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Endogenous group formation and responsibility diffusion: An experimental study ☆

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ABSTRACT

We study the effects of varying individual pivotality and endogenous group entry on the selfishness of group decisions. Selfish choices by groups are often linked to the possibility of diffusing responsibility; the moral costs of these decisions appear smaller when individual pivotality is reduced. Our experimental design explores unanimity voting under distinct defaults to identify this effect. In exogenously formed groups we find evidence of responsibility diffusion, but this diminishes with repetition. Our results also demonstrate the role of self-selection in generating differences in group behaviour depending on individual pivotality. Driven by a heterogeneous selection pattern, endogenous group formation amplifies the effects of a change in pivotality. Some people actively seek an environment to diffuse responsibility, while others join groups to promote pro-social behaviour.

1. Introduction

This paper revisits the role of responsibility diffusion as an explanation of why groups make more selfish decisions than individuals. It also explores how endogenous group formation affects the degree to which group decision making induces selfish behaviour and whether group entry is exploited as a tool to diffuse responsibility.

The literature in behavioural economics has established that decisions by exogenously formed groups often differ from those made by individuals facing the same environment. For overviews, see Charness and Sutter (2012) or Kugler et al. (2012). In many circumstances, group decisions more closely follow standard economic theory and are more selfish compared to individual decisions. Examples include Schopler et al. (1995) for prisoner-dilemma games, Bornstein and Yaniv (1998) for ultimatum games and Luhan et al. (2009) in dictator games.[1] In search of an explanation for this phenomenon, the more recent literature examines the role of individual responsibility for immoral group actions. Individuals in a group collectively share the responsibility, which is thereby diffused. This is theoretically studied by for instance Rothenhäusler et al. (2018) and experimentally in Behnk et al. (2017) and Falk et al. (2020). If individuals do not expect to be pivotal decision

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[1] Cason and Mui (1997), however, observe the opposite for dictator games, with groups acting less selfishly than individuals.

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makers, this allows every actor to believe that they are not fully responsible for the final outcome of the group decision-making process. This reduces incentives to act pro-socially or to act in accordance with a costly moral norm. In a related phenomenon, increasing the number of bystanders witnessing an emergency makes any single bystander less inclined to help, since individuals feel less responsible (Darley and Latané, 1968; Latané and Darley, 1968).

While there is a large strand of literature that compares the choices of individual decisions to group decisions in exogenously formed groups, little is known about how these choices would compare to an environment where the group is allowed to form endogenously. The literature thereby neglects the obvious fact that groups are evolving entities, which, in naturally occurring situations, often form voluntarily. From boards overseeing firms' activities and political committees determining a party's policy to families that jointly make household decisions, group decision making is ubiquitous, but often a choice in itself. Some people might simply prefer to make certain decisions in teams.

Our exploration starts with studying whether conclusions about selfish behaviour in (exogenously formed) groups carry over to an environment with endogenous group formation. Moreover, if group decision making facilitates selfish choices by reducing the disutility subjects experience due to the responsibility they bear, do individuals anticipate this? Does this make individuals prefer group decision making? Many studies emphasise the effects of so-called 'moral wiggle room', introduced initially by Dana et al. (2007). This refers to the possibility of reducing individual moral behaviour by blurring the relationship between actions and consequences. Because group decision making may be seen as offering such wiggle room, we want to investigate whether individuals actively seize such opportunities by joining a group. If this is the case, a third question arises, about *who* seizes these opportunities. Consider a context that involves a trade-off between own and others' wellbeing. Can we expect a selection effect when there is voluntary group membership? That is, will 'selfish' individuals – those benefitting from a reduction in their responsibility – disproportionately join groups? This would imply that endogenously formed groups make (even) more selfish decisions than those formed exogenously. The study of exogenously formed groups would then, in fact, underestimate the true extent of selfish behaviour by groups.

To study how responsibility diffusion can serve as a determinant of group entry, a novel experimental design is introduced. This adopts a simple binary dictator game with a pro-social and a selfish option. The game is played by either individuals or groups of three players. We distinguish between groups that are exogenously formed and groups that are endogenously formed. Endogenously formed groups are composed of individuals stating a preference for group decision making over individual decision making.

Our design focuses on one central dimension of responsibility diffusion, which is a reduction of individual pivotality in a group decision. The idea is that one does not bear the full responsibility of a collective action if one's individual vote is not decisive in the implementation of that action. We will take the distance to being pivotal (Engl, 2018) as a measure of the extent of this decisiveness. In short, this means that an agent is deemed less responsible for a group choice if more votes need to change to make her vote pivotal in the implementation of a selfish outcome. This measure captures how as part of a group, one's vote may not be influential in the implementation of a certain decision. If one were to change one's vote, this would then not affect the outcome of the group decision-making process. An example of this is voting in political elections. Every individual only bears a small fraction of responsibility for the outcome of an election and is usually far from being pivotal. The effect of responsibility diffusion, however, is likely to be asymmetric, which we are going to assume throughout this paper. Agents only want to diffuse their responsibility for the implementation of a selfish decision, not for a pro-social one. Given this asymmetric effect, we only consider the effect of being pivotal for the implementation of a selfish outcome.

We isolate this effect of being pivotal for the implementation of a selfish allocation by requiring unanimous decisions and varying the default option in case of non-unanimity. With a pro-social default, the group decision-making process excludes the possibility of diffusion of responsibility. The selfish outcome is only implemented if this is unanimously agreed upon, resulting in everyone's vote being pivotal and everyone bearing the full responsibility. In contrast, a selfish default facilitates diffusion of responsibility, since only one individual is required to vote in support of the selfish outcome for this to be realised. If at least one additional individual votes in favour of the selfish outcome, the agent is not pivotal for the realised outcome. This default then reduces the individual probability of being pivotal for this selfish outcome and therefore individual responsibility for this allocation.[2]

In this way, this design allows us to isolate the effects of changing pivotality for selfish outcomes on group decisions and to study how this effect is influenced by selection due to endogenous group entry.[3] Diffusion of responsibility likely has multiple dimensions. Note that we are interested in a dimension of responsibility diffusion that goes beyond a feeling of shared guilt. According to our understanding of shared guilt, an individual's disutility from causing a harmful outcome diminishes purely because this is done together with others. In this case, the decision makers share the burden of acting selfishly so the guilt is shared. Shared guilt is then unrelated to an individual's own impact on the group decision. Our design holds guilt sharing constant. In contrast, the dimension of responsibility diffusion we examine is directly linked to a person's individual impact on the decision. In the cases we study, the presence of other decision makers reduces this individual impact when there is a selfish default, but not when there is a pro-social default. Guilt is shared irrespective of the default.

[2] We abstract from social-image concerns here. In the discussion of Result 2, we will address why these concerns do not seem to be an important force here.

[3] Below, we discuss an additional selection effect. A pro-social default allows group members to force a pro-social outcome, irrespective of their group members' votes. This is not possible with a selfish default. Thus, a pro-social default may attract individuals that wish to promote pro-sociality.

To provide a benchmark for behaviour observed in the experiment, we employ a simple categorisation of individuals based on their degree of responsibility aversion. This predicts differences in selection and voting behaviour. From this, we derive hypotheses about the influence of responsibility aversion on selection behaviour and decisions in endogenously and exogenously formed groups. As we observe behaviour in repeated choices, our experiment can also speak to the effects of responsibility diffusion once subjects develop experience with their decision environment.

Our experimental data provide strong evidence for the importance of the group formation process. For exogenously formed groups, we find evidence that the diffusion of responsibility generates selfish choices in initial periods. This effect diminishes with repetition, which contrasts with arguments put forward in the previous literature. With endogenously formed groups, on the other hand, there are striking differences throughout the course of the experiment between environments where responsibility can be diffused and those where it cannot. If the selfish choice represents the default, more subjects vote selfishly than if the pro-social option serves as a default. Our design allows us to attribute this effect directly to the fact that group participation is voluntary. To understand group decision making, both the possibility to reduce individual responsibility for selfish actions and a group's formation process should therefore be taken into account.

We continue and examine the role of self-selection of individuals into groups with specific defaults. First, we detect differences across types in the impact of a selfish default on selection decisions. More specifically, we confirm that types who vote selfishly if responsibility diffusion facilitates this, often seek responsibility diffusion in groups. In other words, a selfish group default has a positive influence on the propensity of selfish individuals to join a group.

Second, the experiment also provides evidence that individuals who – regardless of the type of decision making – choose the pro-social alternative, enter groups if they can guarantee that the pro-social outcome is implemented. This suggests a second motive driving group entry (aside from seeking responsibility diffusion). We find this effect to be stronger and more robust than the selection effect of selfish types. This finding is consistent with the social identity literature (e.g. Tajfel, 1974). If a pro-social default attracts group entry of pro-socials, this allows them to select into an environment with like-minded individuals. This identity effect seems to be more pronounced for pro-socials than for selfish individuals.

Finally, our study allows us to directly compare the decisions of individuals to group decisions in an environment where groups form voluntarily. As a result of the described self-selection, we find that differences between group and individual decisions particularly emerge in environments with a pro-social group default.

The remainder of this paper is organised as follows: First, we relate this study to the literature in section 2. Next, we explain the experimental design in section 3 and outline the hypotheses to be tested in section 4. Section 5 presents the results. Last, we will conclude and briefly discuss the findings in section 6.

2. Related literature

This study is at the intersection of three strands of literature in behavioural economics; the literature on responsibility diffusion and guilt sharing in groups, the literature on endogenous group formation, and the literature on sorting.

2.1. Responsibility diffusion and guilt sharing

Several authors have studied how responsibility can be assigned to single actors that are part of a collective decision-making process and how responsibility may be diffused in groups. Recent theoretical contributions define and formalise the concept of responsibility. Bartling and Fischbacher (2012) define a measure of responsibility that assigns to each agent a degree of responsibility for the implementation of an allocation that depends on the impact of the individual's action on its realisation probability. They do so in the context of decision delegation. More closely related to our framework is Engl (2018). He investigates how responsibility can be attributed if multiple agents are involved in a joint decision-making process. He proposes to take the distance to being pivotal as a measure of an individual agent's (ex-post) responsibility. This is defined as the number of changes in individuals' votes needed to generate a situation where this agent's choice can be decisive in changing the outcome. We will apply this measure below. Finally, Rothenhäusler et al. (2018) develop a model to identify the causal effects of guilt sharing on moral transgression with heterogeneous moral costs. Despite the similarities, shared guilt differs in their set-up to our notion of responsibility diffusion as it depends on the absolute number of supporters of immoral behaviour, independent of how decisive an individual's vote is.

Aside from these theoretical contributions, there is experimental work on responsibility in group decisions. Bartling et al. (2015) is somewhat related to our research. They study the impact of pivotality on responsibility attribution. The authors show in a sequential voting game that voters who are pivotal for the implementation of an unfair distribution of resources are punished more harshly than non-pivotal voters. Our experiment does not study punishment. Instead, our design allows us to directly link the degree of responsibility to the selfishness of a decision. Further experimental evidence is obtained in a labour market setting by Charness (2000, 2004). His results highlight that effort provision in a gift-exchange game is adversely affected if the responsibility for the outcome can be assigned to others or to an external process. Once again, this provides evidence for the importance of responsibility attribution.

Closest to our work is the experimental literature that studies the diffusion of responsibility in group decision making. One such study is Dana et al. (2007), who compare decisions of individuals and two-person groups (pairs) in a binary dictator game. A pair only implements the selfish outcome if both group members vote in favour of this option. As a consequence, both individuals in a pair are pivotal for an unfair outcome. Note that here is no variation in the dimension of responsibility diffusion we are interested in, which is linked to pivotality. While Dana et al. (2007) keep the pivotality in case of a selfish outcome constant, this is exactly what we want to vary and the effect we want to isolate. Yet, the authors observe that pairs are significantly more selfish than individuals.

Similarly, Behnk et al. (2017) observe more selfish decisions by pairs than by individuals in sender-receiver games. However, pairs can only send a deceptive message if both members agree to do so. This implies that every group member is pivotal for sending a deceptive message. As in Dana et al. (2007), the results suggest that the higher selfishness in pairs is the result of sharing guilt rather than reducing pivotality. Selfish decisions by groups are also observed by Irlenbusch and Saxler (2019). They investigate the diffusion of responsibility by comparing decisions by individuals and groups to trade in a market environment where trade causes a negative externality to a third party. Other things equal, groups are more likely to engage in such trade. Given the veto power of an individual group member, an individual vote is again pivotal in groups.

All in all, group decisions tend to be less pro-social than individuals' in these studies. Nevertheless, this cannot be attributed to responsibility diffusion in the sense of reducing pivotality, but rather to shared guilt due to the mere presence of another selfish decider. In all of these studies, an individual's vote contributes just as much to the implementation of a selfish action in a group as it does in individual decision making. This will hold for any environment where unanimity is required for the group to choose selfishly. See Kocher et al. (2017) for an overview of alternative explanations for selfish group behaviour.

Falk et al. (2020) study the diffusion of responsibility in groups in an original manner. Participants in groups of eight face the choice between receiving money at the cost of voting to kill eight mice or foregoing the monetary payoff and not voting to kill the mice. A group implements the first option as soon as one group member votes to kill the mice. In contrast to the studies mentioned before, this means that group members are unlikely to be pivotal for the decision to kill the mice (such pivotality only occurs if all others forgo the money). The results show that the diffusion of responsibility in group choices results in significantly more mice being killed. An interesting observation in Falk et al. (2020) is that an individual's willingness to choose the selfish option decreases with the perceived likelihood of being pivotal. This supports the hypothesis that responsibility diffusion drives differences between individual and group decisions here.

All in all, this literature shows that groups make more selfish decisions than individuals and that a reduction of responsibility may be one of the factors that plays a role. We add to this literature in two important ways. First, we introduce a new mechanism that allows us to directly manipulate the possibility to reduce pivotality and isolate it from shared guilt. Second, endogenising group entry allows us to study whether agents exploit group decision making to make more selfish choices and whether this results in endogenously formed groups being even more selfish than suggested by the literature.

2.2. Endogenous group formation

To date, endogenous group formation has primarily been studied in public good experiments. For instance, Ahn et al. (2008) report a significant impact of the group formation process on public good provision. Both Ehrhart and Keser (1999) and Brekke et al. (2011) demonstrate that endogenously formed groups can sustain higher levels of public good provision because more pro-social individuals select into groups.

Aside from the literature that studies the endogenous formation of institutions in exogenously formed groups, such as Sutter et al. (2010), there is an emerging literature that looks at the endogenous formation of groups with punishment institutions. Kosfeld et al. (2009) show that this endogenous formation increases public good provision. Gürerk et al. (2006, 2014) and Fehr and Williams (2018) show that self-selection into groups and endogenous migration across groups with distinct punishment institutions fosters cooperation. Nicklisch et al. (2016) add that the observability of contribution levels in a public good game encourages individuals to join groups with punishment opportunities. Robbett (2014) further stresses that next to the ability to enter groups with different institutions, the ability to then shape these institutions is crucial.

Similarly, in weakest link games Riedl et al. (2015) and Chen (2017) find individuals choosing the set of players and the group to interact with is effective in promoting efficient coordination. In contests, Herbst et al. (2015) find that self-selection into groups has a significant impact on effort, both through intensified free-riding and increased in-group favouritism. The field study by Hamilton et al. (2003) considers self-selection into group production, finding (somewhat surprisingly) that there is no adverse selection of team members.

Importantly, groups are not decision makers in any of these studies. Instead, individuals make decisions that affect others in their group. Nevertheless, such findings suggest that the neglect of the endogeneity of group membership is a serious gap in the existing literature. The only study we are aware of that considers endogenous group formation in the context of group decision making is Kocher et al. (2006), who do so for beauty contests. They find that while endogenously formed groups perform better than individual decision makers, high ability subjects are more likely to opt for individual decision making. The context we propose here involves an entirely different strategic environment. Furthermore, to the best of our knowledge, ours is the first study that directly compares distributive *decisions by* endogenously and exogenously formed groups, as opposed to *behaviour within* those groups.

2.3. Sorting

Few studies consider the effect of sorting or self-selection on the decision environment. One notable exception is Dana et al. (2006). They demonstrate that a substantial fraction of subjects opt out of playing a dictator game when this en-

Table 1
Treatment overview.

Exogenous group formation	Endogenous group formation
• Individual decision making (*ExoInd*) • Group decision making A default (*ExoGroupA*) • Group decision making B default (*ExoGroupB*)	• A default (*EndoA*) • B default (*EndoB*)

sures that the receiver stays uninformed about the option of playing this game. Also Lazear et al. (2012) show that some types of individuals sort into environments that do not provide the opportunity to share their earnings. This self-selection significantly alters the degree of pro-social behaviour in a dictator game.

Grossman and Van der Weele (2017) investigate sorting of dictators into different information states concerning the payoffs of receivers. They find substantially more pro-social behaviour of dictators who self-selected into environments with knowledge of the receiver's payoff.

Similar to our experiment, these studies underline that sorting provides a mechanism that can decrease the extent of pro-social behaviour. We add to this by considering sorting into various types of groups as such a mechanism.

3. Experimental design

Our experimental design aims to shed light on the effects of responsibility diffusion and endogenous group formation on differences in group and individual choices. In particular, it will allow us to study selection effects in response to the possibility to reduce pivotality for selfish decisions.

The design employs a binary dictator game with the following two options:

$$A : (10, 0)$$

$$B : (6, 6)$$

where the first number depicts the dictator's and the second number the receiver's payoff in experimental tokens. A represents the selfish option and B the pro-social option. This dictator choice involves no strategic interaction. As a consequence, choices are independent of beliefs about other players' behaviour. Throughout the experiment, the dictator and receiver roles are neutrally labelled as Player 1 and Player 2, respectively.

3.1. Treatments

The experiment uses a within-subject design. There are five distinct treatments, varying along two dimensions. First, treatments differ with respect to how decisions are made and second, they differ in the way groups are formed, see Table 1. Groups always consist of three individuals.

All subjects make decisions in the dictator role (how payoffs are determined is explained below). Decisions are made individually or in a group. To start, we explain the treatments in which groups are formed exogenously (as is the allocation to the individual decision-making treatment). Each participant is matched with one other individual, the receiver.

If decisions are made individually, as in *ExoInd*, subjects decide about their payoff and the payoff of the other participant they are matched with. If decisions are made in a group, as in *ExoGroupA* and *ExoGroupB*, a group jointly decides about their payoff and the payoff of another group, consisting of the three individuals the group members are matched with. Within matching groups of nine individuals, subjects are rematched into different groups in each period that involves group decision making. Subjects know that they are rematched in every group decision-making period, but are unaware of the matching groups. Each group member in the dictator and the receiver group obtains the payoffs corresponding to the implemented option. This ensures that group decisions do not differ from individual decisions in terms of per-capita incentives, which could alter the perception of the selfishness of choosing either option. The role of outcome-based explanations for different choices is therefore limited.

Group decisions are made by each group member simultaneously casting a vote. Every period, every individual has only one chance to cast a vote. A decision is implemented if group members unanimously vote in favour of it. There is no communication between group members. This is in line with other studies like Dana et al. (2007), Falk et al. (2020) and Behnk et al. (2017). If group members do not unanimously vote for either option, a default option is implemented. In *ExoGroupA* this default option is A, in *ExoGroupB* it is B.

This specification of the voting process serves as a mechanism to isolate the effects of the pivotality dimension of responsibility diffusion on group choices. If the pro-social outcome B is the default, then there is no possibility to diffuse responsibility, as in having a reduced probability of being pivotal for a selfish decision (compared to when the decision is made individually). As all group members need to agree on A for this to be implemented, every vote is pivotal if A is implemented and every group member bears the responsibility for A being the aggregate decision. In contrast, if A is the default, this allows for diffusion of responsibility. A vote in favour of A is here only pivotal for implementing A if the two other group members vote in favour of B. As soon as at least one other group member votes in favour of A, an individual vote in favour of A is no longer pivotal. In expectation, if we assume a positive probability of any individual voting in favour of A, more votes need to change if the default is A than if the default is B to change the outcome from selfish to pro-social. With default A, an agent voting in favour of A can expect to be further away from being pivotal for the selfish group choice A. This reduces the expected responsibility for implementing the selfish outcome. If one individual would change her vote, the selfish option A could still be implemented.

In contrast to Behnk et al. (2017) and Falk et al. (2020), analysing the effect of diffusion of responsibility here involves the comparison of group decisions in distinct environments. Both Behnk et al. (2017) and Falk et al. (2020) compare group to individual decisions, while we leave all aspects of group decision making constant except the default option.[4] This is especially important as the evidence in favour of a shift to more selfish behaviour in dictator games is inconclusive. Luhan et al. (2009) find more selfish behaviour by groups but Cason and Mui (1997) find the opposite. We apply the dictator game because its lack of strategic interaction provides a clean measure of pro-sociality. We prefer to compare groups to groups (as opposed to groups to individuals) because this allows us to directly capture variations in the diffusion of pivotality without confounds from other drivers of differences between group and individual decisions.

The two treatments in which groups are formed endogenously, *EndoA* and *EndoB*, involve decisions in two stages. First, individuals choose between group and individual decision making. When choosing, they know the default option for a group they would join. This is A in *EndoA* and B in *EndoB*. In the second stage, individuals face, depending on their first stage decision, one or two choices. If individual decision making is chosen, participants face the same choice as in *ExoInd*. If, instead, group decision making is preferred, subjects have to indicate, both, how they would vote if they indeed join a group and how they would decide if they cannot join a group for decision making. We use the strategy method here because this allows us to study groups that are formed purely voluntarily. In case the number of subjects that indicates a preference for group decision making is not a multiple of three, randomly selected participants who prefer group decision making are assigned to make the individual decision.[5] This is common knowledge. Out of nine subjects in a matching group, at most two subjects may have to decide individually instead of in a group, despite preferring group decision making.[6]

3.2. Belief elicitation

If subjects join groups because this allows them to diffuse responsibility, then the likelihood that a selfish individual will join a group is higher, the more other selfish choices she expects. To measure this, we elicit participants' beliefs about the number of selfish choices by others.[7] We do so for four distinct cases, distinguished by the default and whether the decision is individual or in a group.

Each participant is asked to indicate how many out of ten randomly sampled other subjects are expected to choose A. For each elicitation, subjects are endowed with one euro. The elicitation is incentivised by subtracting ten cents multiplied by the absolute difference between the estimated and observed frequencies from this endowment.[8] Asking for frequencies in this way instead of subjective probabilities yields a more accurate elicitation of beliefs (Schlag et al., 2015).

3.3. Timing

This experiment consists of 25 periods plus the belief elicitation stage. These 25 periods include multiple periods of each treatment. As illustrated in Fig. 1, the experiment is split into an initial nine periods without endogenous group formation and an additional 16 periods that alternate in a fixed order between exogenous individual and group decision-making periods and endogenous group formation. The belief elicitation takes place in between these two sets of periods.[9]

The first part serves to allow subjects to gain experience both with individual and with group decision making in environments where A and B are the defaults. This part consists of three rounds of *ExoInd*, three rounds of *ExoGroupA* and three rounds of *ExoGroupB*. Comparing exogenous group decisions in the first part to those decisions in the later part of the experiment allows us to investigate whether the effect of responsibility diffusion is stable across time.

The second part of the experiment comprises four periods of *EndoA* and *EndoB* each, two periods of *ExoGroupA* and *ExoGroupB* each and four periods of *ExoInd*. To reduce as much as possible any effects from the order of decisions taken, periods are organised in blocks of four in the second part. Each block is made up of one *EndoA* period, one *EndoB* period, one *ExoInd* period and one exogenous group decision-making period. The latter alternates between *ExoGroupA* and

[4] As explained above, only *ExoGroupA* allows for a diffusion of responsibility; *ExoGroupB* provides agents with veto power against the implementation of selfish choices. If an agent favours a pro-social allocation of resources, a vote in favour of B guarantees this allocation in *ExoGroupB*.

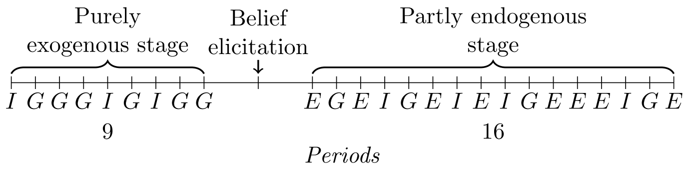
[5] The design is not symmetric here. Subjects opting for individual decision making only face one question, because individual decision making is guaranteed if this is preferred. So their vote in case of joining a group would not have been incentivised. Since subjects may especially dislike inconsistencies between their individual and group decision in a simultaneous choice, our results provide a lower bound of the selection effect.

[6] Note that there is no need to exclude these data. Since we use the strategy method, subjects decide between A and B for both the case they end up as an individual decision maker and the case they end up as part of a group. They do so before they know whether they are an individual decision maker or part of a group. Both of these choices are properly incentivised, as it is possible to end up in either case.

[7] Eliciting such beliefs also enables us to estimate whether participants believe that others use groups to diffuse responsibility.

[8] This linear scoring rule is used to facilitate understanding of the mechanism.

[9] Since the payoff of the belief elicitation only depends on *other* subjects' behaviour, this belief elicitation is not expected to affect behaviour in the second part of the experiment.



I: Period with exogenously-determined individual decision making
G: Period with exogenously-determined group decision making
E: Period with endogenously-determined group or individual decision making

Fig. 1. Timing.

ExoGroupB. Our main analysis will focus on this second part of the experiment, since the level of experience is here similar in the between-treatment comparison.

At the end of the experiment, participants are randomly split into dictators and receivers. Only the decisions by those allocated to the dictator role are implemented. As a consequence, every subject's choices potentially determine someone else's payoff in each of the 25 rounds.

3.4. Procedures

The experiment is computerised using PHP (the programme is available upon request). It was run at the CREED laboratory of the University of Amsterdam. We ran 12 sessions in June and October 2018 with a total of 216 students.[10] Subjects with a variety of backgrounds were recruited. A questionnaire administered at the end of the experiment shows that 63% have a background in either economics or business and 50% are female. Each session consisted of 18 participants, constituting two matching groups. Subjects did not know the identity of the participants who were in their matching group. Upon arrival, subjects were randomly allocated to computer stations and further communication was prohibited. The instructions and images of the decisions screens are available in appendix A and appendix B (Figs. B.1, B.2, B.3), respectively. Understanding of the instruction was tested using practice questions (cf. appendix A). Subjects were only allowed to move on and start the first period of the experiment if they answered all questions correctly.

Final payoffs consisted of a show-up fee of seven euros plus the earnings of the 25 periods and the belief elicitation. Each experimental point corresponds to a payoff of 0.08 euros. Average earnings were 21.71 euros; sessions lasted on average approximately 45 minutes.

4. Behavioural hypotheses

To derive testable hypotheses, we assume that, next to their monetary payoff, individuals care about the extent to which they are responsible for the implementation of a selfish outcome. The associated moral costs depend on two factors.

We call the first 'responsibility aversion'. This reflects an individual-specific parameter that captures the degree to which an individual is affected by being responsible for decreasing someone else's earnings in comparison to the alternative choice. In the experiment, individuals with distinct responsibility aversion would each attach a different weight to diminishing the receiver's earnings from six to zero by choosing A instead of B. The higher the responsibility aversion, the higher are the moral costs for diminishing someone else's payoff.

The second factor reflects the 'degree of responsibility' for implementing a selfish outcome. More precisely, it captures the extent to which the individual concerned is pivotal in the decision to choose A. Holding the responsibility aversion constant, the disutility from decreasing someone else's payoff increases in the degree of responsibility. As introduced by Engl (2018), we take the distance to being pivotal as a measure of responsibility, with a higher distance reflecting lower responsibility.[11] An agent's distance to being pivotal is defined as the number of votes, including that agent's vote, that need to change such that her vote would be pivotal for changing the outcome. The expected distance to being pivotal is then the expected number of votes that need to change. It gives the simple binary concept of pivotality as the determinant of individual responsibility in collective action more nuance.

As argued above, this distance to being pivotal for choosing A is expected to be higher in group decisions with default A than with default B and than in individual decisions. If, for example, A is the default and everyone votes in favour of A, the distance to being pivotal is three. Everyone needs to change their vote for the outcome to change. If B is the default and everyone votes in favour of A, the distance to being pivotal is one. So even if everyone votes selfishly, the distance to being pivotal remains low with B as the default. If B is the default, the expected distance to being pivotal for implementing A is therefore independent of agents' beliefs about others' behaviour.

[10] There was a pilot session before these 12. After the pilot, we introduced a small change in waiting times in endogenous periods. This guaranteed that individuals have no incentive to decide individually in order to avoid waiting for other participants.

[11] While we use the measure of Engl (2018), it is not our purpose to test his model. Such a test would require a different design.

Table 2
Classification of different types of individuals.

Responsibility Aversion	Group decision		Type	Selection	
	A default	*B* default		*A* default	*B* default
low	*A*	*A*	selfish	group	individual
intermediate	*A*	*B*	switcher	group or individual	indifferent
high	*B*	*B*	pro-social	individual	indifferent

The level of responsibility aversion (column 1) determines decisions in groups with default *A* (column 2) and default *B* (column 3) which results in the type classification (column 4). Classification determines selection of environment (columns 5 and 6).

To derive testable hypotheses, we classify individuals based on their degree of responsibility aversion into three types. A given level of responsibility aversion leads to specific choice patterns in groups with varying defaults. Realise that decisions of individual decision makers should be the same as their votes in groups with *B* as the default, since in both cases they are fully pivotal in case of a selfish decision and responsibility thus cannot be diffused.[12] In Appendix C we present and analyse a decision-theoretic model that formalises the classification presented here. This model also provides a formal underpinning for the hypotheses presented below.

Individuals with a low level of responsibility aversion choose *A* irrespective of the group's default; even if responsibility cannot be diffused, they prefer to vote for the selfish outcome. Note that these individuals are not necessarily completely indifferent to the consequences of their actions for others' payoffs. However, their responsibility aversion is not high enough to make them forego the monetary gains associated with the selfish option under either default. Because of their choice pattern, we call these individuals 'selfish'. In periods with endogenous group entry and *A* as the default, these individuals will choose to decide in the group because they can assure a selfish group choice but still might get some benefit out of the diffusion of responsibility. The expected distance to being pivotal for implementing *A* is increased, if there is a positive probability of one other individual voting *A*, while *A* can still be guaranteed. If *B* is the default, they cannot guarantee their preferred outcome *A* and by lack of responsibility diffusion, there is no advantage to joining a group. They therefore prefer to decide individually and then choose *A*.

At the other extreme are those who have a high level of responsibility aversion. This leads them to choose *B* even with default *A*, so they choose *B* irrespective of the default. With *A* as the default, the expected distance to being pivotal for allocation *A* is higher, but this does not suffice to compensate for the moral costs that result from being (even only partly) responsible for a selfish outcome. Because of this voting pattern, we call them 'pro-social'. These individuals prefer to decide individually when *A* is the default because the consequences of being partly responsible for a selfish group choice (*A*) weighs too heavily on them. Therefore, they prefer to decide individually and implement the pro-social *B*. When *B* is the default, they are indifferent about joining a group, because they can always ensure outcome *B* either way.

Finally, there are individuals with an intermediate level of responsibility aversion. Given their degree of responsibility aversion, they choose *A* when *A* is the default and *B* when *B* is the default. Their responsibility aversion is high enough to kick in and make them choose *B* when *B* is the default and the distance to being pivotal for implementing *A* is not increased; the moral costs of voting selfishly are too high if responsibility is not diffused. Yet responsibility aversion is low enough to make them choose *A* if the expected distance to being pivotal for the selfish choice is higher with *A* as the default. Responsibility is then diffused sufficiently such that the higher payoff offsets the moral costs of being partly responsible for someone else's low payoff. We call this type of individuals a 'switcher'. Such an individual will be indifferent about joining a group when *B* is the default because her choices will ensure the outcome *B* in any case. When *A* is the default, she may choose to decide individually or to join a group, depending on the precise value of her responsibility aversion. If responsibility aversion is relatively low, diffusion of responsibility still makes it sufficiently attractive to enter groups and exploit this feature. Higher levels of responsibility aversion ensure that voting individually for *B* dominates being selfish in a group, as the costs of bearing the responsibility for selfish outcomes are too high despite responsibility diffusion.

Table 2 summarises this discussion.

4.1. Experimental hypotheses

Our classification yields the following testable hypotheses.

Hypothesis 1. In exogenously formed groups, option *A* will be chosen more often if *A* is the default than if *B* is the default.

This assumes a positive mass in the type distribution on the switching type. In that case, this hypothesis follows directly from Table 2 by observing that switchers choose *A* (*B*) when *A* (*B*) is the default, while other types do not change

[12] We have no way to know whether subjects realise that they are as pivotal for implementing *A* if this is done in a group with *B* as the default as they are individually. However, our practice questions do ensure that subjects know that they only override the default if everyone votes in favour of doing so.

their behaviour based on the default. Because A is the default which allows for diffusion of responsibility, this hypothesis predicts that the diffusion of responsibility generates more selfish decisions. This is because it decreases the moral costs of making a selfish choice. In our experiment, we expect the share of A choices to be higher in treatment $ExoGroupA$ than in $ExoGroupB$. This first hypothesis serves as a robustness check of previous findings of Behnk et al. (2017) and Falk et al. (2020) using a different identification mechanism for the effects of diffusion of responsibility.

Hypothesis 2. The difference in the share of votes in favour of A between groups with A as the default and groups with B as the default is larger in endogenously than in exogenously formed groups.

Given the theoretical selection patterns depicted in Table 2, individuals with lower responsibility aversion – that is, those more likely to choose the selfish option – select into groups when this entails the possibility to reduce responsibility for selfish actions. In addition, those with high responsibility aversion (who are likely to choose the pro-social option B) select out of groups when responsibility can be diffused. Together, this means that endogenously formed groups with default A have a higher fraction of selfish individuals than the randomly formed exogenous groups with this default. Similarly, a group with default B will not be joined by selfish individuals, so the fraction of selfish types in these groups will be lower than in exogenous groups. This selection of selfish types into endogenously formed groups with a selfish default and out of endogenously formed groups with a pro-social default yields the conclusion that endogeneity amplifies the differences between the defaults. Hence, comparing the difference in selfish decisions in treatments $EndoA$ and $EndoB$ to this difference in $ExoGroupA$ and $ExoGroupB$, we expect the former to be higher. This assumes a positive mass on at least two types with different selection choices under default A.

Hypothesis 3. Individuals classified as selfish join groups more often if A is the default.

This follows directly from Table 2 and the discussion following Hypothesis 2. The fraction of selfish group entrants in $EndoA$ is thus predicted to exceed the fraction of selfish group entrants in $EndoB$.

Hypothesis 4. Individuals classified as pro-social join groups more often if B is the default.

We predict that the opposite of Hypothesis 3 holds true for types that do not take advantage of the diffusion of responsibility, the pro-social types. This is, however, more of a conjecture than a formal result. Though pro-social types prefer individual decision making if A is the default (cf. Table 2), they are indifferent when B is the default. The hypothesis follows if we assume that indifference yields a positive probability of joining a group. In that case, we predict that the fraction of pro-social types that join groups is higher in $EndoB$ than in $EndoA$.

Note that the behaviour predicted in Table 2 is deterministic in the sense that someone either joins a group or does not. Adding noise to decisions would mean that the choices become probabilistic. That is, as the level of responsibility aversion increases, the likelihood to join a group with default A (B) decreases (increases). Then, the ideas underlying Hypotheses 3 and 4 can also be tested using the elicited beliefs. In the reasoning underlying Table 2, a selfish subject's or switcher's propensity to join groups in $EndoA$ will increase in her beliefs about the share of selfish votes in groups because this increases the likelihood that she will be able to diffuse responsibility. The same holds for switchers. The reverse holds for pro-social types, whose propensity to join groups should decrease in their beliefs about the share of selfish votes because more of such votes will increase the likelihood of a selfish outcome.

5. Experimental results

As mentioned above, we have data from 12 sessions (for a total of 216 participants) in a within-subject design. We start by outlining the methodology underlying the data analysis.

5.1. Methodology

We use both parametric and non-parametric techniques. Because of the dependence of observations within matching groups, observations are averaged at the matching group level whenever using non-parametric tests. This results in 24 observations per treatment. We apply Fisher-Pitman permutation tests for paired replicates (FPP) when making within-subject comparisons. When comparing choices across different types of individuals, we use Fisher-Pitman tests for independent samples (FPI) (Kaiser, 2007). These permutation tests are non-parametric and do not require distributional assumptions (Siegel, 1956). At the same time, permutation tests are more powerful than traditional non-parametric techniques such as the Wilcoxon signed-rank and Mann-Whitney U tests. Moir (1998) demonstrates in a Monte Carlo analysis that permutation tests allow for more robust inference with small samples, as discussed in Schram et al. (2019).

In the parametric analysis, standard errors are clustered at the matching-group level to ensure consistent estimates despite dependent observations. p-values reported in the main text stem from these clustered standard errors. To account for a possible downward bias in the estimated residuals due to the small number of clusters (Cameron and Miller, 2015),

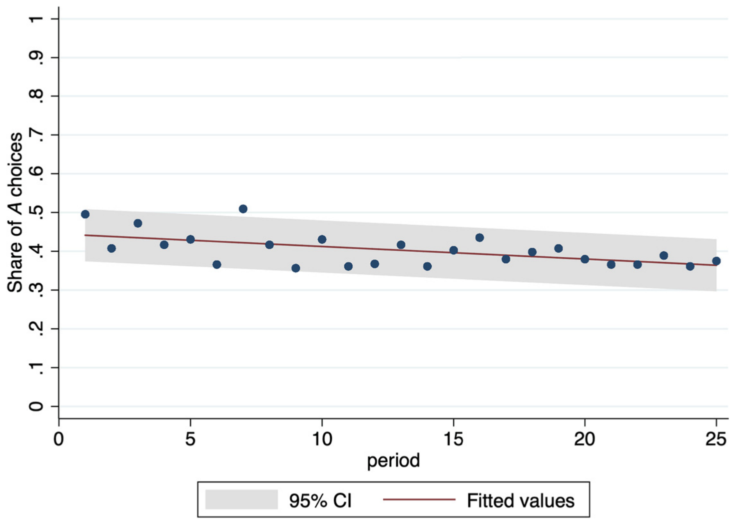


Fig. 2. Share of selfish choices per period.

we include a robustness check using score wild cluster bootstrap to calculate p-values based on Kline and Santos (2012) in all tables.

We categorise subjects into types along the lines of Table 2. To do so, we use choices in periods with exogenous group decisions in the second part of the experiment (constituting two choices each with defaults A and B). If subjects vote for A, irrespective of the default, they are categorised as selfish, and if they always vote for B, they are the pro-social type. If out of the four responses considered, subjects more often vote for A if A is the default than if B is the default, they are assigned to be a switcher. This classification captures 78% of the subjects, with 17% of all subjects being categorised as selfish, 24% as switcher and 37% as pro-social.

To investigate whether our analysis requires a trend correction, Fig. 2 shows the share of individuals deciding for or voting for A over the 25 periods. This fraction is close to 50% in all periods, which allows testing the outlined hypotheses without fearing boundary effects. The mild downward trend in the fraction of selfish choices or votes (Spearman's $\rho = -0.047$; $p < 0.001$) suggests that experience slightly matters. Unless stated otherwise, we therefore consider only decisions in the second part of the experiment, where there is no detectable downward trend (Spearman's $\rho = -0.017$; $p = 0.324$).[13] This is especially important in the comparison of endogenous and exogenous periods to ensure that subjects in exogenous and endogenous rounds have a comparable level of experience. Here, treatments are spread out evenly.

5.2. Results

Table 3 presents summary statistics for the main variables of interest (the fraction of A choices and the choice to enter a group).

In the upper panels, we compare the fraction of A choices and the choice to enter a group across defaults. In the lower panels, the table displays the results of a difference-in-difference analysis. The inequalities indicated are differences in the fraction of A choices or differences in the choice to enter a group across defaults. In the lower-left panel, the cross-default difference in the fraction of A choices is compared between endogenously and exogenously formed groups. In the lower-right panel, differences in the choice to enter a group are compared between individuals classified or not classified ("others") as a certain type.[14]

Result 1. *In exogenously formed groups, option A is not chosen significantly more often when A is the default than when B is the default.*

Hypothesis 1 can thus not be confirmed when focusing on decisions in the second part of the experiment (see below, however, for results on the first part). Using the numbers from Table 3, Fig. 3 illustrates the fraction of votes in favour of A across the group treatments. Although the fraction of votes in favour of A is slightly higher in exogenously formed groups when A is the default (0.38) than when B is the default (0.36), this difference is not statistically significant (FPP; $p = 0.373$).

[13] For the two correlation tests observations are not averaged at the matching group level.

[14] For example, the selfish join the group 15 percentage points more often when A is the default than when B is the default. Together, those not classified as selfish join a group 8 percentage points less often when A is the default than when B is the default. The diff-in-diff between +15 percentage points and -8 percentage points is statistically significant with $p < 0.01$.

Table 3
Summary statistics and tests on selfish votes and group entry.

	A votes			Group entry				
	Exo		Endo	Total		Selfish	Switching	Pro-social
Overall	0.37	$>^{*}$	0.31	0.40		0.28	0.39	0.47
A default	0.38	$>$	0.38	0.38		0.35	0.40	0.39
	$\vee$	$\wedge^{***}$	$\vee^{***}$	$\wedge^{*}$		$\vee^{**}$	$\vee$	$\wedge^{***}$
B default	0.36	$>^{**}$	0.25	0.42		0.20	0.38	0.56
				Others				
Difference				-0.08	$<^{***}$	0.15		
between	0.02	$<^{***}$	0.13	-0.06	$<^{**}$		0.02	
defaults				0.03	$>^{***}$			-0.17
Observations	863		692	1727		288	416	640

Cells report the average fraction of *A* votes in groups and the average fraction of individuals choosing to enter a group. Differences of means and differences in differences are tested with Fisher-Pitman permutation tests using matching group averages. The numbers in the lower panels are explained in the main text. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

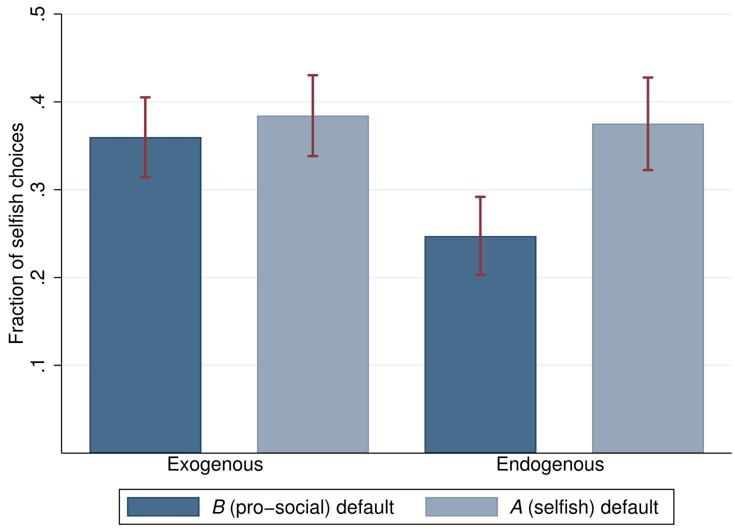


Fig. 3. Comparison of the fraction of selfish choices across treatments. Fraction of votes in favour of *A* across treatments in part 2. Error bars indicate 95% confidence interval based on individual observations.

This result is in contrast to the findings of Behnk et al. (2017) and Falk et al. (2020). Recall that these studies measure responsibility diffusion by comparing individual's decisions when alone to their decisions when in a group. Dimensions of responsibility diffusion other than a change in pivotality might, however, cause distinct behaviour in the two settings. Of course, we cannot exclude the possibility that for some reason responsibility diffusion plays a role in the settings studied by Behnk et al. (2017) and Falk et al. (2020), while it does not in our experimental setting. Nevertheless, we can conclude that changes in an individual's pivotality do not always trigger more selfish behaviour in groups.

Given that our design comprises 25 periods, we can investigate whether and how responsibility diffusion matters at different stages of the experiment. To investigate whether our treatment variation is successful in varying the subjects' perception of responsibility, we explore behaviour of subjects in exogenously formed groups in the first part of the experiment. This allows us to see whether the increase in the probability of being pivotal initially leads to more selfish behaviour by those subjects susceptible to a variation in responsibility. In contrast to the results in the second part of the experiment, we observe that in the first part subjects vote significantly more selfishly in groups with a selfish default. Over the whole course of the experiment, 41% of the votes are selfish in exogenously formed groups with a selfish default, which is significantly more than the 37% in such groups with a pro-social default (FPP; $p = 0.043$). This effect is even stronger if we only consider periods in the first part of the experiment (44% vs. 38%; FPP; $p = 0.015$). Table 4 summarises this.

The effect of a reduction in the probability of being pivotal thus seems to diminish with repetition. This means that our results are consistent with the previous literature, such as Falk et al. (2020) and Dana et al. (2007). These previous studies apply one-shot interactions or only a few repetitions. Falk et al. (2020) find in their 'charity paradigm' that subjects are more selfish in a second period, where subjects are able to form more accurate beliefs about pivotality. Similarly, it is

Table 4
Comparison of votes including first part of the experiment.

	A votes					
	Only 1*st* part			1*st* and 2*nd* part		
	Exo Group		Exo Ind	Exo Group		Exo Ind
A default	0.44	$<$		0.41	$<$	
	$\vee^{**}$		0.48	$\vee^{**}$		0.44
B default	0.38	$<^{***}$		0.37	$<^{***}$	
Observations	648		648	1080		1513

Cells show per default the average fraction of *A* votes in exogenously formed groups and exogenously imposed individual decision making. Differences in means are tested with Fisher-Pitman permutation tests using matching group averages. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

conceivable that with more repetitions subjects start to realise that they are using the diffusion of responsibility to justify their behaviour.

Given that we observe a difference between group decisions with different defaults in the early periods of the experiment, we conclude that our design is successful in varying subjects' perceived diffusion of responsibility. Yet, this variation does not result in a significant change in behaviour in later periods, where subjects start to learn more about their decision environment.[15]

Strikingly, highly significant differences in voting behaviour across defaults do exist in the second part in endogenously formed groups (FPP; $p < 0.001$). As illustrated in Fig. 3, the effect size of introducing a selfish default is much larger in endogenous compared to exogenous groups. Note that differences in exogenously formed groups can only be attributed to a default-induced change in the pivotality for selfish outcomes. We have concluded that this change in pivotality plays no significant role for the exogenous case in the second part. Differences in endogenously formed groups, on the other hand, may stem from either this change in pivotality or from a differential selection that alters the group composition. Because pivotality on its own does not matter here (as seen in the exogenous periods), these differences must stem from selection effects, possibly in response to changes in pivotality. We discuss these selection effects below.

The difference between endogenously and exogenously formed groups gives the second result.

Result 2. *The difference in the share of votes in favour of A between groups with A as the default and groups with B as the default is larger in endogenously than in exogenously formed groups.*

This result confirms Hypothesis 2. The cross-default difference in the number of selfish votes is clearly larger in endogenously formed groups than in exogenously formed groups (0.13 versus 0.02, see Table 3). The difference-in-difference is highly significant (FPP; $p = 0.003$). This means that having a choice between individual and group decision making results in a more pronounced role of defaults. This provides clear evidence that group formation processes matter and should be taken into account when studying group decisions.

We next use the results in Table 3 to consider the selection mechanisms driving these amplified differences. Note first that individuals in endogenously formed groups with a selfish default, *A*, are not significantly more selfish than those in exogenously formed groups with this default (both choose *A* approximately 38% of the time; FPP; $p = 0.538$). Second, individuals in endogenously formed groups with a pro-social default, *B*, vote for *B* significantly more often than individuals in exogenously formed groups with this default (75% versus 64%; FPP; $p = 0.017$, see Table 3). Interestingly, this suggests that the amplification of differences in endogenously formed groups is not primarily driven by the possibility to diffuse responsibility for selfish choices, but by the possibility to ensure non-selfish allocations. This is in line with the expected selection of pro-social types depicted in Table 2, that predicts that pro-social types do to not join groups with *A* as the default, yielding relatively fewer selfish choices if *B* is the default.

This result also demonstrates the limited role of self-image concerns in this setting. Individual group entry decisions are not primarily motivated by the opportunity to caste a pro-social vote at no actual cost in groups with *A* as the default. This would have implied more pro-social votes in endogenously formed groups with default *A*, which is contrary to what we find.

We will now investigate the type-specific selection behaviour in more detail. Overall, individuals join groups 40% of the time, documenting a willingness to forego autonomy for the sake of group decision making. At the aggregate level,

[15] To check whether the lack of differences in the exogenous treatments may be due to subjects' strive for consistency, we examine the intra-individual correlations in exogenous periods in the second part of the experiment. These are only moderate (Pearson's $\rho = 0.4$ between group decision periods with *A* and *B* as the default; Pearson's $\rho = 0.42$ between group decision periods with *A* as the default and individual decisions; Pearson's $\rho = 0.49$ between group decision periods with *B* as the default and individual decisions).

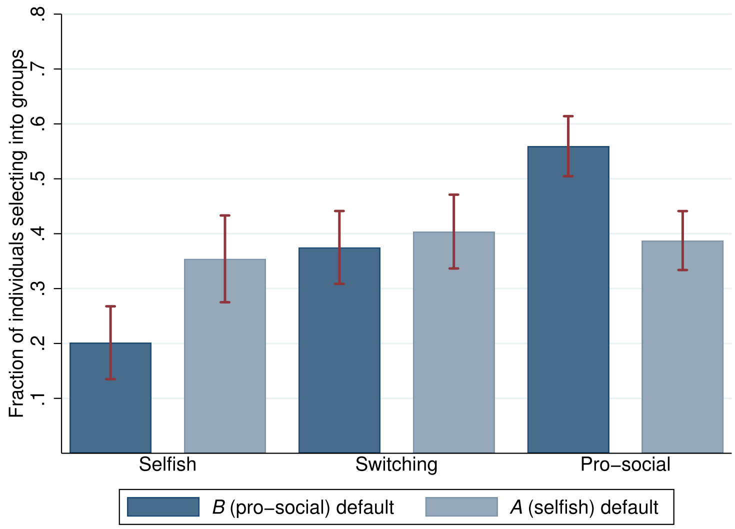


Fig. 4. Selection into groups across types. Fraction of individuals selecting into groups with A or B as the default for different types. Error bars indicate 95% confidence intervals based on individual observations.

we observe a marginally significant effect of the default on selection into group decision making (FPP; $p = 0.097$), with default B being more attractive. This result, however, hides type-specific heterogeneity. Fig. 4 clearly shows that types exhibit differences in their group entry response to a change in the default. These differences are discussed in the next results.

Result 3. *Individuals classified as selfish join groups significantly more often if A is the default.*

This confirms Hypothesis 3. Individuals categorised as selfish join groups in 35% of the cases when A is the default (allowing for the diffusion of responsibility) and in only 20% of the cases with default B, see Fig. 4. The difference is significant (FPP; $p = 0.015$). We see that those individuals that benefit from a selfish default enter groups more often if their selfish vote's pivotality can be reduced. A selfish default, therefore, mainly attracts individuals who, given their choice pattern, actually benefit from the moral wiggle room it provides.

Interestingly, as group entry is voluntary, group members are responsible for being part of a group that allows them to diffuse responsibility. In this way, joining a group for the opportunity to act selfishly could be seen as an immoral act in itself. In principle, this could diminish the moral wiggle room that appears once one is in the group. Our result implies, however, that for selfish types the attraction of reducing their selfish vote's pivotality is strong enough to outweigh the fact that group members deliberately selected into this environment. Therefore, the fact that voluntary group entry entails responsibility for those that enter the group does not prevent selfish individuals from exploiting this wiggle room. Their benefit from being less likely the pivotal selfish decision maker is large enough.

As Fig. 4 shows, switchers do not respond to the default in their selection choice. We do not find any effect of the default on group entry; the difference between 40% joining with default A and 38% with default B is insignificant (FPP; $p = 0.204$). The final formal result describes pro-socials' selection choices.

Result 4. *Individuals classified as pro-social join groups significantly more often if B is the default.*

This result confirms Hypothesis 4. Fig. 4 reveals that, in contrast to other types, pro-social types' frequency of joining a group is significantly lower when A is the group's default than when B is the default (39% versus 56%; FPP; $p = 0.002$). As predicted, this type of individual does not seem to want to free ride on others' selfish voting behaviour to benefit from a high payoff without bearing the responsibility for it. In fact, they join groups if, given the default, an equal split of resources is likely. This suggests that pro-social types join groups when they can guarantee an equitable split for a whole group of participants (they can ensure that the group decision is equitable if B is the default). Note from the bottom row of Table 3 that there are more pro-social types than selfish or switchers. With default B, the pro-socials also have a much higher probability of joining the group. As a consequence, a majority of the group members with default B is pro-social (56% of those we can classify). It is possible that these subjects also join groups to be among like-minded individuals. Individuals

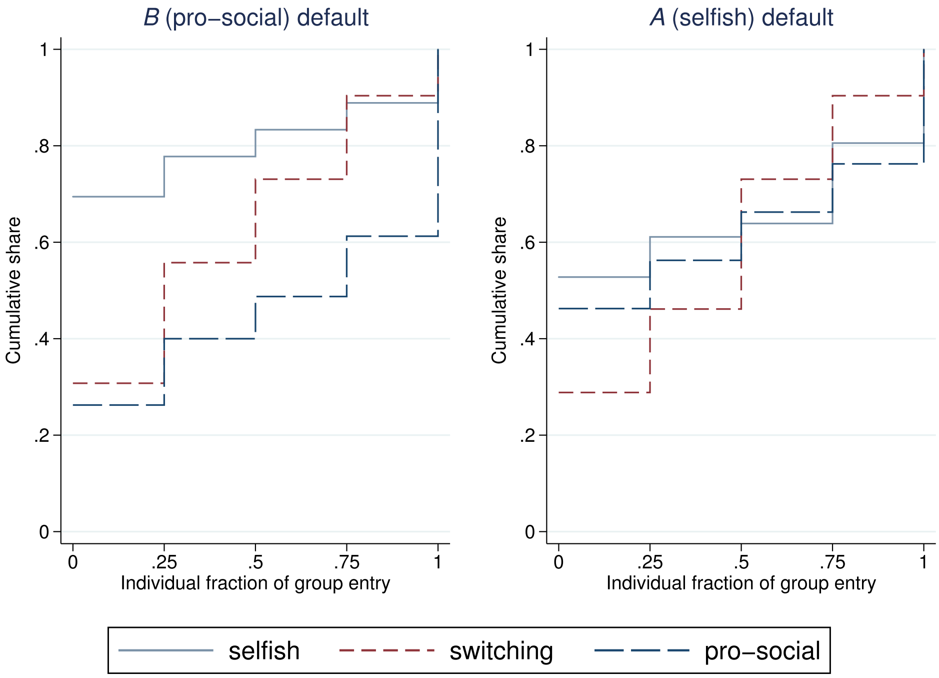


Fig. 5. Comparison of selection distribution across defaults. Cumulative distribution of individual frequencies of joining groups by type and default.

may derive a higher utility from acting pro-socially (choosing B) if this is done in a group they can identify with.[16] While selfish individuals might also prefer to be in a group with similar other individuals, this urge is likely stronger for pro-socials.

Aside from a comparison of means, we also see that the distributions of selection frequencies differ across types. Fig. 5 shows the distribution of individual frequencies of selecting into groups.[17] The figure illustrates that the distribution of group entry frequencies differs significantly between selfish and pro-social types if the default is the pro-social B (Kolmogorov-Smirnov test; $p < 0.001$), but the distributions are much more similar if groups face a selfish default (Kolmogorov-Smirnov test; $p = 0.988$).

Self-selection therefore significantly alters the group composition in an environment with pro-social default, but not so much if the default is selfish.

To analyse how the effect of a default change on a type's group entry decision compares to other types' responses, we use the cross-default difference in the fractions of individuals selecting into groups as a measure to be compared across types. These fractions are given in the lower-right panel of Table 3. For instance, we compare the difference in the fraction of pro-social individuals that choose group decision making across defaults (-0.17) to this difference for individuals that are not pro-social (0.03). As shown in Table 3, pro-social types, compared to other participants, are affected significantly more by a default change. The selfish default A makes them select into groups much less than default B does and this difference is significantly different than the difference for the average other individual, who enters slightly more often with A (FPI; $p < 0.001$). In turn, both selfish types and switchers exhibit a higher positive effect of a selfish default on selecting into group decision making than others (FPI; $p < 0.001$ and $p = 0.029$, respectively). These numbers underline the heterogeneous effects that a change in default has across types.

For an estimate of the magnitude of the type-specific selection effects, Table 5 reports the logit regression results of group entry on the default and the respective average marginal effects. For the selfish, the marginal effect of a selfish default illustrates that selfish types join groups on average 15.3% more often if the default is selfish ($p = 0.006$). In contrast, pro-social individuals join groups significantly less frequently, the average marginal effect of a pro-social default B is 17.2% ($p < 0.001$).

[16] As noted by an anonymous reviewer, joining a group and subsequently acting pro-socially could also be explained by outcome-based social preferences. Choosing B, subjects can guarantee that six subjects receive a payoff of six each, while A would only give three subjects a payoff of 10 each. Sufficiently strong Fehr and Schmidt (1999) or Charness and Rabin (2002) type of preferences would allow for this. However, as we observe pre-dominantly pro-social voting in these groups, the pro-social default B is implemented in 98% of the cases. An individual's vote is pivotal in only 10% of these cases. Joining a group, then, typically does not yield a fair outcome for more individuals. This is why we suggest a preference for joining a group of similar individuals as an explanation (on top of the desire to force a pro-social outcome). This would be in line with Hett et al. (2019), who show that individuals are willing to forego substantial monetary gains to be part of a group they identify with.

[17] Recall that there are four group entry choices per default. This means that entry can be selected 0%, 25%, 50%, 75% or 100% of the time.

Table 5
The effect of *A* being the default on group entry.

Sample	(1) Total	(2) Selfish	(3) Switching	(4) Pro-social
	Entry	Entry	Entry	Entry
A default	-0.176*	0.777**	0.121	-0.696***
	(0.102)	(0.305)	(0.192)	(0.154)
	[0.0901]	[0.0170]	[0.5335]	[0.0010]
	*-0.042**	*0.153****	*0.029*	*-0.172****
Constant	-0.315***	-1.378***	-0.511***	0.239
	(0.120)	(0.302)	(0.191)	(0.203)
Observations	1727	288	416	640
Clusters	24	17	23	21

Logit regression estimating the effect of *A* being the default on group entry for different types. Standard errors clustered at the matching group level are in parentheses. In square brackets, score wild cluster bootstrap *p*-values adjusted for small samples are reported. Average marginal effects are reported in italics. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6
Composition of endogenously formed groups.

	Fraction of type in group		
	Selfish	Switching	Pro-social
A default	0.16	0.26	0.38
	$\vee$**	$\vee$	$\wedge$***
B default	0.08	0.21	0.49
Groups	24	24	24

Cells report the fraction of group members that have a certain type in groups with *A* and *B* as the default. The unit of observation is the average per matching group. Differences are tested with Fisher-Pitman permutation tests using matching group averages. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

To study the impact of these selection patterns, we compare the fraction of selfish, switching and pro-social types in groups with *A* as the default to groups with *B* as the default, see Table 6. This highlights how the observed differences in selection behaviour translate into differences in the group composition. If we allow subjects to reduce the probability of being pivotal for a selfish outcome, the group composition is affected in two ways: First, there are more selfish individuals in groups with *A* as the default (16% vs. 8%; FPP; $p = 0.016$). Second, there are fewer pro-social individuals in groups with *A* as the default (38% vs. 49%; FPP; $p < 0.001$).

These results are all robust to using traditional non-parametric tests, the Mann-Whitney U test for comparisons of independent samples and the Wilcoxon signed-rank test for within-subject comparisons, as reported in Appendix D. We also investigate type-specific behaviour under alternative classification mechanisms, with similar results, which are discussed in Appendix E. In particular, the selection behaviour of pro-social types proves very robust to how individuals are classified.

5.3. Differences in individual and group behaviour

So far, we have exploited the specific characteristics of our design by considering individual behaviour in groups and their entry decision, both under distinct defaults. We can also directly compare individual decisions in isolation and in groups, as is common in much of the previous literature. We add to this by including endogenously formed groups in the comparison. Our results are summarised in Table 7.

The results show that the fraction of selfish choices is lowest (25%) when the default is *B* and groups are formed endogenously and highest (48%) for individuals who had the option to join such groups and chose not to. The difference is highly significant (FPI; $p = 0.001$). Both can be explained as follows. Recall that we previously observed frequent group entry by pro-socials in this environment, where they could impose their preference on the group. As a consequence, the groups have relatively many pro-socials and there are relatively many selfish amongst the remaining individual decision makers.

In contrast, voting in self-selected groups and by individual decision-makers is very similar if the default is the selfish choice *A* (38% and 39%, respectively; see Table 7). The difference is statistically insignificant (FPI; $p = 0.921$). This confirms our earlier conclusion that group entry based on a desire to diffuse responsibility is much weaker than entry to be with other pro-socials. To see whether these aggregate results hide any differences across rounds, Fig. 6 shows the fraction of selfish choices for the four rounds in which a specific environment was implemented. This shows that the mean fraction of selfish choices is relatively constant across the four cases in each of the four situations an individual can end up in.

Table 7
Comparison of group and individual decisions.

	A votes					
	Endo Group		Endo Ind	Exo Group		Exo Ind
A default	0.38	$<$	0.39	0.38	$<$	
	$\vee^{***}$	$\wedge^{***}$	$\wedge^{***}$	$\vee$		0.41
B default	0.25	$<^{***}$	0.48	0.36	$<$	
Observations	692		1035	863		865

Cells show per default the average fraction of *A* votes in endogenously formed groups, endogenously chosen individual decisions, exogenously formed groups, and exogenously imposed individual decision making. Differences in means are tested with Fisher-Pitman permutation tests using matching group averages. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

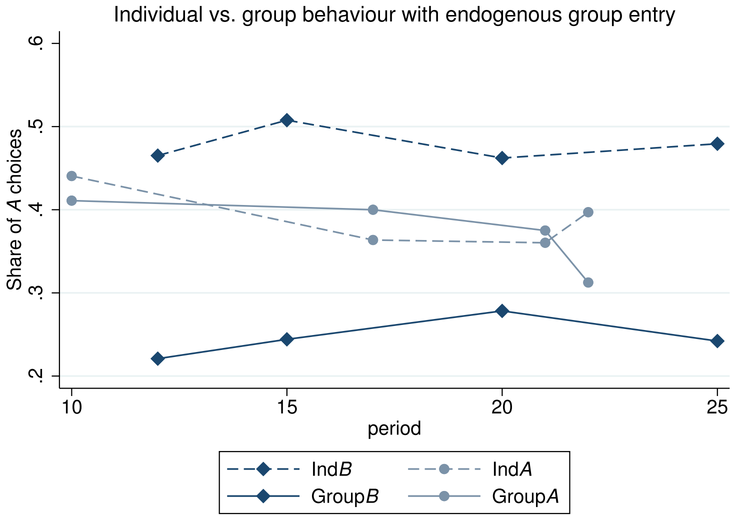


Fig. 6. Group vs. individual decisions depending on default. Lines connect the fractions of selfish votes for individuals deciding alone or in groups for varying defaults in periods with endogenous group formation.

Contrary to previous findings in the existing literature, we cannot detect significant differences between individual and group behaviour with either default if groups are formed exogenously (FPP; $p = 0.127$ if *B* is the default, $p = 0.337$ if *A* is the default). Thus, as with the case of groups with different defaults, a reduction in the probability of being pivotal does not affect behaviour here. Table 4 even shows more selfish behaviour by individuals than by groups with a pro-social default if we take into account the first part of the experiment. This finding is in line with the comparison of group and individual behaviour in dictator games by Cason and Mui (1997) but in contrast to findings by Luhan et al. (2009) and Dana et al. (2007). 44% of votes in the exogenous individual decision-making treatment are selfish. This is statistically indistinguishable from the 41% in exogenously formed groups with *A* as the default, but higher than the 37% in such groups with *B* as the default (FPP; $p = 0.265$ and $p = 0.004$, respectively). The pattern we observe does not conform with our analysis in section 4. The expected distance to being pivotal is unchanged in groups with a pro-social default compared to individual decision making, while it is increased in groups with a selfish default. Recall, however, that we concluded that the distance to pivotality plays no role in the second part of the experiment, which we are considering here. Apparently, the direct comparison of group and individual decisions does not isolate the diffusion of responsibility. Other aspects, such as shared guilt, play a role in the comparison between individual and group choices. This reaffirms our argument in favour of comparing distinct types of group decisions that systematically vary different aspects of responsibility.

Although our results for the dictator game do not contrast sharply with the literature, they are noticeably different from results for experiments that allow for strategic interaction. One potential explanation is that we do not employ any means of communication. Studies like Schopler et al. (1995), Bornstein and Yaniv (1998) and Luhan et al. (2009), which find that groups are more selfish than individuals, allow for communication. It is possible that more direct contact with other group members through communication creates a stronger feeling of group identity (see e.g. Chen and Li, 2009), which could facilitate the use of moral wiggle room such as offered by shared guilt. This should not matter in our main analysis when comparing different types of group decisions. Nevertheless, it could be relevant in the comparison of individual and group decisions.

Moreover, the social psychology literature stresses that group decisions often amplify observed individual tendencies, the so-called group polarisation phenomenon (see e.g. Moscovici and Zavalloni, 1969). The fraction of votes in favour of the pro-social option B in the exogenous individual decision-making treatment is 59%. Thus, a majority votes in favour of the pro-social option. Arguably, this makes the pro-social option the socially desirable choice. Similar to Cason and Mui (1997), social comparison might lead individuals in a group to present themselves more favourably than the average subject. Here, this would then imply choosing pro-socially. This process then provides an explanation for the group polarisation phenomenon.

Finally, Fig. 6 shows a clear impact of endogenous group formation on the comparison of individual and group decisions. Differences between individual and group behaviour are amplified when group entry is voluntary for groups with a pro-social default B (FPP; $p = 0.015$), but not with a selfish default A (FPP; $p = 0.524$). This once again points to subjects using group entry to be part of a group with equally pro-social individuals.

5.4. Beliefs

Voting behaviour and group entry patterns are largely in line with the hypotheses. Analysing beliefs provides further insights into the mechanisms through which the diffusion of responsibility affects these choices.

Elicited beliefs show that subjects believe that if groups are formed endogenously, individuals will behave in a manner consistent with responsibility diffusion. With default B, subjects believe that 39% will vote selfishly in endogenously formed groups, while they believe that 52% will do so if A is the default. The difference is statistically significant (FPP; $p < 0.001$).

As a further way to investigate whether people enter groups because they believe that this will allow them to diffuse responsibility, we correlate the fraction of times that a subject entered a group with default A (out of four opportunities) with their beliefs about others' choices. If more individuals are expected to vote selfishly, this increases the expected distance to being pivotal of someone voting selfishly herself.

We observe neither in aggregate nor for any of the studied types a significant correlation between beliefs and group entry with default A. Subjects' group entry decisions do not depend on the expected degree of responsibility diffusion. This is confirmed by regression analysis (see appendix F, Table F.1). Again it appears that the ability to ensure pro-social outcomes is a more important criterion for group entry than responsibility diffusion.

Indeed, we observe that with a pro-social default B subjects expect more pro-social votes in groups (61%) than pro-social choices amongst individual decision makers (48%) (FPP; $p < 0.001$). In other words, those entering a group correctly anticipate a pro-social outcome. As a consequence, pro-social individuals do not appear to join groups to change the outcome of the group decision (which is expected to be pro-social anyway). Instead, they appear to enjoy joining a group that makes a fair decision. This effect can only be established because we consider endogenous group formation.

6. Conclusion

We demonstrate that endogenous group formation matters in the context of social behaviour. It amplifies the differences we observe between group decision making with and without the possibility to diffuse responsibility. In our study, the degree to which a group member's vote is pivotal matters if individuals self-select into group decision making. Since this is one of the first studies to investigate the effects of endogenous group entry on group decisions, our findings suggest a promising avenue for further research.

Moreover, the analysis shows that these amplified differences in endogenous groups are the result of type-specific selection behaviour. Interestingly, an environment that allows for diffusion of responsibility does not, in the aggregate, make group decisions more attractive. Especially pro-social individuals appear to dislike this kind of environment and exhibit a preference for an environment that allows them to join like-minded pro-social individuals in ensuring an equitable outcome. In contrast, selfish individuals are more prone to select into group decision making in an environment where diffusion of responsibility is possible. This implies that from a policy perspective, the desirability of giving individuals the option to team up before deciding depends not only on whether group decision making would allow for diffusion of responsibility, but also on the type of individuals involved. In an environment where pro-social choices are the default – for example, because they constitute the status-quo or the norm – pro-socials will want to join groups. In our experiments, this is seemingly driven by a preference for acting pro-socially in a group of like-minded individuals. Furthermore, our results imply that, for instance, a committee that decides as a team in an environment where diffusion of responsibility is possible is likely to repel pro-social types. Instead, this environment is likely to attract more selfish types. When creating the rules that govern decision making, such selection effects should be considered.

Furthermore, we add to the existing literature on responsibility diffusion by investigating the repetitive nature of choices where responsibility can be diffused. We identify that a reduction in the probability of being pivotal changes behaviour in exogenously formed groups mainly in early rounds. The effect diminishes with repetition.

We have also contrasted the behaviour of self-selected individual and group decision makers. An environment that allows individuals choosing to join a group to force the pro-social outcome on the group exhibits stark differences in the degree of selfish behaviour between these groups and individual decision makers. Again, this can be attributed to pro-social types being attracted by the group environment while selfish types are deterred from entering such groups. As a consequence, voluntary group entry both affects group and individual decision making.

Appendix A. Experimental instructions

A.1. First part

The experiment consists of two parts and in total of 25 periods. Part 2 will be explained after we have finished Part 1.

The instructions are simple, and if you follow them carefully, you might earn a considerable amount of money. Your earnings can depend on your decisions and may depend on other participants' decisions. You will be paid in private and in cash at the end of the experiment.

Your decisions in the experiment are private to you. We ask you to not communicate with other people during the experiment. Please refrain from verbally reacting to events that occur during the experiment. The use of mobile phones is not allowed during this experiment. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your following of these rules.

Your task Part 1 of the experiment will consist of **9 periods**.

The decision situation This experiment concerns the implementation of distributions of experimental points. Two parties can benefit from the distributions of experimental points. One of the two parties will be called Player 1, the other party will be called the Player 2. Player 1 and Player 2 have different roles. In each period, Player 1 will decide about the distribution of experimental points. Player 2 does not make any decisions.

In this experiment, there are two possible allocations:

- A: Player 1 receives 10 points, Player 2 receives 0 points
- A: Player 1 receives 6 points, Player 2 receives 6 points

The two alternatives are summarised in the table below:

		Payoff	
		Player 1	Player 2
Choice	A	10	0
	B	6	6

During the experiment, you will both be in the role of Player 1 and of Player 2. Everyone will only be making decisions as Player 1, since Player 2 is passive.

After the experiment, it will be randomly determined which half of the participants are assigned the role of Player 1 and which half are assigned the role of Player 2. This determines which half gets their payoff from being Player 1 and which half gets their payoff from being Player 2. Thus, with equal probability, either all of your decisions are relevant and determine your payoffs and the payoffs of participants that are assigned to be Player 2's, or your payoff entirely depends on other participants' choices. Since you do not make any decisions as Player 2, your only actions throughout the experiment will be actions as Player 1.

Be aware that if you are chosen to receive payoffs from being Player 1 at the end of the experiment, your actions in each period determine the sole payoff of another participant. The person you are matched with would not receive any payoffs from their choices as Player 1.

Types of decision-making In the first part of the experiment, as Player 1 you will face two types of decision-making:

1. Individual decision-making
2. Group decision-making

In every period, you will need to choose between an option A and an option B. At the beginning of each period, you will be told whether you will be making this decision in a group or as an individual. In the first 9 periods, you will make 3 decisions as an individual and 6 decisions in a group.

If you are making decisions as an individual, you decide whether you want option A or option B to be implemented. You will be coupled with another individual, Player 2. If you choose option A, you will receive 10 points and Player 2 will receive 0 points. If you choose B, you will both receive 6 points.

In periods in which you are making decisions in a group, you are randomly matched with two other participants and you jointly decide whether you want to implement option A or option B. If the decision is A, each member of your group will receive 10 points. If the decision is B, each member of your group will receive 6 points. In case of group decision-making, your group is coupled with another group of three (Player 2) who will all be affected by your group's decision. If your group's decision is A, each member of the other group will receive 0 points, if option B is chosen each member will get 6 points. Note that the difference between individual and group decisions is that the group decision is implemented for everyone in your own group and everyone in the group with whom you are coupled. The following overview summarises the consequences of the decisions.

	Individual decision-making	**Group decision-making**
Option A	You receive 10 points. Player 2 (an individual) receives 0 points.	Every member of your group receives 10 points. Every member of Player 2 (a group) receives 0 points.
Option B	You receive 6 points. Player 2 (an individual) receives 6 points.	Every member of your group receives 6 points. Every member of Player 2 (a group) receives 6 points.

The group decision-making procedure is as follows: Each of the three group members will individually cast a vote. A decision will be implemented if the vote is unanimous, meaning that all three group members voted for the same option. In case the vote is not unanimous, a default option will be implemented. The default option is either A or B. You will know the default option before you cast your vote.

You will either be assigned the role of deciding between option A and B (Player 1) or the role of the individual or group to which Player 1 is coupled (Player 2).

If you are Player 1, then each time you are making a decision in a group, the group composition will change. This means that it is unlikely that your fellow group members are exactly the same any two times you make a group decision. If you are Player 2, the decisions of your group members will also not matter and therefore under no circumstances affect your earnings. Your group members are also assigned the role of Player 2 if you are Player 2. Therefore, you will also never affect your group member's earnings in case they are Player 2.

Throughout the experiment, no one will ever learn the identity of their group members or the identity of either the Player 1 or the Player 2 they are paired with.

Example In this example, imagine a participant is assigned to make decisions in a group. The default is A. The participant is matched with two other individuals, the group members of the participant. Together, they fulfil the role of Player 1. The two group members both vote for B, while the participant votes for A. Hence, the vote is not unanimous: Not all group members voted for the same option. The default option, A, is therefore implemented.

The group with the role of Player 1 will receive 10 points each in this period, the group with the role of Player 2 they are matched with will receive 0 points in this period.

Payment We will not tell you whether you are Player 1 or Player 2 in today's experiment. Everyone will make choices as if they are Player 1, which may well be the case. We have randomly divided you into two halves. After the final period, the computer will randomly determine which half will be assigned to be Player 1 and which half will be Player 2. Note that the randomisation is in no way related to any decisions made in this session. The decisions by the Player 1's will determine everybody's earnings today.

The experimental points you earned in each period of the experiment, either as Player 1 or Player 2, will be summed up and will be exchanged for money. The exchange rate is as follows: For each point you earn, you will receive €0.08. Additionally, you will receive a show-up fee of €7.

A.2. Practice question first part

We will now ask you some questions to check your understanding. You can always browse back to previous screens. When you have a question for the experimenter, please raise your hand.

1. If you are chosen to be Player 1 and you are deciding individually, how many points do you earn in a period in which you choose option A?
2. If you are chosen to be Player 1 and you are deciding individually, how many points does your Player 2 earn in a period if you choose option B?
3. If you are chosen to be Player 1 and you are making decisions in a group where B is the default, how many points do you earn individually in a period if one of your group members votes for A, one of your group members votes for B and you vote for A?
4. If you are chosen to be Player 1 and you are making decisions in a group where B is the default, how many points does each individual in the group of Player 2 who you are paired with earn in a period in which both of your group members vote for A and you vote for A?

A.3. Second part

Your task Part 2 of the experiment will consist of **16 periods** and is similar to part 1 of the experiment.

Again, in each period, Player 1 will decide about the distribution of experimental points, that will at the end of the experiment be exchanged for money. Player 2 does not make any decisions. As before, in this experiment, there are two possible allocations:

- A: Player 1 receives 10 points, Player 2 receives 0 points
- A: Player 1 receives 6 points, Player 2 receives 6 points

The two alternatives are summarised in the table below:

		Payoff	
		Player 1	Player 2
Choice	A	10	0
	B	6	6

There are three different types of periods in this part:

1. Individual decision-making
2. Group decision-making
3. **Choice between individual and group decision-making**

At the beginning of each period, you are shown what type of period you are in. In total, you will face 4 periods of individual decision-making (type 1), 4 periods of group decision-making (type 2) and 8 periods in which you choose between individual and group decision-making (type 3). The two first types of periods are identical to what you have encountered in part 1 of the experiment, with the same rules applying here to individual and group decision-making as in part 1 of the experiment. Type 3 is new.

In periods in which you have the choice between deciding as an individual or group (type 3), you will first be asked whether you prefer to be part of a group or decide alone. In case you prefer to decide alone, you will be making your choice individually. Groups will only be formed by those that prefer to decide in a group. In case you state that you prefer to be part of a group, you are likely to make your decision in a group. It is possible, however, that you will nevertheless have to decide as an individual; if the number of participants that wants to decide in a group is not a multiple of three, some individuals preferring the group need to choose individually. It is still in your best interest to state your preferred type of decision-making truthfully, since this will always increase the probability with which you will be assigned to your preferred type.

Before you choose between individual and group decision-making, you will always be told the default in a group that you can join. If you enter a group, your group will be paired with three individuals who are Player 2 in this period. If you opt for individual decision-making, you will be paired with one individual who is Player 2 in this period.

After choosing the type of decision-making, you face the choice of Player 1, similar to part 1. If you opted for individual decision-making, you have to decide between option A and B. If you prefer making decisions in a group, you will be asked to make both the decision on what you vote for in case you will be in group and on what you decide in case you are forced to decide individually after all.

Please note that after each period in which you choose between individual and group decision-making (type 3), you will wait for all your fellow participants before you go to the next period. Your waiting time is therefore independent of whether you choose individual or group decision-making.

Payment As explained in part 1, you will not know until the end of the experiment whether you are Player 1 or Player 2 in this experiment. The randomisation at the end of the experiment will determine your role for both parts. This means that you are either Player 1 in both parts or Player 2 in both parts. The randomisation is in no way related to any decisions made in this session.

Recall that the experimental points you earned in each period of the experiment, either as Player 1 or as Player 2, will be summed up and exchanged for money. The exchange rate is as follows: For each point you earn, you will receive €0.08. Additionally, you receive a show-up fee of €7.

A.4. Practice question second part

We will now ask you some questions to check your understanding. You can always browse back to previous screens. When you have a question for the experimenter, please raise your hand.

1. Are the rules that determine how a group decision is reached different in this part compared to in part 1?
2. In a period where you can choose between individual and group decision-making, is it possible that you have to decide individually although you chose group decision-making?
3. In a period where you can choose between individual and group decision-making, is it always in your best interest to truthfully state which mode of decision-making you prefer?
4. In the next 16 periods, are there also periods in which you do not have the possibility to choose between individual and group decision-making, but are assigned to either individual or group decision-making?
5. In periods in which you choose between individual and group decision-making (type 3), does your waiting time depend on whether you choose individual or group decision-making?

A.5. Belief elicitation

Before you start with the next 16 periods in part 2, we would like to know what decisions you expect others to make in different situations.

		Payoff	
		Player 1	Player 2
Choice	A	10	0
	B	6	6

We will ask you how many out of 10 randomly drawn decisions are A for decisions from four different categories of participants.

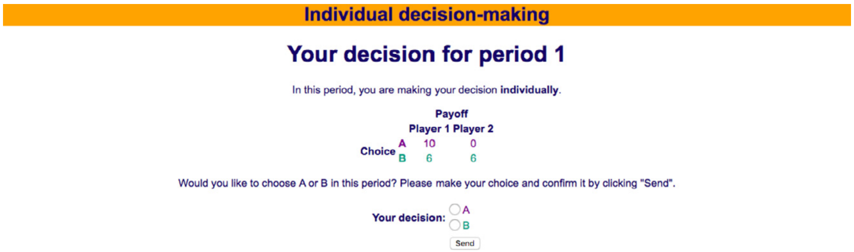
Payment You can earn money by predicting other participants' decisions well. At the end of the experiment, we will randomly choose 10 decisions in each category excluding your own decisions and compare your predictions with the actual choices. Your prediction error is how far your prediction is off. For each question you are asked, your earnings are 1 minus your prediction error times 10 cents. Your payoff from each question will be added to your payoff from part 1 and part 2 at the end of the experiment.

Realise that your actions in the next part will not influence your payoffs from answering these questions.

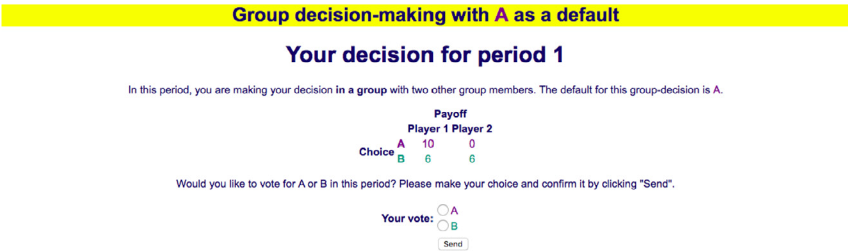
Example Imagine you believe that 3 out of 10 participants that prefer group decision-making if B is the default choose A. The actual number of participants that choose A out of the 10 draws of participants that prefer group decision making if B is the default is 4. Therefore, you receive as your payoff from this decision 90 cents:

$$1 - 0.1 \times |3 - 4| = 0.9$$

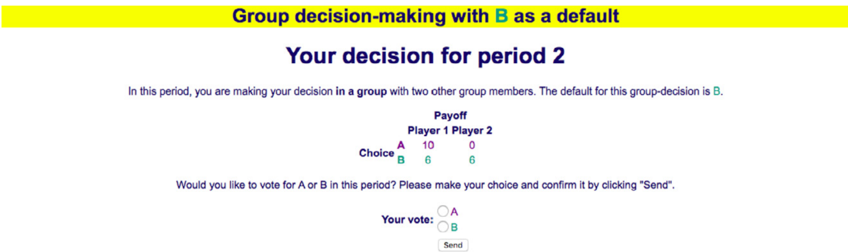
Appendix B. Images of decision screens



(a) Individual decisions

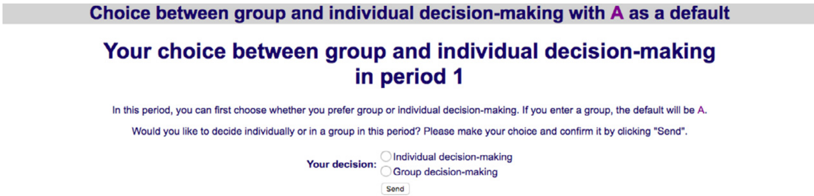


(b) Exogenous group decisions with A as default

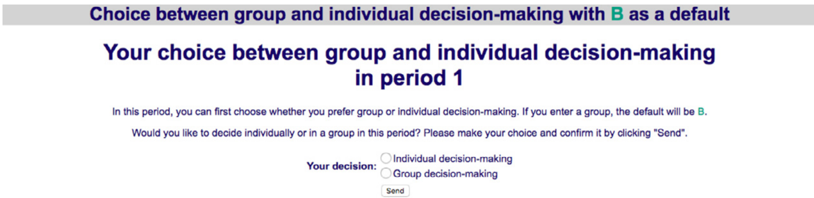


(c) Exogenous group decisions with B as default

Fig. B.1. Decision screens: Exogenous periods.

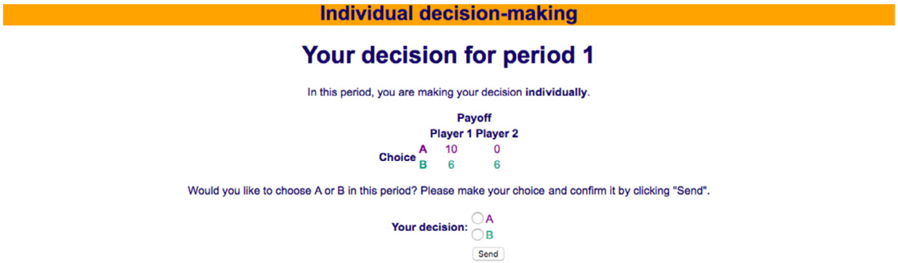


(a) Selection with A as default

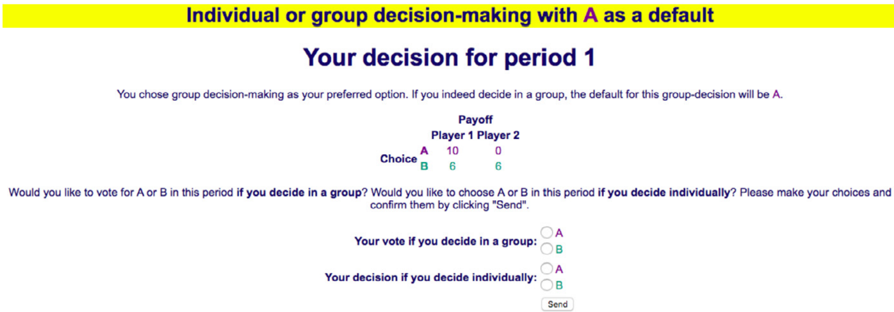


(b) Selection with B as default

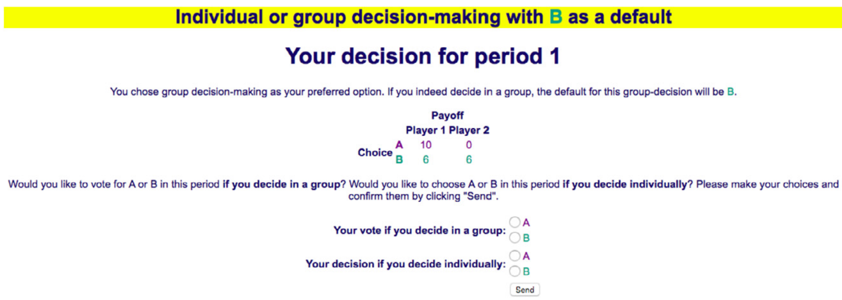
Fig. B.2. Decision screens: Selection in endogenous periods.



(a) Individual decisions



(b) Endogenous group decisions with A as default



(c) Endogenous group decisions with B as default

Fig. B.3. Decision screens: Endogenous periods.

Appendix C. Decision-theoretic model

To formalise the intuitive reasoning about the diffusion of responsibility that underlies the hypotheses presented in the main text, we present here a model of individual decision making that yields the same hypotheses.

C.1. Theoretical framework and results

The model's essential ingredient is that individuals are averse to being responsible for a selfish action. We assume that individuals are heterogeneous in the degree of this responsibility aversion, which is captured by $\alpha_i \geq 0$ for individual i. Borrowing from Engl (2018), responsibility is measured as the distance to being pivotal, d_i. The distance to being pivotal is defined as the number of votes that need to change (including agent i's vote) such that agent i is pivotal for changing the outcome. The model adopts a consequentialist approach as in Rothenhäusler et al. (2018) by assuming that an agent only feels responsible if voting in favour of taking a selfish action and this outcome materialises. We further assume that there is a monotone linear relationship between the reduction of the other party's monetary payoff and the subsequent decline of i's utility through responsibility aversion. We are interested in the dictator's decision and denote the dictator as Player 1 and the receiver as Player 2. We denote by i a Player 1, who may be in a group with other dictators. Her utility U_i^A from supporting the selfish action A can then be defined as

$$U_i^A(\alpha_i, d_1, \boldsymbol{\pi}) = \pi^B + \mathbb{1}_{\{Y_{-i} \geq k-1\}} \left(\pi^{A1} - \pi^B - \frac{\alpha_i}{d_i} \left(\pi^B - \pi^{A2} \right) \right)$$

Here, k denotes the number of votes needed to select the selfish action A and Y_{-i} denotes the number of other dictators in the group that choose that action. π refers to an option's monetary payoff, with π^B referring to the payoff of choosing B, which is the same for both players. π^{A1} and π^{A2} denote the payoff from choosing A for Player 1 and Player 2, respectively. $\mathbb{1}$ is the indicator function.

The realised utility U_i^B from supporting B is given by

$$U_i^B(\alpha_i, d_i, \boldsymbol{\pi}) = \pi^B + \mathbb{1}_{\{Y_{-i} \geq k\}} \left(\pi^{A1} - \pi^B - \alpha_i c_i \left(\pi^B - \pi^{A2} \right) \right)$$

$\alpha_i c_i$ captures i's (non-diffusive) moral costs associated with being part of a group that implements a selfish choice without i voting in favour of it. This is modelled to be a fraction of the responsibility aversion.

We assume $\frac{\mathrm{E}\left(\frac{1}{d_i}\right)}{1+p_0} < c_i < \mathrm{E}\left(\frac{1}{d_i}\right)$, where p_j is the subjective probability that i attributes to j other agents in her group voting for A. $\mathrm{E}\left(\frac{1}{d_i}\right)$ is i's expected responsibility when voting selfishly, which is given by $p_0 + p_1 \frac{1}{2} + p_2 \frac{1}{3}$. The expected costs associated with voting selfishly when implementing A provide a natural upper bound on the moral costs of being part of a group that implements A while not voting selfishly. The assumption on the lower bound of c_i ensures that the model truly captures the diffusion of responsibility. It can be interpreted as c_i being high enough to prevent agents who vote B from free-riding on others' A choices. If i believes that A is likely to be implemented in any case, she still does not benefit from joining a group and voting for B.[18]

Furthermore, we assume that in case of indifference individuals prefer B over A. This can be motivated by Fehr and Schmidt (1999) or Charness and Rabin (2002) type of preferences: If individuals are indifferent, they prefer the equitable and efficient allocation.

If decisions are made individually, $k = 1$ and $d_i = 1$. For group decisions where B is the default, $k = 3$ and, given the lack of any possibility to of responsibility being diffused, $d_i = 1$. If A is the default $k = 1$ and $d_i = Y_{-i}$. Finally, we denote by $\omega = \frac{\pi^{A1} - \pi^B}{\pi^B - \pi^{A2}}$ the advantage that the dictator has relative to the receiver's loss when B is replaced by A. The dictator gains more (less) than the receiver loses if $\omega > (<) 1$. For our experimental parameters, $\omega = \frac{2}{3}$, because the move from B to A improves the dictator's earnings by 4 and reduces the receiver's by 6.

This setup allows us to derive the following propositions.

Proposition 1. *Individual decision makers choose A if and only if $\alpha_i < \omega$.*

Proof. As individuals choose B if they are indifferent, individual i chooses A if and only if

$$\pi^{A1} - \alpha_i \left(\pi^B - \pi^{A2} \right) > \pi^B \Rightarrow \alpha_i < \frac{\pi^{A1} - \pi^B}{\pi^B - \pi^{A2}} = \omega \quad \square$$

[18] The costs associated with this action are $(p_1 + p_2)\alpha_i c_i \left(\pi^B - \pi^{A2}\right)$. These costs are higher than the gains $(p_1 + p_2)\left(\pi^{A1} - \pi^B\right)$ for the individuals concerned.

Only individuals not too averse to being responsible for reducing someone else's payoffs choose the selfish option. If the monetary benefits of taking the selfish action ($\pi^{A1} - \pi^{B}$) are larger than the responsibility felt for the dictator's loss $\alpha_i(\pi^{B} - \pi^{A2})$, then the dictator will vote for A.

Proposition 2. *In groups with B as the default, individuals vote for A if and only if $\alpha_i < \omega$.*

Proof. With individuals voting in favour of B if they are indifferent, individual i votes for A if B is the default if and only if

$$\mathrm{E}\left(\pi^{B} + \mathbb{1}_{\{Y_{-i}\geq k-1\}}\left(\pi^{A1} - \pi^{B} - \frac{\alpha_i}{d_i}\left(\pi^{B} - \pi^{A2}\right)\right) |i \text{ votes for } A\right) >$$
$$\mathrm{E}\left(\pi^{B} + \mathbb{1}_{\{Y_{-i}\geq k\}}\left(\pi^{A1} - \pi^{B} - \alpha_i c_i\left(\pi^{B} - \pi^{A2}\right)\right) |i \text{ votes for } B\right).$$

Because B is the default, $k = 3$. On the l.h.s. of the inequality, A is implemented if $Y_{-i} \geq k - 1$ and therefore $d_i = 1$. The inequality then reduces to

$$\mathrm{E}\left(\mathbb{1}_{\{Y_{-i}\geq 2\}}\left(\pi^{A1} - \pi^{B} - \alpha_i\left(\pi^{B} - \pi^{A2}\right) |i \text{ votes for } A\right)\right) > 0$$

This is satisfied if and only if

$$\pi^{A1} - \pi^{B} - \alpha_i\left(\pi^{B} - \pi^{A2}\right) > 0 \Rightarrow \alpha_i < \frac{\pi^{A1} - \pi^{B}}{\pi^{B} - \pi^{A2}} = \omega. \quad \square$$

Intuitively, since individuals also bear the full responsibility for selfish choices when deciding in a group with B as the default, the same threshold α_i characterises the set of individuals voting A in groups with B as the default as the set choosing A in the individual decision.

Proposition 3. *In groups with A as the default, individuals vote for A if and only if $\alpha_i < \frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right) - c_i}\omega$ for $p_0 \neq 0$.*

Proof. Assuming that individuals vote for B if they are indifferent, individual i votes for A if A is the default if and only if

$$\mathrm{E}\left(\pi^{B} + \mathbb{1}_{\{Y_{-i}\geq k-1\}}\left(\pi^{A1} - \pi^{B} - \frac{\alpha_i}{d_i}\left(\pi^{B} - \pi^{A2}\right)\right) |i \text{ votes for } A\right) >$$
$$\mathrm{E}\left(\pi^{B} + \mathbb{1}_{\{Y_{-i}\geq k\}}\left(\pi^{A1} - \pi^{B} - \alpha_i c_i\left(\pi^{B} - \pi^{A2}\right)\right) |i \text{ votes for } B\right)$$

Because $k = 1$ when A is the default, this reduces to

$$\pi^{A1} - \pi^{B} - \mathrm{E}\left(\frac{1}{d_i}\right)\alpha_i\left(\pi^{B} - \pi^{A2}\right) >$$
$$(p_1 + p_2)\left(\left(\pi^{A1} - \pi^{B}\right) - \alpha_i c_i\left(\pi^{B} - \pi^{A2}\right)\right)$$
$$\Rightarrow \alpha_i < \frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right) - c_i}\omega$$

This uses $c_i < \mathrm{E}\left(\frac{1}{d_i}\right)$, $1 - p_1 - p_2 = p_0$, and $p_0 \neq 0$. $\square$

Compared to the case with B as a default, i's expected degree of responsibility enters the threshold for α_i and inflates this threshold, because $\frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right) - c_i} \geq 1$.[19] Therefore, some levels of responsibility aversion will make individuals vote for A in groups with A as the default but for B when B is the default. For this reason, default A is predicted to increase the frequency of selfish choices compared to default B. In this way, the model predicts Hypothesis 1 of the main text.

Next, we consider the environment with endogenous group formation. An individual will choose to join a group if the expected utility from the group decision exceeds the expected utility from individual decision making.

Proposition 4. *If B is the group's default, individuals with $\alpha_i < \omega$ will never join a group; other individuals are indifferent between joining a group and deciding individually.*

[19] Since $c_i > \frac{\mathrm{E}\left(\frac{1}{d_i}\right)}{1+p_0}$, $\frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right) - c_i} \geq \frac{1+p_0}{\mathrm{E}\left(\frac{1}{d_i}\right)} \geq 1$ for $p_0 \neq 0$. This uses $E\left(\frac{1}{d_i}\right) = p_0 + p_1\frac{1}{2} + p_2\frac{1}{3} \leq p_0 + 1$.

Proof. i joins a group if the expected utility from doing so, $EU(\text{Group})$, is higher than the expected utility from making the decision individually $EU(\text{Ind})$.

If $\alpha_i < \omega$ and B is the default, i both chooses A individually (Proposition 1) and votes for A in the group (Proposition 2). Therefore, i joining a group requires

$$EU(\text{Group}) \geq EU(\text{Ind}) \iff (p_0 + p_1)\pi^B + p_2\left(\pi^{A1} - \alpha_i\left(\pi^B - \pi^{A2}\right)\right) \geq$$
$$\pi^{A1} - \alpha_i\left(\pi^B - \pi^{A2}\right) \iff (1 - p_2)\pi^B \geq (1 - p_2)\left(\pi^{A1} - \alpha_i\left(\pi^B - \pi^{A2}\right)\right)$$

Now note that $\alpha_i < \omega$, implies $\pi^{A1} - \alpha_i\left(\pi^B - \pi^{A2}\right) > \pi^B$, so EU(Ind)< EU(Group). i prefers individual decision making.

If $\alpha_i \geq \omega$ and B is the default, i chooses B individually (Proposition 1) and votes for B in the group (Proposition 2). Therefore, i strictly preferring group decision making requires that

$$EU(\text{Group}) = \pi^B > \pi^B = EU(\text{Ind})$$

which is never satisfied. In this case, i is indifferent between individual and group decision making. □

Agents with $\alpha_i < \omega$ refrain from joining a group because their preferred option A may not be implemented and, since there is no mechanism through which responsibility can be diffused when the default is B, these agents have nothing to gain from joining a group. Individuals with $\alpha_i \geq \omega$ are indifferent between group and individual decision making, as they will vote for B in groups and therefore, given the default, in both cases receive the payoff corresponding to this option. With Fehr and Schmidt (1999) or Charness and Rabin (2002) type of preferences, individuals could however prefer to join a group to ensure the equitable share of resources for a more people.

Proposition 5. *If A is the group's default, only individuals with* $\alpha_i < \frac{1}{\mathrm{E}\left(\frac{1}{d_i}\right)}\omega$ *will join a group.*

Proof. If $\alpha_i < \omega$ and A is the default, i both chooses A individually and votes for A in the group. Therefore, for i to (weakly) prefer group decision making, it is necessary and sufficient that

$$EU(\text{Group}) = \pi^{A1} - \alpha_i \mathrm{E}\left(\frac{1}{d_i}\right)\left(\pi^B - \pi^{A2}\right) \geq$$
$$\pi^{A1} - \alpha_i\left(\pi^B - \pi^{A2}\right) = EU(\text{Ind})$$

which is always satisfied because $\mathrm{E}\left(\frac{1}{d_i}\right) \leq 1$.

If $\omega \leq \alpha_i < \frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right) - c_i}\omega$ and A is the default, i chooses B individually but votes for A in a group. For i to (weakly) prefer group decision making, it is necessary and sufficient that

$$EU(\text{Group}) = \pi^{A1} - \alpha_i \mathrm{E}\left(\frac{1}{d_i}\right)\left(\pi^B - \pi^{A2}\right) \geq \pi^B = EU(\text{Ind})$$

This condition can be rewritten as

$$\frac{1}{\mathrm{E}\left(\frac{1}{d_i}\right)}\omega \geq \alpha_i$$

We know that

$$\omega \leq \frac{1}{\mathrm{E}\left(\frac{1}{d_i}\right)}\omega \leq \frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right) - c_i}\omega$$

Hence, $\frac{1}{\mathrm{E}\left(\frac{1}{d_i}\right)}\omega \geq \alpha_i$ is satisfied for individuals with $\omega \leq \alpha_i \leq \frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right)}\omega$, but not for those with $\frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right)}\omega < \alpha_i \leq \frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right) - c_i}\omega$.

Finally, if $\frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right) - c_i}\omega \leq \alpha_i$ and A is the default, i chooses B individually and votes for B in a group. To prefer group decision making, it is necessary that

$$EU(\text{Group}) = p_0\pi^B + (p_1 + p_2)\left(\pi^{A1} - \alpha_i c_i\left(\pi^B - \pi^{A2}\right)\right) \geq \pi^B = EU(\text{Ind})$$

This condition can be rewritten as

$$\omega \geq \alpha_i c_i$$

Given the assumed $c_i > \frac{\mathrm{E}\left(\frac{1}{d_i}\right)}{1+p_0}$ and $\alpha_i \geq \frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right)-c_i}\omega$, we have

$$\alpha_i c_i > \frac{\mathrm{E}\left(\frac{1}{d_i}\right)}{1+p_0} \frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right) - \frac{\mathrm{E}\left(\frac{1}{d_i}\right)}{1+p_0}} \omega = \omega$$

Hence, the condition cannot be satisfied and i in this case never wants to join a group. □

When A is the default, agents with $\alpha_i < \omega$ have an incentive to select into group decision making, since they might benefit from the diffusion of responsibility and can ensure the high payoff from A by voting for A. Also individuals with $\omega \leq \alpha_i \leq \frac{1}{\mathrm{E}\left(\frac{1}{d_i}\right)}\omega$ join groups, because for their level of responsibility aversion, the higher payoff associated with A together with possibly diffused responsibility make group decision making more attractive. For individuals with $\alpha_i > \frac{1}{\mathrm{E}\left(\frac{1}{d_i}\right)}\omega$, selecting into group decision making is not appealing, since a potentially higher payoff cannot compensate for the moral costs associated with bearing at least part of the responsibility for a selfish outcome (those that vote for A) or being part of a group that causes this outcome (those that vote for B).

With A as the default, for individuals with $\alpha_i \leq \frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right)-c_i}\omega$, the attractiveness of joining a group is increasing in the expected number of individuals voting for A, since this both increases the likelihood of receiving the high payoff and the expected distance to being pivotal for agents voting for A. For agents with $\alpha_i > \frac{p_0}{\mathrm{E}\left(\frac{1}{d_i}\right)-c_i}\omega$, the opposite holds true, since the costs associated with being part of a group that implements a selfish outcome are higher than the expected monetary gains from a higher payoff.

It follows from Proposition 4, that any individual joining a group with B as the default has a high responsibility aversion. They will vote for B (Proposition 2). Proposition 5 shows that when A is the default, it is those with low responsibility aversion that join groups; they vote A (Proposition 3). Compared to the case of exogenous group formation, this amplifies the difference between the two defaults in terms of the number of A votes. This is how the model predicts the comparative statics formulated in Hypothesis 2 of the main text. Together, Propositions 4 and 5 imply that those with a low aversion to responsibility are more likely to join a group when A is the default than when B is. This is what Hypothesis 3 predicts. Finally, these propositions predict that an individual with high responsibility aversion might join a group when B is the default (they are indifferent), but will not do so A is the default. This is captured by Hypothesis 4.

Appendix D. Traditional non-parametric tests

Tables D.1, D.2, D.3 and D.4 replicate the results from Table 3, 6, 4 and 7 using Wilcoxon signed-rank and Mann-Whitney U tests instead of permutation tests.

Table D.1
Summary statistics with traditional non-parametric tests.

	A votes			Group entry				
	Exo		Endo	Total		Selfish	Switching	Pro-social
Overall	0.372	$>$	0.3078	0.4007		0.2778	0.3894	0.4734
A default	0.3843	$<$	0.375	0.3796		0.3542	0.4038	0.3875
	$\vee$	$\wedge^{***}$	$\vee^{***}$	$\wedge^{*}$		$\vee^{**}$	$\vee$	$\wedge^{***}$
B default	0.3596	$>^{**}$	0.2473	0.4218		0.2014	0.375	0.5593
				Others				
Difference				-0.0812	$<^{***}$	0.1528		
between	0.0247	$<^{***}$	0.1277	-0.0647	$<^{**}$		0.0288	
defaults				0.0343	$>^{***}$			-0.1718
Observations	692		863	1727		288	416	640

Average fraction of A votes in groups and average fraction of individuals choosing to enter a group. Differences of means are all tested with Wilcoxon signed-rank tests using matching group averages, except for differences for different types, which are tested with Mann-Whitney U tests. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table D.2
Comparison of votes including first part of the experiment.

	A votes					
	Only 1*st* part			1*st* and 2*nd* part		
	Exo Group		Exo Ind	Exo Group		Exo Ind
A default	0.44	$<$		0.41	$<$	
	$\vee^{*}$		0.48	$\vee^{**}$		0.44
B default	0.38	$<^{**}$		0.37	$<^{***}$	
Observations	648		648	1080		1513

Cells show per default the average fraction of *A* votes in exogenously formed groups and exogenously imposed individual decision making. Differences in means are tested with Wilcoxon signed-rank tests using matching group averages. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table D.3
Composition of endogenously formed groups with traditional non-parametric tests.

	Fraction of type in group		
	Selfish	Switching	Pro-social
A default	0.16	0.26	0.38
	$\vee^{**}$	$\vee$	$\wedge^{***}$
B default	0.08	0.21	0.49
Groups	24	24	24

Cells report the fraction of group members that have a certain type in groups with *A* and *B* as the default. The unit of observation is the average per matching group. Differences are tested with Wilcoxon signed-rank tests using matching group averages. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table D.4
Comparison of group and individual decisions with non-parametric tests.

	A votes					
	Endo Group		Endo Ind	Exo Group		Exo Ind
A default	0.375	$<$	0.3918	0.3843	$<$	
	$\vee^{***}$		$\wedge^{***}$	$\vee$		0.4104
B default	0.2473	$<^{***}$	0.479	0.3596	$<$	
Observations	692		1035	863		865

Average fraction of *A* votes in groups compared to average fraction of *A* votes of individuals in either endogenous or exogenous group formation periods. Differences of means are tested using matching group averages with Wilcoxon signed-rank tests, except for differences between individuals and groups in endogenous periods, which are tested with Mann-Whitney U tests. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Appendix E. Different type classification mechanisms

To test the robustness of our findings regarding type-specific behaviour, we examine different classification mechanisms.

First, we repeat the analysis while classifying types based on their relative selfishness. We focus on the classification of selfish and pro-social types, not switching types. As our hypotheses only concern these two types, this does not impose a restriction. Table E.1 summarises the results, using the fraction of selfish choices in exogenous group decisions as a measure.

Table E.1
Robustness check of type-specific behaviour: Classification based on decisions in exogenously formed groups.

	Group entry			
Relative selfishness	(1) Top 25%	(2) Bottom 25%	(3) Top 50%	(4) Bottom 50%
A Default	0.375	0.3875	0.3763	0.3821
	$\vee^{**}$	$\wedge^{***}$	$\vee^{**}$	$\wedge^{**}$
B Default	0.2902	0.5593	0.3011	0.5132
Observations	448	640	744	983

Average fraction of individuals choosing to enter a group. Column (1) considers individuals whose fraction of selfish choices is within the upper quartile, column (2) individuals whose fraction of selfish choices within the lower quartile, column (3) individuals whose fraction of selfish choices is not below the median, column (4) individuals whose fraction of selfish choices is below the median. For this classification, only decisions in exogenously formed groups in the second part of the experiment are considered. Differences of means are all tested with Fisher-Pitman permutation tests using matching group averages. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table E.2 uses the fraction of selfish choices in all exogenous periods, including individual decision-making periods, instead.

Table E.2
Robustness check of type-specific behaviour: Classification based on decisions in all exogenous periods.

	Group entry			
Relative selfishness	(1) Top 25%	(2) Bottom 25%	(3) Top 50%	(4) Bottom 50%
A Default	0.3538	0.307	0.4414	0.3143
	$\vee^{*}$	$\wedge^{***}$	$\vee^{**}$	$\wedge^{**}$
B Default	0.2625	0.5395	0.386	0.4595
Observations	519	456	887	840

Average fraction of individuals choosing to enter a group. Column (1) considers individuals whose fraction of selfish choices is within the upper quartile, column (2) individuals whose fraction of selfish choices within the lower quartile, column (3) individuals whose fraction of selfish choices is not below the median, column (4) individuals whose fraction of selfish choices is below the median. For this classification, decisions in all exogenous periods in the second part of the experiment are considered. Differences of means are all tested with Fisher-Pitman permutation tests using matching group averages. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Appendix F. Beliefs and selection choices

Table F.1
The effect of beliefs on selection into groups.

Sample	(1) Total	(2) Selfish	(3) Switching	(4) Pro-social
	Entry	Entry	Entry	Entry
Belief on *A* votes	-0.00867	0.111	0.0596	-0.107
	(0.0534)	(0.121)	(0.0895)	(0.0872)
	[0.8949]	[0.3774]	[0.5085]	[0.2342]
Constant	-0.453	-1.364	-0.721	-0.00718
	(0.332)	(0.885)	(0.537)	(0.479)
Observations	860	144	208	316
Clusters	24	17	23	21

Logit regression estimating the effect of individuals' beliefs on the number of *A* votes in groups with *A* as a default on selecting into groups. Standard errors clustered at the matching group level are in parentheses. In square brackets, score wild cluster bootstrap *p*-values adjusted for small samples are reported. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

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