Group versus individual decision-making: Is there a shift?*

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Abstract

The phenomenon that decisions of groups of individuals differ in a systematic way from decisions of individuals in isolation has been documented in a wide variety of experiments. This paper revisits this question with a design soliciting both individual decisions of group members and the group's joint decision in second-mover contributions in gift-exchange games, and in lottery choices. We examine which group members are influential in the group decision. In gift-exchange games, if group decisions are obtained without deliberation by public voting, there is no shift relative to the median individual decisions, indicating that the social context itself does not change behavior. When deliberation is allowed and no decision rule is imposed on the group, besides the median member, the individual one position away in the selfish direction also becomes influential in the group decision. The findings contradict the social comparison theory and are consistent with the persuasive argument theory from social psychology. We demonstrate that a researcher incorrectly assuming that the group decision is a function of the mean individual decision would conclude that there is a selfish level shift. In lottery choices, the median individual decision becomes the group decision with very high probability. Nevertheless, if the distribution of individual choices in a given choice problem is asymmetric enough in some direction, since median group members are likely to be in that direction, group decisions are even more tilted in that direction. Our results highlight that the question whether people behave differently in group settings can only be addressed relative to a theory of how groups make decisions.

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1 Introduction

Many important decisions in the society are made by groups of individuals such as committees, governing bodies, juries, business partners, teams, and families. Experiments in various contexts demonstrate systematic differences between choices made by groups of individuals and by individuals making decisions in isolation. There is a large literature in social psychology documenting and analyzing this phenomenon, referring to it as the "discontinuity effect" or "group shift", and a relatively recent literature in economics investigating it both experimentally and theoretically.[1]

Some of the experiments feature tasks in which there is a normative criterion for evaluating the quality of the decisions. Laughlin (1980) and Laughlin and Ellis (1986) refer to these tasks as intellective.[2] In these situations it is natural to expect the distribution of groups' decisions to differ systematically from the distribution of individual decisions if group members can interact with each other, since group members can convey information to each other that rationally changes the intended action of the others.[3] More surprising is the finding that there is a group shift in many non-intellective tasks, in particular when only the decision-makers' personal preferences should dictate choice. There is a large literature examining attitudes towards cooperation and reciprocity, mostly concluding that people in groups act more selfishly than when they make decisions individually ("selfish shift").[4] Another line of literature, starting with Stoner (1961), investigates risk attitudes expressed by groups and individuals differing.[5] In most choice problems involving a safe and a risky option groups tend to take more risk ("risky shifts"), but in some types of lottery decisions

[1] In social psychology, the topic became a standard textbook chapter: see for example Brown (1986), chapter 6.

[2] Within intellective tasks Gigone and Hastie (1993) define highly demonstratable ones as those for which arguments prescribed by the normative model are self-evidently correct, making it very likely that the correct arguments win in a discussion. The corresponding terminology used in the economics literature, starting with Cooper and Kagel (2005) is "the truth-wins norm."

[3] Even if no communication is possible before the decision-making mechanism, if the latter involves sequentiality (like sequential voting) group members can learn information from each other during the mechanism.

[4] In the prisoner's dilemma context this conclusion is reached by Pylyshyn et al. (1966), Wolosin et al. (1975), Lindskold et al. (1977), Rabbie (1982), Insko et al. (1990), and Schopler and Insko (1992). Wildschut et al. (2003) contains a meta-analysis of the subject, while Charness et al. (2007) is a more recent contribution in economics. In centipede games Bornstein et al. (2004), while in ultimatum games Robert and Carnevale (1997) and Bornstein and Yanive (1998) report similar findings. In gift-exchange games, Kocher and Sutter (2007) find no difference between groups and individuals if giving a gift is relatively cheap and unlimited discussion is allowed within groups, but show that groups are more selfish if group members can only communicate anonymously, through the computer network. In dictator games Cason and Mui (1997) report an altruistic shift, but Luhan et al. (2009) in a modified design find a selfish shift.

[5] See also Teger and Pruitt (1967), Burnstein et al. (1973), and Brown (1974). Recent papers in economics include Shupp and Williams (2008), Baker et al. (2008) and Masclet et al. (2009).

the opposite is observed ("cautious shifts").[6]

The two main general explanations in social psychology for such shifts are the social comparison theory (Levinger and Schneider, 1969) and the persuasive argument theory (Burnstein et al., 1973; Brown, 1974).[7] The social comparison theory emphasizes that people in group settings behave differently than in isolation. In particular, it assumes that people are motivated both to perceive and present themselves in a socially desirable way. To accomplish this, a person might react in a way that is closer to what he regards as the social norm than how he would act in isolation. According to the persuasive argument theory, the reason why deliberation drives group decisions in a particular direction is that the pool of arguments in that direction is more persuasive. A related explanation of group shifts is that people with certain preferences tend to be more persuasive than others (for example, more selfish individuals are also more aggressive in deliberation).

In this paper we provide an experimental investigation of group shifts in the context of non-intellective tasks, and examine both the social comparison theory and the persuasive argument theory. The central point we make is that the question whether there is a systematic shift in the behavior of people in group settings can only be addressed relative to some benchmark hypothesis on how individual preferences are aggregated into group decisions. For example, it is well-known that if individuals have single-peaked preferences and employ majority voting in their decisions then the group decision is equal to the median of the group members' decisions (Moulin, 1980). Then if the distribution of individual preferences in a subject pool is asymmetric, so that the population median is not equal to the population mean, there is an expected shift in the direction of the population median when one compares the average of individual decisions to the average of group decisions, even if there is no change of behavior in social settings. This is an important observation because most of the existing literature on group shift bases its conclusions on comparing average group decisions to average individual decisions. Moreover, there is a line of literature explicitly exploring the relationship between the mean of individual decisions and the mean of group decisions across different specifications of lottery choice problems (see for example Teger and Pruitt, 1967; Myers and Arenson, 1972). We are only aware of one paper showing that deliberation causes a group shift relative to the initial median individual opinion in the group, in the context of an intellective task: Schkade et al. (2000) demonstrate this in an experiment in which subjects need to decide an appropriate punitive damage award in a case of recklessly negligent behavior.[8]

We conducted our investigation in two contexts. The first one is a gift-

[6] As Hong (1978) demonstrates, the cultural setting can also influence the direction of the shift in the same decision problem.

[7] See other explanations, mostly in specific types of decision problems, in the next section.

[8] Kerr et al. (1996), in a meta-analysis of intellective tasks, also recognize that the aggregation method influences the distribution of group decisions. They consider several aggregation methods, including simple majority voting, but they don't investigate whether there is a group shift relative to a given aggregation method.

exchange game (Fehr, Kirchsteiger and Riedl, 1993; Brandts and Charness, 2004), widely studied in experimental economics. In this context we looked at decisions as a respondent (second-mover), made by groups and by individuals consisting these groups. The decision problem of the respondent, namely how much gift to reciprocate, is a non-intellective task if there is no continuation in the interaction between the first-mover and the second-mover. It should purely reflect how much the decision-maker feels compelled to reciprocate gifts by others. Existing studies suggest that with respect to reciprocity the distribution of preferences in a typical subject pool is asymmetric: based on data from ultimatum games and repeated public good contribution games, several papers drew the conclusion that typically roughly 40% of subjects reciprocate others' contributions to various degrees, while 50-60% of the subjects seem to care only about their own material payoffs.[9] This implies that the population median is at the selfish extreme, and in particular the median decision in related contexts is different (more selfish) than the average decision.

The second setting we examined is binary choices between lotteries, based on the risk preference elicitation questionnaire of Holt and Laury (2002). This type of decision problem is again typically considered to be a non-intellective task, reflecting the subject's attitudes towards risk-taking.

To compare individual and group decisions, we implemented a design in which some subjects were randomly allocated to be individual decision-makers, while other subjects were allocated to groups of five. In gift-exchange games, individual decision-makers played the roles of the first movers, and subjects allocated to groups played the roles of the second movers. In every gift-exchange game, after the amount of gift from the first mover was revealed to group members, first we solicited how much the group members would reciprocate individually, and then the group decision. For each of these decisions it was randomly determined whether the group choice was implemented, or one of the individual choices, and if the latter, which one. In both cases, the effective group choice influenced all group members' payoffs identically (even if it happened to be one of the group members' individual decision). Similarly, in lottery choices first we solicited individual choices of group members, and then group decisions, with the understanding that it was randomly determined whether one of the individual decisions or the group decision would become the actual lottery choice, but in both cases the same decision would apply to all group members.

As far as we know our experiment is the first in which both the group decision and the intended individual decisions of the group members were solicited for the same decision and monetary incentives were provided for both types of choices. There are studies, like Cason and Mui (1997) and Luhan et al. (2009), in which both individual and group decisions are solicited from the same subjects for the same type of decision, but in these studies individual decisions only apply to the individual itself.[10] As shown recently by several papers (Charness et al., 2007;

[9]See Ledyard (1995), Palfrey and Prisbey (1997), Brandts and Schram (2001), and Fischbacher et al. (2001). The data we collected in the experiments for Ambrus and Pathak (2007) is also consistent with these findings.

[10]Furthermore, in the cited studies, groups interact with groups, while individuals interact

Chen and Li, 2009; Sutter, 2009), it affects individuals' decisions whether the consequences of the decision only apply to them or whether they apply to a group of people they belong to. For this reason, we find it important that the individual and group decisions apply to the same set of people for investigating possible sources of group shifts related to the social comparison theory and the persuasive argument theory. Another aspect in which our experiments differ from the ones featured in the above studies is that having groups of five individuals allows us to examine the influence of non-median group members closer versus further away from the median on the group decision.[11]

We conducted two different treatments. In the benchmark, No Deliberation, group members were not allowed to deliberate on the choice, and the group decision was determined by a sequential public voting mechanism. This treatment ruled out the possibility of a group shift arising from asymmetric preference aggregation such as in the persuasive argument theory. However, since the voting procedure was publicly observed by group members, it left open the possibility that group members acted differently in the group setting than when making their individual decisions, as in the social comparison theory. In the alternative treatment, Deliberation, we allowed for unrestricted deliberation among group members before agreeing upon a group decision (after all of them submitted their individual decisions secretly), hence allowed for the possibility that certain individuals affect the group decision more than others. Moreover, similarly to most studies of group decisions, in this treatment we did not impose a voting mechanism, and left it completely to the groups to decide on how they come up with a group decision. We chose the above two treatment conditions because both of them have been popular in earlier experiments on group decision-making. We analyze preference aggregation in the two treatments separately, instead of directly comparing them, as they differ in multiple potentially important dimensions.

The primary focus of our empirical investigation is on the gift-exchange games, where the larger action space and the larger spread of individual decisions allowed us a more elaborate testing of which group members were influential in shaping group decisions than in binary lottery choice problems. Based on regressing the group decision on the ordered (from lowest to highest) individual decisions by the group members, we tested three formal hypotheses. The first one is that the group decision is a function of the mean of individual decisions, as implicitly or explicitly assumed by most of the literature. This hypothesis implies that all individuals within a group should have the same regression coefficient, significantly different from zero. The second one is that the group decision is a function of the median decision: in this case only the median group member (the third lowest individual decision) should have a regression coefficient significantly different from zero. The third hypothesis is that there is a group shift corresponding to a level effect when subjects make the group decision: in this case the regression coefficient for the constant term should be

with individuals.

[11] Cason and Mui (1997) investigated groups of two individuals, while Luhan et al. (2009) examined groups of three individuals.

significantly different from zero (negative for a selfish shift), independently of how different individual decisions get aggregated into a group decision.[12]

In the No Deliberation treatment, the only significant parameter in the regression (at the 1% level) is the median group member's individual contribution. The mean hypothesis is strongly rejected, while the median hypothesis cannot be rejected. The coefficient for the constant term is not significantly different from zero, therefore we do not find evidence for a group shift corresponding to a level effect.

In the Deliberation treatment, the coefficient for the constant remains insignificantly different from zero, showing that there is no group shift corresponding to a level effect in this condition, either. However, besides the median individual decision, the second lowest individual decision also becomes significant in determining the group decision. The mean hypothesis is still rejected, but in the Deliberation treatment the median hypothesis is also rejected. While the group members with the most extreme opinions do not influence the group decision, the group member one position away from the median in the selfish direction does seem to have a significant effect. The point estimate of the regression coefficient for the second lowest individual contribution is smaller than the estimated coefficient for the median decision, but the difference is not significant.

We found the above findings to be robust to only including data from later phases of the experimental sessions. That is, while subjects may change their individual opinions throughout the experiment about possible choices, the way individual choices get aggregated into a group choice stays constant throughout different phases of the experiment.

Our results provide evidence against the social comparison theory. The finding that the constant term in both conditions is insignificant, and hence no level shift in contributions independent of the aggregation was observed, indicates that the social setting by itself does not alter subjects' choices in our context. In particular, the fact that the median group member's individual contribution is the only significant explanatory variable in the No Deliberation treatment suggests that there is no group shift, if one defines group shift appropriately, without the possibility of persuasion. On the other hand, our findings are in line with the predictions of the persuasive argument theory. Deliberation makes the group member with the second lowest individual contribution influential in the group decision.

Interestingly, when regressing the group decision on the mean of the individual decisions in the Deliberation session, the constant term in the regression becomes significantly negative. Hence, a researcher working with a specification assuming that the group decision depends on the mean of individual decisions would conclude that there is a selfish shift when switching from individual to group decisions. At the same time, when regressing the group contribution on the median individual decision, the point estimate for the constant term is

[12] For example, both when the group decision is the mean of the expressed opinions and when the group decision is the median of the expressed opinions, if the publicly expressed opinion of group members differs by a constant c from subjects' secretly submitted individual choices, the expected coefficient of the constant term is c.

insignificant and very close to zero.

In lottery choices, we find that in 96% of the cases the median individual decision becomes the group decision, in both the Deliberation and the No deliberation treatments. In the remaining cases there is no clear pattern about the direction of the shift in the group decision relative to the median. Nevertheless, in all lottery choice problems in which more than 60% of individual subjects prefer one option (either the safe or the risky one), the share of groups choosing that option is even higher than the share of individuals choosing it, which an analyst simply comparing average decisions of groups versus individuals would interpret as a group shift. However, the main driving force behind the differences of the average decisions of individuals and groups is that in some lottery choice problems the median individual decision is the safe choice, even when a significant minority chooses the risky one, or vice versa. In the group decisions the minority opinion tends to be oppressed, leading to a different distribution of choices for groups than for individuals. The result that this effect has the same impact no matter whether the distribution of individual decisions is skewed towards the safe choice or towards the risky choice provides an explanation why previous studies found "cautious shifts" in certain lottery choice problems, while "risky shifts" in others.

We recorded certain demographic information on subjects: gender, age, and whether the subject is studying an economics-related field. These characteristics seem to have little effect on how influential a person is in deliberation. The only consistent effect we found is that women, if their positions within the group were close to the median, were somewhat more influential in the Deliberation treatment than men. This finding is in contrast with Christensen and Abbott (2000), who find that women's ideas are often less influential and sometimes suppressed altogether in mixed-gender groups.

2 Related literature

The literature on group shifts in social psychology dates back to Stoner (1961). Subsequent research showed that in most decision problems exhibiting a group shift, groups tend to take more extreme decisions than individuals. That is, in one-dimensional decisions in which the distribution of individual decisions is skewed in one direction, group decisions tend to shift further in that direction. Moscovici and Zavalloni (1969) labeled this as "group polarization", and risky/cautious shifts and selfish shifts are regarded as particular instances of this regularity. Sunstein (2000, 2002) and Manin (2005) point out the related phenomenon of "group extremization": even in tasks in which individual preferences on average are not tilted in one direction, if in a particular group preferences are more towards one direction, a group shift tends to occur in this direction. That is, groups make more extreme decisions, although not systematically in one direction. On the other hand, there are a few papers that found decision problems in which deliberation leads to depolarization of opinions (Ferguson and Vidmar, 1971; Burnstein, 1982).

There are many explanations provided in the literature for systematic group shifts that could apply to contexts involving non-intellective tasks, besides the two most popular lines of explanation highlighted in the Introduction. The in-group versus out-group sentiments theory (Tajfel et al., 1971; Kramer, 1991) posits that subjects develop more other-regarding preferences toward their group members than towards subjects outside the group. A recent line of papers starting with Charness et al. (2007) provides experimental evidence along these lines.[13] The identifiability explanation (Wallach et al., 1962, 1964) claims that people in group decisions act more selfishly because the other side's ability to assign personal responsibility is more limited. Eliaz et al. (2005) point out that in lottery choice problems subjects who are not expected utility maximizers exhibit a group shift, because the decision problem associated with the possibility of being pivotal in a group's lottery choice decision differs from individually deciding on the lottery choice if the probability of being pivotal is less than 1.

Less directly related to our paper is the literature on intellective tasks. In this environment, a string of papers showed that groups tend to outperform individuals.[14] However, psychologists found several examples in which groups are more likely to choose incorrect decisions (group members are more likely to herd with someone arguing for a particular incorrect choice).[15] Glaeser and Sunstein (2009) provide a theoretical analysis of group shifts in the context of intellective tasks.

A recent survey of the experimental economics literature on group decisions, both on intellective and non-intellective tasks, is provided in Niederle (2009).

3 Competing Hypothesis

We investigate situations in which five individuals first make an individual choice, and then jointly decide on a group choice, for the same decision problem. The models we examine can be generally written as:

$$y_{gt} = f(x_{1gt}, x_{2gt}, x_{3gt}, x_{4gt}, x_{5gt}, X_g, t)$$

where t stands for a time period (which for every group is associated with one particular decision problem), y_{gt} is group g's observed decision in period t, x_{igt} is the observed individual decision of individual i in the same period, and X_g is a vector of characteristics of the group members, which allows for the group's decision to depend on observed demographic characteristics of the group. Note that we allow the aggregation function f to depend on t. We also use $x_{gt}^{(j)}$ to

[13] See also Charness and Jackson (2009), Chen and Li (2009), and Sutter (2009).

[14] Kocher and Sutter (2005) conclude that groups learn faster and make better judgments in beauty contest games. Blinder and Morgan (2005), in an experiment in which subjects were asked to make statistical inferences in a design that mimicked certain aspects of monetary policymaking, find that groups consistently outperform individuals. Cooper and Kagel (2005) show that groups play more strategically than individuals in signaling games.

[15] For an overview, see Asch (1995).

refer to the jth highest decision among in the individuals in group g, where $x_{gt}^{(1)}$ and $x_{gt}^{(5)}$ are the highest and lowest, respectively.

All of our comparisons are between the individual decisions and group decisions for a particular period t. In our basic specification we assume that the relationship between group and individual decisions - that is, how individual decisions are aggregated to a group decision - does not depend on the particular time period. In Subsection 6.2, we provide evidence for the validity of this assumption.

In most of the analysis we focus on models in which the group decision is a linear function of $(x_{igt})_{i=1,..,5}$. In particular, we omit X_g from most of the analysis, for the reason that we found that observed demographic characteristics of group members played little role in the aggregation. For results on how demographic characteristics influence aggregation, see Subsection 5.2.

We focus on linear models and our basic specification is:

$$y_{gt} = \alpha + \beta_1 x_{gt}^{(1)} + \beta_2 x_{gt}^{(2)} + \beta_3 x_{gt}^{(3)} + \beta_4 x_{gt}^{(4)} + \beta_5 x_{gt}^{(5)} + \epsilon_{gt}. \tag{1}$$

The first hypothesis we examine, the **mean hypothesis**, implies that the group's decision is simply a function of the mean of the individual decisions. This implies that

$$y_{gt} = \beta \left(\frac{1}{5} \sum_{i=1}^{5} x_{gt}^{(i)} \right).$$

That is, the mean is a sufficient statistic for the group's decision. If $\beta = 1$, then the mean exactly predicts the group's decision. If $\beta < 1$, then the group's predicted decision is systematically lower than the mean of the individuals, but there is no systematic difference which is independent of the mean decision. In our econometric tests, we test whether we can reject the hypothesis that $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5$. The version of the mean hypothesis which further requires the mean to exactly predict the group decision, what we call the **strong mean hypothesis**, involves tests of the hypothesis that $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \frac{1}{5}$.

The second hypothesis, the **median hypothesis**, implies that the group's decision is a function of the median individual decision only, so that

$$y_{gt} = \beta x_{gt}^{(3)}.$$

In our econometric tests, we estimate equation (1), and test whether we can reject the hypothesis that $\beta_1 = 0, \beta_2 = 0, \beta_4 = 0, \beta_5 = 0$. The version of the hypothesis which further requires the median to exactly predict the group decision, what we call the **strong median hypothesis**, involves testing whether we can reject both $\beta_1 = 0, \beta_2 = 0, \beta_4 = 0, \beta_5 = 0$ and $\beta_3 = 1$.

The last hypothesis, the **level-shift hypothesis**, predicts that there is a systematic shift between the group's decision and the individual decision. The group shift can happen relative to either the mean decision or the median decision. To allow either possibility, we test the level-shift hypothesis in our main specification by examining whether it is possible to reject the hypothesis that

$\alpha = 0$. We also examine models where we only include the mean of the individual decisions and an intercept, and models where we only include the median of the individual decisions and an intercept, and test whether we can reject the hypothesis that the coefficient on the intercept is zero.

We conclude this section with relating the above simple hypotheses to the two main theories explaining group shifts in social psychology. According to the social comparison theory, the social setting itself alters people's behavior and choices. We associate this with a level-shift, corresponding to a coefficient α significantly different from zero (significantly negative for a selfish shift), in both of our treatments. As opposed to this, if the social setting itself does not have a significant effect on people's choices, we expect not to be able to reject the strong median hypothesis and the hypothesis that $\alpha = 0$. The persuasive argument theory by design can only have an impact in the Deliberation treatment, in the form of individual decisions in a particular direction from the median becoming significant determinants of the group decision, leading to the rejection of the median hypothesis. In the No deliberation treatment we regard the testing of the median hypothesis as a consistency check.

4 Experimental design and procedures

To test the hypotheses, our experiment utilizes decision making situations from the two main domains of economic experiments: strategic social interaction and non-strategic, individual decision making. We confront subjects with the choice of a second mover in a gift-exchange game, and with a list of binary lottery choice situations as in Holt and Laury (2002). As we elicit both individual and group choices from the same individuals over the same decision task, our design allows us to observe the aggregation of individual choices to group decisions.

The first game featured in our experiments is structurally the same as the one in Brandts and Charness (2004), and following their terminology we refer to it as a gift-exchange game.[16] In the version of the game we use, a first mover and a second mover are each endowed with 10 tokens of monetary value. First, the first mover may send a gift of 0 to 10 tokens to the second mover. The amount is deducted from the first mover's account, but is tripled on the way before being awarded to the second mover. Then the second mover can decide whether he wants to send a gift of 0 to 10 tokens to the first mover under the same conditions: For each token sent one token is deducted from the second mover's account, and the triple of the amount is added to the first mover's account. While the socially optimal behavior is to exchange maximal gifts, in the unique Nash equilibrium outcome neither player contributes any gift.

The typical experimental data on this game shows first movers trusting and a significant likelihood of reciprocal behavior among second movers, yielding outcomes which are closer to the socially efficient one. Individuals differ both

[16] The term gift-exchange game was introduced by Fehr et al. (1993). Gift-exchange games are similar in structure to trust games, introduced by Berg et al. (1995), and can be more generally classified as sequential social dilemma games.

in their degrees of trust as well as in their pattern of reciprocal behavior. In our experiment we concentrate on the latter, studying how individual reciprocal patterns to a diverse set of stimuli are aggregated to group behavior.

For the risk choice situation, we used a version of the risk preference elicitation questionnaire of Holt and Laury (2002), displayed in the Appendix of the current paper. In this questionnaire, subjects have to make ten choices between two lotteries, namely $p[\$11.50] \oplus (1-p)[\$0.30]$ vs. $p[\$6.00] \oplus (1-p)[\$4.80]$ with $p \in \{0, 0.1, 0.2, ..., 0.9\}$. Of this choice list, one lottery is randomly selected, the decision implemented and the corresponding lottery played out. Most experiments observe heterogeneous individual risk attitudes, with a majority of people being slightly to strongly risk averse. Our experiment studies how these individual risk preferences are aggregated to a group risk attitude when the group has to make a decision that applies to all members.

The experimental sessions took place from January to March 2008 in the Computer Laboratory for Experimental Research at Harvard Business School. We conducted four sessions with a total of 109 student subjects.

The experiment was computerized using the z-Tree software (Fischbacher, 2007). After subjects arrived instructions were distributed.[17] An experimenter (the same in all sessions) led subjects through the instructions and answered open questions. Then, subjects were randomly assigned to be either one of 6 purely individual decision-makers, or to be a member of a group of 5 participants, by drawing a numbered card.

The six purely individual decision-makers stayed in the main lab and made n first-mover decisions in a row at the beginning of the experiment, without any feedback, with n equal to the number of groups in the session.[18] Afterwards they had to stay in the lab until the end of the session.

Group participants were led to small group rooms to make their decisions. For them, each session consisted of three phases. Between phases, the initial random assignment to the n groups g was reshuffled by assigning each group member i to her new group $g + i \pmod n$. During a phase groups stayed constant. In each phase, group members made decisions as second movers in two gift-exchange games (with two different first movers) and in one lottery task. In each game, group members first made individual decisions, after seeing the first mover's gift, and submitted their decisions secretly to a researcher conducting the experiment. Then, depending on treatment, they either freely discussed and made a group decision, or participated in a sequential public voting mechanism to determine the group decision.[19] We refer to the first type of session as a

[17] Instructions for the Deliberation treatment are included in the Appendix.

[18] About half of first movers in our sessions did vary their offers, despite receiving no feedback between offers, while the other half didn't. All decisions of a single first mover were played against different groups.

[19] In the voting procedure, in the gift exchange games, a researcher first asked how many group members would support giving at least one unit of gift to the first proposer. Group members were asked to raise a hand in case they supported the proposal. In case the majority of group members supported giving at least one unit, the researcher asked the group members how many of them would support giving at least two units. The procedure continued until a majority indicated not supporting any higher amount of gift. For the risky choice experiment,

Deliberation session, and the second type of session as a **No Deliberation** session. After all decisions in all three phases had been made, group members filled in a post-experimental questionnaire asking for demographic data and containing open questions for motivations of subjects' decisions.

There was one session with 18 groups (6 distinct groups in each of the three phases) of the No Deliberation treatment, where the experimenters used a voting mechanism to aggregate group decisions. There were three sessions with 12, 12 and 9 groups, respectively, (in total 33) of the Deliberation treatment, where participants in groups discussed their choice without the presence of the experimenter. The treatment conditions, the total number of group decisions and distinct groups are summarized in Table 1. Overall, we collected five individual and one group choice for each of 102 gift exchange games and 510 single choices between lotteries.

At the end of the experiment all participants were paid in cash. Units of token money for the gift-exchange game were converted to real money at a fixed exchange rate, plus subjects received an additional fixed show-up fee.[20] Group members earned the income from each gift exchange game and from one randomly chosen out of the three lottery questionnaire choices they were involved in. Subjects were told that for each of those choices with 50% probability one of the individual decisions would become the effective group choice, with equal probability allocated to every group member's decision, and that in this case it would not be revealed to the group whose individual decision was chosen. With the remaining 50% probability the group's joint decision became the effective group choice. The average payoff for purely individual and group participants was $22.25 and $24.01 with a standard deviation of $3.55 and $4.25, respectively. Each session lasted approximately one hour and thirty minutes.

5 Experimental findings in the gift-exchange games

5.1 Main results

Table 2 presents summary statistics about group and individual group members' decisions. The table shows that in the No Deliberation treatment the mean of the group decisions is 6.86 and standard deviation is 3.09, while the mean of the group decisions in the three sessions of the Deliberation treatment is 3.11 with a standard deviation of 3.63. The difference between the mean group decision in the No Deliberation and Deliberation treatments can be partially accounted for by a higher mean first mover offer of 8.46 in the No Deliberation session versus a mean first mover offer of 7.26 in the Deliberation treatment. However,

we solicited the number of subjects who preferred the first choice for each of the 10 questions. Note that since we imposed simple majority voting and the groups consisted of an odd number of members, our design did not imply default options like in Charness and Jackson (2006) that could potentially become a focal choice for the group.

[20] The exchange rate for gift-exchange games of $0.10 per token was verbally announced at the beginning of sessions.

the ratio of the first mover's offer to the group's decision in the deliberation sessions is much larger than this ratio in the No deliberation session. This may suggest that there is a different subject pool in the No Deliberation session. However, this does not invalidate the tests we conducted as long as the way different opinions get aggregated does not depend on the vector of individual opinions (as in the mean or median hypotheses, which postulate that whatever the individual decisions are, the group decision is the mean or the median of individual decisions). Comparing the three deliberation sessions, the mean of the group decisions is between 2.8 and 3.5, and the mean of the first movers' offers are comparable across these sessions.

The next two columns of Table 2 report the mean and median of the decisions of the five members of a group. In the No Deliberation treatment, the mean and median of the group members' individual decisions bracket the mean of the group's decisions. In contrast, in all of the Deliberation sessions, both the mean and the median of individual decisions are larger than the group decision.

Table 3 presents estimates using data from the No Deliberation session. The first regression includes a constant and all five individual decisions ordered from lowest to highest. The estimated constant is not significantly different from zero, which is evidence against the group-level shift hypothesis. Of the five individual decisions, only the third largest group member (the median) has a significant influence on the group's decision at the 1% level. In addition, the group member who made the largest individual decision has a marginally significant effect at the 10% level. The pattern remains the same when we include fixed effects for each phase of each session in the second column. The last five rows of the table report F-statistics and p-values for our various hypothesis tests. In both specifications, we reject both the mean and strong mean hypothesis with high significance. We cannot reject the median or strong median hypothesis, and we do not find support for a group-level shift.

When we aggregate the decisions of group members by computing their mean and median for each group decision in column (3) and (5), we find that both the mean and median are very good predictors of the group's decision, where the coefficient on the mean is 1.06 and the coefficient on the median is 0.95. Both regressions include a constant, which is not estimated significantly. Columns (4) and (6) parallel the specifications but include fixed effects for each phase of each session, with almost no difference in the estimates from columns (3) and (5), respectively. These estimates show that both the mean and median are highly significant, and have a coefficient which is indistinguishable from 1. Finally, in 28 of our 36 observations, the median of the individual decisions is exactly equal to the group's decision. It is a reassuring test of our experimental setup that the median hypothesis holds in our No Deliberation session because the session so closely mirrors majority voting.

Table 4 presents the estimates from the Deliberation sessions pooled together, while Table 5 reports estimates for each session separately. In Table 4, in column (1), we estimate that the second lowest and median group member have a statistically significant impact on the group's decision, with the median group member having a larger weight. When we include fixed effects for each phase of each session as controls in column (2), we find virtually no change in the estimated coefficients for the second and median group member.

In both specifications, we reject both the mean and strong mean hypothesis with high significance. The fact that the second group member has a reliably significant effect across specifications also casts doubt on the median and the strong median hypothesis. Both of these hypotheses are rejected under either specification (1) or (2), though the level of significance is greater for the strong median hypothesis.

Next, we aggregate the group members' decisions by computing the mean and median for each group decision. In contrast to the No Deliberation session, we now find a significant difference between the two models. The estimated coefficients do not change in a significant way when we add fixed effects for each phase of each session as controls in column (4) and (6). In both specifications, the coefficient on the mean or median is statistically significant. But in the mean specification, the coefficient on the intercept is negative and statistically significant, while in the median specification, the coefficient on the intercept is not statistically significant.

A lower fraction of the variation is explained by the median regression in the Deliberation session than in the No Deliberation session. In the Deliberation session, in a lower fraction of observations, 39 out of 66, the median is exactly the same as the group's decision. In 41% of the observations, the individual median is different from the group. In most of the remaining cases, the group decision is lower than predicted by the median. These patterns suggest that the Deliberation treatment may add extra variance relative to the No Deliberation treatment.

Figure 1 presents visual evidence. The scatter plots real group decisions over mean (solid squares) and median (dashed circles) of individual decisions in groups in the sessions of the Deliberation treatment. The lines in the figure (solid and dashed, respectively) are formed from the estimates in specifications (4) and (6) in Table 4. As we observed in the regression estimates, there is no significant intercept in the median regression, so the line almost goes through the origin. In contrast, the mean line is shifted. Looking at the data for each group decision shows that if the median is extreme (0 or 1) then the minority's opinion does not affect the group's decision and the majority's opinion - that is, the median's opinion prevails. If the median is in between, then in a lot of cases the group decision is not the median individual decision.

5.2 Additional specifications

5.2.1 Robustness across sessions

Table 5 investigates the robustness of our results for the Deliberation treatment in the gift-exchange games by examining the results separately for each session. The advantage of looking at each session separately is that it does not require us to make assumptions about comparability across sessions. In the first three columns of the table, we report the estimates from the specification where each member of the group is ordered by their individual decision and we include a constant. Since each session only has no more than 24 observations of group decisions, we have limited power to estimate significant coefficients in the specifications. Nonetheless, we see in column (1) and (2) that the median group member has a significant and largest impact on the group's decision. In Session 2, the second lowest group member has a marginally significant impact, while in Session 3, the second highest group member has a marginally significant impact. For the first and second columns, we also are able to reject both the mean and the strong mean hypothesis. In column (3), we find that none of the estimated coefficients are significant and we are unable to reject the equality of the coefficients at conventional levels. One reason for this is that we have 25% fewer observations in this session than in the other sessions. Finally, in each of the columns we cannot reject the median hypothesis, and are only able to reject the strong median hypothesis in column (1). Despite the limited power of these specifications, the estimates in columns (1) and (2) support the earlier findings that the median group member is influential and the mean hypothesis is rejected, while the estimates from all three columns do not allow us to reject the median hypothesis.

The remaining columns of Table 5 focus on the comparison between the two ways of aggregating preferences of the individuals in a group. We confirm the earlier findings for each of the sessions when examined separately: the mean regression shows a significant group level shift, while the median regression does not. Moreover, the coefficient on the mean is larger than the coefficient on the median. The estimated group shift is significant at the 1% level in the first and third session, and at the 5% level in the second session.

5.2.2 Robustness across phases

Table 6 investigates the robustness of our results for the Deliberation treatment by examining how individuals reach their group decision in the different periods in the experiment. This has the advantage that we can examine differences in the aggregation to group decisions over time. During the course of the experiment, an individual belongs to three different groups, and the estimates are reported for each of these phases. The first two columns repeat our earlier main specification but only consider the first set of groups in the experiment. We pool across sessions leaving a total of 22 group decisions. The difference between column (1) and (2) is that column (2) includes fixed effects for interactions between the session and whether it is the first or second decision made by the group in that phase. The pattern in column (1) mirrors our earlier findings: there is no group level shift, the second and median group member are most significant, a pattern which is robust to the added controls of column (2). The mean regression in column (3) exhibits a highly significant group level shift, while in the median regression in column (5) there is no group shift and the coefficient on the median is exactly 1.

The specifications for the second set of decisions and the third set of decisions largely parallel the first set of decisions. First, the median is significant for both sets. For the second set of decisions, the median is the only significant individual decision, while for the third set of decisions, the three individuals who are at the middle of the group are all significant. When we allow the coefficient on each of the individual group members to vary with the phase (unreported), we cannot reject the hypothesis that the coefficients are equal across the phases. Next, in the mean regression, we detect a group shift, which is not present in the median regression. Taken together, the results presented in this table confirm our earlier findings, and show that the way individual decisions get aggregated into a group decision stays the same throughout different phases of the experiment.

5.2.3 Role of demographic characteristics

Finally, we investigate how our analysis in the Deliberation treatment depends on the demographic characteristics of the participants. In our sessions of the Deliberation treatment, 60% of subjects are male, 29% study an economics-related field, and the mean age is 22.[21] Panel A of Table 7 examines how these three characteristics are related to the individual decisions. In each column, we report the estimate of a regression on indicators for gender and economics-related field, and a linear function of age. We include dummies for the first offer in the gift exchange game. The coefficient on male both in specification (1) and (4) is large and significant. The coefficient implies that men on average contribute about 0.8 points less than women faced with the same first offer. The coefficient on the indicator for economics-related field is also significant, but at the 10% level and implies that these subjects also return back less.

Panel B investigates how the gender of a group member influences the weight (s)he has on the group's decision. The regression follows our main specification, but includes interactions of ordered individuals with their gender being female.[22] Adding these gender-specific interactions results in only the median group member's coefficient being significant. Moreover, when the median group member is a female, her value has even more influence on the group's decision than when the median group member is male, and the difference in the coefficients is highly significant. We explored the same specification for age and economics-related subject and did not detect any effect of the variable on being influential in the group decision.

6 Experimental findings in the lottery choices

In this section, we describe the data from the risk choice situations. Each lottery choice experiment asks for the comparison between $p[\$11.50] \oplus (1-p)[\$0.30]$ vs.

[21] One of the subjects in the third session did not answer the question on age in the questionnaire.

[22] More precisely, the interaction term is between the contribution corresponding to the given order statistics and the share of females among subjects who are tied at this contribution level. For example, if there are three individuals contributing 10 while the other two contrib ute less, and two of these three individuals are female, then the share of females for the median, the second highest and the highest contribution in the group are all 2/3.

$p[\$6.00] \oplus (1-p)[\$4.80]$ as p ranges from 0 to 0.9. Since the payoffs from the first lottery choice are more variable than the payoffs for the second choice, we refer to the first choice as the risky choice and the second choice as the safe choice.

Table 8 reports the fraction of decisions which are the risky choice as p varies. In both the No Deliberation and Deliberation treatments, virtually no individuals make the risky choice when the probability of the high payoff of \$11.50 is small (lottery decisions 2 and 3), while nearly all individuals make this lottery choice when the probability of \$11.50 is large (lottery decisions 9 and 10). The group decisions exhibit the same pattern.

In the No Deliberation session, there are 18 observations of group choices over the lotteries yielding a total of 180 observations. For lottery decisions 1-4 and decisions 7-10, the median lottery choice of the group is always equal to the group's choice. There is only disagreement for the 5th and 6th lottery choice. In particular, in only one observation of the 5th lottery choice does the median of the individual choices and the group's decision disagree, while there are 4 observations of the 6th lottery choice where they disagree. In 4 of these 5 cases of disagreement, the group opts for the safe lottery even though the majority of individual decisions are for the risky lottery.

In the Deliberation session, there are 33 observations of group choices over the lotteries yielding a total of 330 observations. As with the No Deliberation treatment, the median almost always predicts the group's choice. There are a total of 14 lottery choices, or less than 5% of the observations, where the group's choice differs from the median of the individuals. In contrast to the No Deliberation treatment, in 6 of these cases, the group choice is risky relative to the median, while 8 times it is the safe choice.

The above findings suggest that for both the No Deliberation and Deliberation treatments, the median model is a good predictor of binary choice (in fact, a perfect predictor in most of the binary choice problems in our experiments). Nevertheless, as Table 8 shows, whenever at least 60% of individuals prefer either the safe or the risky lottery in a particular lottery choice problem, the share of groups choosing that lottery is even higher than the share of individuals choosing it. Although this is primarily a consequence of the fact that the distribution of median group member choices is different from the individual choices, a researcher comparing average individual versus group decisions might reach a conclusion that people change their attitudes towards risk in group settings, and in certain lottery choice problems they exhibit a cautious shift, while in others they exhibit a risky shift.

We also investigated specifications where the group's decision depends on the choices made by each of the five group members, analogous to Table 3, although the binary nature of the decision problem limits the scope of such investigation in the lottery choice context. For example, the first and second group member make the same choice nearly all of the time (96% of our observations in the No Deliberation treatment, and 91% of our observations in the Deliberation treatment) and the fourth and fifth group member make the same choice in the vast majority of our observations (93% of the time in the No Deliberation treatment, and 90% of the time in the Deliberation treatment), making it difficult to draw firm conclusions on which group members become influential in group decisions. Moreover, the results are driven by the very few number of observations in which the group decision differs from the median individual decision. For these reasons, we regard findings from this investigation as at most suggestive, as opposed to being conclusive.

We estimated linear probability models as well as probit regressions. In both specifications, and in both treatment conditions, we find that the median group member coefficient is the largest. In the No deliberation treatment in the probit regression only the median individual decision is significant, while in the linear probability model the group member one position from the median in the risky direction also becomes significant.[23] Hence, our experiments do not yield conclusive evidence either for or against the median hypothesis in the No deliberation treatment. The possibility that non-median members might become influential in this treatment is created by the sequentiality of soliciting group decisions in lottery choices: even though choosing between lotteries not dominating each other is not an intellective task, people might try to learn what the "correct" choice is from others' votes. Hence, observing the distribution of votes in earlier lottery choice problems might influence some subjects' votes in subsequent problems. This implies that the order in which we solicited group decisions in the binary lottery choices may have influenced the choices of the groups, which merits further investigation.

In the Deliberation treatment, we also find that the median group member has the largest coefficient, while the group members one position away from the median in both directions also become significant, with coefficients that are similar to each other in magnitudes.[24]

Analogously to many previous experiments, men in our lottery choice problems are willing to take significantly more risk than women.[25] It is not clear how gender affects a subject being influential on group decisions in the deliberation treatment. Just like in the gift-exchange game, the median group member is significantly more influential on the group decision if the median is female. However, the gender effect reverses for the amount of influence the second most cautious group member has on the group decision.[26] Age and the indicator of being an economics major do not have a significant effect on individual lottery choices, and on influencing the group decision in lottery choices.

[23] In the linear probability model with controls for lottery choice*phase, the estimated coefficient on the median group member is 0.65 and the coefficient on the group member who makes a riskier choice is 0.28, both of which are highly significant.

[24] In the linear probability model with controls for lottery choice*phase*session, the estimated coefficient on the median group member is 0.36 (significant at 1%), the coefficient for the group member who makes a risker choice than the median is 0.19 (significant at 1%), while the coefficient for the group member who makes a less risky choice than the median is 0.13 (significant at 10%).

[25] Analogous to the regressions on the demographic effects on trust decisions reported in Table 7 Panel A, we ran linear probability models on individual lottery decisions, yielding a significant effect for male decision makers, but no effect for economic education or age. Alternative Ordered Probit regressions confirmed this result.

[26] Those observations are based on regressions of group lottery choices on individual decisions and gender interactions analogous to Table 7 Panel B.

The limited variation in our lottery choice data prevents us from investigating the same formal hypothesis that we did with the gift-exchange experiments. The study of risky choices made by individuals and groups will likely require an experimental design that features lottery choices in which subjects have a larger set of choices and more diversely distributed preferences.

7 Conclusion

This paper argues that comparing average individual decisions to average decisions made by groups of people can lead to an identification of a group shift which, however, only rests upon the distribution and specific aggregation of individual choices, but not on a real preference shift. We also show that a theory according to which the median group member's individual decision becomes the group decision explains the data well in the two contexts we examined if deliberation is not allowed. If deliberation is allowed then other group members close to the median position can also become influential in the group decision. Group members too far away from the median position do not seem to be able to influence the group decision.

Although we do find that deliberation can make non-median group members influential, we think that it is important to reexamine whether there is such an effect in other contexts. If one defines group shift as the expected difference between average individual decisions and average group decisions, then a group shift might be detected even when according to our definition there is no shift (the median group member's opinion prevails). This can explain for example why previous research found shifts in opposite directions in two decision problems involving the same kind of task. The observation that in certain lottery choice problems groups exhibit risky shifts, while in others exhibiting cautious shifts could be explained by the median hypothesis if in the first type of lottery choice problems the distribution of individual preferences was skewed towards the risk-taking extreme, while in the other type of lottery problems they are skewed towards the safe extreme. Finally, the possibility that in many contexts the group shift documented by the literature might be simply explained by a theory that the median group member's opinion prevails is consistent with two general observations on group shifts. One is that group shifts tend to occur in the direction of the original inclination of the group (that is in the direction towards which the distribution of preferences is skewed).[27] The second one is that group shifts are less likely to occur when groups tend to have roughly equal number of individuals predisposed one way versus the other - that is when the distribution of preferences in the subject pool is close to symmetric.[28]

In future research we also plan to investigate the question of how individual preferences get aggregated into a group decision in settings in which people are not likely to have single-peaked preferences over choices, and hence the median voter theorem does not apply.

[27] See for example Brown (1986), p210-212.

[28] See for example Sunstein (2000), p90.

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Table 1 - Treatment Conditions

No Deliberation-treatment	Deliberation-treatment
(Session 1)	(Sessions 2-4)
36 group decisions 18 distinct groups	66 group decisions 33 distinct groups

Table 2 - Group versus Individual Decisions

Treatment	**Session**	**Group decisions**	**Individual decisions** Mean of Group	Median of Group
No Deliberation-Treatment	1	6.86 (3.09)	6.34 (2.77)	7.06 (3.17)
Deliberation-Treatment	2	3.50 (3.46)	3.70 (2.53)	3.54 (3.88)
Deliberation-Treatment	3	2.83 (3.63)	3.29 (2.65)	3.04 (3.50)
Deliberation-Treatment	4	2.94 (3.99)	3.74 (2.66)	3.94 (3.90)
Deliberation-Treatment	2-4	3.11 (3.63)	3.56 (2.58)	3.47 (3.71)

Notes: Numbers in parenthesis are standard deviations.

Table 3 - Determinants of Group Decision from Individual Preferences (No Deliberation-Treatment)

	Dependent variable: group decision					
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)
intercept	-0.36		0.13		0.16	
	(0.37)		(0.41)		(0.29)	
lowest	0.01	0.00				
	(0.05)	(0.05)				
second	0.02	0.05				
	(0.08)	(0.08)				
third	0.76***	0.73***				
	(0.16)	(0.16)				
fourth	-0.03	-0.01				
	(0.18)	(0.18)				
highest	0.23*	0.23*				
	(0.13)	(0.13)				
mean			1.06***	1.06***		
			(0.06)	(0.06)		
median					0.95***	0.95***
					(0.04)	(0.04)
phase FE	N	Y	N	Y	N	Y
R2-Adj	0.95	0.95	0.90	0.90	0.95	0.95
N	36	36	36	36	36	36
F, p-value						
mean	9.62, 0.00	9.72, 0.00				
strong mean	8.12, 0.00	8.22, 0.00				
median	1.27, 0.31	1.40, 0.26				
strong median	1.60, 0.20	1.70, 0.18				
group-level shift	0.95, 0.34		0.10, 0.75		0.30, 0.59	

*Notes: Standard errors are in parenthesis. * denotes significance at the 10-percent level, ** at the 5-percent level, and *** at the 1-percent level. To control for time and groups, specifications (2), (4), and (6) contain phase dummies.*

Table 4 - Determinants of Group Decision from Individual Preferences (Deliberation-Treatment)

	Dependent variable: group decision					
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)
intercept	-0.15		-1.46***		0.03	
	(0.48)		(0.32)		(0.26)	
lowest	0.02	0.06				
	(0.12)	(0.12)				
second	0.39***	0.40***				
	(0.11)	(0.12)				
third	0.51***	0.51***				
	(0.12)	(0.12)				
fourth	0.12	0.14				
	(0.11)	(0.11)				
highest	0.02	0.02				
	(0.08)	(0.09)				
mean			1.28***	1.33***		
			(0.07)	(0.08)		
median					0.89***	0.91***
					(0.05)	(0.06)
session * phase FE	N	Y	N	Y	N	Y
R2-Adj	0.86	0.85	0.82	0.82	0.82	0.81
N	66	66	66	66	66	66
F, p-value						
mean	4.44, 0.00	3.79, 0.01				
strong mean	7.12, 0.00	7.12, 0.00				
median	2.63, 0.06	2.24, 0.09				
strong median	6.83, 0.00	5.88, 0.00				
group-level shift	0.10, 0.76		20.56, 0.00		0.02, 0.90	

*Notes: Standard errors are in parenthesis. * denotes significance at the 10-percent level, ** at the 5-percent level, and *** at the 1-percent level. To control for pooling of sessions, time and groups, specifications (2), (4), and (6) contain interactions of phase and session dummies.*

Table 5 - Determinants of Group Decision from Individual Preferences, Disaggregated by Session (Deliberation-Treatment)

	Dependent variable: group decision								
	Session 2	Session 3	Session 4	Session 2		Session 3		Session 4	
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
intercept	0.29	-0.67	-0.37	-1.20***	0.51	-1.42***	-0.17	-1.88**	-0.41
	(0.66)	(0.61)	(2.04)	(0.49)	(0.32)	(0.41)	(0.32)	(0.88)	(0.78)
lowest	0.01	0.03	0.27						
	(0.14)	(0.18)	(0.39)						
second	0.25*	0.21	0.47						
	(0.14)	(0.24)	(0.30)						
third	0.59***	0.42*	0.47						
	(0.13)	(0.23)	(0.37)						
fourth	0.15	0.42*	0.01						
	(0.12)	(0.22)	(0.37)						
highest	-0.10	0.02	0.09						
	(0.11)	(0.09)	(0.41)						
mean				1.27***		1.29***		1.29***	
				(0.11)		(0.19)		(0.19)	
median					0.85***		0.99***		0.85***
					(0.06)		(0.07)		(0.14)
R2-Adj	0.90	0.91	0.79	0.85	0.89	0.88	0.90	0.74	0.69
N	24	24	18	24	24	24	24	18	18
F, p-value									
mean	3.67, 0.02	2.61, 0.07	0.82, 0.54						
strong mean	4.77, 0.01	4.38, 0.01	1.08, 0.42						
median	0.67, 0.58	0.95, 0.44	1.04, 0.41						
strong median	2.99, 0.05	1.66, 0.20	1.76, 0.20						
group-level shift				6.12, 0.02	2.51, 0.13	11.94, 0.00	0.28, 0.60	4.56, 0.05	0.27, 0.61

*Notes: Standard errors are in parenthesis. * denotes significance at the 10-percent level, ** at the 5-percent level, and *** at the 1-percent level.*

Table 6 - Determinants of Group Decision from Individual Preferences, Disaggregated by Phase (Deliberation-Treatment)

	Dependent variable: group decision																	
	Set of decisions made in first phase						Set of decisions made in second phase						Set of decisions made in third phase					
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
intercept	0.69		-2.22***		-0.85		0.18		-1.08*		0.07		-0.53		-1.49***		0.51	
	(1.23)		(0.80)		(0.67)		(0.84)		(0.55)		(0.42)		(0.55)		(0.34)		(0.31)	
lowest	-0.07	-0.21					-0.04	0.01					-0.02	0.11				
	(0.20)	(0.26)					(0.24)	(0.30)					(0.24)	(0.26)				
second	0.78***	0.85**					0.26	0.11					0.32**	0.32**				
	(0.27)	(0.35)					(0.21)	(0.30)					(0.12)	(0.13)				
third	0.47*	0.58*					0.78**	1.01**					0.35***	0.28*				
	(0.24)	-0.28					(0.33)	(0.43)					(0.11)	(0.14)				
fourth	0.08	0.08					-0.02	-0.10					0.28**	0.32**				
	(0.21)	(0.24)					(0.28)	(0.33)					(0.10)	(0.11)				
highest	-0.21	-0.32					0.00	-0.06					0.10	0.14				
	(0.22)	(0.27)					(0.28)	(0.20)					(0.09)	(0.08)				
mean			1.35***	1.39***					1.26***	1.27***					1.35***	1.35***		
			(0.15)	(0.18)					(0.12)	(0.13)					(0.10)	(0.09)		
median					1.00***	1.04***					0.93***	0.94***					0.75***	0.78***
					(0.11)	(0.12)					(0.08)	(0.09)					(0.08)	(0.08)
session*decision in group FE	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
R2-Adj	0.84	0.90	0.78	0.81	0.79	0.77	0.85	0.80	0.83	0.78	0.86	0.85	0.90	0.92	0.89	0.93	0.82	0.84
N	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
F, p-value																		
mean	3.01, 0.05	2.27, 0.13					1.52, 0.24	1.52, 0.26					1.36, 0.29	0.60, 0.67				
strong mean	3.85, 0.02	3.15, 0.05					2.17, 0.11	1.99, 0.16					3.68, 0.02	3.19, 0.05				
median	2.73, 0.08	1.94, 0.18					0.59, 0.63	0.29, 0.83					0.74, 0.54	0.48, 0.71				
strong median	2.69, 0.07	1.69, 0.22					0.71, 0.60	0.22, 0.92					10.07, 0.00	8.68, 0.00				
group-level shift	0.31, 0.58		7.63, 0.01		1.62, 0.22		0.05, 0.83		3.95, 0.06		0.02, 0.88		0.92, 0.35		19.56, 0.00		2.73, 0.11	

*Notes: Standard errors are in parenthesis. * denotes significance at the 10-percent level, ** at the 5-percent level, and *** at the 1-percent level. Set of decisions made in first group refer to the first two group decisions made in the first part of the experiment. The next two sets of columns correspond to the two decisions made by the second group and the two decisions made by the third group.*

Table 7 - Gender Effects (Deliberation-Treatment)

Panel A: Gender effects on individual decisions

	Dependent variable: individual decision			
Independent variables	(1)	(2)	(3)	(4)
male	-0.87**			-0.83**
	(0.38)			(0.42)
econ		-0.80*		-0.71*
		(0.42)		(0.42)
age			0.08	0.04
			(0.05)	(0.05)
dummies for first_offer	Y	Y	Y	Y
R2-Adj	0.57	0.57	0.58	0.59
N	330	330	324	324

Panel B: Gender effects on group decision

	Dependent variable: group decision	
	estimate	std. error
first	0.18	(0.21)
first*female	-0.08	(0.26)
second	0.29	(0.18)
second*female	0.10	(0.19)
third	0.42***	(0.15)
third*female	0.23*	(0.14)
fourth	-0.01	(0.17)
fourth*female	0.20	(0.17)
fifth	0.08	(0.13)
fifth*female	-0.07	(0.10)
R2-Adj		0.91
N		66

*Notes: Standard errors are in parenthesis. * denotes significance at the 10-percent level, ** at the 5-percent level, and *** at the 1-percent level. All specification in Panel A include session*phase interactions. Specification in Panel B includes fixed effects for group composition and session*phase interactions.*

Table 8 - Risky Choices

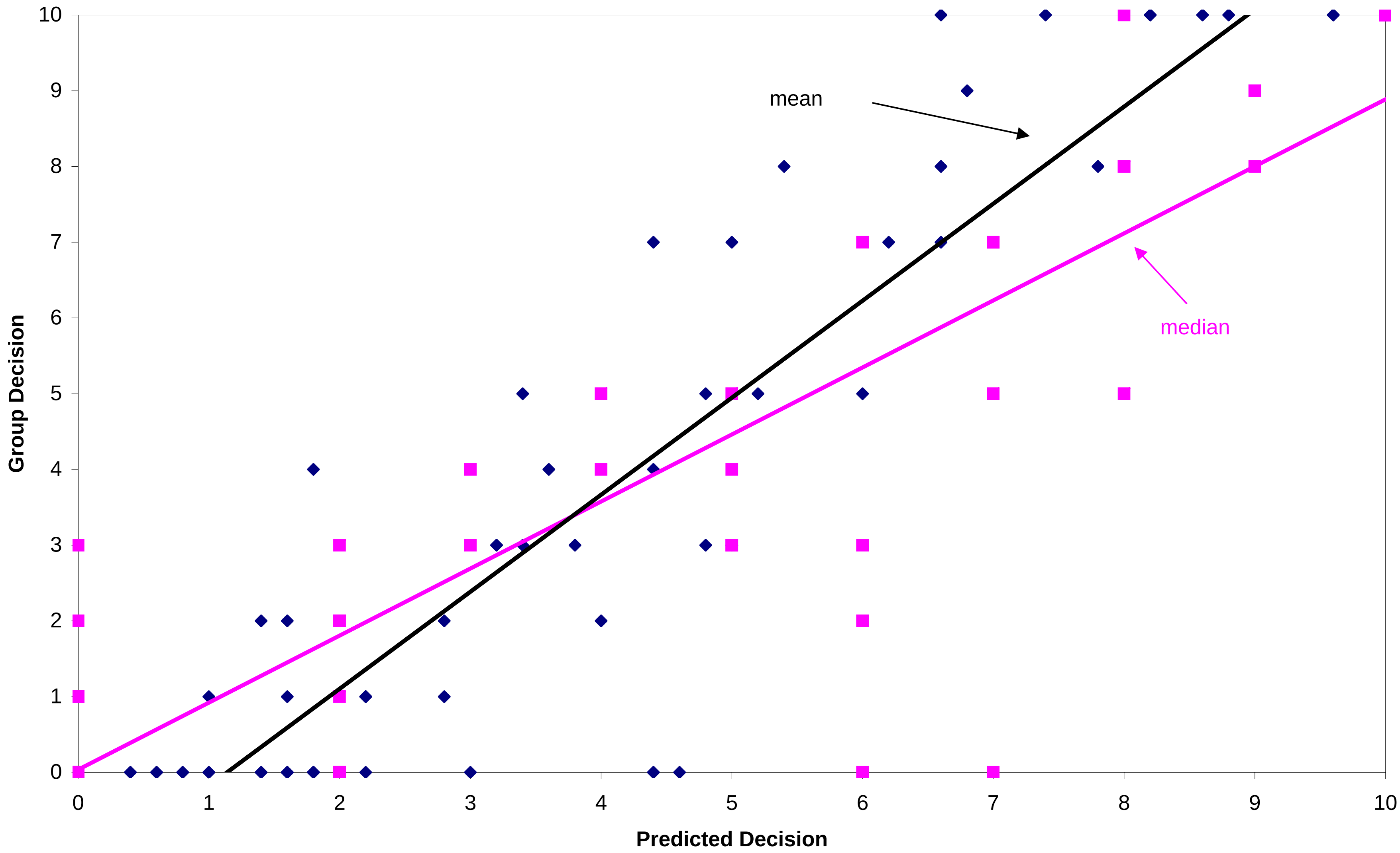
Panel A: No Deliberation

Lottery decision	Share of risky choices: Individuals	Share of risky choices: Groups	Share of group choices equal to median
1	0.00	0.00	1.00
2	0.00	0.00	1.00
3	0.00	0.00	1.00
4	0.00	0.00	1.00
5	0.22	0.11	0.94
6	0.39	0.33	0.78
7	0.63	0.78	1.00
8	0.92	1.00	1.00
9	1.00	1.00	1.00
10	1.00	1.00	1.00

Panel B: Deliberation

Lottery decision	Share of risky choices: Individuals	Share of risky choices: Groups	Share of group choices equal to median
1	0.01	0.00	1.00
2	0.01	0.00	1.00
3	0.01	0.00	1.00
4	0.02	0.00	1.00
5	0.05	0.03	0.97
6	0.27	0.15	0.88
7	0.58	0.58	0.82
8	0.85	0.94	0.91
9	0.96	1.00	1.00
10	0.97	1.00	1.00

Figure 1: Comparison of Predicted Group Decision using Mean and Median (Deliberation)



APPENDIX: LOTTERY CHOICE QUESTIONNAIRE

LOTTERY CHOICES

Subject # ____________________

Decision # ____________________

Room # ______________________

Please think about the following lottery choices. Write down either a 1 or 2 corresponding to choice 1 or 2 below.

	Choice 1	Choice 2	
Decision 1:	$0.30 if throw of die 1-10	$4.80 if die 1-10	__________
Decision 2:	$11.50 if throw of die 1 $0.30 if die 2-10	$6 if die 1 $4.80 if die 2-10	__________
Decision 3:	$11.50 if throw of die 1-2 $0.30 if die 3-10	$6 if die 1-2 $4.80 if die 3-10	__________
Decision 4:	$11.50 if throw of die 1-3 $0.30 if die 4-10	$6 if die 1-3 $4.80 if die 4-10	__________
Decision 5:	$11.50 if throw of die 1-4 $0.30 if die 5-10	$6 if die 1-4 $4.80 if die 5-10	__________
Decision 6:	$11.50 if throw of die 1-5 $0.30 if die 6-10	$6 if die 1-5 $4.80 if die 6-10	__________
Decision 7:	$11.50 if throw of die 1-6 $0.30 if die 7-10	$6 if die 1-6 $4.80 if die 7-10	__________
Decision 8:	$11.50 if throw of die 1-7 $0.30 if die 8-10	$6 if die 1-7 $4.80 if die 8-10	__________
Decision 9:	$11.50 if throw of die 1-8 $0.30 if die 9-10	$6 if die 1-8 $4.80 if die 9-10	__________
Decision 10:	$11.50 if throw of die 1-9 $0.30 if die 10	$6 if die 1-9 $4.80 if die 10	__________

INSTRUCTIONS GIVEN TO PARTICIPANTS
(For Deliberation Treatment)

The instructions which we have distributed to you are only for your private information. During the experiment, please do not communicate with any of the other participants. If you have any questions at any point during the experiment, raise your hand and the experimenter will help you. Also, please turn off all cell phones, mp3 players and other devices. If you violate this rule, we will need to exclude you from the experiment and you will forfeit payment from participating in the experiment. At the end of the session, we will only keep track of your ID number and your decisions for our research purposes.

Objectives

In this experiment we will ask you to make decisions that are simplified versions of decisions that you have to take in many real-world situations. Please think carefully about your decisions before making them, considering all possible choices!

Procedure

At the beginning of the experiment, we will randomly assign you to be either *making decisions in isolation in the main computer lab,* or *making decisions in a small room with four other participants*. You will draw a participant card with a number printed on it, which determines whether you stay in the main room or join one of the groups in the small rooms. If you join one of the small rooms, you will have to make both individual decisions in this experiment, and joint decisions with participants in the same room.

We will ask you to make two types of decisions: participating in a gift-exchange situation, and making choices between lotteries.

The gift-exchange situation

There are two participants in this situation, a first proposer and a second proposer. Those of you who are randomly selected to stay in the main lab will always be first proposers, and those of you in the small rooms will always be in the role of second proposers. In the gift-exchange situation, both players will be given 10 tokens (the experiment money) as an endowment. The first proposer will begin by offering a split of the 10 tokens to the second proposer, from 0 to 10 such that if they offer the second proposer some amount X, the second proposer will receive 3X. The remaining 10-X tokens are kept by the first proposer (but they don't get tripled). For instance, if the first proposer offers 5, (s)he will get to keep 5 for him(her)self and the second proposer will obtain 15. After seeing what the first proposer did, the second proposer offers a split of tokens from his(her) endowment. Again, if the second proposer offers some amount Y, the first proposer will receive 3Y (and the rest is kept by proposer 2, but it doesn't get tripled).

For example, suppose the first proposer offers 8 to the second proposer and the second proposer offers 7 to the first proposer. Then the first proposer receives:

2 (from first period) + 7 * 3 (from second period) = 23

and the second proposer receives:

8 * 3 (from first period) + 3 (from second period) = 27.

Lottery choices
You will be shown a set of lottery choices (a lottery means that your prize is determined randomly). The set involves 10 choices, and in each of them you will be asked to choose between two lotteries. Participants will be asked to think about the lotteries, and then will be asked to select which lottery they prefer.

An example of a lottery choice is the following: you are asked to make a choice between option 1 and option 2. Option 1 implies that your prize is determined by the roll of a 10-sided dice, and it is $6 if the roll is 1-4, and it is $4.80 if the roll is 5-10. Option 2 also implies that your prize is determined by the roll of a 10-sided dice, but now it is $11.50 if the roll is 1-4 and $0.30 if the roll is 5-10.

Sequence of events for participants in the small rooms
The experiment will be split into three phases for you. In every phase you will have to make the same set of decisions, but with different people. That is, between phases we will take some of you to different rooms, where you will make decisions with a different group of participants.

We start with taking you to your initial room, with four other participants and an experimenter assigned to the group. Then we run phase I, then regroup people, run phase II, again regroup people, and then run phase III. At the end of phase III you will be brought back to the main lab, where you will receive your payments for the experiment.

In each phase you will have to play two gift-exchange situations as second proposers (with first proposers in the main lab), and make one set of lottery choice decisions.

In the gift-exchange situations first the Experimenter announces to you how much the first proposer offered you in the game. Then you and your group members will be asked what you would choose to do in this game as second proposer if it was completely your decision. During this phase you and your group members cannot talk to each other (the Experimenter in the room will supervise this). After carefully thinking about your choice, each of you will have to write down your chosen counter-offer, together with your participant ID number (from the card you drew) to an answer sheet. You are asked not to show these answer sheets to other participants in the room. Once the Experimenter collected your individual answer sheets, he(she) leaves the room, and you and your group members can privately discuss what the group's decision should be. This discussion is completely unrestricted, but at the end of the day you have to come up with a joint decision. After you reached this decision, fill out the group answer sheet, open the door and give it to your Experimenter.

In each of the gift-exchange situations it will be randomly determined (with 50-50% probability) whether it is the group's joint decision which mattered (which determined the counter-offer in the situation) or one of the individual decisions of the group members. In the latter case, it will be randomly determined which group member's choice prevailed. We will only reveal you which decision mattered at the end of the experiment.

The lottery choices again start with each of you in the group making your individual decisions. The Experimenter will be in the room during this time. Once you filled out your lottery choice answer sheet and wrote down your participant ID number on the sheet, the Experimenter collects the answer sheets and leaves the room. After this you can freely discuss it with your group members what the group's decision should be in the lottery choices. At the end of the experiment, it will be randomly determined (with 50-50% probability) whether it is the group's joint decision which mattered or one of the individual decisions of the group members. In the latter case, it will be randomly determined which group member's choice prevailed.

All in all you will play 6 rounds of gift-exchange situations as second proposers, and make three rounds of lottery choices. In each round of the gift-exchange situations the first offer comes from a different participant in the main room (no group will interact with the same first proposer more than once).

Payoffs for participants in the small rooms

Your payoff in this experiment will depend on your choices, as well as on choices of participants you interact with. Moreover, your choices affect the payoffs of the participants in your room, and the participants in the main room who you interact with in the gift-exchange situations. All rounds of the gift-exchange situations matter, but in each of them only one of the counter-offer decisions count: it can be either an individual decision (and with some probability your decision) or the group's joint decision. In either case, the decision that becomes the second offer in the game determines everyone's payoff in the room in that round. At the end of the experiment we will add up the tokens you collected in the gift-exchange situations, and convert it to dollars using a fixed exchange rate.

As for lottery choices, you will fill out three sets of lottery choices, one in each of the phases. However, only one of these will matter: it will be randomly determined at the end of the experiment which phase. At the same time, it will also be randomly determined whether from this round it is the group's joint decision that determines lottery payoffs in the group, or one of the individual decisions, and if the latter then which member's decision in the group. From the selected answer sheet then we will randomly choose one of the lottery choices (out of the ten choices), see which lottery was selected on this sheet, and execute that lottery. This becomes everyone's lottery payoff from the group.

Lottery prizes are specified in (real) dollar terms.

Note that every choice you make is relevant with some probability: it can become the actual choice that determines your payoff!

At the end of the experiment you will get a printout summarizing which decisions mattered and how your payoff was calculated.

Participants in the main lab

You will play six rounds of the gift-exchange situation, each time as first proposer. In every situation you will interact with a different group of participants in the small rooms. The counter-offers to your offers will only be revealed to you at the end of the experiment.

After you made your first offer decisions, we will ask you to wait until the participants in the small room finished making all their decisions, since their decisions will determine your payoffs.

Each gift-exchange situation that you participate in is relevant for your payment. The tokens that you collect from these situations will be converted using a fixed exchange rate to dollars.

You will not be asked to make lottery choices in this experiment.

Please wait patiently until all participants have finished reading these instructions.