitudes towards refugee). *SN_mean* captures the average response to perceived social norms in the group, measured on a 5-point Likert scale (higher values indicate stronger norm-driven behavior). *Like-minded* equals 1 if the group consisted of participants with aligned initial decisions.

Participant types (selfish, fair, generous) were classified based on whether their individual vote retention exceeded, matched, or fell below the median retention in their respective group size condition. This fairness benchmark allows for interpreting participants' types predicting voting and aligns with the trends that were found by the Tobit model.
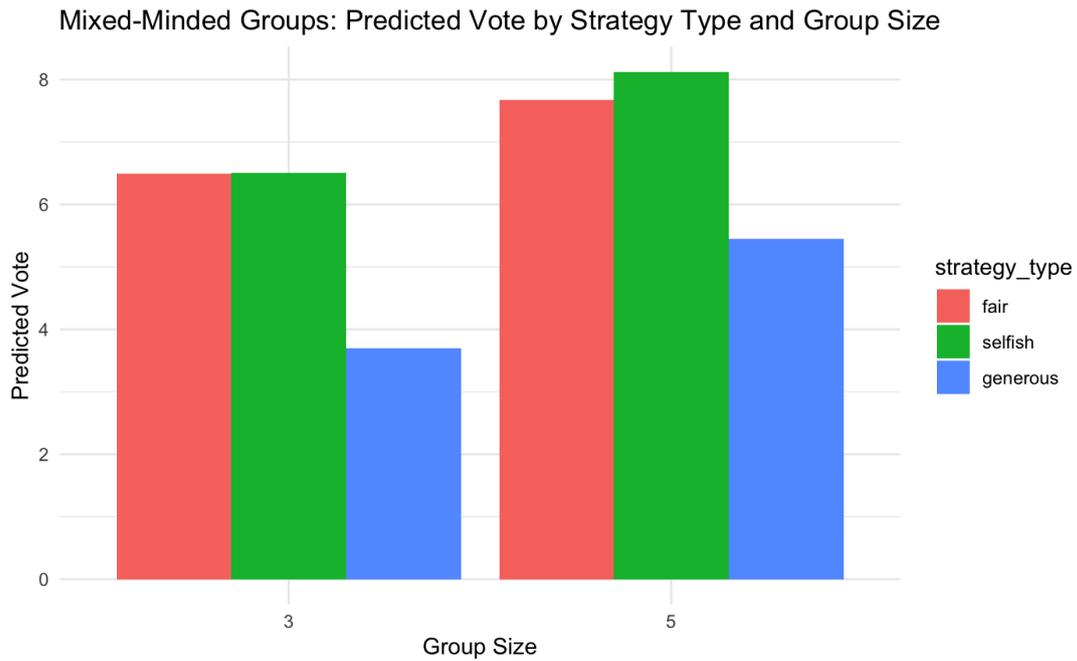
Figure 3.3: Predicted Vote by Strategy Type and Group Size in Mixed-Minded Groups

Notes: Predicted values from Tobit regression using interaction terms between type and group size. Group composition is held constant (mixed-minded). Votes range from 0 (fully altruistic) to 10 (fully self-serving).

Deliberation Analysis

In this section, we focus on deliberation data indicators. Mainly, we analyzed deliberation duration and its intensity, measured by the number of messages sent per participant. Specifically, we assessed how these outcomes varied as a function of group size, like-mindedness, and the voting rule (unanimity vs. median).

Figure 3.4 shows that deliberation time did not differ significantly between mixed and like-minded groups. While mixed groups deliberated slightly longer on average (median = 7.37 minutes) than like-minded groups (median = 6.38 minutes), the difference was not statistically significant. A Mann–Whitney test yielded $W = 521.50$, $p = .31$, with a small rank-biserial effect size $\hat{r}_{\text{biserial}} = 0.16$ and a 95% confidence interval ranging from -0.15 to 0.44 ($n = 65$). Similarly, Figure 3.5 shows deliberation times by voting rule and indicates no difference between groups assigned to majority rule (median = 6.47 minutes) and those voting under unanimity (median = 7.37 minutes). The Mann–Whitney test yielded $W = 500.00$, $p = 1.00$, and $\hat{r}_{\text{biserial}} = 0.00$ with a 95% CI of $[-0.28, 0.28]$, based on 65 observations. Thus, neither group composition nor the voting rule significantly affected the total duration of deliberation.

$W_{\text{Mann-Whitney}} = 521.50$, $p = 0.31$, $\hat{r}^{\text{rank}}_{\text{biserial}} = 0.16$, $\text{CI}_{95\%}$ [-0.15, 0.44], $n_{\text{obs}} = 65$

$\hat{\mu}_{\text{median}} = 7.37$

$\hat{\mu}_{\text{median}} = 6.38$
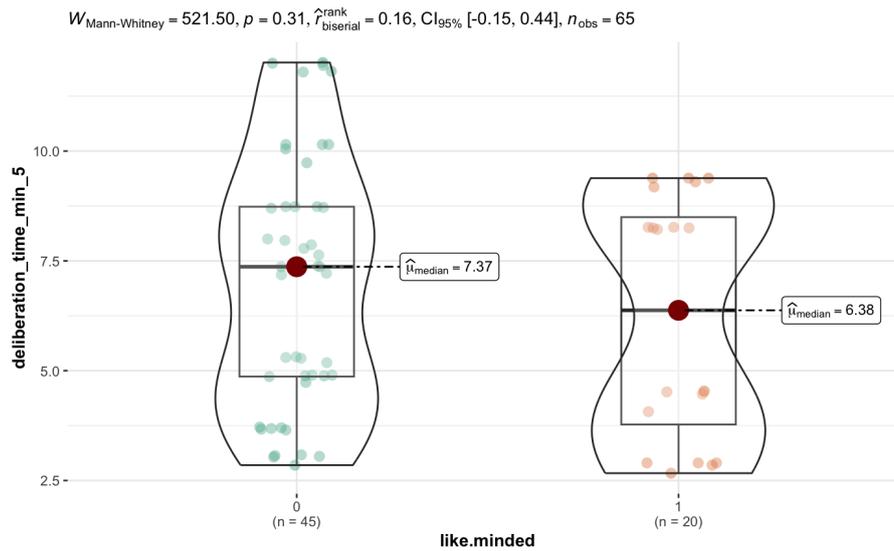
Figure 3.4: Deliberation Time by Composition Treatment

$W_{\text{Mann-Whitney}} = 500.00$, $p = 1.00$, $\hat{r}^{\text{rank}}_{\text{biserial}} = 0.00$, $\text{CI}_{95\%}$ [-0.28, 0.28], $n_{\text{obs}} = 65$

$\hat{\mu}_{\text{median}} = 6.47$

$\hat{\mu}_{\text{median}} = 7.37$
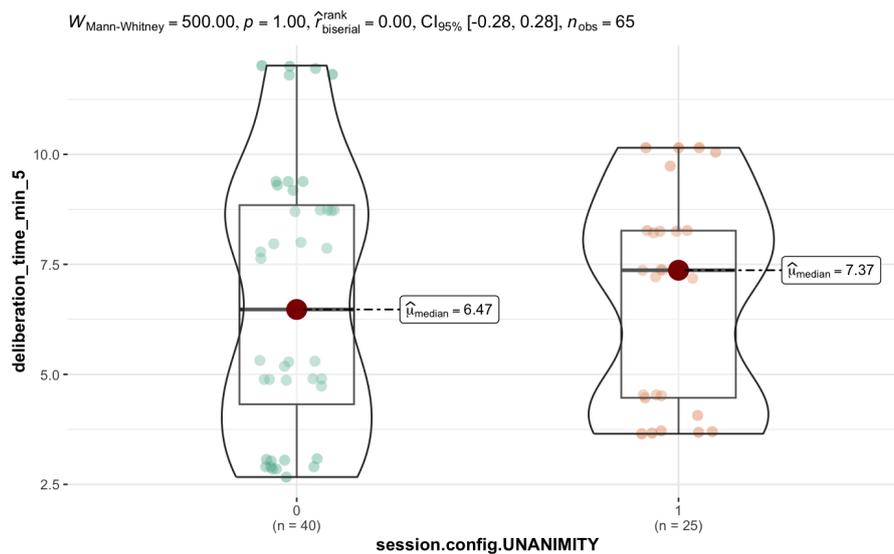
Figure 3.5: Deliberation Time by Voting Rule

Looking at the statistics on the number of messages sent per participant varied across conditions, as presented in Figures 3.6 and 3.7. Figure 3.6 illustrates how message volume was driven by a three-way interaction between group size, group composition, and allocation rule. The highest average number of messages per participant occurred in five-member, mixed-minded groups under unanimity. Like-minded groups, in contrast, showed relatively flat message rates across voting rules and group sizes, with lower means overall. This pattern is presented in Figure 3.7, which displays normalized message volume with error bars. Under unanimity, mixed-minded groups engaged in significantly more sending messages than like-minded groups, particularly in five-member groups.
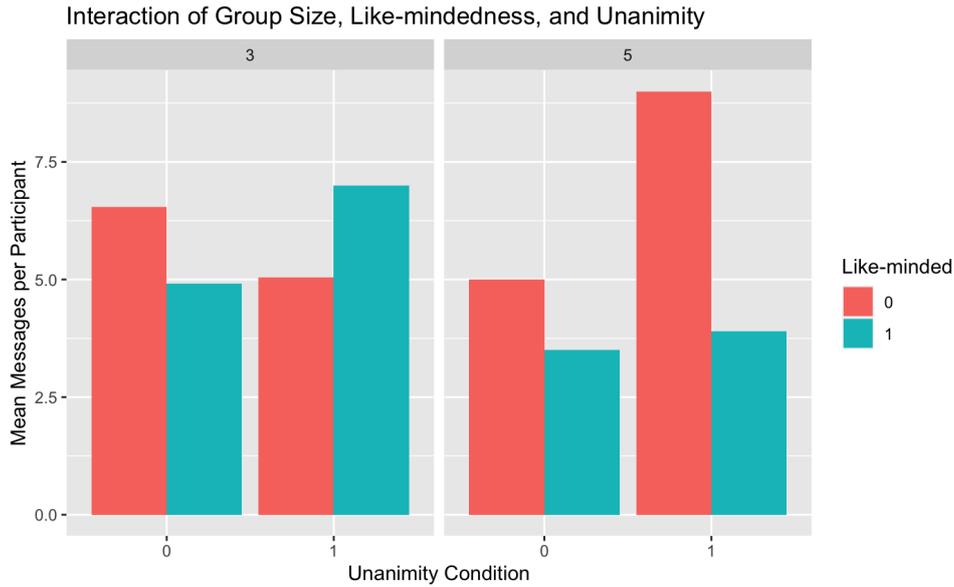
Figure 3.6: Interaction of Group Size, Like-mindedness, and Unanimity on Message Volume
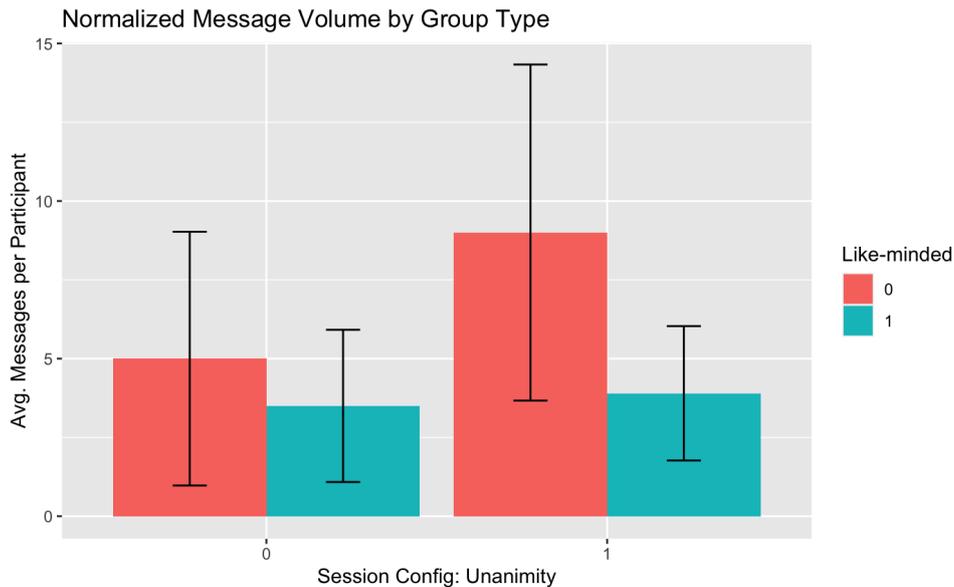
Figure 3.7: Normalized Message Volume by Group Type (5-member Groups)

To formally evaluate these relationships, we conducted a Type III ANOVA on the number of messages per participant. Type III sums of squares are appropriate in this context because the model includes interaction terms. While the design is unbalanced, with unequal group sizes across experimental conditions, this approach tests each main effect and interaction while controlling for all other terms in the model. This approach provides a robust estimate of each predictor's contribution to message volume. The results, summarized in Table 3.4, indicate that the unanimity rule and its interactions with group size and mixed-mindedness significantly increased message volume. The model re-

vealed a significant main effect of unanimity ($F(1, 268) = 14.76$, $p < .001$), indicating that groups voting under unanimity sent more messages overall. This main effect was underlined by a significant interaction between like-mindedness and unanimity ($F = 11.23$, $p < .001$). It shows that mixed-minded groups in the unanimity treatment deliberated more intensely than like-minded groups. Moreover, a significant interaction between unanimity and group size ($F = 14.98$, $p < .001$) indicated that unanimity increased message volume more strongly in larger groups. These effects conclude in a significant three-way interaction among group composition, voting rule, and group size ($F = 8.75$, $p = .003$). This confirms that the highest deliberative effort occurred when mixed-mindedness, group size, and rule aligned. The full results are shown in Table 3.4.

Table 3.4: Type III ANOVA: Effects on Message Volume During Deliberation

Predictor	Sum of Squares	Df	F-value	p-value	Signif.
(Intercept)	484.5	1	31.42	$< .001$	***
Like-mindedness	5.8	1	0.38	.539	
Unanimity	227.6	1	14.76	$< .001$	***
Group Size	50.3	1	3.26	.072	·
Like-mindedness × Unanimity	173.2	1	11.23	$< .001$	***
Like-mindedness × Group Size	0.1	1	0.01	.937	
Unanimity × Group Size	231.0	1	14.98	$< .001$	***
Like-mindedness × Unanimity × Group Size	134.9	1	8.75	.003	**
Residuals	4132.9	268			

Notes: Significance codes: *** $p < .001$, ** $p < .01$, · $p < .10$

Furthermore, we conducted a sentiment analysis of the chat transcripts. We are interested in examining the sentiment tone of group interactions using the Bing lexicon. Figure 3.8 shows the proportion of positive and negative sentiment-bearing messages across group sizes. Across both three- and five-member groups, positive sentiment expressions outnumbered negative ones. However, the effect was larger in five-member groups. Specifically, larger groups have a notably higher proportion of positive messages (approximately 38%) compared to negative ones (22%). In contrast, three-member groups showed a smaller proportion, with both positive and negative messages making up roughly 20% and 14% of their total message volume.

Figure 3.9 provides the absolute numbers of sentiment counts for five-member groups. The absolute frequency of positive sentiment was higher than that of negative sentiment. This supports the proportional findings previously. Together, these results suggest that larger groups were more likely to deliberate in a positive tone, even when accounting for differences in message volume. This may indicate that increased group size not only demands more messaging but also promotes a more positive tone of exchange.
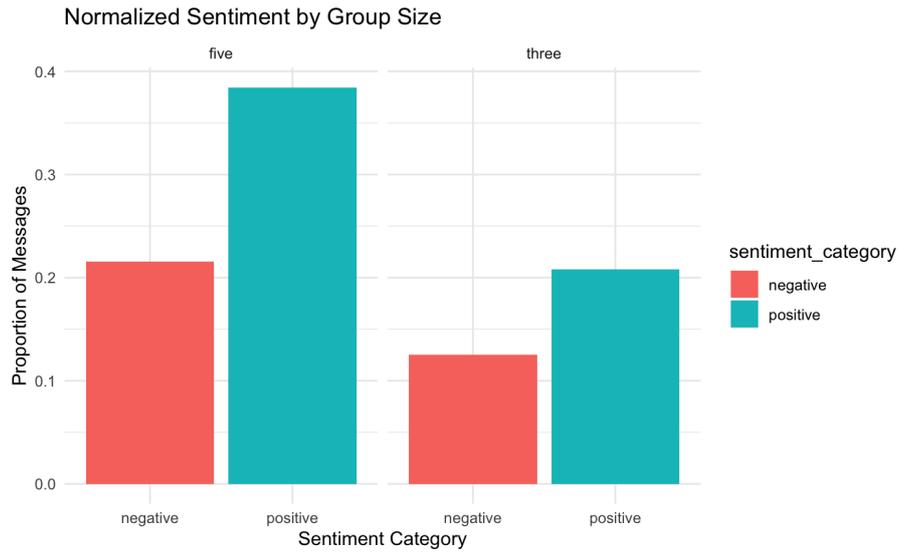
Figure 3.8: Normalized Sentiment Proportions by Group Size
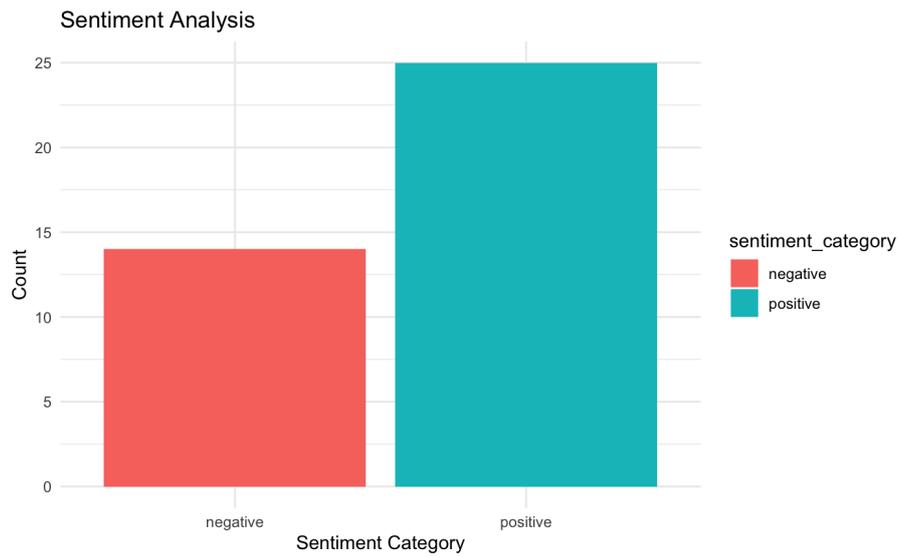
Figure 3.9: Absolute Sentiment Counts in Five-Member Groups

3.5 Discussion

We investigated the research question of how larger group size, like-mindedness, and voting rules impact deliberation and voting in the modified group dictator game. Our findings contribute to a growing body of literature focused on the design considerations of mixed-model deliberation. Moreover, we provide an exploratory, controlled setting in which we held all variables constant except for group size.

Our findings contribute to the robustness of the findings in Chapter 2 regarding the manipulation of the voting rules. We found no significant difference between voting and outcomes in the median versus the unanimity treatment. Even though the literature provides evidence for rule-driven alteration of voting behavior (Sorkin et al., 1998; Guarnaschelli et al., 2000), it seems that this impact is muted in our design. However, voting rules impact deliberation data in larger groups. Specifically, under the unanimity treatment, mixed-minded groups sent a higher volume of messages. This suggests that for a larger number of participants that a stricter rule demands more intensive exchange to align preferences. This supports the literature of social influence and deliberative burden (Lorenz et al., 2011; Becker et al., 2017), in which decision rules interact with group heterogeneity to impact the depth and intensity of deliberation.

We find that group composition mattered. Unlike three-member like-minded generous groups, we found that five-member like-minded groups retained less than individuals. This also holds in the second individual round. However, we need to emphasize the limited number of observations. This rather aligns with our explanation of deliberating social appropriateness rather than truth-telling on preferences. Regardless, we detected a small change in individual preferences in the second individual round. In contrast, mixed-minded groups showed more self-centered withdrawal decisions. Within these mixed-minded groups, selfish participants tended to maintain their initial preferences, while generous participants were more likely to converge toward the group median. These dynamics align with prior findings on the longevity of group decisions to dominant preferences and status dynamics (Ohtsubo and Masuchi, 2004; Fujisaki et al., 2018). Moreover, this reflects the broader challenge of sustaining cooperation in mixed-minded groups when dominance occurs.

Interestingly, deliberation time did not differ significantly across conditions. This may reflect our imposed time limits in the design or suggest that participants quickly reach consensus in deliberative exchanges, regardless of the group composition. Yet the observed increase in message volume under unanimity in mixed-minded groups suggests that more exchange, not just duration, is a more decisive factor of deliberative engagement. This has interesting practical implications for measuring deliberation quality and for rule choices in contexts where time is constrained.

Moreover, the sentiment analysis provided further insight into the emotional dynamics

of group deliberation. We found that five-member groups expressed a greater proportion of positively valenced messages relative to three-member groups. Furthermore, in all conditions, positive sentiment outweighed negative sentiment. These patterns suggest that increased group size may foster more affirming communication. This supports the notion that rules (e.g., unanimity) can enhance not only the volume but also the tone of deliberative exchange.

The observed effects of group size also varied with composition. In mixed-minded groups, five-member groups tended to retain more points, possibly due to a diffusion of responsibility or decreased accountability. Conversely, in like-minded generous groups, increasing size was associated with more generous outcomes. These contrasting trends support that the impact of group size is mediated by group dynamics and shared norms, as suggested by Kao and Couzin (2014) and Mannes et al. (2014). Our findings thus fit the current narrative of concluding that larger groups do not necessarily provide more informed decision-making. As with three-member groups, norms and appropriateness in our social context may play a larger role in how decisions are formed.

We would like to address several limitations that need to be acknowledged. First, the lab environment provides a controlled setting. However, we interpret our findings with caution regarding validity. Real-world deliberative settings involve more complex incentives and personally related stakes. Second, while we have a type-balanced set of participants, we do not have any observations for like-minded selfish groups, nor a powerful overall sample size. These findings need to be interpreted as an explorative attempt to shed light on the issue of group size and deliberative decision-making. Further data would be needed to sufficiently compare our results.

3.5.1   Contribution Overview

This study wants to contribute to an exploration of small-group deliberation and voting with a five-member group dictator game. First, we demonstrated that group composition has a significant impact on the allocation of votes and the outcome. This adds as a robustness check to our conclusion in Chapter 2, as we find norm-driven behavior instead of high engagement and learning from deliberation in our task. Additionally, we added robustness to our finding that the voting rule did not impact voting and decision-making outcomes. Second, we find that voting rules have a significant impact on deliberation data. For mixed-minded groups, the unanimity treatment significantly increased messaging. Third, by conducting a sentiment analysis, the study contributes to a novel evaluation method to detect the tone of conversational data. Our analysis showed that participants not only sent more messages, but the tone was emotionally more positive in larger groups compared to the smaller ones. This is in line with our perception that participants were comparing and aligning rather than truthfully deliberating, which could potentially lead

to more discursive tones.

3.5.2 Future Implications for Research

Future research could build on these explorative findings in several directions. To better capture the impact of group size on decision-making, researchers could change the task to one with epistemic accuracy. This could potentially make comparisons more valuable in the context of the wisdom of crowds. Furthermore, this yields the potential to analyze argument quality. Moreover, the role of emotions and suppression of feelings or discursive harshness is an interesting pathway when studying deliberation. The question of why there is a hate issue in social media, but an appropriateness alignment in our anonymous study, shows how crucial the perceived closeness of the group members appears to be. This corresponds to the final pathway, that is, whether similar patterns arise in more real-life deliberative settings. For example, how these patterns vary across partisan orientations in citizen assemblies with varying group sizes.

3.6 Conclusion

This chapter investigated how group size, group composition, and voting rules interact to impact collective decisions and deliberation in small-group settings. Building on previous findings about the influence of like-mindedness, we extended the analysis to include five-member groups. Our results demonstrate that group composition is a dominant variable for voting outcomes: Like-minded generous groups show more robust norms of self-restraint in their voting behavior, while mixed-minded groups have a more median-driven voting pattern.

While voting rules showed no effects on voting outcomes, they significantly affected deliberation. Unanimity rule increased message volume, particularly in five-member mixed-minded groups, indicating that less salient decision thresholds promote more messaging. Moreover, sentiment analysis revealed that larger groups were not only more communicative but also more likely to express a positive emotional tone. This suggests that deliberative engagement and group size promote less tension in the discourse.

Finally, these findings show that how we design deliberative decision-making discourses has a significant impact on the outcome. Future research should potentially focus on individual elements, such as group size in epistemic accuracy-relevant tasks, to better understand how the effect of appropriateness unfolds in performance-relevant contexts.

Chapter 4

Strategic Voting Behavior

We experimentally investigate sequential voting with single-peaked preferences under two common aggregation rules: the median and mean. While the median rule is strategy-proof in settings with single-peaked preferences, the mean rule is not. We design a laboratory experiment based on a formal model of subgame perfect Nash equilibrium with costly participation. Importantly, we construct peak distributions that yield identical equilibrium outcomes under both rules, isolating framing effects from strategic structure implied by the rules. Despite theoretical predictions of full participation in all but one distribution, observed behavior systematically deviates. Participation rates were significantly lower for extreme peaks in the distribution. Second-stage behavior is more aligned with equilibrium play under the mean rule. Pivotal voters under the median rule show more accuracy in predicting and strategic reasoning. While this is true, we expect voting behavior to be bounded and shaped by the framing of the rule. We contribute to the literature on voting games and bounded rationality in behavior. We demonstrate how responses to voting rules, even if held constant, vary depending on peak distributions.

4.1   Introduction

How voting rules impact participation decisions and voting is an important question in designing participative institutions. Two interesting and very salient voting rules for practitioners are the median and mean rules.

The median rule is a common allocation mechanism in political science and social choice theory (see empirical evidence, e.g., Puppe and Rollmann, 2021). It selects the middle value of all individual votes or preferences and is closely linked to majoritarian logic, especially in one-dimensional policy spaces. A well-established result is the median voter theorem, which states that when preferences are single-peaked, the outcome preferred by the median voter will defeat any alternative in a pairwise majority vote (Jones et al., 2022; Sauermann, 2023). Single-peakedness implies that individuals have one most-preferred alternative and that their satisfaction decreases as outcomes move away from this ideal point in either direction of a preference distribution. Hence, the median rule enforces strategy-proofness, which means that participants have no incentive to misreport their preferences. The aggregation mechanism is immune to manipulation of the process.

In contrast, the mean rule aggregates all individual votes by calculating their average. While the mean rule is sensitive to the distribution of all preferences and may be seen as more inclusive in aggregating information, it is not strategy-proof. Individuals may be incentivized to exaggerate or understate their true preferences to pull the outcome closer to their ideal point. This introduces additional strategic complexity and may affect participation incentives and coordination outcomes in group decision-making settings. However, the potential for successful strategic manipulation under the mean rule is reduced in large-scale voting scenarios. As the number of participants grows, the influence of any single vote diminishes, and the aggregate outcome becomes more stable due to the law of large numbers.

This can lower individual incentives for misrepresentation and enhance robustness against isolated extreme votes, although coordinated manipulation remains a possible concern (Ehlers et al., 2004).

Empirical evidence on small-group voting tasks suggests that the median rule contributes to different voting patterns. Puppe and Rollmann (2021) find that voters under the median rule vote rarely sincerely in an allocation task, while Sauermann (2023) finds that median voter dynamics prevailed in a redistribution task testing the Meltzer-Richard redistribution mechanism. In addition, Puppe and Rollmann (2021) provided evidence for the behavior of voters when using the mean rule. Voters show extreme voting behavior in contrast to the median rule. Nevertheless, there is limited empirical evidence comparing voting behavior under these rules.

We contribute to the understanding of empirically testing how aggregation rules affect participation decisions and voting by using a sequential voting game with single-peaked

preferences and minimal costly participation. Based on the formal model with linear utility functions and participation costs, we aligned our design on the theory of subgame perfect Nash equilibrium (SPNE) under mean and symmetric median rules (Müller, 2022).

We identify peak distributions that ensure unique and identical equilibria across both rules, allowing us to isolate the framing effect of the voting rule from strategic considerations. We tested whether participants recognize and play the Nash equilibria predicted by theory. The proof for the equilibrium characterization results can be assessed in Müller (2022). Specifically, we investigate whether behavior aligns with the theoretical equilibria even when the strategic environment is identical under different voting rules. To this end, we implement a laboratory experiment where equilibrium outcomes and strategies are matched across rules by design.

The second objective of this project is to explore participation patterns. Specifically, we are interested in voters' behavior under extreme preferences. While some theoretical models suggest that voters with extreme preferences have a stronger incentive to participate due to expected influence (Osborne et al., 2000), our analysis does not confirm this intuition. We test whether extremeness correlates with high participation rates in a controlled experiment.

Our study adds to the experimental literature on costly voting and pivotal voter models, which has mainly examined simultaneous voting with dichotomous choices (Levine and Palfrey, 2007; Agranov et al., 2018). Closest to our work is Rollmann (2020), who study costly participation under incomplete information.

We use the sequential voting task with complete information to provide comparability in the equilibria structure and internal validity.

This chapter is structured as follows. Section 4.2 presents relevant literature on voting from a social choice theoretical and behavioral stance. Section 4.3 and section 4.4 outline the experimental design and procedures in the lab. Section 4.5 reports the empirical findings on participation and voting. Section 4.6 discusses equilibria behavior and deviations, and potential mechanisms behind these findings. Section 4.7 concludes.

4.2 Background Literature

4.2.1 Sequential Voting in Theory

Voting on one-dimensional outcomes in budget allocation at the policy level, for example, is a dominant topic in social choice and game theory. Sequential voting games provide a pathway to model participation decisions based on the strategic considerations of their second-stage voting anticipations and their implications on the voting outcome.

There is a given complexity that arises from strategic participation decisions. Theoretical advancements offer an understanding through equilibria characterization. Müller

(2022) contributes to this issue by providing a full set of comprehensive equilibrium analyses of two aggregation rules: the symmetric median rule and the mean rule. His approach refines SPNE, which ensures robustness of the participants' strategy for the whole sequential game. Hence, Müller focuses on strong Nash equilibria in the second stage of the game. In this stage, participants jointly vote after a participation decision has been made. Strictly dividing the process into two stages accounts for the nonspecific preference distributions depending on participation.

Müller's framework explicitly introduces a small but strictly positive participation cost, thereby capturing meaningful trade-offs that potential voters face. His model assumes generic preferences (distinct peak locations for each participant), ordered by the location of these peaks. This ordering significantly influences the incentives under both rules: the median rule's outcome hinges critically on the identity of the median participant, whereas the mean rule equally weights the preferences of all participants.

Earlier work, such as Moulin (1988), emphasized paradoxical effects. We refer to the no-show paradox. By modeling sufficient participation costs, Müller provides an understanding of the strategic incentives of participating. The literature on strategy-proofness emphasizes the robustness of voting against misreporting or manipulating. Ehlers et al. (2004) elaborate on threshold strategy-proofness, which is an important reference to the partial participation scenarios in Müller's model. The use of SPNE and a unique Nash equilibrium definition aligns with standard game-theoretic modeling practice. It aims to reduce non-credible outcomes and ensure coalition-proofness in sequential decision-making (Osborne and Rubinstein, 1994). However, we lack empirical validation of the predictions. This paper addresses precisely this gap by experimentally investigating whether actual behavior aligns with the predicted SPNE outcomes, and how the choice between median and mean aggregation rules affects strategic participation and group-level decisions. We thus provide a controlled empirical test of Müller's theoretical framework after a pilot was conducted previously.

4.2.2   Behavioral Considerations of Equilibria Predictions

Experimental studies on group decision-making offer mixed insights into how different voting rules interact with cognition, strategic reasoning, and social dynamics.

Some evidence supports that voting behavior is prone to the aggregation mechanism of preferences (Bassi, 2015). Furthermore, participants' ability to recognize equilibrium strategies is an interesting path to evaluate a rule's effectiveness.

Sauermann (2023), for instance, provides empirical evidence from a laboratory setting. They show that median voter dynamics can shape allocation decisions under majority and voting by veto rule. Thus, individual preferences converged toward the central point. This supports the predictive nature of the median voter theorem even in small-scale

experimental contexts.

Another interesting finding is the analysis of sincere versus strategic voting. Studies show that voters frequently show forward-looking behavior. They adapt to the anticipation of others' decisions and strategic incentives given the voting rule (Forsythe et al., 1996; Bassi, 2015).

Strategic manipulation is not limited to complex settings but emerges even in relatively simple electoral contexts, highlighting voters' responsiveness to not only payoff structures but also coordination heuristics (e.g., due to uncertainty) (Cason and Mui, 2005). A further behavioral concern is how voting rules affect the efficiency and welfare of collective outcomes. Experimental findings indicate that allocation design can significantly influence the accuracy of group decisions, the distribution of welfare across participants, and the overall performance of participating groups (Battaglini et al., 2007; Freer et al., 2020). In certain study contexts, some rules foster more effective information aggregation (Baujard et al., 2014) or lead to more equitable outcomes (Battaglini et al., 2007), while others may privilege speed or simplicity at the expense of deliberative accuracy or fairness (Bol et al., 2023). Hence, voters show sensitivity towards different voting rules regarding sharing and redistributing. Examples are shown in studies on public good provision or allocation tasks (Gallier et al., 2017; Sauermann, 2023). How decision-making processes are designed not only impacts the outcome itself, but also participants' perceptions of legitimacy and justice for the outcome. Thus, preferences over outcomes are also related to the process of how they are achieved. Beyond the aggregation process itself, several empirical studies presented effects on voting behavior and group dynamics in the context of tasks and procedures. Unanimous or sequential voting has been shown to affect the agreement and deliberation quality of groups (Guarnaschelli et al., 2000; Bouton et al., 2017). The findings reveal a trade-off between the decisiveness of participants and inclusivity. More demanding voting rules require exchange and anticipation (e.g., in unanimous settings). Occasionally, this is leading to deadlock or insincere behavior.

Participation dynamics, particularly turnout and abstention, have also been explored under varying institutional constraints. Research on compulsory versus voluntary voting participation and on multi-tier procedures shows that rule context affects participation rates. Studies show that participants are often driven by their expectations of their influence in the majority formation process (Bhattacharya et al., 2014; Hizen et al., 2025). In sequential settings, voting is not solely an expression of preferences, but depends on other normative and strategic considerations (e.g., costs of participation).

Finally, several studies present further relevant constraints to voting behavior, such as rule compliance, switching, or merely cognitive errors. Less salient contexts can promote biases in voting behavior, especially under uncertainty (Baujard et al., 2014; Feess et al., 2020; Bol et al., 2023; Apffelstaedt and Freundt, 2024). Together, we show how these findings support the notion that how we design aggregation processes is crucial to

behavior.

4.3 Study Design

The study design is based on a pilot study from Müller (2022). We apply the between-subjects design with the voting rule treatment: the median and mean rule. Manipulation occurs on the session level. Participants are informed at the outset that they will take part in a two-stage voting procedure. In the first stage, individuals decide whether to participate, knowing that participation incurs a fixed cost. Participants choosing to engage then submit a vote in the second stage. Decisions occur within groups of four individuals, with group composition changing in every round via a stranger matching protocol. Participants thus face new group constellations each round, potentially encountering some previously matched participants without the possibility of identifying them. We utilize the strategy method from Selten (1967), providing each participant with a complete list of possible peak distributions for the upcoming round as tested in a previous pilot (Müller, 2022). We asses the complete strategy-set of each individual for each peak in the distribution. The participation decision is peak dependent in each distribution. After all participation decisions have been submitted, each participant is randomly assigned a peak according to a predetermined, randomized assignment scheme. This assignment remains constant across all experimental sessions. Peak distributions are designed to ensure fairness, preventing disadvantageous peak allocations.

Once peaks are assigned, the participants' earlier participation choices are executed. The assignment of the peaks is common knowledge. Participants are reminded of their participation decision and which peaks are actively participating in the voting stage of the task.

Those participants to choose to participate submit their votes. We included the possibility for all participants to predict the voting outcome, based on the realized peaks of the rounds. However, those predictions were not payoff relevant. We chose to include the predictions for the outcome as a proxy for their strategic understanding and expectation regarding the equilibrium outcome. After all votes are submitted, the results are shown to the participants, and they proceed to the next round. Group size is held constant at four to reduce complexity in detecting equilibria strategies. We chose the smallest group size in which the symmetric median and mean rules deviate in their strategic implications. Moreover, all peak distributions yield unique equilibria outcomes. This minimizes the ambiguity of the strategies. The study was implemented in oTree (Chen et al., 2016) as it allows us to collect data on many participants simultaneously in the lab. We were also able to facilitate control rounds that aimed at participants' understanding of the proceedings of the task and the rules.

This procedure ensures that the participant's utility is maximized when the outcome

aligns with their peak. The normalization constant $(100 + c)$ takes care of the utility such that it remains positive as long as some members of the group participate. The payoffs are expressed in "points," with 10 points corresponding to 1 Euro. Payoffs are transparent to the participants and ensure incentive compatibility of the design of the task. Participation costs are fixed at 10 points to maintain strategic relevance. The costs are sufficiently high to make not participating a possible option. Still, the costs are low enough not to distract from the robustness of the equilibrium predictions.

To model participants' preferences, we use a simple utility function. Each participant i is assigned a most preferred outcome, or "peak", $p_i \in [0, 100]$. The final outcome of the group decision is denoted by x, and individuals choose whether to participate in the vote ($\delta_i = 1$) or not ($\delta_i = 0$). Participation comes at a fixed cost $c > 0$, which only applies if the individual chooses to vote.

The utility function reflects two factors: (1) how close the outcome x is to the participant's peak p_i, and (2) whether or not the participant chose to take the cost of participation. To make payoffs easy to interpret and to ensure that outcomes with at least some participation always lead to a positive utility, we define the utility function as follows:

$$
u_i(x, p_i, c, \delta_i) = \begin{cases} (100 + c) - |x - p_i| - \delta_i \cdot c & \text{if } \sum_{j \in N} \delta_j > 0 \\ 0 & \text{else.} \end{cases} \tag{4.1}
$$

This means that participants earn more points when the outcome is closer to their peak and when they avoid unnecessary participation costs. The case in which no one votes is treated as the worst-case scenario, with a utility of zero for all participants.

4.3.1 Peak Distributions

This section presents six different peak distributions to investigate equilibrium participation behavior in a voting setting. Each distribution consists of four voter ideal points (peaks), and for all distributions, the cost of participation is sufficiently low to ensure that full participation constitutes the unique Nash equilibrium except for distribution six. By systematically varying the dispersion and symmetry of the peaks, we aim to explore whether and how participation behavior differs between moderate and extreme voters and between symmetric and asymmetric distributions. The graphical illustrations accompanying each distribution provide visual support for the comparative analysis.

Peak Distribution 1

Peak Distribution 1 includes the peaks at 5, 10, 90, and 95. The unique equilibrium in this setting is full participation by all individuals.
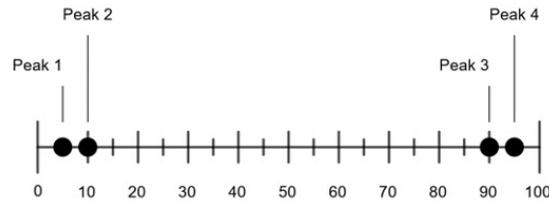
Figure 4.1: Peak Distribution 1

This distribution is symmetric and characterized by highly polarized peak values. Due to the risk that abstaining might result in an outcome far from an individual's peak, we expect a high level of participation.

Peak Distribution 2

Peak Distribution 2 comprises peaks at 5, 30, 70, and 95. As with the previous case, the unique equilibrium is full participation.
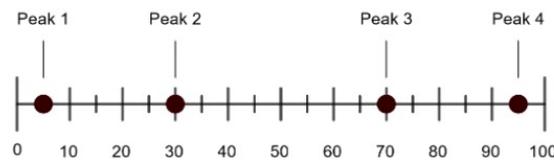
Figure 4.2: Peak Distribution 2

Compared to Peak Distribution 1, this setting includes two more moderate peak values. Nonetheless, equilibrium outcomes and strategies remain unchanged. This distribution helps to investigate whether participation varies between moderate and extreme voters, despite identical equilibrium predictions.

Peak Distribution 3

Peak Distribution 3 features peaks at 25, 30, 70, and 75. Again, the unique equilibrium is full participation.

This distribution introduces even more centralized peaks compared to Distribution 2, potentially making abstention a more relevant consideration for all participants in the median treatments. The equilibrium outcome and strategies are identical to the previous symmetric distributions.
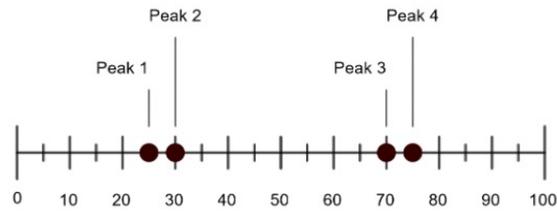
Figure 4.3: Peak Distribution 3

Peak Distribution 4

Peak Distribution 4 is the first asymmetric distribution, with peaks at 5, 10, 65, and 70.
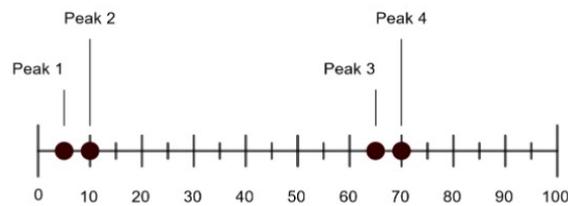
Figure 4.4: Peak Distribution 4

The unique equilibrium remains full participation. In this distribution, the lower half contains only extreme peaks, while the upper half includes more moderate values. Starting from full participation, abstention by individuals with lower peaks leads to smaller outcome shifts compared to abstention by those with higher peaks. Therefore, although abstaining is not beneficial for anyone, lower-peak individuals might be more prone to abstain.

Peak Distribution 5

Peak Distribution 5 consists of peaks at 30, 35, 90, and 95.
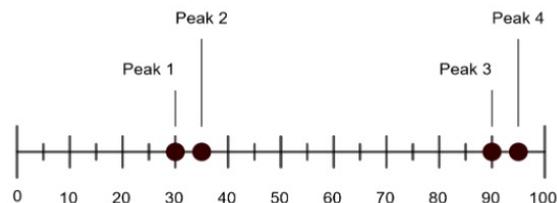
Figure 4.5: Peak Distribution 5

This asymmetric setting also leads to full participation in equilibrium. Strategically, it mirrors Peak Distribution 4 when starting from full participation. Thus, no behavioral

differences are anticipated, even though one vote is more extreme. However, if individuals with lower peaks participate less, it would contradict the intuition suggested by Osborne et al. (2000).

Peak Distribution 6

Peak Distribution 6 includes peaks at 5, 7, 10, and 25, and tests the ability of detecting single participation scenarios.
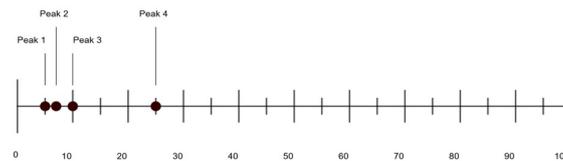
Figure 4.6: Peak Distribution 6

Peak Distribution 6 comprises four participants with ideal points at 5, 7, 10, and 25. The distribution is notably asymmetric due to the presence of a single participant with a substantially higher peak at 25. In this setting, the equilibrium outcome is characterized by *single participation*, with only the individual holding peak 25 choosing to vote. The underlying rationale is strategic and applies under both the mean and median aggregation rules. In simultaneous participation, each individual submits a numerical allocation proposal. Under full participation, the individual with peak 25 would propose an allocation near the upper bound of the scale (e.g., 100), while the three lower-peaked individuals would propose allocations near 0. The outcome would converge to 25, regardless of the voting rule. Recognizing the equilibrium outcome, the three lower-peaked participants of the group do not influence the outcome by their votes. Thus, it would incur only costs to participate. Their dominant strategy is to abstain and allow the peak-25 participant to determine the outcome alone. This distribution is an example of strategic abstention and cost-saving free-riding that can emerge. Furthermore, we learn that two distinct voting rules yield the identical strategic incentive even if full participation is not dominant. These dynamics align with findings in the literature on costly voting and strategic behavior in group decision-making (e.g.,DeGroot, 1974; Matsusaka and Palda, 1995; Feddersen and Pesendorfer, 1996).

4.3.2 Hypotheses

Building upon the findings of our previous work Puppe and Rollmann (2021) and, in particular, the observations in the pilot study by Müller (2022), we applied the hypotheses and refined our experimental design. In light of both the theoretical considerations and

behavioral findings described in Müller's analysis, we introduce two additional hypotheses (H2 and H5). These aim to test strategic behavior in a controlled, salient decision space and to evaluate whether the observed deviations from equilibrium predictions in Müller's study persist under modified conditions in our design.

Hypothesis H1

Participants play Nash equilibrium strategies in the second stage of the game.

In the pilot, participants occasionally identified and played second-stage Nash equilibrium strategies, particularly under the symmetric median rule with six participants. In the current design, we reduce group size to simplify the strategic environment. We expect that participants will more reliably recognize and choose the unique (strong) Nash equilibrium strategies at the second stage.

Hypothesis H2

Participants play Nash equilibrium strategies across the entire game.

In the pilot, participants had difficulty identifying full-game equilibrium strategies, except in very limited cases. With reduced complexity in our design, we hypothesize improved equilibrium decisions across both stages.

Hypothesis H3

Equilibrium strategies are more frequently played when the equilibrium implies full participation.

The pilot study observed higher equilibrium adherence when the predicted equilibrium involved full participation. While this might have been influenced by non-strategic factors (e.g., normative heuristics), we focus on this more closely in the present experiment by survey analysis.

Hypothesis H4

The decision rule (mean vs. symmetric median) does not significantly affect equilibrium play.

Müller's findings in the pilot suggested no significant difference between the voting rules. Given that the peak distributions are strategically equivalent and game complexity is reduced, we expect no significant rule effect for misinterpretation. Nevertheless, potential familiarity with the mean rule and its perceived impact on outcomes may influence participation behavior (Rollmann, 2020).

Hypothesis H5

The participation level per peak is lower for more extreme peaks.

In the pilot, we observed an inverse U-shaped relationship between peak extremity and participation levels. While the pattern lacked statistical robustness, the present study tests this relationship under improved conditions. If confirmed, this finding challenges the theoretical predictions in (Osborne et al., 2000) that extreme voters are more likely to participate, offering an avenue for further research.

4.4 Study Procedure and Data

The study was conducted at the Karlsruhe Decision and Design Laboratory (KD2Lab) using the participant recruitment system HRoot (Bock et al., 2014). The study received ethics approval from the Ethics Committee of the Karlsruhe Institute of Technology (KIT), and all participants gave informed consent before their participation. Participants were predominantly students from the Karlsruhe Institute of Technology (KIT). For each treatment condition, defined by the voting rule applied, we recruited 44 individuals. In total, ten study sessions were conducted to complete data collection across both treatment conditions. Upon arrival, participants were randomly assigned to computer terminals to ensure anonymity. Written instructions, blank paper, and pens were provided. Audio instructions were used to standardize procedures across sessions. The experiment was implemented in oTree (Chen et al., 2016), which allowed for efficient session management and automated data collection. Before starting the main task, all participants completed control questions to verify comprehension. Throughout the experiment, participants were randomly rematched in groups of four in each of six rounds via a stranger matching protocol. After the final round, participants completed a short demographic and strategy questionnaire. Payouts consisted of a show-up fee and the payoff from one randomly selected experimental round. All payments were made individually and in private. Average earnings were approximately 10.75 Euros.

Data

A total of 88 participants were recruited through the KD2Lab at the Karlsruhe Institute of Technology (KIT) and randomly assigned to one of two conditions: a mean rule condition ($n = 44$) and a median rule condition ($n = 44$). Participants were predominantly students in engineering disciplines, with a mean age between 21 and 25 years. The gender distribution in the sample was balanced. Participants' familiarity with game theory was average, and their knowledge of the Nash equilibrium concept was approximately evenly distributed between those who were familiar with it and those who were not, with some participants unsure of the concept (see Table 4.1).

Table 4.1: Participant Demographics

Category	Characteristic	N / Description
Treatment Condition	Mean Rule	44
	Median Rule	44
	Total Individuals	**88**
Age	Mean Age Range (years)	21–25
Gender	Gender Distribution	Balanced
Field of Study	Predominantly Engineering	–
Knowledge of Nash Equilibrium	Yes	37
	No	38
	Not Sure	9
Game Theory Knowledge	Self-Assessed Mean	Average

4.5 Findings

Participation Across All Peak Distributions

Table 4.2 presents the participation rates for all six peak distributions under both aggregation rules (mean and median). Participation is reported in percentages and absolute frequencies (out of 44), alongside statistical significance of differences using Wilcoxon signed-rank tests.

Across all distributions except for Distribution 6, full participation is the unique equilibrium strategy. Observed participation rates, however, systematically fall short of this prediction. Participation was generally high, often exceeding 70% , but rarely reached full participation as an outcome. The shortfall was particularly pronounced at extreme peak values (e.g., peaks 5 and 95), whereas participation was consistently higher at central or moderate peaks (e.g., peaks 30, 35, 65, 70). This pattern suggests that participants were sensitive to the strategic relevance or perceived pivotality of their position, even if they did not follow equilibrium logic strictly. Differences between the voting rules were generally modest. However, three peaks reached statistically significant differences in participation at the 10% level: peak 90 in Distribution 1, and peaks 30 and 70 in Distribution 3. In each case, participation was higher under the median rule. This finding fits the perception that participants view the median rule as more robust in distributions with central peaks. The results for Distribution 6 stand in contrast. Here, equilibrium predicts participation only for the unique peak (exactly for 25), yet observed participation exceeded this prediction across the peak values. This overparticipation suggests that participants either did not find the strategic incentives convincing or followed heuristics based on fairness or group inclusion. Figure 4.7 illustrates these patterns, showing participation rates for each peak across all distributions and rules. Asterisks (*) mark statistically significant

Table 4.2: Participation Levels Across Peak Distributions

Distribution	Peak	Median Rule	Mean Rule	Significance
1	5	47.7% (21 of 44)	45.5% (20 of 44)	n.s.
	10	75.0% (33 of 44)	81.8% (36 of 44)	n.s.
	90	77.3% (34 of 44)	90.9% (40 of 44)	$p < 0.1$
	95	50.0% (22 of 44)	52.2% (23 of 44)	n.s.
	All	62.5% (110 of 176)	67.6% (119 of 176)	n.s.
2	5	52.2% (23 of 44)	52.2% (23 of 44)	n.s.
	30	88.6% (39 of 44)	79.5% (35 of 44)	n.s.
	70	86.4% (38 of 44)	79.5% (35 of 44)	n.s.
	95	56.8% (25 of 44)	56.8% (25 of 44)	n.s.
	All	71.0% (125 of 176)	67.0% (118 of 176)	n.s.
3	35	63.6% (28 of 44)	70.5% (31 of 44)	n.s.
	30	93.2% (41 of 44)	70.5% (31 of 44)	$p < 0.1$
	70	93.2% (41 of 44)	68.1% (30 of 44)	$p < 0.1$
	75	68.1% (30 of 44)	72.7% (32 of 44)	n.s.
	All	79.5% (140 of 176)	70.5% (124 of 176)	n.s.
4	5	56.8% (25 of 44)	63.6% (28 of 44)	n.s.
	10	79.5% (35 of 44)	77.3% (34 of 44)	n.s.
	65	88.6% (39 of 44)	86.4% (38 of 44)	n.s.
	70	72.7% (32 of 44)	84.1% (37 of 44)	n.s.
	All	74.4% (131 of 176)	77.8% (137 of 176)	n.s.
5	30	75.0% (33 of 44)	84.0% (37 of 44)	n.s.
	35	86.3% (38 of 44)	88.6% (39 of 44)	n.s.
	90	72.7% (32 of 44)	81.8% (36 of 44)	n.s.
	95	59.0% (26 of 44)	68.1% (30 of 44)	n.s.
	All	73.2% (129 of 176)	80.6% (142 of 176)	n.s.
6	5	70.5% (31 of 44)	77.3% (34 of 44)	n.s.
	7	70.5% (31 of 44)	77.3% (34 of 44)	n.s.
	10	70.5% (31 of 44)	68.2% (30 of 44)	n.s.
	25	68.1% (30 of 44)	81.8% (36 of 44)	n.s.
	All	69.8% (123 of 176)	76.1% (134 of 176)	n.s.

rule differences at the $p < 0.1$ level.
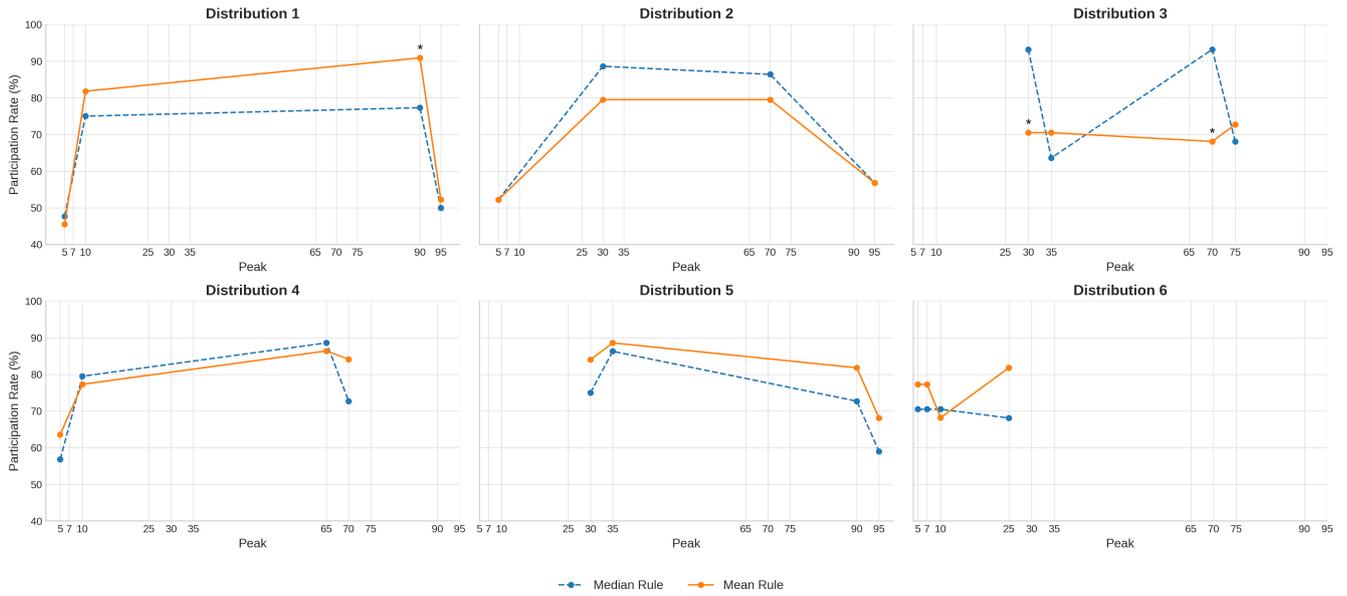
Figure 4.7: Participation rates across peaks for each distribution under Median and Mean aggregation rules. Asterisks (*) indicate statistically significant differences at $p < 0.1$.

In sum, the findings on the participation decision show deviations from equilibrium predictions. While most participants did not play equilibrium strategies for the whole task, their behavior reveals a boundedly rational responsiveness, e.g., preferring center peaks over extremes.

Strategic Voting Behavior

This section examines whether participants who chose to participate in the election behaved following Nash equilibrium strategies, incentivized by their peak in the round-specific distribution, and assumptions about the behavior of others. A vote was classified as strategically rational if it corresponded to the equilibrium action under the respective aggregation rule. This provides a behavioral measure of participants' ability to engage in strategic reasoning within different institutional contexts.

Figure 4.8 illustrates the proportion of votes that aligned with Nash equilibrium strategies under the median and mean aggregation rules. Under the median rule, 55.8% of participants in pivotal positions, those whose vote could change the outcome, selected the equilibrium-consistent action. When extending the analysis to all voting participants under the median rule, the share of equilibrium-consistent choices declines to 35.6%. This suggests that strategic voting was more prevalent among participants with clear incentives to reason about their influence on the group decision, such as pivotality.

Under the mean rule, 61.2% of participants acted in line with equilibrium predictions. Each vote contributes equally to the group outcome, regardless of others' behavior. This uniformity simplifies the decision space, making the equilibrium strategy more transparent and easier to detect. As a result, a higher proportion of participants may have

converged on equilibrium-consistent behavior. This is due not necessarily through sophisticated reasoning, but because the equilibria were more cognitively accessible through, e.g., heuristics.
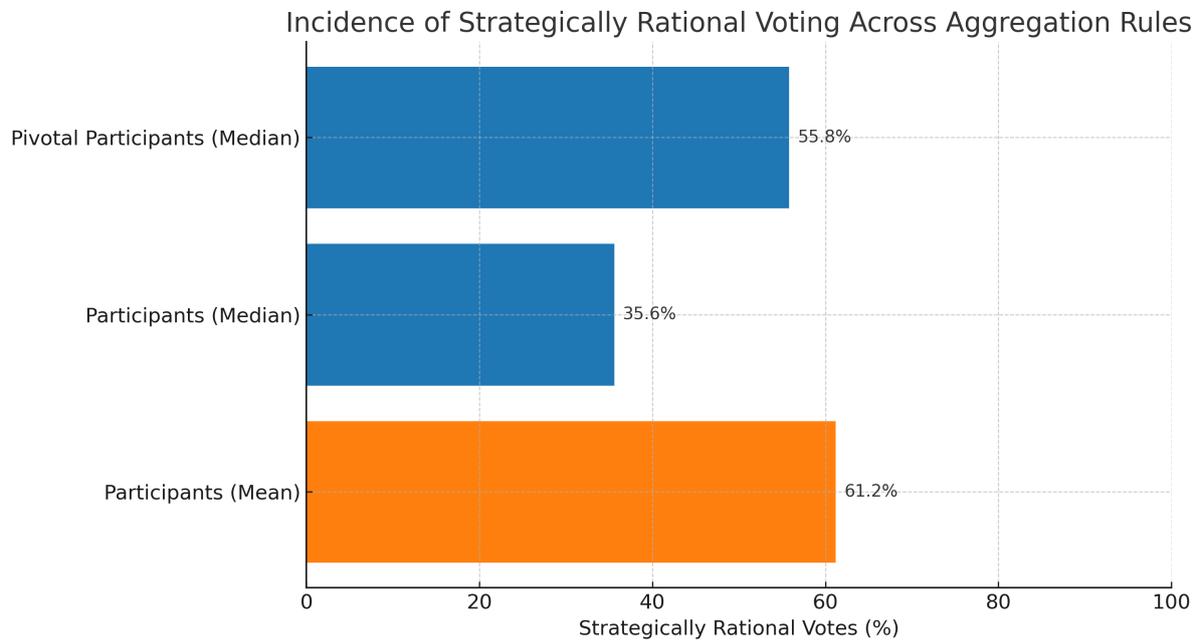
Figure 4.8: Incidence of strategically rational voting across aggregation rules. Bars show the share of participants whose vote aligned with a Nash equilibrium strategy under the respective rule. Strategic alignment was higher among pivotal participants under the median rule, and overall under the mean rule.

These findings highlight how the structure of the aggregation rule shaped participants' propensity to engage in equilibrium-consistent behavior, particularly through its influence on the salience and cognitive accessibility of individual pivotality.

Rational Expected Outcome

After each group decision, we asked all participants to state what they expected the election outcome to be, based on the peak distribution realized in their group and the actual participation decisions. This prediction task was not incentivized and served to assess participants' strategic understanding of how outcomes emerge under different aggregation rules.

Figure 4.9 shows participants' accuracy in predicting the rational expected outcome under each aggregation rule. While overall accuracy was relatively low under the mean rule (29.2% across all participants), participants under the median rule demonstrated substantially higher predictive accuracy (52.3%). Among pivotal participants, those whose input could influence the outcome, accuracy increased under the median rule to 87.5%. This suggests that participants were better able to internalize and anticipate collective de-

Accuracy of Rational Expected Outcome Predictions
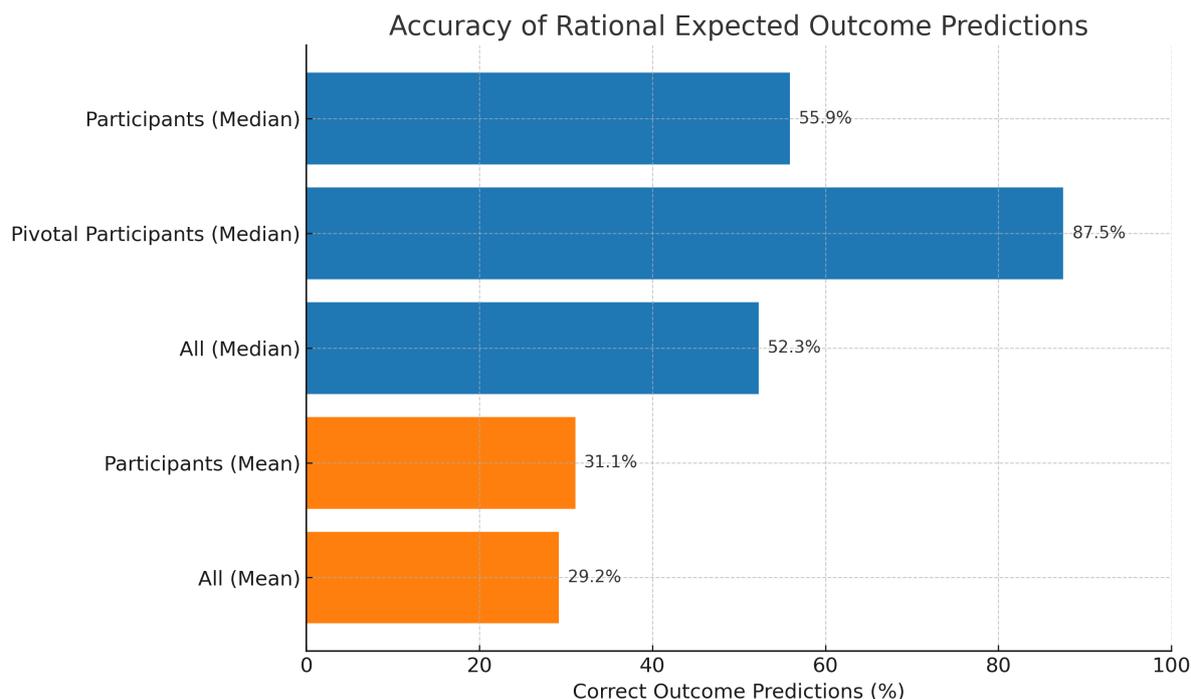
Figure 4.9: Accuracy of rational expected outcome predictions across participant types and aggregation rules. Bars show the proportion of participants who correctly anticipated the group outcome. Median rule participants, especially pivotal voters, are substantially more accurate than those under the mean rule.

cisions under the median rule, possibly due to its more intuitive structure and robustness to outliers.

Controls: Cognition and Risk Preferences

We used the Rational–Experiential Inventory (REI), a validated psychometric instrument that measures individuals' reliance on rational (analytic, deliberate) versus experiential (intuitive, affective) thinking (Pacini and Epstein, 1999) (see Appendix C.6). Across both experimental conditions, mean and median rule, participants exhibited moderately high scores on both the Rational Scale (RS) and the Experiential Scale (ES), suggesting a balanced profile on cognition.

An independent samples t-test revealed no significant differences in RS or ES scores between the mean rule treatment and the median rule treatment. This finding was supported by non-parametric Mann–Whitney U tests. These results indicate that participants' self-reported cognition patterns did not vary across the treatments. We can rule out that cognition is a confounding factor in treatment effects.

We collected individual risk preferences using the Holt–Laury multiple price list task (Holt and Laury, 2002) (see Appendix C.5). Statistical analysis confirmed that the average switching point across both treatment conditions corresponded closely to the risk-neutral benchmark. This suggests that participants, on average, showed behavior consistent with

risk neutrality. Furthermore, there were no significant differences in switching behavior between the mean rule and median rule treatments. This suggests that risk preferences were balanced and did not vary across the treatments. Thus, this finding was supported by non-parametric Mann–Whitney U tests.

4.6   Discussion

This section contains an evaluation of the hypotheses and a discussion of possible explanations and shortcomings. We acknowledge the limitation of a small number of observations, which could explain some null results. While effect sizes should be interpreted with caution, the observed trends suggest pathways for further research.

Evaluation of Hypotheses

Based on the data from both decision stages, participation and voting, and participants' predictive accuracy, we evaluate our five hypotheses (H1–H5) below.

H1: Participants play Nash equilibrium strategies in the game's second stage. This hypothesis receives partial support. Participants demonstrated a substantial degree of equilibrium-consistent behavior in the second-stage voting task, particularly under the symmetric median rule. Among pivotal participants, 55.8% voted in line with their Nash strategy, and even under the mean rule, 61.2% of participants did so. While these rates reflect improved strategic engagement compared to the pilot study, the lack of near-complete adherence, especially among non-pivotal participants under the median rule, indicates that bounded rationality continues to shape behavior.

H2: Participants play Nash equilibrium strategies across the entire game. This hypothesis is only weakly supported. First-stage participation rates fall significantly short of the full participation equilibrium predicted in distributions 1 through 5. For instance, in Distribution 1, only 69.6% (median rule) and 67.6% (mean rule) of participants chose to enter. These deviations suggest that while some strategic insight exists, participants do not consistently apply equilibrium reasoning across both stages of the game.

H3: Equilibrium strategies are more frequently played when the equilibrium implies full participation.   This hypothesis is strongly supported. Participation levels are systematically higher in distributions where the equilibrium prescribes full participation (Distributions 1–5) than in Distribution 6, where partial abstention is the equilibrium strategy. This pattern is robust across both aggregation rules, suggesting that full participation equilibria are more cognitively accessible or align with normative expectations.

H4: The decision rule (mean vs. symmetric median) does not significantly affect equilibrium play. This hypothesis is only partially supported. While participation rates are broadly similar across the two rules, significant differences arise in second-stage behavior. Under the median rule, pivotal participants achieved notably higher accuracy in predicting outcomes and exhibited more strategic voting. These results point to an effect of the rule structure on strategic accessibility, which challenges the assumption of behavioral equivalence between rules.

H5: The participation level per peak is lower for more extreme peaks. This hypothesis is strongly supported. Across most distributions, an inverse-U shaped relationship emerges between extremity and participation: moderate peaks (e.g., 50–70) show the highest entry rates, while extreme peaks (e.g., 5 and 95) are associated with significantly lower participation. This finding suggests that extreme participants may feel strategically marginalized or anticipate lower influence, contradicting standard predictions from rational turnout theory.

Table 4.3: Summary of Hypothesis Evaluation

Hypothesis	Support	Summary Justification
H1: Second-stage equilibrium play	Partial	Pivotal participants and participants under the mean rule show moderate alignment with Nash voting strategies.
H2: Full-game equilibrium play	Weak	Participation in the first stage often deviates from equilibrium, indicating incomplete strategic reasoning across stages.
H3: Higher adherence when equilibrium implies full participation	Strong	Participation is reliably higher when the equilibrium strategy involves full participation, especially in Distributions 1–5.
H4: No rule effect	Partial refutation	Participation is similar across rules, but second-stage strategic behavior and outcome prediction differ by rule.
H5: Lower participation for extreme peaks	Strong	An inverse-U pattern emerges: participants with moderate peaks enter more often than those with extreme peaks.

Our results reveal a consistent pattern of partial yet strategic participation across distributions. We found short-fallings of consistent strategic decision-making, while game-theoretic models predict full participation in all but one distribution (Distribution 6). This deviation aligns with findings on bounded rationality in strategic decision-making (Simon, 1997).

Generally, participation was high, oftentimes exceeding 70%. We rarely detected full participation, particularly at extreme peaks (e.g., 5 and 95). This suggests participants

may have perceived a lower probability of being pivotal when their peak was far from the center (Fischbacher et al., 2001; Goeree and Holt, 2001). Conversely, participation was highest at central peaks (e.g., 30, 35, 65, 70). This could be interpreted as a sensitivity to strategic salience rather than strict equilibrium logic. Such behavior is consistent with bounded rationality and level-k reasoning, where individuals anticipate others' actions only to a limited extent (Nagel, 1995; Crawford and Iriberri, 2007). Differences across aggregation rules were modest, but some central peaks showed higher participation under the median rule. This may reflect a perception of the median as a fairer or more robust mechanism. Distribution 6 showed significant overparticipation, even though only one peak supports equilibrium play. This may indicate fairness norms or cooperative heuristics overriding payoff-maximizing logic (Fehr and Schmidt, 2001; Charness and Rabin, 2000). Participants exhibited more equilibrium-consistent behavior under the mean rule, likely due to its linear and transparent structure. It simplifies the strategic decision space. These findings seem to be in contrast to decisions in the median rule treatment. Pivotality may be obscured, especially for the participants in non-central peak positions. This aligns with cognitive hierarchy models, where individuals adopt heuristics when strategic reasoning becomes complex (Simon, 1957; Nagel, 1995; Charness and Rabin, 2000; Chong et al., 2016). The stronger response to central rather than extreme peaks suggests behavior was guided by perceived influence rather than optimization. Participants could have relied on their intuition about when their vote "mattered". This could explain why they are using cues like peak centrality as proxies for strategic relevance. This is shown in theories on bounded rationality and heuristic reasoning (Gigerenzer and Selten, 2002; Chong et al., 2016), as well as findings on perceived pivotality in public goods and voting contexts (Feddersen and Pesendorfer, 1996; Tyran and Feld, 2006).

The observed behavioral patterns can be partly explained by differences in rule sensitivity: how strongly an aggregation rule responds to individual votes. As a reminder, the mean rule is highly sensitive to every vote. Extreme voting highly influences the outcome by pulling the average in their direction. This creates an incentive for outliers to participate. They anticipate that their vote will meaningfully shift the outcome in their favor. This is not true in the median treatment, where central voters determine the outcome. Voters with extreme peaks may therefore perceive themselves as non-pivotal and opt out. This distinction helps explain why we observe higher turnout at central peaks under the median rule, and elevated participation at extreme peaks under the mean rule.

Further evidence of bounded strategic behavior emerges when examining how participation varied with peak position and aggregation rule. As visualized in Figure 4.10, participation was highest at central peaks (e.g., 30, 35, 65, 70), consistent with theories of perceived pivotality (Feddersen and Pesendorfer, 1996; Tyran and Feld, 2006). The mean rule treatment showed higher rates of participation (e.g., peak 90 in Distribution 1), suggesting that participants understood how to shift outcomes under a rule sensitive

to outliers.
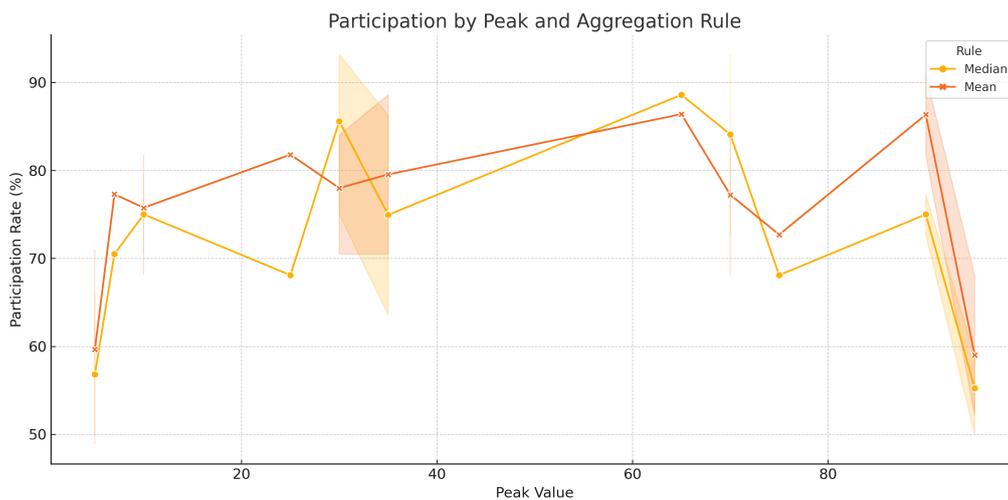
Figure 4.10: While equilibrium predicts full participation in Distributions 1–5 (Müller, 2022), turnout varies with peak position. Participation under the median rule is higher at central peaks, while the mean rule draws more turnout at extremes (e.g., peak 90), consistent with differences in rule sensitivity and perceived influence.

Conversely, the median rule consistently decreased participation at extremes while encouraging turnout at central peaks. This pattern suggests that participants intuitively understood the median rule's robustness to extreme values and may have discounted the efficacy of voting when their preferred outcome was unlikely to be pivotal. These results reflect the cognitive implications of rule sensitivity: the mean rule incentivized strategic pull, whereas the median rule rewards centrality and discourages participation at the edges. Participants appear to adjust their behavior accordingly, not by calculating precise strategic equilibria, but by relying on intuitive heuristics about when their vote is likely to "matter." This complements theories of satisficing and heuristic reasoning in environments with limited cognitive bandwidth (Simon, 1957; Gigerenzer and Selten, 2002; Chong et al., 2016).

4.6.1 Contribution Overview

This study makes several contributions to the literature on strategic voting, bounded rationality in voting, and rules in collective decision-making. First, it provides one of the first controlled experimental tests of sequential voting games under two canonical aggregation rules, the mean and the symmetric median, while holding equilibrium predictions constant. By constructing strategically equivalent environments across rules, we isolate the behavioral impact of aggregation-rule framing and institutional salience.

Second, our findings demonstrate that participants do not uniformly behave according to subgame perfect Nash equilibrium (SPNE) predictions. Instead, their behavior reflects bounded strategic reasoning that is sensitive to perceived pivotality, the installed rules,

and peak extremity (positioning). Participation patterns, particularly the inverse-U shape concerning peak extremity, challenge traditional rational turnout models and support cognitive theories of participation based on perceived influence and heuristic salience.

Third, we show that the mean and median rules differ in their cognitive accessibility and strategic transparency. Participants were more likely to vote strategically under the mean rule. This suggests it may lower reasoning efforts to strategic behavior. Conversely, the median rule facilitated more accurate outcome predictions among pivotal voters. This indicates that different aggregation rules may support different competencies to detect strategies.

4.6.2   Future Implications for Research

Our findings open several promising avenues for future experimental and theoretical research. First, they suggest that rule complexity and cognitive load interact in meaningful ways. They influence the extent to which participants can recognize equilibrium strategies. Future work should examine how simplifying mechanisms (e.g., visual aids, real-time feedback) or learning across rounds affect strategic behavior in sequential voting environments.

Further, extending the experiment to settings with communication, deliberation, or social identity cues could reveal how group dynamics shape turnout and strategic voting. For instance, allowing pre-vote deliberation or peer signaling may shift participation thresholds or induce coalition behavior, especially under rules that condition outcome sensitivity on group composition.

Finally, the overparticipation observed in Distribution 6 points to the relevance of social norms. Fairness heuristics may drive participation in settings where strategic abstention is optimal. Future studies should explore how these drivers of participation interact with formal incentives, especially in public goods, participatory budgeting, or collective governance contexts.

4.7   Conclusion

This chapter offers a controlled test of strategic behavior in sequential voting games with costly participation under two aggregation rules. By constructing strategically equivalent peak distributions under both the median and mean rules, we isolate the behavioral consequences of aggregation-rule framing. Our findings contribute to the theoretical and experimental literature on voting and mechanism design, providing new evidence on how individuals engage with collective decision rules when faced with strategic trade-offs and limited cognitive capacity. Consistent with prior evidence in behavioral economics, behavior diverges from equilibrium predictions. First-stage participation falls short of full-

participation equilibria, especially for individuals with extreme peaks. This contradicts models of rational turnout and supports the growing literature on level-k reasoning and bounded strategic sophistication (Nagel, 1995; Crawford and Iriberri, 2007). Notably, we observe that rule sensitivity plays a key role in shaping behavior: the mean rule's responsiveness to extreme inputs encourages strategic turnout, while the median rule's robustness to outliers promotes central participation and discourages strategic distortion. Second-stage voting aligns more closely with equilibrium play under the mean rule, likely due to its linear and transparent structure. The median rule, by contrast, appears to facilitate better outcome prediction among pivotal voters, but also imposes higher cognitive demands on those at the extremes. These asymmetries highlight that formally equivalent mechanisms may differ significantly in their cognitive accessibility and behavioral implications. Our study complements earlier work on costly voting (e.g., (Levine and Palfrey, 2007; Agranov et al., 2018)) and mechanism robustness under strategic uncertainty. Future work could explore how communication, learning, or endogenous group formation shape behavior in similar environments. Moreover, applications to public good allocation, participatory budgeting, and deliberative processes offer fertile ground for testing the external validity of our findings.

Chapter 5

Boosting Deliberation

We investigate the effect of deliberation and unanimous decision-making on donation. In addition, we assess the effects of Mental Contrasting with Implementation Intentions (MCII), a self-regulation intervention, on this task. In a preregistered experiment, 396 participants participated in a three-stage donation task involving organizations related to abortion rights. Participants were randomly assigned to a control group, a standard MCII treatment with a self-defined goal, or an MCII treatment with a predefined consensus-oriented goal. Results show that while group deliberation itself led to more moderate and consensual decisions, the MCII interventions had limited additional effects on vote change or donation preference stability. However, participants in the MCII treatment, especially those with a predefined goal, wrote longer messages and used a more positive language. This suggests that reflective goal setting impacts deliberation. The findings contribute to research on behavioral interventions in small-group decision contexts. We highlight both the potential and the limitations of self-regulation interventions in morally sensitive group settings.

5.1   Introduction

This explorative study investigates deliberation on donation decisions and the support of the engagement by intervening with a well-studied motivation strategy. We focus on Mental Contrasting with Implementation Intentions (MCII). The intervention fosters individuals to commit to their goals and prepare for obstacles. MCII combines visualization of desired outcomes with a specific if-then planning technique to anticipate challenges in reaching goals. Research suggests that MCII enhances goal pursuit in several domains on an individual level (e.g., academic careers, behavioral change) (Oettingen et al., 2010; Kappes et al., 2012; Bartholomeyczik et al., 2024). However, little is known about its application in group decision-making, especially when the issue is attitude-charged and polarized. We test the effects of deliberation and MCII in a controlled experiment on a donation allocation task. Participants make donation decisions on which organizations

should be supported, with very polarizing positions on abortion rights. The task unfolds in three stages: First, a solely deliberation group (control group). Second, a standardized MCII treatment was used before the group decision to allow participants to define their own process goal. Third, a modified MCII treatment, where we offer a predefined goal that emphasizes deliberative goals (Barabas, 2004; Bächtiger et al., 2018; Fishkin, 2019). We assess pre- and post-deliberation and voting preferences individually in a three-round donation task. This design allows us to test whether intervening in the process with self-reflection and action proposals boosts engagement upon several indications, such as sentiment and frequency. We use the unanimous rule as a prerequisite for consensus building. Additionally, we test whether the intervention and group decisions impact individual votes.

We find that MCII modestly impacts the involvement of the participants, boosting longer, more elaborate, and affected contributions in deliberation. However, its influence on decision-making and learning is limited. The findings show potential pathways for future research on group-level interventions.

This chapter is organized as follows. Section 5.2 reviews literature on participation in deliberation and summarizes research on MCII. Section 5.3 outlines the experimental design, including procedures, treatment, and measurement strategy. Section 5.4 presents the empirical findings on, e.g., decision change, deliberation behavior, such as sentiment. Section 5.5 discusses the implications of the findings to the literature, and Section 5.6 concludes and elaborates open questions for future research.

5.2   Background Literature

5.2.1   Challenges and Conditions for Effective Deliberation

While deliberation provides potential pathways to more informed and inclusive decision-making, the effects on voting are mixed. If well-designed, deliberation can foster cooperation, mutual understanding, and attitude change (Dryzek and List, 2003; Gastil et al., 2008). Participants of deliberative procedures report richer reasoning, learning, and a greater willingness to compromise in moderated settings (List et al., 2013). However, these benefits are not guaranteed.

Several studies have shown that deliberation may also move attitudes towards extremes, which fosters polarization. Particularly, when groups are like-minded and participate in enclave deliberation, or are additionally emotionally invested in the issue at stake. In such cases, participants may selectively process information and reproduce preexisting beliefs, forming echo chambers (Sunstein, 2002; Schkade et al., 2010). Group deliberation may activate identity-protective cognition. This might lead participants to ignore opposing viewpoints or participate in herding behavior (Schkade et al., 2007). Moreover,

deliberation in online or anonymous contexts poses added risks for bubble formations. As social cues are weakened and the feeling of responsibility reduces, attitudinal diversity is under threat.

These mixed findings suggest that effective deliberation depends on both structural and psychological considerations. Mixed-minded group composition and clearly defined procedures help mitigate dominance and echo chamber dynamics (Lindell et al., 2017; Strandberg et al., 2019). Participants should be motivated and equipped to engage reflectively and constructively in an open-minded setting. This calls for behavioral interventions that prepare participants of involvement projects for the demands that deliberation might initiate, especially in polarized salient settings.

5.2.2 Mental Contrasting with Implementation Intentions as a Preparatory Intervention

We want to address these challenges by introducing self-regulation to the deliberative process, namely Mental Contrasting with Implementation Intentions (MCII). MCII is an intervention developed from two methods that combine mental contrasting and if-then planning. The aim is to strengthen commitment to goals and resilience. It was developed for individual goal striving. Robust effects were found in several domains, ranging from health to work-related tasks (Oettingen and Stephens, 2009; Oettingen et al., 2010; Bartholomeyczik et al., 2024). In group-related tasks, Kirk et al. (2013) found that negotiation outcomes performed better when MCII was applied.

Mental contrasting has the property to help individuals vividly imagine a desired future and then reflect on the obstacles that may hinder the desire from coming true. The combination of imagined desires and obstacles fosters an understanding of what needs to be done to overcome them. By doing so, the likelihood of forming realistic and committed plans increases. MC unfolds its impact when individuals expect success and therefore increase goal pursuit by engaging subconsciously in goal-relevant behavior (Oettingen, 2012).

Implementation intentions further conceptualize the goal-relevant behavior. It helps to link the anticipated obstacle to concrete responses. The if-then format of the strategy provides individuals with a clear action plan for when the obstacle arises. Already developed if-then plans strengthen cue responses in difficult, obstacle-related situations (Gollwitzer and Sheeran, 2006). Taken together, these strategies support sustained effort even while experiencing pressure or distraction. Nonetheless, MCII was not primarily conceptualized for group-related tasks. Its efficacy depends on intrinsic goal commitment and a corresponding well-defined action plan. In deliberative settings, participants face unfamiliar group dynamics due to the ad hoc nature of the processes. Limited information on other members and uncertainty of own capability might constitute challenges to

meaningful contributions. Without this adaptation, we exploratively use MCII to set a baseline for the integration of interventions into these kinds of procedures.

5.2.3   Designing MCII for Group Deliberation

To investigate whether MCII can be effectively applied to democratic decision making, we designed an experiment in which participants deliberated in small groups on how to allocate a donation across organizations with opposing positions on abortion. This morally charged topic was chosen to gain strong priors and potential disagreement. Before deliberation, participants were randomly assigned to one of three conditions: no intervention (control), a standard MCII exercise with a self-defined wish, or an MCII condition with a predefined wish focused on contributing to a fair and thoughtful group decision.

This design tests two core hypotheses. First, we examine whether MCII, especially in its standard form, can enhance individuals' motivation to engage deliberatively by prompting reflection on internal goals and anticipated obstacles. Second, we assess whether a predefined, shared goal can scaffold this process and support group-level cooperation. The predefined wish anchors the MCII process in a shared value. This potentially makes the plan more applicable to the dynamic setting of deliberation.

We build our design on work by Kirk et al. (2013). The authors applied MCII in bilateral negotiations. However, our contexts differ on crucial points. Deliberation is not about persuasion, but rather mutual understanding and openness to learn. Moreover, group members are strangers, and the task requires consensus, not compromise. Therefore, we chose to include a third compromising organization to offer participants a compromise and not depend on persuasion in such a polarized decision space.

The study contributes to an understudied literature strand on interventions in participatory settings. The study offers insights into the design implications of self-regulation strategies.

5.3   Study Procedure and Task

This research procedure was approved by the Institutional Review Board (IRB) of the Karlsruhe Institute of Technology (KIT) and complies with ethical standards for human subjects research. We preregistered research questions and methods. We asked participants to complete a three-round donation decision task, which we implemented in oTree (Chen et al., 2016). Data collection was conducted via Prolific.

The task was designed to investigate individual and group decision-making in the context of a morally and politically polarized issue in the U.S.: abortion. We used a context with real-life moral weight to respond to the current interest in developing interventions that increase learning abilities and potentially even reduce polarized discourse (Gollwitzer

and Sheeran, 2006). It is crucial to use an emotionally salient topic to test MCII in group decision-making. We expect this topic to activate personal beliefs and responses, which leads to goal setting and obstacle definition being meaningful. Thus, fulfilling core components of MCII. Oettingen and Gollwitzer (2011) emphasize that the effectiveness of MCII depends on individuals vividly imagining desired outcomes and realistically contrasting them with internal or external obstacles. Furthermore, participants should be emotionally invested in the context as a prerequisite for MCII to facilitate behavioral change. In the first round, participants make an individual donation decision. The donation is a 5-dollar amount that needs to be allocated to one of three organizations (two of them abortion rights-related). Therefore, we decided to take the most prominent opponent organizations for the task: Pro-Choice and Pro-Life. To provide a non-related, but woman-targeted alternative organization, we decided to include Girls Who Code, which focuses on educating girls in IT-related tasks. This decision was made to ensure that engagement has a tangible impact in reality. In the second round, participants were randomly assigned to one of three experimental conditions: a control condition, a standard mental contrasting with implementation intentions (MCII) condition with a self-defined wish, or a predefined MCII condition centered on cooperation and fair group decision-making. We chose a wish closely related to the literature on deliberative democracy: "I want to contribute to a fair and thoughtful group decision." Participants were then digitally placed in chat rooms and asked to deliberate via synchronous text-based chat to reach a unanimous decision on the same donation allocation task. The group decision was only implemented if full consensus was reached. In the third round, participants made a second individual donation decision. The first and third are identical except that the third round is hypothetical. It serves to assess potential changes in individual votes following group deliberation. Following the task, participants complete our survey on demographics and other controls. The Social Comparison Scale (Schneider and Schupp, 2011) (see Appendix C.3) and the Ambivalent Sexism Inventory (ASI) (Glick and Fiske, 2018) (see Appendix C.7) provide additional control variables relevant to the issue.
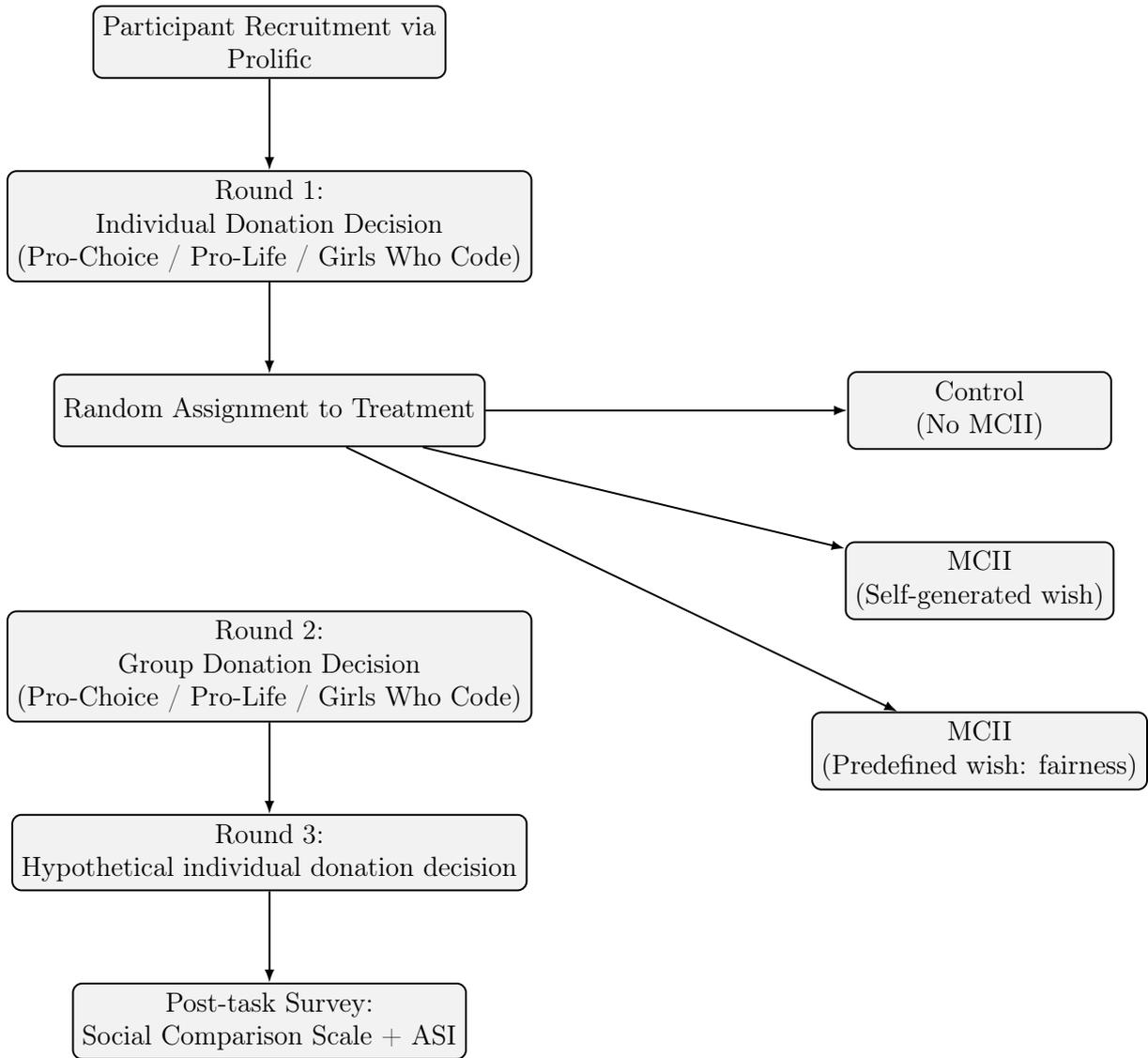
Figure 5.1: Workflow of Three-Round Experimental Design Including MCII Conditions and Post-Task Survey

5.4   Findings

5.4.1   Data and Summary Statistics

A total of 396 U.S. participants were recruited through Prolific and randomly assigned to one of three conditions: MCII with a self-defined wish ($n = 128$), MCII with a predefined, deliberation-value wish ($n = 135$), and a control condition ($n = 133$). The average age of the participants was 41.75 years, and the sample consisted of approximately 212 female participants. Ninety-one participants held a Master's degree or higher. In terms of political affiliation, the sample consisted of 161 Republicans, 167 Democrats, 103 Independents, and 7 participants who identified with another affiliation (see Table 5.1).

The sample is generally well balanced across our demographic variables. The mean

Table 5.1: Participant Demographics (Main Study)

Category	Characteristic	N / Mean
Treatment/Control	MCII (self-generated wish)	128
	MCII (predefined wish)	135
	Control	133
	Total Participants	396
Age	Mean Age (years)	41.75
Gender	Female Participants	212
Education	Master's Degree or Higher	91
Party Affiliation	Republican	161
	Democrat	167
	Independent	103
	Other	7

age ranged from 40.2 to 42.7 years, and the proportion of female participants was approximately 53 per cent across all groups. While some variation was observed in political affiliation and education, with a slightly higher proportion of participants holding a Master's degree or higher in the predefined wish group, no substantial imbalances were evident.

To assess whether the random assignment produced equivalent groups across the demographic variables, we conducted a series of balance checks. We are using the `CreateTableOne()` function from the `tableone` package in R. Standardized mean differences (SMDs) were below the conventional threshold of 0.3 for all variables except education (SMD = 0.29), indicating acceptable balance. No statistically significant differences were detected between groups for age ($p = .222$), gender ($p = .686$), political affiliation ($p = .607$), or education ($p = .074$). These results suggest that the randomization successfully yielded comparable groups across measured covariates (see Appendix B.7).

5.4.2 Decision Preferences Across Treatments and Rounds

Here, we present how participants' decision preferences varied across treatments and rounds. Table 5.2 reports the distribution of organization choices across the three decision-making rounds for each treatment condition. Across all treatments and rounds, Girls Who Code was the most frequently selected organization, particularly in Round 2, where its selection peaked (e.g., 57.9 percent in Control, 59.4 percent in MCII, and 58.5 percent in MCII predefined). In the MCII condition, participants showed the strongest initial support for pro-Choice organizations in Round 1 (41.4 percent), which then decreased in subsequent rounds. Pro-Life choices declined steadily across rounds in all conditions. Notably, while MCII (predefined wish condition) and control treatment show a relatively stable voting distribution across rounds, the MCII group exhibited greater variability, potentially reflecting stronger deliberative effects or vote updating across rounds.

Table 5.2: Distribution of Organization Choices by Round and Treatment Group

Treatment	Round	Choice	n	%
Control	Round 1	Girls Who Code	63	47.4
		pro-Choice	33	24.8
		pro-Life	37	27.8
	Round 2	Girls Who Code	77	57.9
		pro-Choice	33	24.8
		pro-Life	23	17.3
	Round 3	Girls Who Code	65	48.9
		pro-Choice	40	30.1
		pro-Life	28	21.1
MCII	Round 1	Girls Who Code	45	35.2
		pro-Choice	53	41.4
		pro-Life	30	23.4
	Round 2	Girls Who Code	76	59.4
		pro-Choice	38	29.7
		pro-Life	14	10.9
	Round 3	Girls Who Code	52	40.6
		pro-Choice	52	40.6
		pro-Life	24	18.8
MCII predefined	Round 1	Girls Who Code	64	47.4
		pro-Choice	34	25.2
		pro-Life	37	27.4
	Round 2	Girls Who Code	79	58.5
		pro-Choice	32	23.7
		pro-Life	24	17.8
	Round 3	Girls Who Code	75	55.6
		pro-Choice	34	25.2
		pro-Life	26	19.3
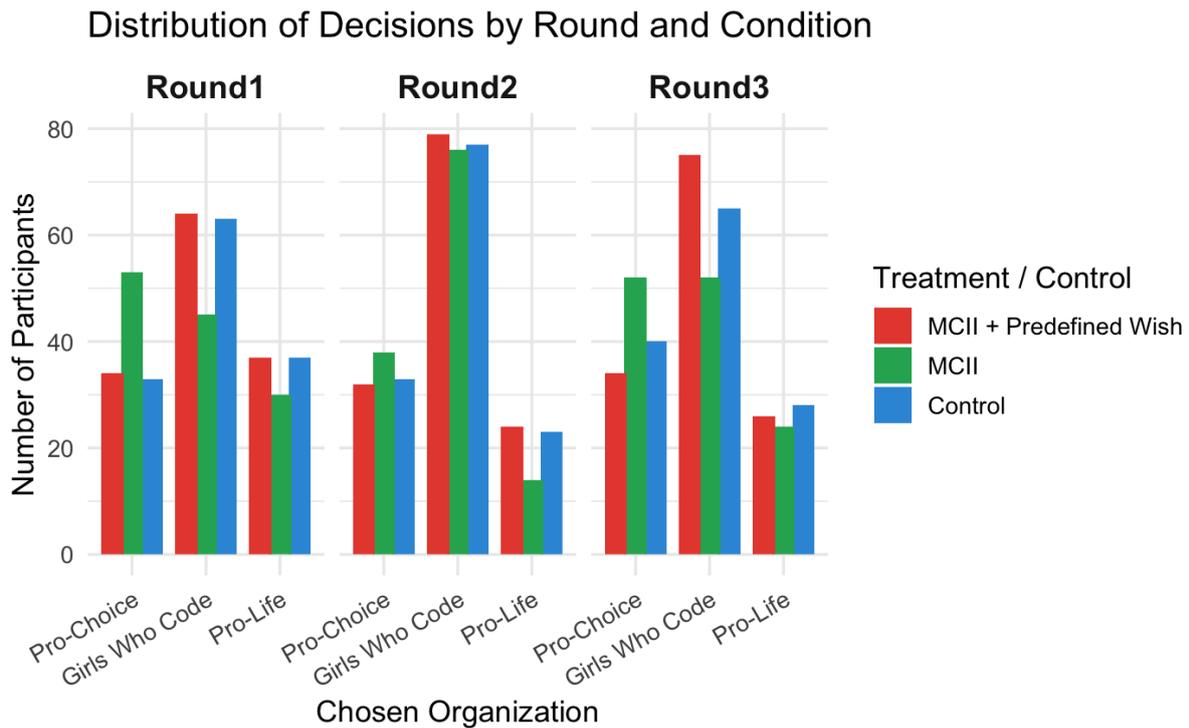
Figure 5.2: Distribution of donation choices by round and treatment condition. Bars represent the number of participants who selected each organization (Pro-Choice, Girls Who Code, or Pro-Life) across the three rounds and treatment groups.

Figure 5.2 shows participants' donation choices across three rounds, disaggregated by treatment condition. In all groups, the proportion of participants choosing Girls Who Code increased notably from Round 1 to Round 2, where deliberation and voting were introduced. This pattern suggests that deliberation itself may lead participants to converge on less polarizing, consensus-oriented options. Although the MCII conditions display slightly steeper reductions in Pro-Life selections, the overall distributional changes are qualitatively similar across treatments. The final round, framed as a hypothetical individual decision, reflects some reversion or stabilization of votes, with Girls Who Code remaining the most frequently selected organization. These trends indicate that both deliberation and repeated reflection can shift votes, but the treatment effects appear modest at the aggregate level.

Pearson's chi-squared tests were conducted to assess whether donation choices differed significantly across treatment groups within each round. In Round 1, a statistically significant difference between the treatments is found ($\chi^2(4) = 11.26$, $p = .024$). This suggests that initial votes were not fully balanced across treatment groups despite random assignment. By Round 2, following group deliberation, no significant differences were found ($\chi^2(4) = 3.50$, $p = .478$). We see convergence in group choices across all experimental conditions. In Round 3, which reassessed individual votes post-deliberation and voting, the differences between groups approached significance but did not meet conventional

thresholds ($\chi^2(4) = 8.34$, $p = .080$). Together, these results suggest that the deliberation process may have reduced initial disparities in donation preferences. However, only modest treatment effects emerged after the intervention.

Standardized residuals were examined to identify which cell-level deviations contributed to the significant chi-squared result in Round 1. Participants in the MCII condition selected Pro-Choice organizations more often than expected ($z = 3.32$) and Girls Who Code less than expected ($z = -2.30$), indicating a distinct initial voting profile in that group. In contrast, Control and Predefined MCII groups showed no substantial deviations from expected frequencies. In Round 3, residuals approached significance in opposite directions: MCII participants continued to favor Pro-Choice more than expected ($z = 2.60$), while Predefined MCII participants showed higher-than-expected support for Girls Who Code ($z = 2.02$). Although overall treatment effects on choice distributions were modest, the MCII with a predefined fairness-focused wish condition could have encouraged participants to shift toward the consensus-friendly option after deliberation. Taken together, these findings underline the role of deliberation and grouping participants to vote in moderating donation choices, regardless of the intervention. The MCII (predefined wish) intervention may have supported some participants to shift their votes more enduringly. These effects remained modest in comparison to the convergence by deliberation itself. However, we interpret the results with caution. We found significant baseline differences across treatments (R1 decisions), underlining the importance of controlling the data. Analyzing the overall distribution of choices moving modestly after treatment, the individual change patterns remain an open question. Who shifted their vote between rounds, and under what conditions? To better understand the dynamics of attitude change, it is crucial to examine not just where the groups ended up voting, but who moved their vote, and why. In the next section, we take a closer look at individual vote switching behavior before and after group deliberation, followed by a qualitative analysis of the deliberation transcripts. This allows us to explore how participants reasoned about their votes, whether they internalized group norms, and how the MCII intervention may have shaped the content and quality of discourse across treatment conditions.

5.4.3   Vote Change Across Treatments and Donation Groups

To assess whether the MCII intervention influenced participants' willingness to revise their initial vote in the donation task, we measured vote change after deliberation. Figure 5.3 displays the proportion of participants who changed their vote across three experimental conditions, *MCII with predefined wish*, *MCII*, and *Control*, arranged by ideological affiliation: *Girls Who Code*, *Pro Choice*, and *Pro Life*. Participants in the MCII condition show the highest overall rate of vote change, with particularly pronounced effects among Pro Life participants, over 70% of whom changed their vote. The MCII (predefined wish)

condition shows slightly lower change rates, especially among the Girls Who Code cohort. In contrast, participants in the Control condition changed their vote at more modest rates across all ideological groups, ranging from roughly 25% to 40%. To evaluate the statistical significance of these patterns, we conducted several Pearson's chi-squared tests of independence. A full-sample test across all three treatment groups did not reach significance, $\chi^2(2, N = 396) = 3.07$, $p = .215$. The contingency table is shown below:

Table 5.3: Contingency table for vote change by condition

Condition	Changed	Kept	
Control	45	88	[flushleft]
MCII	54	74	
MCII + Predefined Wish	44	91	

Note. Counts shown. Overall Pearson $\chi^2(2, N = 396) = 3.07$, $p = .215$.

We also conducted focused comparisons. Comparing *MCII* with *Control* only, the difference remained non-significant, $\chi^2(1, N = 261) = 1.59$, $p = .207$ (Yates' correction). Among *Pro Life* participants, a three-group comparison showed no significant effect, $\chi^2(2, N = 132) = 3.27$, $p = .195$. A pairwise comparison of *MCII* vs. *Control* among *Pro Life* participants again revealed no significant difference, $\chi^2(1, N = 85) = 2.10$, $p = .147$ (Yates' corrected). Although these differences were not statistically significant, the descriptive trends are noteworthy from a theoretical perspective. In particular, the MCII condition led to a higher proportion of changed voting among participants with more ideologically heated positions (Pro Life participants), suggesting that the self-guided intervention may be more effective than goal priming through predefined wishes. That the same group showed substantially less change in the Control condition underscores this contrast. This pattern aligns with prior work on MCII, which emphasizes the importance of autonomy in goal setting and mental contrasting for overcoming cognitive dissonance and resistance to the process.

To better understand the relationship between treatment condition, initial decision of the particpants, and the likelihood of changing one's vote, we estimated a logistic regression model with interaction terms (Table 5.4). The dependent variable was whether a participant changed their vote (1) or not (0), after group deliberation under a unanimity rule. Compared to participants who chose Girls Who Code in the first round, participants voting for Pro Choice ($\beta = 1.16$, $p = .013$) and especially Pro Life ($\beta = 1.18$, $p = .009$) were significantly more likely to change their vote. However, unanimity requires change, which does not necessarily transfer to long-term persuasion. Importantly, because participants were not forced to reach consensus, vote change under the unanimity rule reflects a voluntary shift rather than mere compliance. This indicates a deliberate choice to facilitate agreement rather than opting out by sticking on initial votes. None of the treatment conditions alone nor their interactions with voting type reached statistical significance.
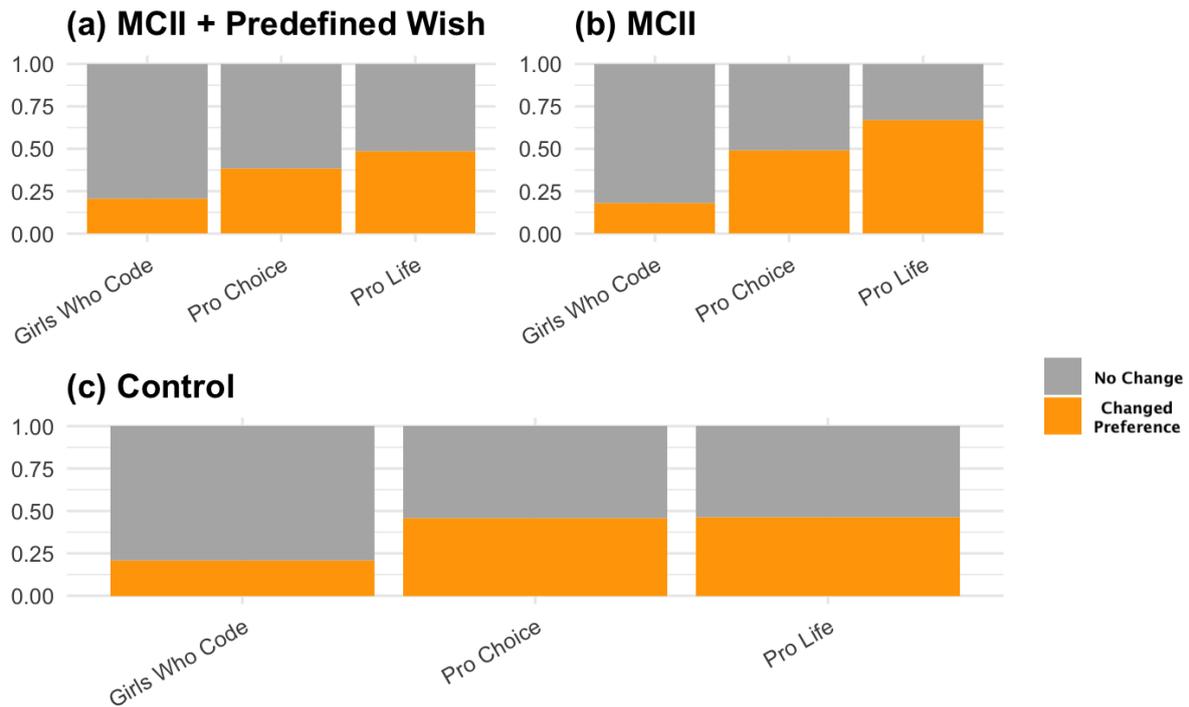
Figure 5.3: Proportion of participants with changed vs. unchanged votes across treatment conditions and ideological affiliations.

Table 5.4: Logistic Regression Predicting Vote Change (MCII × Ideological Affiliation)

Predictor	Estimate	Std. Error	z value	$\Pr(> |z|)$
(Intercept)	-1.3471	0.3113	-4.327	$< .001^{***}$
MCII	-0.1844	0.4990	-0.370	0.712
MCII + Predefined Wish	-0.0198	0.4398	-0.045	0.964
Pro Choice	1.1647	0.4681	2.488	0.013^{*}
Pro Life	1.1845	0.4536	2.611	0.009^{**}
MCII × Pro Choice	0.3290	0.6683	0.492	0.623
MCII + Predefined Wish × Pro Choice	-0.2774	0.6635	-0.418	0.676
MCII × Pro Life	1.0401	0.7126	1.460	0.144
MCII + Predefined Wish × Pro Life	0.1283	0.6407	0.200	0.841

Note: Dependent variable is `changed_vote` (1 = changed, 0 = kept). Reference categories: *Control group, Girls Who Code.*

AIC = 493.54; Null deviance = 518.01 (df = 395); Residual deviance = 475.54 (df = 387); Number of Fisher scoring iterations = 4.

Signif. codes: $^{***}p < .001, ^{**}p < .01, ^{*}p < .05$

However, the interaction between MCII and Pro Life participants was positive and moderately sized ($\beta = 1.04$, $p = .144$), suggesting that this subgroup may have been more inclined to shift votes following the MCII intervention. While not significant, this pattern aligns with our descriptive results (Figure 5.3), in which Pro Life participants showed the highest rate of change under MCII without a predefined wish. Taken together, the regression supports the interpretation that both initial decision and the nature of the intervention condition shape how participants navigate vote change in group settings requiring unanimity. Moreover, MCII may help more strictly positioned participants soften their issue positions in the requirement of unanimous voting. However, these findings are explorative and should be interpreted in the context of this design. Model diagnostics showed an acceptable fit (AIC $= 493.54$ and residual deviance $= 475.54$ on 387 degrees of freedom). We compared individual rounds (Round 1 and Round 3) to assess the stability of individual voting decisions. The third round occurs right after the unanimous group vote is formed. The comparison of the individual rounds allows us to distinguish between strategic rule or norm-driven behavior (as seen between Round 1 and 2) and persuasive voting change based on the deliberation phase. Figure 5.4 shows the proportion of participants who changed their vote from Round 1 to Round 3. Specifically, we break down the data by treatment and individual votes. Overall, long-term change was lower than immediate post-deliberation change. This indicates that some initial changes made during the group phase were not persistent. Nevertheless, persistent vote change remained most pronounced in the MCII + Predefined Wish and MCII groups, particularly among Pro Life participants. In the Control group, changes were generally less frequent across all donation groups.

To test whether these observed differences were statistically significant, we conducted a Pearson's chi-squared test on the Round 1 to Round 3 change data:

Condition	Changed	Kept
Control	31	102
MCII	26	102
MCII + Predefined Wish	34	101

Table 5.5: Number of participants who changed or kept donation vote across conditions.

The differences across conditions were not statistically significant, $\chi^2(2, N = 396) = 0.89$, $p = .640$. These results suggest that while MCII-based interventions may support slightly more durable change descriptively, the treatment effects on voting stability were not robust enough to be distinguished from natural variation in this sample. Importantly, because participants were not required to align with their group's decision and could have simply reverted to their initial individual vote, the Round 3 responses reflect voluntary, individual-level decisions. A persistent change between Round 1 and Round 3 can be
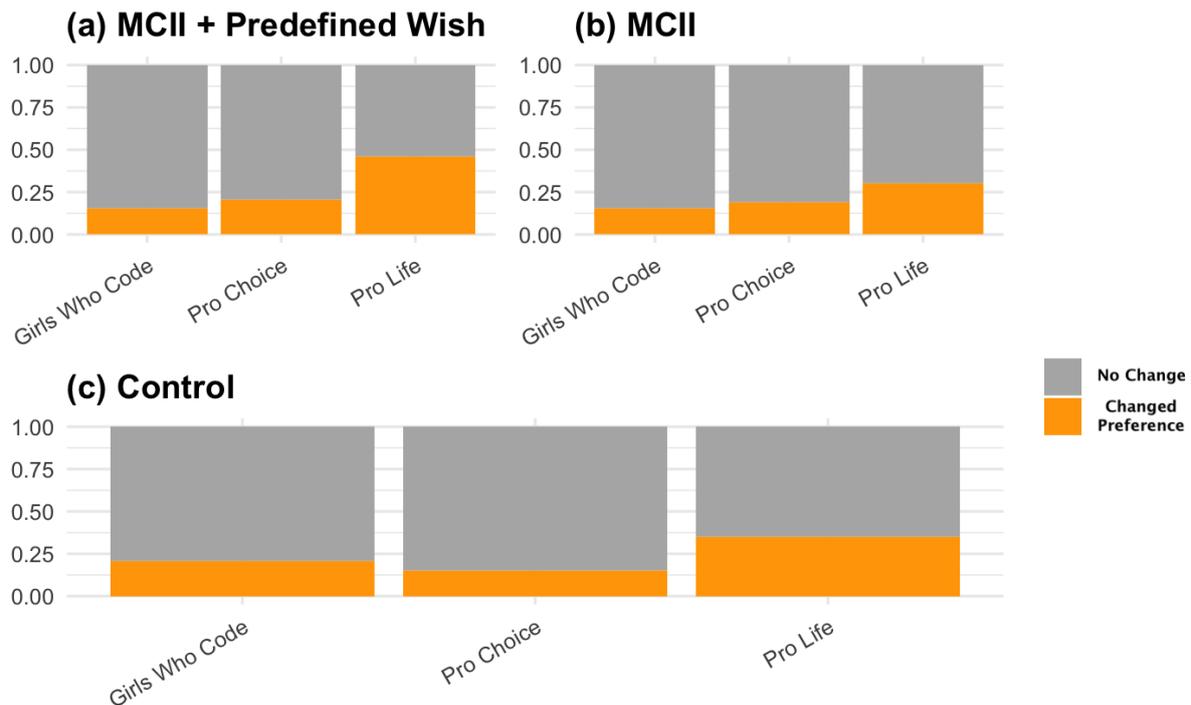
Figure 5.4: Proportion of participants who changed votes between Round 1 and Round 3, by treatment condition and ideological affiliation.

interpreted as a persuasive act shown in the revised vote that is not driven by norm or strategy in the group phase.

We emphasize that these results are exploratory and not conclusive. However, the observed interaction between ideological rigidity and intervention format. This could be a valuable pathway for future research to be used in different contexts.

Modeling Voting Preferences.   We estimated a multinomial logistic regression model to examine how treatment condition, gender attitudes (measured by the ASI scale), and individual characteristics predicted group voting outcomes (reference category: Girls Who Code). Higher ASI scores significantly increased the likelihood of selecting a pro-life target ($b = 1.76$, $p < .001$), consistent with the hypothesis that sexist attitudes are aligned with conservative policy preferences. ASI scores did not significantly predict pro-choice voting ($b = -0.42$, $p = .14$). The INCOM scale, capturing social comparison orientation, was a marginal predictor of pro-life voting ($b = -0.59$, $p = .045$), with higher comparison tendencies slightly reducing pro-life support.

While the interactions between ASI and treatment group were not statistically significant, we observed a significant main effect of ASI in the MCII predefined wish condition on pro-life voting ($b = -1.40$, $p = .012$). The predicted probabilities (Figure 5.5) suggest that the MCII treatment may alter how internal attitudes translate into group decisions: for example, pro-life support among high-ASI participants was attenuated under the MCII

predefined wish, while MCII without a predefined wish showed a stronger increase in pro-life voting as ASI increased. This pattern supports the interpretation that goal-setting interventions can shape the extent to which individuals' internal attitudes manifest in group decisions, even in the absence of statistically robust interaction terms.

Table 5.6: Multinomial Logistic Regression Predicting Group Voting Choice (Reference: Girls Who Code)

Predictor	Pro-Choice	Pro-Life
Intercept	–0.05 (1.21)$p = .260$	–5.28 (1.89) $p = .745$
Treatment: MCII	0.63 (1.00) $p = .945$	1.02 (2.22) $p = .914$
Treatment: MCII (Predef. Wish)	1.19 (1.02) $p = .475$	4.77· (1.90) $p = .075$
ASI (Sexism Scale, centered)	–0.42 (0.28)$p = .139$	1.76*** (0.49)$p = .000$
INCOM (Social Comparison)	0.21 (0.26) $p = .437$	–0.59* (0.29)$p = .045$
Age	–0.01 (0.01)$p = .225$	0.00 (0.01) $p = .816$
Male (ref: Female)	0.56* (0.26)$p = .032$	0.17 (0.32) $p = .597$
Non-binary (ref: Female)	–0.62 (1.28)$p = .630$	1.35 (1.48) $p = .360$
High School (ref: Bachelor+)	0.62 (0.43) $p = .146$	0.10 (0.56) $p = .858$
Master's+ (ref: Bachelor+)	0.31 (0.34) $p = .358$	–0.30 (0.39) $p = .447$
Some College (ref: Bachelor+)	0.29 (0.34) $p = .386$	0.06 (0.44) $p = .885$
Party: Independent (ref: Democrat)	–0.45 (0.35)$p = .199$	–0.64 (0.55) $p = .249$
Party: Other	–1.08 (1.15)$p = .349$	–0.40 (1.19) $p = .740$
Party: Republican	–0.50 (0.33)$p = .135$	0.30 (0.40) $p = .450$
MCII × ASI	–0.24 (0.37)$p = .529$	–0.39 (0.64) $p = .546$
MCII (Predef) × ASI	–0.51 (0.38)$p = .173$	–1.40* (0.56)$p = .012$
AIC / Log-Likelihood	724.61 / –330.31	
N (Participants)	396	

Standard errors in parentheses.

Exact p-values shown below each estimate.

·p < .10, *p < .05, ***p < .001

Modeling Vote Change (R1 → R2). To investigate whether participants changed their group vote between Round 1 and Round 2, we estimated a logistic regression model predicting vote change (1 = changed, 0 = no change) (see Appendix B.8). Predictors included centered ASI scores, treatment group (MCII and MCII with predefined wish, with Control as the reference), and their interaction. We also included covariates: INCOM (social comparison scale), age, gender, education level, and political affiliation.

No significant main effect of ASI emerged ($b = -0.24$, $p = .311$), nor did its interaction with MCII ($b = 0.07$, $p = .827$) or MCII with predefined wish ($b = 0.21$, $p = .500$). Treatment groups themselves were not significantly associated with vote change (MCII: $p = .172$, predefined: $p = .692$). Among covariates, age showed a marginal negative association ($b = -0.02$, $p = .063$), indicating that older participants were slightly less likely to change their votes.

Effect of ASI Score on Voting by Treatment
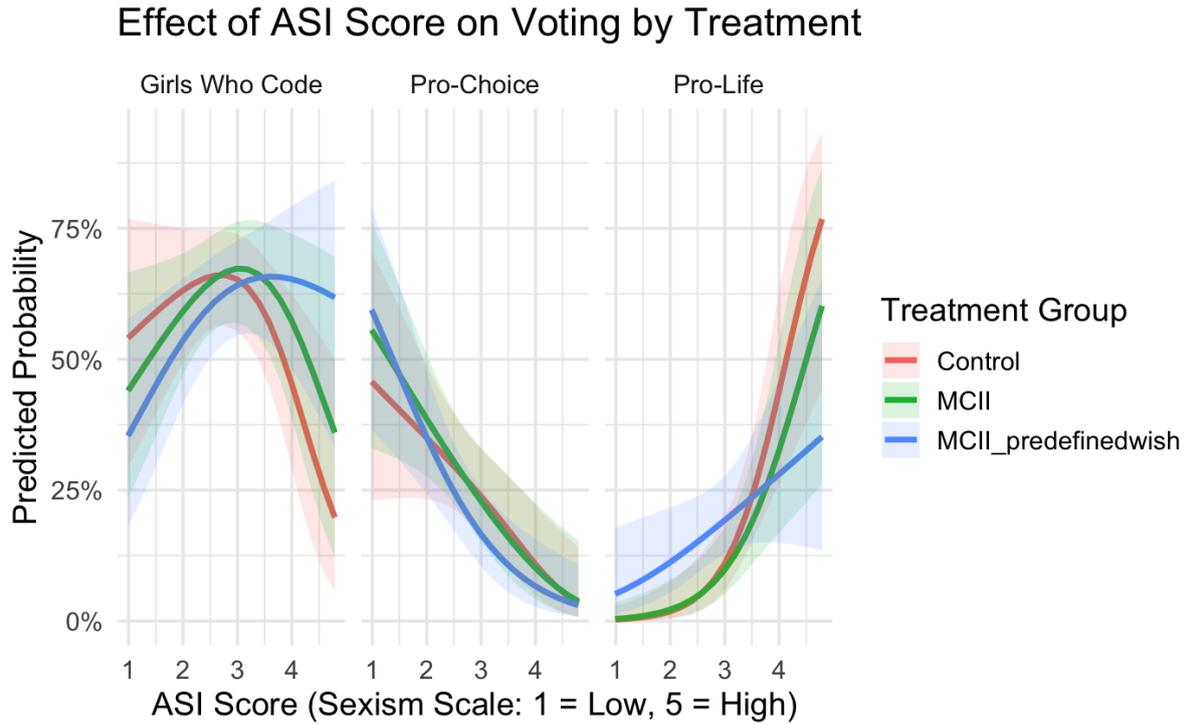
Figure 5.5: Effect of ASI Score on Group Voting by Treatment. Predicted probabilities are based on a multinomial logistic regression with interaction between ASI (sexism scale) and treatment group. The shaded areas represent 95% confidence intervals.

Table 5.7: Deliberation Volume by Treatment Group

Treatment Group	Messages	Total Words	Avg. Words per Message
Control	1,146	9,500	8.29
MCII	761	6,566	8.63
MCII + Predefined Wish	825	8,103	9.82

5.4.4   Deliberative Communication: Frequency and Sentiment

To assess how the different treatment conditions affected deliberative engagement, we analyzed both the volume and the tone of chat messages exchanged during the group decision-making phase.

Message Frequency and Engagement.   To examine how the interventions influenced participants' communication behavior, we analyzed both the volume and content length of chat messages across the three treatment groups. Table 5.7 summarizes the total number of messages exchanged, total word count, and the average number of words per message.

Groups without an intervention (control group) produced the highest number of messages and the largest overall word count. However, the message length was the shortest on average (8.29 words). This suggests more fragmented communication or rapid turn-taking. In contrast, participants in the MCII with predefined wish treatment sent fewer

messages, but overall, longer messages on average (9.82 words). This indicates more engaging contributions of the participants in that treatment.

The MCII group produced the fewest messages and a moderate average message length (8.63 words), pointing to shorter but potentially more focused statements. To test the significance between the treatments, we calculated the average words per message per participant and compared distributions across treatment groups. A Shapiro-Wilk test confirmed that residuals from a standard ANOVA violated the assumption of normality ($W = 0.75$, $p < 0.001$). Hence, we use a non-parametric Kruskal-Wallis test. The Kruskal-Wallis test confirmed a significant difference in average message length across conditions, $\chi^2(2, N = 377) = 10.66$, $p = .005$. Hence, we can confirm that participants varied in how much they wrote per message in different treatments. Shortly, participants in the MCII predefined wish condition contributed the longest messages. This is followed by the MCII group, and finally the Control group. We find that this suggests not only the intervention, but the structure of the intervention impacts how participants express their views. In particular, participants who reflected on a predefined wish before deliberation wrote in a more extended and elaborated manner. This remains true even when participating less frequently overall.

Sentiment of Deliberative Communication. We conducted a sentiment analysis on all chat messages to understand the underlying tone of deliberation data. Each message was classified as having either negative, neutral, or positive sentiment and assigned a continuous sentiment score.

Figure 5.6 shows the density distribution of sentiment scores across the three treatment groups.

Across all groups, the sentiment distribution is right-skewed, with most messages clustered around zero and a long tail toward positive sentiment. The MCII and MCII (Predefined Wish) groups exhibit a slight rightward shift in their distributions, indicating a more positive conversational tone compared to the Control group.

Table 5.8 reports the share of messages in each sentiment category. In all groups, positive sentiment dominated, followed by neutral and then negative sentiment.

Table 5.8: Distribution of Message Sentiment by Treatment

Treatment	Negative	Neutral	Positive
Control	46 (7.7%)	240 (40.5%)	370 (51.8%)
MCII	73 (9.6%)	242 (31.8%)	446 (58.6%)
MCII + Predefined Wish	61 (7.4%)	283 (34.3%)	481 (58.3%)

The highest share of positive sentiment occurred in the MCII group (58.6 percent), closely followed by the MCII (Predefined Wish) group (58.3 percent). The Control group
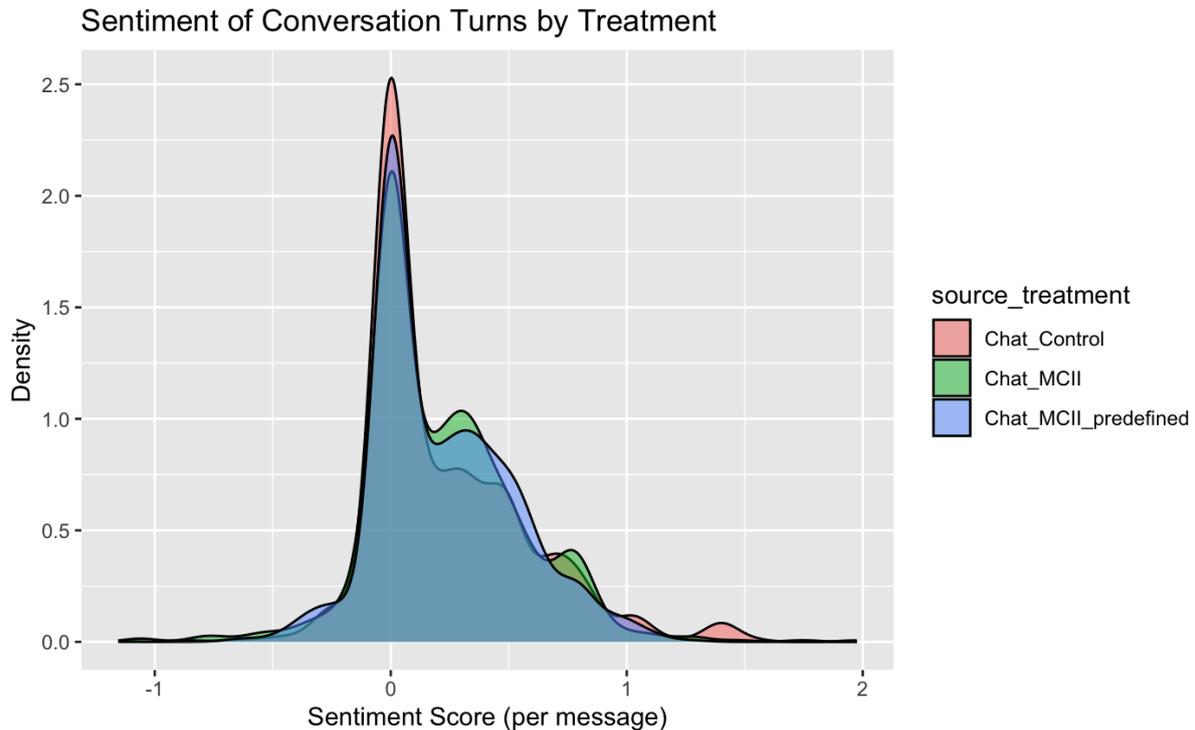
Figure 5.6: Density of sentiment scores by treatment group. Higher values indicate more positive sentiment.

had a lower proportion of positive sentiment (51.8 percent) and the highest share of neutral messages (40.5 percent). The frequency of negative messages remained low across all groups.

To test whether the distribution of sentiments differed significantly across treatments, we conducted Pearson's chi-squared tests. The overall difference across all three groups was not statistically significant, $\chi^2(4, N = 2{,}542) = 6.30$, $p = .178$. We then conducted an exploratory, uncorrected pairwise comparison between the Control and MCII groups. This test yielded a marginally significant result, $\chi^2(2, N = 1{,}417) = 5.46$, $p = .065$. This implies a potential difference in the distribution of affective tone between these two treatment groups. Moreover, the MCII group shows a reduced share of neutral messages. Furthermore, we find slightly higher proportions of both positive and negative sentiment relative to the Control group. While this difference does not reach conventional levels of statistical significance, it may indicate that the MCII intervention encouraged a more emotional deliberative tone. This pattern is consistent with the idea that motivational reflection can shape not only what participants say but also how they express themselves.

Decision Time and Group Consensus.   To examine whether reaching a unanimous group decision was associated with longer deliberation, we compared decision durations between groups that successfully reached consensus and those that did not. Groups with missing decision data (consensus = NA) were excluded from this analysis, as they

typically reflect incomplete sessions or technical issues rather than substantive deliberation outcomes.

Figure 5.7 displays the distribution of decision times by consensus outcome.
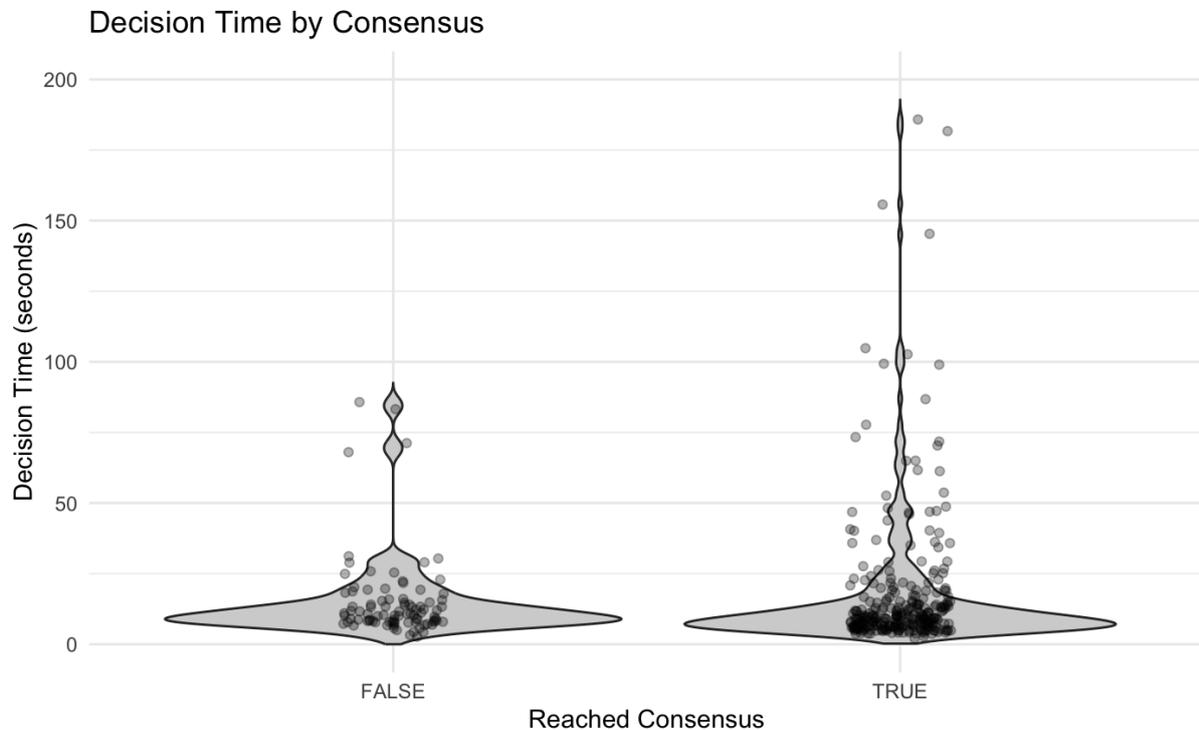
Figure 5.7: Decision time by group consensus outcome. Groups with missing decision data were excluded.

While both groups show a wide range of durations, groups that reached consensus appear to have a longer upper tail. In contrast, groups that failed to reach consensus tended to cluster around shorter durations.

We tested the statistical difference in decision time using a non-parametric Kruskal-Wallis test. The result approached but did not reach statistical significance, $\chi^2(1, N = 172) = 2.88$, $p = .090$. This suggests a possible trend toward longer deliberation in groups that achieved consensus. Though the evidence does not meet conventional significance thresholds of $p < .05$.

Turn-Taking Inequality by Treatment   We want to understand how evenly participants contributed during group deliberation. We calculated the Gini coefficient of word contributions for each group. Higher values indicate more unequal participation. Figure 5.8 presents violin plots of the Gini coefficients by treatment group. Visually, the MCII with a predefined wish stage intervention group shows a tighter distribution around lower Gini values. Hence, we find more balanced turn-taking compared to the Control and MCII conditions.
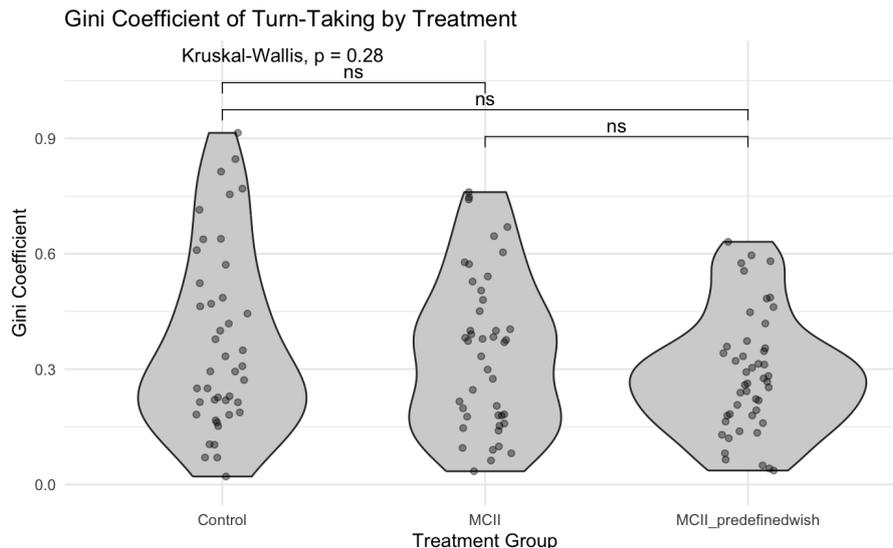
Figure 5.8: Gini coefficient of turn-taking across treatment groups. Each point represents a group-level Gini coefficient. Wider sections of the violin indicate higher density. Horizontal lines show results of the Kruskal-Wallis test and pairwise Wilcoxon tests (all non-significant).

Table 5.9: Text Lengths and T-Test Results by MCII Condition

MCII Component	MCII	MCII + Predefined Wish	t-statistic	p-value
Outcome Length (chars)	96.67	137.36	-4.65	$< .001$
Obstacle Length (chars)	110.11	132.13	-2.41	.017
Action Length (chars)	95.39	129.02	-4.06	$< .001$

A Kruskal-Wallis test revealed no statistically significant differences in turn-taking inequality across treatments ($\chi^2 = 2.51$, df = 2, $p = .28$). Pairwise Wilcoxon rank-sum tests (adjusted for ties) confirmed no significant differences between conditions. Despite this, the distribution in the MCII (Predefined Wish) treatment indicates a possible trend toward more balanced participation. This aligns with the hypothesis that structured mental contrasting with predefined goals can foster more inclusive deliberation.

Intervention Engagement and Wish Compliance Across MCII Conditions We compared the textual output between participants in the *MCII* condition, who formulated their wish, and those in the MCII_predefinedwish condition, who responded to a predefined wish. As shown in Table 5.9, participants in the predefined treatment wrote significantly longer prompts across all three intervention components: expected outcome ($t = -4.65$, $p < .001$), obstacle ($t = -2.41$, $p = .017$), and action ($t = -4.06$, $p < .001$). These results suggest that the predefined framing may reduce cognitive load in the initial step. Hence, this would explain the larger input in reflections.

We controlled for agreement with the wish in the predefined MCII treatment. We find
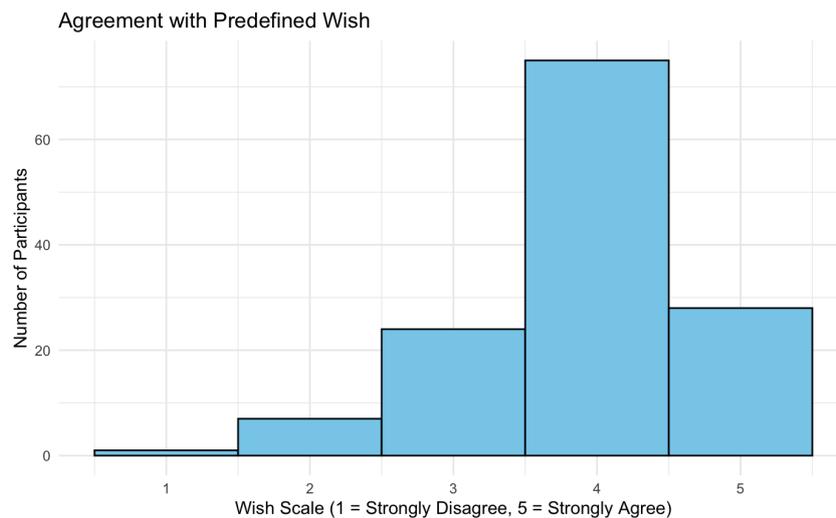
Figure 5.9: Agreement with the Predefined Wish (Likert scale, 1 = strongly disagree to 5 = strongly agree).

high agreement levels. Figure 5.9 displays the distribution of responses on the 5-point Likert scale. Overall, 76% of participants rated the wish as either *agree* or *strongly agree*, while fewer than 6% expressed disagreement. This indicates strong compliance with the intervention's wish premise.

5.5 Discussion

This study provides an explorative picture of how MCII-based interventions influence group deliberation and voting outcomes in polarized online settings. While many statistical effects were modest, multinomial and logistic regression models offer insights into how pre-reflection, especially when fairness-oriented, can shape group decisions, deliberation, and individual vote stability in a three-stage donation task.

MCII interventions affected how participants communicated. In the predefined wish condition, participants wrote fewer but longer messages. This shows more elaborate contributions. This shift in deliberation pattern, confirmed by a significant Kruskal-Wallis test on message length. We learned that the intervention may prompt more reflective discourse. Sentiment analysis revealed a slight increase in affective expression (positive and negative sentiment) in the self-defined MCII condition. Although the overall group differences were not significant, exploratory comparisons indicated that motivational interventions may encourage more emotionally engaged dialogue. Groups reaching consensus tended to deliberate longer, consistent with the idea that joint decisions require more reasoning and negotiation. Gini coefficients revealed that the MCII predefined condition may have promoted more equitable speaking patterns, though the effects were not statistically significant. We found between-group variability, which likely limited statistical power. Future work should allocate more group-level data to account for that. Control

variables, such as those captured by the Ambivalent Sexism Inventory (ASI), confirmed that participants' sexist attitudes strongly predicted group voting outcomes. This suggests that sexist attitudes align with conservative policy preferences. Importantly, in the MCII with a predefined wish condition, this effect was significantly reduced. We expect that motivational framing may moderate the behavioral expression of partisan beliefs. A second model examined whether participants changed their votes between Round 1 and Round 2. Logistic regression results showed no significant effect of ASI, MCII treatment, or their interaction on vote change. Descriptive trends suggested that vote switching occurred more often in the MCII condition, especially among Pro-Life participants. However, these effects were not statistically robust. Age was the only covariate approaching significance, suggesting that younger participants may have been more open to revising their votes. The comparison between the two MCII conditions reveals how the structure of goal formulation influences participant engagement in the intervention. The longer responses in the MCII with a predefined wish treatment suggest that removing the need to formulate a wish may reduce cognitive load and encourage engagement with the MCII process. High agreement levels with the assigned wish further indicate that predefined goals can still feel personally relevant. All together, we find that these results imply that structured interventions can enhance engagement without sacrificing internalization of the intervention.

The results suggest that MCII can shape how internal attitudes, such as sexism, show in voting decisions. While MCII had only modest effects on changing initial voting preferences or changing votes, it appears to moderate how ideological beliefs influence group outcomes. We see this especially when combined with fairness-oriented framing. Moreover, the interventions influenced the form and tone of deliberation more than their outcomes. Pointing to MCII's potential as a tool for shaping deliberative quality, we can confirm this rather than for the voting patterns. Although MCII is effective in promoting goal pursuit across a variety of individual domains (Gollwitzer and Sheeran, 2006), we find a limited effect in this study. Even on a morally and emotionally salient topic like abortion, there are explanations in the literature. First, MCII requires individuals to personally commit to a desirable and feasible goal. This means in group deliberation contexts with externally assigned tasks, participants may lack such goal ownership. This could weaken the intervention's motivational leverage (Oettingen, 2012). Second, while emotional salience can diminish this issue, morally charged topics could trigger identity-protective reasoning. This could diminish reflection (Gollwitzer and Sheeran, 2006). Third, group deliberation involves social dynamics, such as conformity to social norms. Reputation concerns, or conflict avoidance, may decrease self-reflection. Finally, group decision tasks, which require compromises and collective decision-making, could collide with the action orientation of MCII. These reflections could explain why MCII, though powerful at the individual level, requires adaptation to boost engagement in complex group settings.

5.5.1 Contribution Overview

We contribute to the literature on small-group decision-making. More specifically, we focus on interventions that target motivation in deliberation and voting. First, it is one of the first studies to apply MCII in a group deliberation context. To increase inclusivity, we attempted to include goal-pursuit in a participative decision process. Second, our analysis highlights the importance of distinguishing between surface-level engagement (e.g., word count, message frequency) and the quality or tone of that engagement (e.g., message length, sentiment). Now, we can offer a richer understanding of deliberation dynamics. Third, the study provides knowledge on how intervention effects may vary between partisan lines and mindsets. Findings from our study show how personality traits or identity are linked with the effectiveness of interventions.

5.5.2 Future Implications for Research

While MCII has proven effective in promoting individual goal pursuit, its limited effects in this study point to several directions for future research. First, interventions may need to be adapted to increase goal ownership in collective tasks, potentially by allowing groups to co-create shared objectives or tailor their motivational prompts collaboratively. Second, emotionally charged group contexts may require MCII to be supplemented with emotional regulation strategies or deliberative norm-setting to offset identity-protective cognition and affective overload. Third, researchers should further investigate how MCII interacts with group composition and task framing. It may be particularly effective in like-minded groups to train openness to other opinions. When paired with training in empathy or norm awareness, MCII could have potential for overcoming biases. Lastly, future work could explore hybrid intervention formats. The combination of reflexive, deliberative, and procedural components in group decision-making could better support mutual exchange.

Taken together, these findings suggest that while the MCII intervention (in both treatments) can influence group discourse, the outcome variables of what the intervention is intended to achieve need to be clear.

5.6 Conclusion

This study investigated the effects of Mental Contrasting with Implementation Intentions (MCII) on group deliberation and vote change in a politically and morally polarizing decision context. Drawing on 396 U.S.-based participants randomly assigned to one of three experimental conditions, we examined whether MCII, either with a self-defined or predefined fairness-oriented wish, could influence how participants engage, express

themselves, and revise their votes during an online group deliberation on abortion-related
donation.

The results suggest that while MCII had modest effects on the way participants com-
municated, such as encouraging longer and more elaborated messages and slightly more
affective expression, it did not produce consistent changes in voting distributions or de-
cision outcomes. Groups across all conditions tended to converge toward a consensus-
friendly choice, namely Girls Who Code, during deliberation, with only limited variation
across treatments. Vote changes were most frequent in the MCII condition and par-
ticularly noticeable among Pro Life participants, yet these effects were not statistically
significant. Likewise, while MCII appeared to influence the emotional tone and structure
of deliberative messages, it did not alter the overall sentiment composition or decisiveness
in a substantial way.

These conclusions are based on descriptive and inferential statistical evidence. We
included multinomial and logistic regression models to analyze our data. They confirmed
that while individual predictors, particularly sexist attitudes, were associated with voting
behavior, the MCII intervention itself had limited direct effects on vote outcomes or
change towards consensus.

These findings are consistent with research suggesting that MCII is most effective when
individuals feel a sense of ownership over the goal. Another pillar of the intervention to
fully work is that they can act autonomously to achieve it. In the setting of this study,
however, group deliberation introduced a different motivational structure. Tasks were ex-
ternally assigned, emotionally salient, and embedded in a collective environment. Social
dynamics such as conformity or echo chambers are likely to constrain the self-regulatory
mechanisms that MCII is designed to activate. Although the decision context of abortion
rights donations can increase feelings of involvement, it may also intensify affective polar-
ization or defensive reasoning. This can also limit the intervention's effectiveness on the
participants.

At the same time, the study offers several contributions. It shows that MCII, even
when adapted for deliberative contexts, can shape how people engage with one another in
small groups. This is done by increasing more thoughtful and reflective communication.
The combination of decision and deliberation data offers interesting pathways to analyze
the influence of the intervention. Of particular interest is the finding that the MCII with
predefined fairness wish appears to encourage participants to prioritize shared reasoning
over individual ideological commitments. This suggests a promising direction for future
refinement.

Finally, this research discusses both the promise and the limitations of using motiva-
tional interventions in collective decision-making settings. While having limited implica-
tions on decision-making and vote change, MCII can influence the quality of deliberation.
Future work should explore how MCII and related tools can be adapted to support joint

reasoning in participation. By doing so, researchers and practitioners can move closer to designing interventions that not only support individual well-being and expression. Thus, it strengthens the basis for inclusive and empowered democratic decision-making.

Chapter 6

Discussion and Conclusion

6.1 General Discussion

Merging Findings on Composition and Size   Across the four studies, I find a consistent pattern of deliberation: Small-group voting is not moving towards extremes but towards moderation. This holds for both like-minded and mixed-minded groups, as well as under median and unanimity rules. It also holds when I enlarge the analysis of groups from three to five members. At the same time, I do not see stable individual learning across rounds. Participants return to their original positions once the group round is done in a multiple-round task. In strategic settings with costly participation, behavior departs from full equilibrium play and follows behavioral cues about when a vote seems to influence the outcome. In intervention settings, MCII alters how people engage, but not the outcome of donation decisions.

Summarizing the findings, I conclude that composition matters more than formal rules for outcomes. While rules and size shape how people deliberate, I do not find an impact on voting. Generous members often drive convergence in mixed-minded groups, and the presence of one generous member can mute selfish pulls in a social context. Larger groups have a higher frequency of messaging with a more positive sentiment. However, they do not necessarily deliver more informed choices. Deliberation quality and decision outcomes are related but distinct.

Mechanisms: Norms, Rule sensitivity, and Bounded Reasoning   A common explanation for my findings is the behavioral force of social norms. In both like-minded and mixed-minded settings, participants appear to seek socially appropriate allocations rather than to share individual preferences. This aligns with findings of norm-driven behavior and philosophical work on "impartial spectator" intuition (Kimbrough and Vostroknutov, 2016; Smith, 2010). Perceived status and appropriateness in argumentation can further steer voting outcomes (Cason and Mui, 1997; Ohtsubo and Masuchi, 2004; Fujisaki et al., 2018).

Rule sensitivity is also an important pathway to discuss the results. Under the mean rule, every vote affects the outcome. Hence, extreme voters feel influential and tend to enter. Under the symmetric median rule, central voters are decisive, so extremes often abstain. These patterns match perceived pivotality in voting (Feddersen and Pesendorfer, 1996; Tyran and Feld, 2006) and simple levels of strategic reasoning (Simon, 1957; Nagel, 1995; Crawford and Iriberri, 2007). With larger groups, diffusion of responsibility and lower accountability could affect groups, i.e., like-minded generous groups become even more generous (Kao and Couzin, 2014; Mannes et al., 2014).

Deliberative Quality versus Decision Outcomes   The measures separate volume from duration and tone. Unanimity increases message volume in mixed-minded groups, while total time does not change significantly. Five-member groups write more frequently and show increased positive overall sentiment than three-member groups. First proposers often anchor the exchange. Taking turns is not equally distributed, though in some MCII treatments, we see more equal participation. These observations suggest that what we often label as more engagement can be alignment work rather than a deep exchange. They also show that conversational metrics carry useful information beyond outcomes.

Role of Group Composition and Size   Composition is an interesting driver of outcomes. In mixed-minded groups, generous members pull outcomes toward fairness and can neutralize selfish influence in social contexts (Cason and Mui, 1997). In like-minded groups, we still observe moderation. Size interacts with composition. In mixed-minded groups, larger size can reduce accountability and lift retention, while in like-minded generous groups, it can strengthen generosity. These regularities caution against simple prescriptions that larger groups are "better" through the activation of crowd wisdom. Rather, it is the increasing complexity in the ad-hoc nature of the group building.

Voting Rules and Institutional Design   Across studies, median and unanimity produce similar outcomes on average, but they structure deliberation differently. Unanimity raises the deliberative burden in mix-minded groups by requiring more exchange to align preferences (Lorenz et al., 2011; Becker et al., 2017). Where time is scarce, rule choice will shape how much discussion is needed to reach an acceptable proposal. We also find many unanimous votes even under the median rule. This is consistent with responsibility and pivotality aversion and with a search for uncontroversial solutions (Bartling et al., 2015). The take frame may influence such norm following, though prior work does not find that framing destabilizes preferences (Dreber et al., 2013).

Interventions: MCII and Goal Ownership in Groups   MCII affects the form and tone of deliberation more than the final vote on donations. The predefined wish treatment

of MCII leads to fewer but longer messages and hints at more reflective contributions. Fairness framing appears to weaken the link between sexist attitudes and group votes. This suggests a moderation of ideological expression within the group. Simultaneously, I find only modest changes in preferences or vote switching. This matches the idea that MCII is strongest when people own the goal and can act autonomously (Gollwitzer and Sheeran, 2006; Oettingen, 2012). In collective, morally charged settings, identity-protective reasoning and conflict avoidance can decrease self-reflection.

Methodological Contributions I combine three elements of small-group decision-making. First, I study strategically equivalent decision spaces for mean and median to isolate behavioral responses to rule framing. Second, I link group choices with conversational traces, using volume, duration, sentiment, and simple inequality measures. Third, we bring a motivational intervention into a group deliberation task to test how discourse and outcomes engage together to boost and empower participants. The design choices allow us to separate norms and rule sensitivity from pure payoff logic in small group contexts.

6.1.1 Limitations

The design isolates mechanisms in controlled lab and online settings with limited generalizability. The sample is largely student-based, and in the online study, US-specific. The results may not generalize to other populations or issues. The factorial structure sometimes yields thin cells. i.e., like-minded selfish groups in the five-member design, which reduces the analysis for some contrasts relevant to the research question. Deliberation took place in synchronous text chat with a fixed time constraint. This increases internal validity and control but removes nonverbal signals and other social drivers that can compress deliberation in this environment. MCII is a self-regulatory strategy, and compliance likely varies across individuals and groups. This tends to weaken the effects. For the sentiment analysis, we used quantitative measures that might overlook irony or related forms of language.

6.1.2 Future Research Agenda

Several directions follow. First, future research could use other interesting tasks. Moving from allocation to epistemic tasks yields the possibility to test whether (larger) groups improve accuracy and how argument quality is impacted. Second, study repetition and counter-narratives to see whether moderation persists over time and whether we can reduce bubble effects. This could be researched with support from language models that surface balanced information. Third, research could include moderation that provides information. This could reduce the deliberative burden under strict rules while keeping

room for discovery. Fourth, field studies are an interesting pathway for external validity. Varying the composition and size of groups in citizens' assemblies where the stakes are really high and measuring discourse and outcomes across party lines could provide further pathways to the literature. Fifth, the adaptation of MCII for collective contexts by building shared goal ownership. This could be done by combining wish building with emotion regulation and simple norms that make reflection possible. Finally, design direct tests of diffusion of responsibility and pivotality aversion in group decisions.

6.2   Conclusion

6.2.1   Main Contributions

I study how composition, rules, and size shape small group decisions and discourse, and how a motivational intervention can shift deliberation and voting. Composition and norms play a crucial role in voting. Formal rules have only a moderate impact on group reasoning and outcomes. Groups tend to moderate. In a socially driven context of the dictator game, generous members often guide mixed-minded groups toward fairness. Second, rules and size shape deliberation. Unanimity raises messaging in heterogeneous groups, and larger groups communicate increasingly positive messages without clear learning effects. Regarding the MCII, interventions can change discourse and can loosen the tie between ideology and outcomes, even when voting changes remain moderate.

Policy Recommendations   Designers should choose rules with a focus on deliberative burden, time budgets, and heterogeneity. Where time is tight and groups are diverse, the median can reach acceptable outcomes with less exchange. However, unanimity can be used deliberately to promote exchange when the process values voice and alignment. Composition deserves attention. A small presence of prosocial members can shift outcomes markedly. When using motivational tools like MCII, the building of ownership and autonomy into the process is crucial. Adding light moderation and setting simple norms that make disagreement safe to share could help to mitigate the issue. Volume, tone, and sharing balance reveal how participants of deliberation reach a decision and can be used to tune the process.

6.2.2   Closing Remarks

Across settings, I find groups searching for socially acceptable solutions rather than pushing to extremes. Participants respond to norms, to how rules make influence salient, and to the presence of others who set the tone. If designers of involvement aim for inclusive and empowered collective choices, we should design for these facts. That means pairing

simple, transparent institutions with composition-aware practices and light motivational support. It also means evaluating not only outcomes, but how they were formed. This is how we can turn small group decision-making into a reliable building block for democratic practice.

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Appendix A

Experimental Materials

A.1 Like- and Mixed-Mindedness in Deliberation and Voting: Study Instructions (German Version)

In dieser Studie durchlaufen Sie drei Runden. In jeder Runde treffen Sie eine Entscheidung. Jede Entscheidung ist auszahlungsrelevant.

Runde 1: Individuelle Entscheidung

In der ersten Runde erhalten Sie 10 Punkte. 1 Punkt entspricht 0,50 €. Sie haben die Aufgabe zu entscheiden, wie die Punkte zwischen Ihnen und der gemeinnützigen Organisation Lernfreunde-Haus in Karlsruhe aufgeteilt werden sollen. Das Lernfreunde-Haus stattet hauptsächlich Kinder Geflüchteter mit Schulmaterialien aus und gibt Deutsch-bzw. Nachhilfeunterricht. Sie müssen sich für einen ganzzahligen Wert zwischen 0 und 10 Punkten entscheiden. Dieser Wert entspricht der Anzahl der Punkte, die Sie für sich behalten möchten.

Runde 2: Gruppenentscheidung mit Diskussion

In der zweiten Runde bilden Sie mit vier weiteren Teilnehmer*innen eine Gruppe. Jede*r von Ihnen erhält 10 Punkte. 1 Punkt entspricht 0,50 €. Sie haben die Aufgabe abzustimmen, wie die Punkte zwischen Ihnen und der gemeinnützigen Organisation Lernfreunde-Haus aufgeteilt werden sollen. Über die Chatfunktion können Sie über Ihre Präferenzen zur Aufteilung diskutieren, d. h. wie viele der jeweils 10 Punkte Sie für sich behalten wollen. Dafür haben Sie 15 Minuten Zeit. Unter dem Chatfenster finden Sie ein Abstimmungsfeld. Die Abstimmungsregel entnehmen Sie den ausgedruckten Regeln vor Ihnen. Sollte es zu keiner Abstimmung nach 15 Minuten kommen, d. h. mindestens ein Gruppenmitglied enthält sich, gehen alle Punkte dieser Runde an die Versuchsleitung zurück und Sie und das Lernfreunde-Haus erhalten für die zweite Runde keine Punkte.

Runde 3: Individuelle Entscheidung (wie Runde 1)

In der dritten Runde ist das Vorgehen identisch zur ersten Runde. Sie entscheiden allein, wie viele der 10 Punkte Sie für sich behalten möchten.

Zusätzliche Hinweise:

Bitte beachten Sie, dass es zu Wartezeiten kommen kann, da Sie mit allen Teilnehmer*innen gleichzeitig agieren.

Im Anschluss bitten wir Sie, Fragebögen zu Ihrer Person zu beantworten.

Sollten Sie Fragen an die Versuchsleitung haben, bitten wir Sie, Ihre Tür zu öffnen. Die Versuchsleitung wird zu Ihrer Kabine kommen.

Freiwilligkeit und Datenschutz:

Die Teilnahme an der Studie ist freiwillig. Die Befragung erfolgt anonym. Die Erhebung der soziodemografischen Daten wie Geschlecht usw. erfolgt ausschließlich zu dem Zweck, die Aussagen gruppenheterogen auszuwerten. Es werden keinerlei Versuche unternommen, aus den Ihrerseits getätigten Angaben Rückschlüsse auf konkrete Personen zu ziehen. Die Auswertungsergebnisse werden ausschließlich in anonymisierter Form (in Tabellen und/oder Graphiken) veröffentlicht, sodass Rückschlüsse auf Einzelpersonen nicht möglich sind.

Bitte tragen Sie in die Freitextfelder keine personenbezogenen Daten, auch nicht von Dritten, ein.

Gemäß Art. 4 Ziff. 1 Datenschutz-Grundverordnung (DS-GVO) sind „personenbezogene Daten" alle Informationen, die sich auf eine identifizierte oder identifizierbare natürliche Person beziehen; als identifizierbar wird eine natürliche Person angesehen, die direkt oder indirekt, insbesondere mittels Zuordnung zu einer Kennung wie einem Namen, zu einer Kennnummer, zu Standortdaten, zu einer Online-Kennung oder zu einem oder mehreren besonderen Merkmalen, die Ausdruck der Identität dieser natürlichen Person sind, identifiziert werden kann.

A.2 Like- and Mixed-Mindedness in Deliberation and Voting: Study Instructions (English Version)

This study consists of three rounds. In each round, you will make a decision. Each decision is payment relevant.

Round 1: Individual Decision

You will receive 10 points, where 1 point equals €0.50. Your task is to decide how to split these points between yourself and the nonprofit organization *Lernfreunde Haus* in Karlsruhe, which provides school supplies and tutoring to children of refugees. You must choose a whole number between 0 and 10, which represents the number of points you wish to keep for yourself.

Round 2: Group Decision with Deliberation

You will form a group with four other participants. Each of you again receives 10 points, with 1 point equaling €0.50. Your task is to vote on how to split the points between yourself and *Lernfreunde Haus*. You can deliberate about your preferences — that is, how many of your 10 points you want to keep — using the chat function. You will have 15 minutes for this deliberation.

Below the chat window, you will find a voting panel. The voting rule is stated on the printed sheet in front of you.

If no vote is cast after 15 minutes — for example, if at least one group member abstains — no one receives any payout, and all points from this round go back to the experimenter. That means neither you nor *Lernfreunde Haus* receives any points for Round 2.

Round 3: Individual Decision (Again)

This round is identical to Round 1. You decide alone how many of the 10 points you wish to keep for yourself.

Additional Notes:

Waiting Times: Please be aware that you may experience waiting periods, as all participants act simultaneously.

Questionnaires: After the main part of the study, you will be asked to complete some questionnaires about yourself.

Questions: If you have questions for the experimenters, please open your booth door. A staff member will come to assist you.

Voluntary Participation and Data Protection:

Participation in the study is voluntary. The survey is anonymous. The collection of demographic data, such as gender, is solely to analyze group-level differences. No attempt will be made to identify you personally based on your responses.

The results will only be published in anonymous form (tables and graphs), so that no

conclusions about individuals are possible.

Please do not enter any personal data into free-text fields. This includes information about yourself or others.

According to Article 4, paragraph 1 of the General Data Protection Regulation (GDPR), personal data refers to any information relating to an identified or identifiable natural person. A person is considered identifiable if they can be identified directly or indirectly, in particular by reference to a name, identification number, location data, online identifier, or one or more characteristics expressing the identity of that person.

A.3 Like- and Mixed-Mindedness in Deliberation and Voting: Gruppenentscheidungsregeln (deutsche Version)

Je nach Versuchsbedingung galt eine der folgenden Abstimmungsregeln:

Median Regel

Die Gruppenentscheidung wird über die Median Regel bestimmt. Der Median der Stimmen entspricht derjenigen Stimme, welche genau „in der Mitte" steht, wenn man die Werte der Stimmen der Größe nach sortiert. Das Ergebnis entspricht somit der mittleren der drei Stimmen.

Bitte beachten Sie, dass Ihre Stimmabgabe in der Abstimmung bindend ist. Sobald alle drei Gruppenmitglieder abgestimmt haben, wird automatisch die Median-Stimme gezählt.

Einstimmigkeitsregel

Die Gruppenentscheidung wird über die Einstimmigkeitsregel bestimmt. Alle drei Gruppenmitglieder entscheiden einstimmig, wenn alle denselben Abstimmungswert wählen.

Bitte beachten Sie, dass Ihre Stimmabgabe in der Abstimmung bindend ist. Sobald alle drei Gruppenmitglieder für denselben Wert abgestimmt haben, wird automatisch die Stimme als Gruppenergebnis gezählt.

A.4 Like- and Mixed-Mindedness in Deliberation and Voting: Group Voting Rules (English Version)

Depending on the experimental condition assigned to your group, one of the following decision rules applies:

Median Rule

The group decision is made using the median rule. This means that after all members have voted, the votes are arranged in ascending order, and the middle value is taken as the group outcome. In a group of three, this is the second-highest vote.

Please note that your vote is binding. As soon as all three group members have submitted a vote, the median is automatically counted as the group decision.

Unanimity Rule

The group decision is made using the unanimity rule. This means that the group only decides if all three members vote for the same value.

Please note that your vote is binding. As soon as all three members have voted identically, that value becomes the group result. If the group fails to reach unanimity, no

decision is made, and the points go back to the experimenter.

A.5   Introductory Page: MCII Condition

Welcome to the Study
This study is designed to explore decision-making processes in individual and group settings. Over the next 20 minutes, you will participate in three rounds of decision-making.

First Round
You will make an individual decision about how to allocate $5 to one of three organizations. Your decision will be implemented in reality, meaning the chosen organization will receive the $5 donation. Afterward, you will go through a brief exercise called Strategy for Goal Setting to prepare for the next round.

Second Round
You will go through a brief exercise called Strategy for Goal Setting to prepare for the group task. You will be placed in a group of three participants to make a unanimous decision about which organization will receive the $5. The waiting time to form a group can take up to 5 minutes. If no group is formed within this time, you will proceed directly to the surveys. Use the chat window to discuss your arguments with your group and come to a unanimous decision. The deliberation time is 10 minutes. If no unanimous decision is reached within this time, the $5 will be returned to the experimenter, and you will proceed to the surveys. Your decision will be implemented in reality if a unanimous decision is reached.

Third Round
You will make another individual decision, similar to the first round. However, this round is hypothetical, meaning your decision will not be implemented in reality.

Surveys
After the decision rounds, you will answer a short questionnaire about basic demographics and yourself.

Compensation
The study takes about 20 minutes to complete. You will be compensated after the study is finished.

A.6 WOOP materials (MCII condition)

Wish

When you think about the deliberation phase and the group decision, what do you want? What is your wish in these terms?

Participant input field

[Participants entered their wish here.]

Wish (predefined)

Think about the wish to contribute to your group's decision thoughtfully and collaboratively. To guide you, we have identified the following specific wish:

"I want to contribute to a fair and thoughtful group decision."

Keep this wish in mind as you approach the task. Your contribution matters, and focusing on these goals can help ensure a successful and meaningful group discussion.

Outcome

Now please think of the best outcome for you if the wish were to come true. What would such an outcome be?

Participant input field

[Participants entered their best outcome here.]

Outcome visualization

Now take a moment and imagine this best outcome as vividly as possible. Take as much time as you need to imagine this outcome as fully as you can.

Identify your obstacle

Sometimes, achieving our wishes can be difficult. What might hold you back from fulfilling your wish during the group task? What within you could get in the way? It might be an emotion (e.g., "I feel nervous"), or a habit (e.g., staying quiet instead of contributing).

Participant input field

[Participants entered their inner obstacle here.]

Obstacle visualization

Now take a moment to imagine this inner obstacle vividly. Picture what it might look like or feel like if it came up during the group task. Take as much time as you need to imagine this obstacle as fully as you can.

If then plan

To overcome obstacles, it helps to have a clear plan. Think about the inner obstacle you

just identified. Name one action you can take or one thought you can think to overcome your obstacle.

Name an action

[Participants entered their planned action or thought here.]

Appendix B

Supplementary Regression Tables

B.1 Correlations Between Individual (R1) Decisions and Attitudinal Measures

Table B.1: Pearson correlations between Round 1 decisions and attitudinal measures

Variable	r	p
Social Comparison (corrected mean)	.15	.029
Refugee Attitudes – Cognitive	-.03	.669
Refugee Attitudes – Affective	-.08	.240
Refugee Attitudes – Behavioral	-.17	.010

B.2 Robustness Check: Attitudinal Scale Means

Table B.2: Pearson correlations between Round 1 allocation and attitudinal scale means (robustness check)

	Refugee Attitudes (RA_{mean})	Social Comparison (SC_{mean})	Social Norms (SN_{mean})
Allocation	-0.125	0.080	0.079

Note. The Social Norms scale was included as a robustness check. While correlations with allocation showed a pattern similar to Social Comparison, associations were weaker and conceptually overlapping. For clarity and model parsimony, the scale was not included in the main analysis.

B.3 Wilcoxon Signed-Rank and Rank-Sum Test Results (Exact p-values)

Table B.3: Wilcoxon Signed-Rank and Rank-Sum Test Results (Exact p-values)

Comparison	Group/Type	Rounds	Exact p-value
Median vs. Unanimity	All groups	R2	0.553
	LM generous	R2	0.652
	LM selfish	R2	**0.026**
	Mixed-minded	R2	0.436
Within LM selfish		R1 vs R2	**< 0.001 (1.30e-05)**
		R3 vs R2	**< 0.001 (6.75e-05)**
		R3 vs R1	0.312
Within LM generous		R1 vs R2	0.243
		R3 vs R2	0.145
		R3 vs R1	0.451
MM overall		R1 vs R2	**0.009**
		R3 vs R2	**0.013**
		R3 vs R1	0.618
Within MM generous		R1 vs R2	**0.044**
		R3 vs R2	0.055
		R3 vs R1	0.974
Within MM selfish		R1 vs R2	**< 0.001 (5.73e-08)**
		R3 vs R2	**< 0.001 (7.95e-07)**
		R3 vs R1	0.157
Within MM fair		R1 vs R2	0.221
		R3 vs R2	0.623
		R3 vs R1	0.445

Note. The table reports exact p-values from Wilcoxon signed-rank and rank-sum tests comparing allocation behavior across decision rounds and voting rules. Significant differences are observed in selfish groups under both like-minded and mixed-minded conditions, especially between individual and group decisions (R1 vs R2 and R3 vs R2).

B.4 Post-hoc Power Analysis

Table B.4: Post-hoc Power Analysis for Predictors across Models

Model	Predictor	N	Coef.	SE	t	f²	Power
Vote (with controls)	selfish	132	0.522	0.480	1.088	0.010	0.098
	generous	132	-2.166	0.549	-3.947	0.126	0.840
	female	132	-1.081	0.436	-2.479	0.050	0.390
	bachelor	132	-0.469	0.434	-1.081	0.009	0.098
	RA_mean	132	-0.649	0.373	-1.739	0.024	0.195
	SN_mean	132	0.701	0.765	0.917	0.007	0.083
	SC_mean	132	0.702	0.522	1.345	0.015	0.129
Outcome (with controls)	selfish	132	0.509	0.490	1.040	0.009	0.094
	generous	132	-2.200	0.560	-3.928	0.124	0.836
	female	132	-1.072	0.445	-2.411	0.047	0.369
	bachelor	132	-0.535	0.443	-1.206	0.012	0.111
	RA_mean	132	-0.589	0.381	-1.547	0.019	0.160
	SN_mean	132	0.716	0.781	0.917	0.007	0.083
	SC_mean	132	0.631	0.533	1.185	0.011	0.109
Vote (no controls)	selfish	132	0.885	0.482	1.836	0.026	0.357
	generous	132	-2.268	0.557	-4.074	0.129	0.963
Outcome (no controls)	selfish	132	0.868	0.490	1.772	0.024	0.335
	generous	132	-2.272	0.566	-4.013	0.125	0.958
Vote: Selfish × Like-minded	selfish	216	1.896	0.447	4.244	0.085	0.970
	like.minded	216	-1.533	0.526	-2.916	0.040	0.802
	selfish:like.minded	216	2.186	0.723	3.025	0.043	0.838
Outcome: Selfish × Like-minded	selfish	216	1.882	0.457	4.118	0.080	0.959
	like.minded	216	-1.330	0.537	-2.477	0.029	0.679
	selfish:like.minded	216	1.857	0.739	2.514	0.030	0.692
Vote: Selfish × Mixed-minded	selfish	132	4.082	0.569	7.180	0.403	1.000
	mixed.minded	132	1.533	0.526	2.916	0.066	0.777
	selfish:mixed.minded	132	-2.186	0.723	-3.025	0.071	0.791
Outcome: Selfish × Mixed-minded	selfish	132	3.739	0.581	6.439	0.324	1.000
	mixed.minded	132	1.330	0.537	2.477	0.048	0.729
	selfish:mixed.minded	132	-1.857	0.739	-2.514	0.049	0.738
Vote: Generous × Like-minded	generous	216	-2.811	0.436	-6.448	0.196	1.000
	like.minded	216	0.656	0.438	1.495	0.011	0.236
	generous:like.minded	216	-1.248	0.693	-1.800	0.015	0.306
Outcome: Generous × Like-minded	generous	216	-2.869	0.445	-6.447	0.196	1.000
	like.minded	216	0.502	0.448	1.122	0.006	0.149
	generous:like.minded	216	-0.850	0.707	-1.203	0.007	0.174
Vote: Generous × Mixed-minded	generous	132	-4.059	0.540	-7.522	0.442	1.000
	mixed.minded	132	-0.656	0.438	-1.495	0.017	0.188
	generous:mixed.minded	132	1.248	0.693	1.800	0.025	0.292
Outcome: Generous × Mixed-minded	generous	132	-3.719	0.550	-6.766	0.358	1.000
	mixed.minded	132	-0.502	0.448	-1.122	0.010	0.120
	generous:mixed.minded	132	0.850	0.707	1.203	0.011	0.132

B.5   Key Coefficients and Confidence Intervals

Table B.5: Key Coefficients with 95% Confidence Intervals

Predictor	Estimate	95% CI	Model
Selfish	0.88†	[–0.06, 1.83]	Vote, Mixed-Minded (No Ctrl)
Generous	–2.27***	[–3.36, –1.18]	Vote, Mixed-Minded (No Ctrl)
Selfish × Like-minded	2.19**	[0.77, 3.60]	Vote
Selfish × Mixed-minded	–2.19**	[–3.60, –0.77]	Vote
Generous × Mixed-minded	1.25†	[–0.11, 2.61]	Vote
Female	–1.08*	[–1.93, –0.23]	Vote, With Controls

Note. Estimates are derived from censored regression models (Tobit). Confidence intervals are based on normal approximation (Wald method).
† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B.6   Robustness Check: Cluster-Robust Standard Errors

Table B.6: Robustness Check: Cluster-Robust Standard Errors for Main Models

Model	Coefficient	Cluster-Robust SE	p-value
Vote (w/ controls): Generous	–3.00	0.37	< .001
Outcome (w/ controls): Generous	–3.04	0.25	< .001
Vote (no controls): Generous	–3.05	0.27	< .001
Outcome (no controls): Generous	–3.08	0.16	< .001
Vote: Selfish × Like-minded	2.19	0.01	< .001
Outcome: Selfish × Like-minded	1.86	0.01	< .001
Vote: Selfish × Mixed-minded	–2.19	0.01	< .001
Outcome: Selfish × Mixed-minded	–1.86	0.01	< .001
Vote: Generous × Like-minded	–1.25	0.01	< .001
Outcome: Generous × Like-minded	–0.85	0.01	< .001
Vote: Generous × Mixed-minded	1.25	0.01	< .001
Outcome: Generous × Mixed-minded	0.85	0.01	< .001

Note. All models were estimated using Tobit regression with cluster-robust standard errors at the group level. Only relevant coefficients shown; full output available upon request.

B.7 Sample Characteristics and Balance Checks

Table B.7: Balance Check by Treatment Group

Group	N	Age (M ± SD)	% Female	% Rep	% Dem	% Ind.	% Master+
Control	133	40.17 ± 13.30	52.6	44.4	33.8	20.3	20.3
MCII (self-generated)	128	42.69 ± 12.69	54.7	35.2	45.3	17.2	21.9
MCII (predefined wish)	135	42.37 ± 12.54	53.3	42.2	39.3	17.0	31.9
Total	396	41.76 ± 12.88	53.5	40.6	39.5	18.1	24.9

B.8 Logistic Regression Predicting Vote Change

Table B.8 reports the logistic regression results predicting whether participants changed their vote from Round 1 to Round 2. Figure B.1 illustrates the predicted probabilities for the Ambivalent Sexism Inventory (ASI) score.

Table B.8: Logistic Regression Predicting Vote Change (R1 → R2)

Predictor	Estimate	Std. Error	p-value
Intercept	−0.81	0.87	.357
ASI (centered)	−0.24	0.24	.311
Treatment: MCII	0.36	0.27	.172
Treatment: MCII (Predefined Wish)	−0.11	0.27	.692
INCOM (Social Comparison)	0.17	0.21	.437
Age	−0.02	0.01	.063
Gender: Male	−0.16	0.22	.465
Gender: Non-binary	0.41	1.05	.699
Education: High School	0.28	0.37	.446
Education: Master's+	0.45	0.28	.100
Education: Some College	0.11	0.30	.706
Party: Independent	0.08	0.32	.801
Party: Other	0.61	0.81	.446
Party: Republican	0.38	0.28	.177
MCII × ASI	0.07	0.31	.827
MCII (Predef Wish) × ASI	0.21	0.31	.500

Note: Logistic regression with logit link. ASI is mean-centered. Reference: Control, Female, Bachelor's, Democrat.
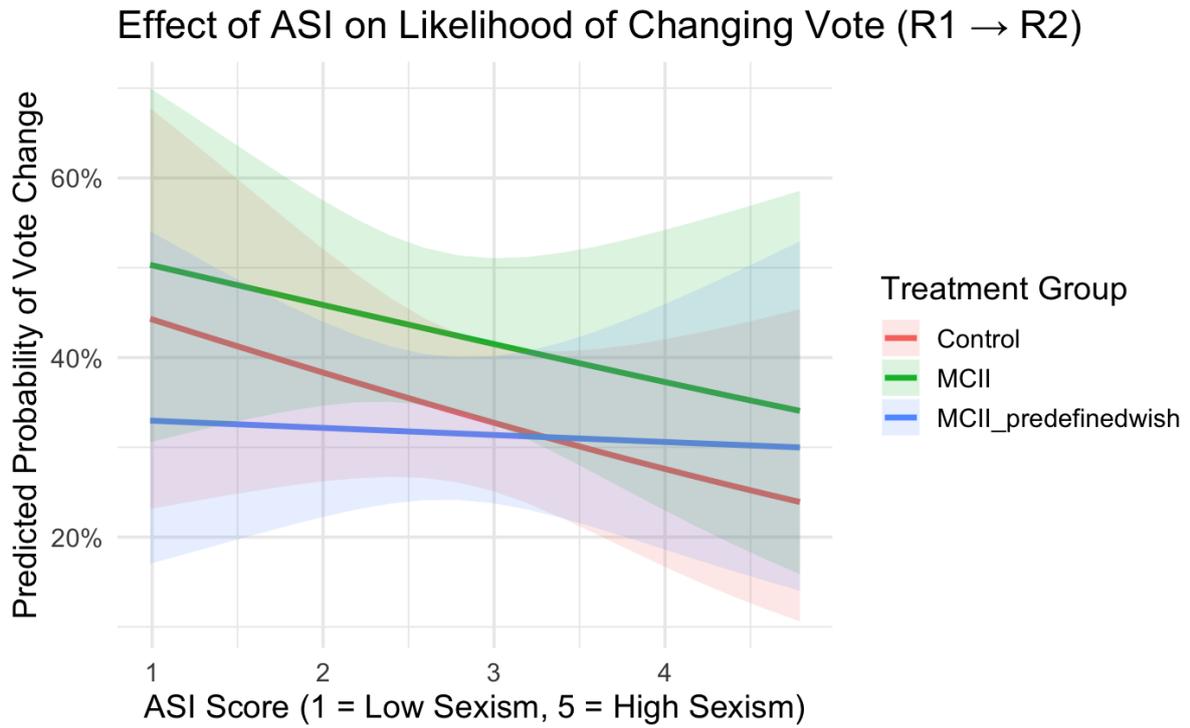
B.9   Effect of ASI Score on Changing Vote

Figure B.1: Effect of ASI Score on Likelihood of Changing Vote (R1 → R2). Predicted probabilities with 95% confidence intervals.

Appendix C

Scales and Variables

C.1 Variable Overview

Variable	Description
snes_mean	Social-norm espousal (mean score)
incom_mean	Social comparison orientation (mean score)
ra_mean	Refugee and immigration attitudes (mean score)

Table C.1: Overview of scale variables used in Chapter 2

C.2 Social-Norm Espousal Scale (SNES)

The Social-Norm Espousal Scale (SNES) was used to assess participants' general endorsement of social rules and expectations. The items were adapted from Bizer et al. (2014). Participants responded on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

German instruction: Bitte geben Sie an, wie sehr Sie den folgenden Aussagen zustimmen (1 = stimme überhaupt nicht zu, 5 = stimme voll und ganz zu).

German Item (Beispiel)	English Translation (Example)
Menschen sollten sich an Regeln halten, auch wenn niemand hinsieht.	People should follow the rules even when no one is watching.
Es ist wichtig, sich an die Erwartungen der Gruppe anzupassen.	It is important to go along with what the group expects.

Table C.2: Example items from the Social-Norm Espousal Scale (SNES)

Only selected items are shown here due to copyright. Full content is available in the cited source. Responses were averaged to compute the variable snes_mean.

C.3   Social Comparison Orientation (INCOM)

Social comparison orientation was measured using 11 items adapted from Schneider and Schupp (2011), based on the original INCOM by Gibbons and Buunk. The scale captures the tendency to compare one's abilities, opinions, and status with others. Participants rated each item on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

German instruction: Bitte beantworten Sie die folgenden Aussagen auf einer Skala von 1 (stimme überhaupt nicht zu) bis 5 (stimme voll und ganz zu). Mit den Werten zwischen 1 und 5 können Sie Ihre Meinung abstufen.

Responses were averaged to form the composite variable `incom_mean`. Items 5 and 11 were reverse-coded.

C.4   Refugee and Immigration Attitudes Scale (RA)

To assess attitudes toward refugees, we used six items adapted from Kotzur et al. (2022). The scale included cognitive, affective, and behavioral components. Participants rated each item on a 5-point Likert scale.

German instruction: Bitte geben Sie an, wie sehr Sie den folgenden Aussagen zustimmen (1 = stimme überhaupt nicht zu, 5 = stimme voll und ganz zu).

German Item (Beispiel)	English Translation (Example)
Deutschland hat eine humanitäre Verpflichtung, Geflüchtete zu unterstützen.	Germany has a humanitarian responsibility to support refugees.
Geflüchtete stellen eine unzumutbare Belastung für den Sozialstaat dar. *(Reverse)*	Refugees place an unreasonable burden on the welfare state. *(Reverse)*

Table C.4: Example items from the Refugee Attitudes Scale (RA)

Only selected items are shown here to comply with publication rights. Responses were averaged to form the composite variable `ra_mean`, where higher values indicate more favorable refugee attitudes.

C.5   Risk Preference Task (oTree Version)

Participants made 10 choices between two lotteries, Option A and Option B. In each row, both options paid either 1,00 or 2,00 , but the probabilities differed. After all choices, one row was randomly selected and the chosen lottery was played to determine payment.

#	German Item	English Translation
1	Ich vergleiche häufig das Wohlergehen meiner Angehörigen (Partner, Familienangehörige, etc.) mit dem von anderen.	I frequently compare the well-being of my close ones (partner, family members, etc.) with that of others.
2	Ich achte immer sehr stark darauf, wie ich Dinge im Vergleich zu anderen mache.	I always pay close attention to how I do things compared to others.
3	Wenn ich herausfinden möchte, wie gut ich etwas erledigt oder gemacht habe, dann vergleiche ich mein Ergebnis mit dem anderer Personen.	When I want to assess how well I've done something, I compare my result with that of others.
4	Ich vergleiche häufig meine sozialen Fähigkeiten und meine Beliebtheit mit denen anderer Personen.	I often compare my social skills and popularity with those of other people.
5	Ich bin nicht der Typ Mensch, der sich oft mit anderen vergleicht. *(Reverse)*	I'm not the type of person who compares with others often. *(Reverse)*
6	Ich vergleiche mich häufig selbst mit anderen in Bezug auf das, was ich im Leben (bislang) erreicht habe.	I often compare myself with others regarding what I have achieved in life so far.
7	Ich tausche mich gerne häufig mit anderen über Meinungen und Erfahrungen aus.	I frequently exchange opinions and experiences with others.
8	Ich versuche häufig herauszufinden, was andere denken, die mit ähnlichen Problemen konfrontiert sind wie ich.	I often try to find out what others think who are facing similar problems as I am.
9	Ich möchte immer gerne wissen, wie sich andere in einer ähnlichen Situation verhalten würden.	I always like to know how others would behave in a similar situation.
10	Wenn ich über etwas mehr erfahren möchte, versuche ich herauszufinden, was andere darüber denken oder wissen.	When I want to learn more about something, I try to find out what others think or know about it.
11	Ich bewerte meine Lebenssituation niemals im Vergleich zu der anderer Personen. *(Reverse)*	I never evaluate my life situation by comparing it to that of others. *(Reverse)*

Table C.3: Bilingual item list: Social Comparison Orientation (adapted INCOM)

Table C.5: Ten lottery choices with probabilities for winning 2,00 (and 1,00 otherwise)

#	Option A	Option B
1	10% 2,00 , 90% 1,00	90% 2,00 , 10% 1,00
2	20% 2,00 , 80% 1,00	80% 2,00 , 20% 1,00
3	30% 2,00 , 70% 1,00	70% 2,00 , 30% 1,00
4	40% 2,00 , 60% 1,00	60% 2,00 , 40% 1,00
5	50% 2,00 , 50% 1,00	50% 2,00 , 50% 1,00
6	60% 2,00 , 40% 1,00	40% 2,00 , 60% 1,00
7	70% 2,00 , 30% 1,00	30% 2,00 , 70% 1,00
8	80% 2,00 , 20% 1,00	20% 2,00 , 80% 1,00
9	90% 2,00 , 10% 1,00	10% 2,00 , 90% 1,00
10	100% 2,00 , 0% 1,00	0% 2,00 , 100% 1,00

C.6 Rational–Experiential Inventory (REI)

The Rational–Experiential Inventory (REI) is a validated instrument measuring individuals' reliance on rational (analytic, deliberate) versus experiential (intuitive, affective) thinking (Pacini and Epstein, 1999). Participants responded on a 5-point Likert scale from 1 (definitely not true of myself) to 5 (definitely true of myself).

German instruction: Bitte geben Sie an, wie sehr die folgenden Aussagen auf Sie zutreffen (1 = trifft überhaupt nicht zu, 5 = trifft vollkommen zu).

German Item (Beispiel)	English Translation (Example)
Ich habe Freude an intellektuellen Herausforderungen.	I enjoy intellectual challenges.
Ich vertraue meinen ersten Gefühlen gegenüber Menschen.	I trust my initial feelings about people.

Table C.6: Example items from the Rational–Experiential Inventory (REI)

Only selected items are shown here due to copyright. Full content is available in the cited source. Responses were averaged to compute the rationality (`rei_rational`) and experientiality (`rei_experiential`) subscale means.

C.7 Ambivalent Sexism Inventory (ASI)

The Ambivalent Sexism Inventory (ASI) was used to measure participants' endorsement of benevolent and hostile sexist attitudes (Glick and Fiske, 2018). Participants responded on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Instruction: Please indicate how much you agree with the following statements (1 = strongly disagree, 5 = strongly agree).

Benevolent Sexism (Example)	Hostile Sexism (Example)
Women should be cherished and protected by men.	Women exaggerate problems they have at work.
Men are incomplete without women.	Feminists are making unreasonable demands of men.

Table C.7: Example items from the Ambivalent Sexism Inventory

Only selected items are shown here due to copyright. Full content is available in the cited source. Responses were averaged to compute `asi_benevolent`, `asi_hostile`, and `asi_mean`.

Appendix D

Screenshots of oTree Interfaces
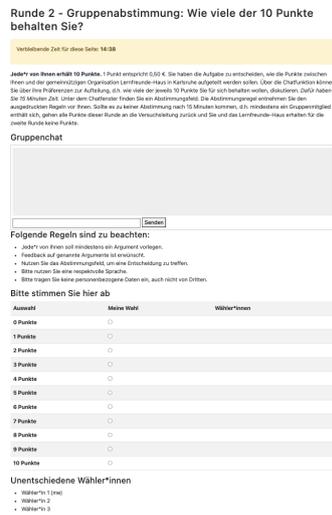
(a) Round 2 group decision page

(b) Round 1 individual decision page

(c) Round 3 individual decision page

Figure D.1: oTree Group Composition and Size Projects

Figure D.2: oTree Sequential Voting Game Project
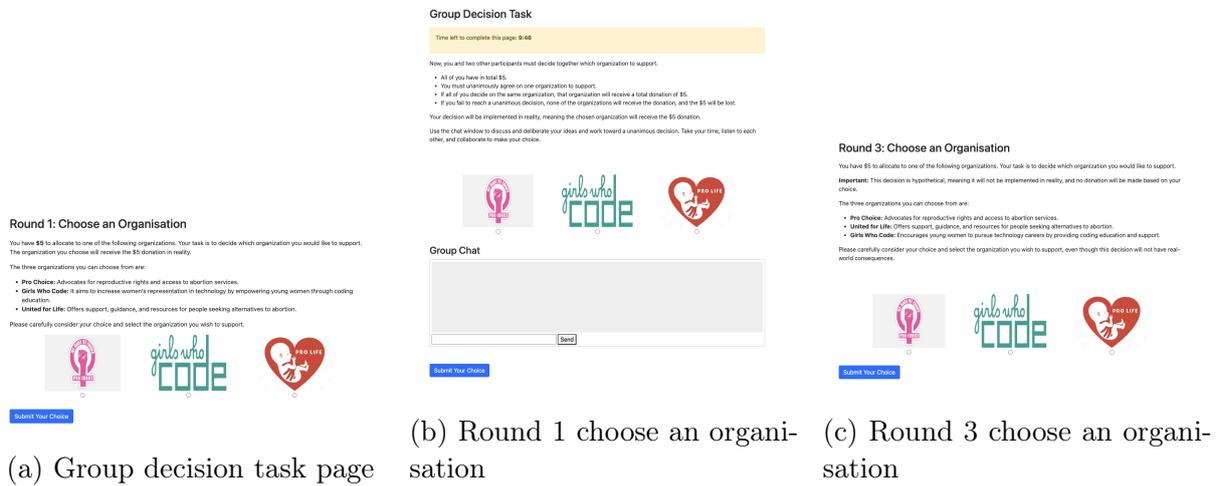
(a) Group decision task page

(b) Round 1 choose an organisation

(c) Round 3 choose an organisation

Figure D.3: oTree Intervention Project