The Role of Interpersonal Uncertainty in Prosocial Behavior

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February 15, 2025

Abstract

In prosocial decisions, decision-makers face *interpersonal uncertainty*–uncertainty about how their choices impact others' utility. We use three approaches to show how it shapes classic patterns of prosocial behavior like ingroup favoritism, merit-based fairness, and self-favoring behavior. First, we compare standard allocation decisions with decisions where we remove social consequences but retain uncertainty, revealing strikingly similar patterns across both. Second, we exogenously vary interpersonal uncertainty to estimate the aversion to interpersonal uncertainty and quantify how it combines with preferences to determine prosocial decisions. Finally, we show that self-reported interpersonal uncertainty systematically predicts behavior across individuals, choice patterns and behavioral interventions.

Keywords: prosocial behavior, social preferences, ingroup versus outgroup decisions, dictator games, fairness preferences, interpersonal uncertainty
JEL Classification: C91, D01, D91

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Acknowledgements: We thank Peter Andre, Björn Bartling, Douglas Bernheim, Felix Chopra, Bikramaditya Datta, Josh Dean, Benjamin Enke, Armin Falk, Simon Gächter, Andrés Gago, Thomas Graeber, Yucheng Liang, John A. List, Ted O'Donoghue, Ryan Oprea, Devin Pope, Chris Roth, George Wu and Florian Zimmermann for valuable comments. Dasha Khamaza provided excellent research assistance.
Funding: Funded by the German Research Foundation (DFG) under Germany's Excellence Strategy - EXC 2126/1- 390838866, UCD Small Research grants (FS24ECH) and Global Affairs Seed grant.
Ethics approval: The study was approved by the ethical committees of the University of Chicago (#24-0099) and the University of California, Davis (#2134317-1).
Research transparency: All studies were preregistered (#159530, #161634, #174673, #159768, #162610, #180119, #209617). See Appendix K for details. The instructions of all studies are available at OSF.

1 Introduction

We as humans can only experience our own utility but not other's utility. Thus, prosocial decisions are inherently made under uncertainty, where we are uncertain about how our decisions impact others' utility. We refer to this uncertainty present in prosocial decisions as *interpersonal uncertainty*. If individuals respond to interpersonal uncertainty as they do to other forms of uncertainty, their responses will shape their prosocial decisions. Yet, most theories of prosocial behavior abstract from interpersonal uncertainty, and empirical studies interpret and estimate prosocial behavior under the assumption of certainty.

In this paper, we show theoretically and demonstrate empirically that interpersonal uncertainty shapes behavior across three key paradigms of the social preference literature. Specifically, people's perception of interpersonal uncertainty, and their responses to it reinforce *ingroup favoritism* in ingroup versus outgroup allocation decisions, *self-favoring behavior* in dictator games, and *redistributive behavior* when endowments are earned versus received by windfall. As a consequence, prosocial behavior reflects both social preferences and beliefs in the form of interpersonal uncertainty, implying that any estimation of social preferences can be biased if beliefs are not accounted for. We demonstrate how to disentangle and identify these effects in isolation. We further show that increases in prosocial behavior under two prominent interventions–*identifiable victim* and *contact effects*–correlate with the extent to which these interventions decrease interpersonal uncertainty.[1] Thus, the malleability of interpersonal uncertainty may help explain both why and how prosocial behavior responds to behavioral interventions. Overall, our results suggest that interpersonal uncertainty serves as a unifying mechanism that, alongside social preferences, helps explain prosocial behavior across different paradigms and interventions.

We use three complementary experimental designs to provide evidence on the role of interpersonal uncertainty. First, we design both *social* decision scenarios–standard allocation tasks that capture ingroup/outgroup, dictator game, and fairness behavior–and novel *non-social* decision scenarios that remove the scope for social preferences while retaining subjective interpersonal uncertainty. This design allows us to compare behavior in the presence and absence of social preferences. Second, we ask subjects to allocate money between members of two synthetic groups, where interpersonal uncertainty and preference-based influences are independently (and objectively) varied at the group level. This allows us to measure the causal effect of objective interpersonal uncertainty on prosocial behavior, and to quantify subjects' risk attitude toward it. Third, we directly elicit subjects' *self-reported interpersonal uncertainty* to link subjective perceptions to behavior.

[1]Consistent with this finding, many charities use vivid storytelling in their fundraising appeals, incorporating pictures, testimonials, and narratives detailing recipients' lives and struggles, which can be interpreted as an effort to reduce interpersonal uncertainty about the recipients.

Social and non-social decisions. We illustrate our approach of using *social* and *non-social* decisions with the ingroup versus outgroup paradigm. In the *social* decision, a decision maker (DM) has to allocate money between two randomly matched individuals. The two individuals receive the allocated money in the form of gift cards: the decision thus has consequences for both. One of the individuals belongs to the DM's social group, making them an ingroup member, while the other is an outgroup member. Allocating more money to the ingroup member is typically interpreted as an expression of an explicit *preference* or *taste* for the ingroup. For instance, a DM may get a higher marginal utility from the benefit received by the ingroup member (U_{in}) compared to the outgroup member (U_{out}).

We design the *non-social* decisions to rule out any such preference or taste-based channel but retain the interpersonal uncertainty. As before, the DM splits gift card money between an ingroup and an outgroup member, but now without any consequences for either. Instead, the DMs themselves are paid the sum of their matched ingroup and outgroup members' utilities U_{in} and U_{out} from receiving the gift card money. To do so, we measure U_{in} and U_{out} by eliciting the ingroup and outgroup members' willingness-to-pay (WTP) to receive gift card money. The DMs are paid the sum of the two WTPs, weighted by their allocations to the respective members. Importantly, because both WTPs contribute symmetrically to the DMs' total payment, DMs no longer have any taste-based reason to favor either. However, since DMs do not know the WTPs, they face interpersonal uncertainty, and their uncertainty about the distribution of U_{in} and U_{out} might be asymmetric.

In particular, we hypothesize that the DM perceives higher interpersonal uncertainty about U_{out} than U_{in} , for instance, due to her lower familiarity and fewer interactions with the outgroup, and that uncertainty contributes to her ingroup favoritism. As we derive in our theoretical framework, higher uncertainty about the outgroup is indeed sufficient to generate ingroup favoritism under risk aversion. Intuitively, allocations to the ingroup are a "safer bet" and thus preferable under risk-aversion.

We find that behavior in the *non-social* decisions is similar to the *social* decisions. Using shared hobbies/interests, political views, and religious beliefs as groups, subjects allocate on average 61% of the endowment to the ingroup member in the *non-social* decisions compared to 63% in the *social*. Both the average allocations and distributions are similar, as we fail to reject the null of different distributions between *non-social* and *social* for shared hobbies/interests and religious beliefs. Subjects make both *non-social* and *social* decisions in a randomized order. While the last results were between-subject comparisons obtained using only the first decision, using both for a within-subject comparison reveals a high correlation at the individual level ($r = 0.53$). In fact, the median subject makes the same choice in both decisions. The interpersonal uncertainty inherent in the *social* and *non-social* decisions is thus sufficient to generate the ingroup-favoritism pattern and thereby reinforces the ingroup favoritism observed in the *social* decisions.

To ensure that the observed similarity between the *social* and *non-social* decisions is not confounded by subjects being confused or inattentive about the incentives, we run three robustness experiments. In these, we systematically vary the *non-social* incentives. In the first, we increase the multiplier on the ingroup member's WTP, which incentivizes more ingroup giving. In the second, we increase the outgroup member's WTP multiplier, incentivizing more outgroup giving. In the third, subjects are instead paid the minimum of the ingroup and outgroup members' allocation-weighted WTP, which incentivizes equal allocations. We find that subjects strongly respond to these changes: ingroup favoritism increases in the first treatment, flips to outgroup favoritism in the second, and vanishes entirely in the third. These results demonstrate that *non-social* behavior is a conscious and deliberate decision.[2]

Synthetic groups. Our next treatment uses synthetic groups to directly measure and provide causal evidence that people are risk-averse towards interpersonal uncertainty - a key assumption of our framework. In the treatment, subjects allocate money between individuals randomly chosen from two exogenously created groups. We provide subjects with the actual valuation distribution within each group and exogenously vary this distribution across decisions. Crucially, the greater the variance in valuations within a group, the higher the interpersonal uncertainty about recipients of that group. Independently, we also vary whether the group members share the DM's social group (ingroup status). The factorial variation of group information and interpersonal uncertainty allows us to isolate the marginal influence of each factor.

In the absence of ingroup/outgroup information, subjects allocate on average 60% of their endowment to the group having a lower variance in valuations, revealing an aversion to interpersonal uncertainty. When we provide both ingroup information and the distribution of valuations, subjects on average allocate 64% to the ingroup when the outgroup's valuations are more uncertain and 49% when the ingroup's valuations are more uncertain. Lastly, when all members across both groups have the same valuation, and thus interpersonal uncertainty is absent, subjects allocate 57% to the ingroup. Accordingly, changes in interpersonal uncertainty shape differences in allocations in the direction predicted by our framework.

When we regress allocations on the treatment variations, we find that the marginal response to interpersonal uncertainty is similar in magnitude to the marginal effect of ingroup preference, with both increasing allocations by around 7% of the endowment. We also estimate a structural model that quantifies the effect of each factor in isolation: aversion towards interpersonal uncertainty is best fit through a CRRA parameter of 0.37 and the strength of pure ingroup preference through a 7% higher allocation to the ingroup.

Direct measurement of interpersonal uncertainty. Our third and final piece of evidence for the relevance of interpersonal uncertainty in ingroup versus outgroup decisions directly

[2]While we see our robustness treatments as a more direct test for the influence of confusion, we also show that our results of the main experiment are not affected if we exclude subjects that fail comprehension checks.

elicits interpersonal uncertainty from subjects. We asked subjects to separately state (using Likert scales) how certain they are about ingroup and outgroup members' WTPs. As predicted by our framework, subjects perceive significantly higher uncertainty about outgroup members' WTPs compared to ingroup members' WTPs. At the same time, they perceive no difference in average WTPs. Moreover, higher relative outgroup uncertainty significantly predicts stronger ingroup favoritism in the *social* decisions ($r = 0.37$).

Next, we test whether interpersonal uncertainty explains the malleability of prosocial decisions by implementing two interventions—contact and identifiable victim—known to increase prosociality. We replicate their effectiveness in boosting prosocial behavior and find that both interventions simultaneously lower perceived interpersonal uncertainty compared to controls. These results suggest that interpersonal uncertainty may be a key mechanism driving the success of interventions that promote prosocial behavior.

Explaining self-regarding behavior. Building on this three-part evidence of interpersonal uncertainty shaping ingroup-outgroup behavior, we then investigate its importance in shaping self versus other behavior. We again use our *social* and *non-social* approach, creating two treatments that consist of a *Self social* and a *Self non-social* decision scenario. While the former is a standard dictator game where DMs allocate gift card money between themselves and another person, the *Self non-social* decision again has no consequence for others. Instead, the DMs' incentives are to maximize the sum of their own WTP and the other person's WTP. Since both WTPs contribute equally to DMs payments, a self-preference no longer predicts more allocation to the self. However, since subjects only know their own WTP but not others' WTP, aversion to interpersonal uncertainty is sufficient to generate "selfish looking choices".

We find that *Self non-social* behavior resembles behavior in *Self social*. Compared to the 69% of the endowment that subjects allocate to themselves in *Self social*, they allocate 64% to themselves in *Self non-social*, and we cannot reject the equality of the two distributions. The similarity extends to within-subject comparisons: the two decisions are highly correlated ($r = 0.71$), making the *Self non-social* decision one of the strongest predictors of dictator game behavior in the literature. Moreover, our direct measurements of interpersonal uncertainty show that subjects report significantly greater uncertainty about others' WTP than their own. In addition, higher relative uncertainty predicts the degree to which subjects allocate more to themselves.

Explaining merit-based fairness. Our ingroup versus outgroup and self versus other paradigms demonstrate how DMs respond when one recipient's (their own or an ingroup member's) valuation-distribution has lower interpersonal uncertainty than the other's. Our third paradigm–merit-based fairness ideals–considers how DMs react when the recipient's valuation-distribution *shifts to the right* (mean-shifted distribution). In particular, we compare dictators who are allocating money from recipients' earned endowments to dictators who are allocating money from windfall endowments. We hypothesize that dictators believe that the recipient's value-distribution in the first case is a mean-shifted version of the second case, and this contributes to DMs increased hesitancy to take money for themselves in the first case.

We test this hypothesis by designing the *Taking social* decision. In this modified dictator game, instead of the dictator splitting a windfall endowment as in *Self social*, the other person earned the endowment, from which the dictator can take for themselves. This difference has a significant impact on allocations. Subjects in *Taking social* allocate (take) only 41% for themselves, a significant decrease compared to the *Self social* decision. Such behavior has a natural explanation based on merit-based fairness concerns or norms: taking someone's earned money is considered more unfair than keeping money originating from a windfall.

Our *non-social* decision strips the choice of such considerations while retaining its interpersonal uncertainty. Compared to *Self non-social*, in the *Taking non-social* decision, the DM's incentive no longer depends on the recipient's WTP but on the recipient's willingness-to-accept (WTA) to give up gift card money they previously earned, thus capturing the recipient's utility loss from the DM "taking" the gift card money away. Accordingly, DMs split money to maximize the sum of their own WTP and the other individual's WTA. If DMs believe that WTA is higher, something we validate empirically, then the induced *non-social* incentive leads dictators to take less money for themselves. Indeed, subjects in *Taking non-social* allocate significantly less to themselves compared to *Self non-social*, and *Taking non-social* decisions are significantly associated with *Taking social* behavior. These results suggest that the change in behavior from the dictator game to the taking paradigm is not exclusively driven by fairness considerations but instead is also influenced by the changing utilitarian calculus made under uncertainty.

Related literature. We demonstrate how interpersonal uncertainty influences patterns of prosocial behavior which have been documented across three different strands of the literature. First, a large literature finds evidence that people behave more prosocially towards ingroup members, a finding that is robust across different groups, domains, and methods (such behavior has been labeled ingroup favoritism, parochial altruism or moral universalism, see Charness and Chen, 2020; Shayo, 2020; Enke, 2023, for recent overviews).[3] Second, many studies have documented that in *self versus other* decisions, most people behave prosocially but tend to make choices that favor themselves more than others (see Fehr and Charness, 2023; Capraro et al., 2024, for overviews). Third, in allocation decisions, it has been shown that the source of the endowment matters (see Cappelen et al., 2020, for an overview). In particular, people redistribute less if the money was earned (merited) rather than attained by windfall (Ruffle, 1998; Cherry, 2001; Cherry et al., 2002; Cherry and Shogren, 2008; Oxoby and Spraggon, 2008; Krupka and Weber, 2013). We propose a uni-

[3]See Iyengar et al. (2019) and Böhm et al. (2020) for a review of the recent literature on ingroup favoritism in political science and psychology, respectively.

fied, belief-based mechanism that contributes to each of these patterns of prosocial behavior.[4] Our results show that due to the inherent presence of uncertainty, observed prosocial behavior cannot be interpreted solely as expressions of social preferences even in standard elicitation tasks. In particular, our results imply that these tasks overestimate the extent of ingroup preferences (or taste-based discrimination), underestimate the degree of altruism in dictator games, and overestimate merit-based fairness preferences. We provide a methodology to separately identify and quantify the roles of beliefs and preferences in driving prosocial behavior.

With our subjective uncertainty-based explanation of prosocial behavior, we relate to a recent literature that explains a range of behavioral patterns through people's cognitive response to (subjective) uncertainty. Enke and Graeber (2023) investigate how people's uncertainty over the optimal decision influences choice under risk, belief formation, and forecasts. In the domain of intertemporal decisions, a series of theoretical studies show that risk and time preferences closely intertwine when DMs are uncertain about future consumption (Sozou, 1998; Dasgupta and Maskin, 2005; Halevy, 2008; Chakraborty et al., 2020) or future preferences (Amador et al., 2006; Chakraborty, 2021). While this literature focuses on characterizing a logical equivalence between subjective uncertainty and risk or time preference patterns, we study the connection between subjective uncertainty and prosocial behavior both theoretically and empirically. In particular, our non-social treatments allow us to quantify the extent to which subjective uncertainty in the form of interpersonal uncertainty drives standard patterns of social behavior.[5]

To isolate the importance of interpersonal uncertainty in prosocial choices, we construct the non-social decisions by stripping the original social decisions of all other-regarding motivations. This is reminiscent of Oprea (2024) and Enke et al. (2024), who construct diagnostic decisions by stripping risk or discounting-based motivations from standard risky and intertemporal tasks to isolate the role of complexity on decision-making under risk and time.

2 Conceptual framework

Building on our central premise that decision-makers (DMs) experience *interpersonal uncertainty* when making choices that affect others, we introduce a simple "*as if*" model to formalize this idea. In this model, a DM allocates $100 between two recipients and evaluates

[4] Previous belief-based explanations of prosocial behavior have been mainly applied to strategic interactions, such as trust or reciprocity (Berg et al., 1995; Fehr and Gächter, 2000).

[5] We thus differ from papers investigating prosocial behavior under experimenter-induced *objective risk* over consequences to study ex-post versus ex-ante fairness (e.g., Brock et al., 2013), the use of risk to act selfishly (Exley, 2016), or, risk-induced morality (Chen and Zhong, 2025). Further, Cappelen et al. (2022, 2024) study redistribution decisions when the source of inequality is uncertain. Moreover, Kappes et al. (2018) vary uncertainty about the wealth level of recipients, finding evidence against the hypothesis that people exploit such uncertainty to license more selfishness.

each outcome using a function U that combines the recipients' utilities symmetrically[6]. The DM represents the interpersonal uncertainty through two probabilistic priors, one for each recipient' potential utilities. Next, we formally define what it means to experience higher interpersonal uncertainty over one of the priors. Then, we derive testable predictions for DM's decisions that maximize the expectation of a risk-averse U based on the DM's priors.

2.1 Assumptions about interpersonal uncertainty

For simplicity, we assume that the DM is probabilistically sophisticated and believes that dollars are valued non-negatively. Interpersonal uncertainty then means that the DM believes the per-dollar valuation of recipient j is distributed as $v_j \sim f_j$, where f_j is a probability distribution with non-negative support contained in $[0, b]$, and F_j is the corresponding CDF. For $x \geq 0$, we define $S_j(x) = \int_0^x F(y)$.

Next, we assume that these belief distributions have two key features. First, a DM understands that different recipients might derive different values from the same allocated dollar amount based on their personalities, past experiences, socioeconomic status, or tastes. Thus, distributions over the valuations of others are non-degenerate.

Second, the belief distributions for different recipients systematically differ, depending on the DM's familiarity with the recipients, or the source of the $\$100$ endowment. For instance, suppose one recipient shares their hobbies/ religious/ political interests with the decision-maker (ingroup member) while the other does not (outgroup member). This makes the allocation decision an ingroup versus outgroup tradeoff, which will be our leading example. Facing this tradeoff, a DM might think that shared interests or identity with a recipient is indicative of shared past experiences, economic status, and tastes. As a consequence, DMs may feel less familiarity and thus perceive higher interpersonal uncertainty about the outgroup. Similarly, in situations involving the DM herself as one of the two recipients, DMs may naturally face higher uncertainty about others than about themselves since we are most familiar with our own tastes and circumstances. In other situations, DMs might think that one recipient is systematically more likely to have higher valuations than another recipient. Formally,

Definition 1. *DMs perceive a higher interpersonal uncertainty for recipient 2 than recipient 1 if $S_1(x) \leq S_2(x)$ for all x and $S_1(y) < S_2(y)$ for some y. DMs perceive a mean-shifted interpersonal uncertainty for recipient 2a compared to recipient 2b, if there exists $c \in \mathbb{R}_{++}$ such that for all x, $F_{2a}(x + c) = F_{2b}(x)$.*

The condition for higher interpersonal uncertainty is best understood as a generalization of "*f_2 is a mean-preserving spread of f_1*" or equivalently "*f_2 is second-order stochastically dominated by f_2*", because the two quoted notions are defined identically with the

[6]Symmetry implies that the DM has no bias towards either recipient, which serves as our benchmark.

additional condition that f_1 and f_2 have equal means. We use the concept of higher interpersonal uncertainty to characterize the optimal allocation x^*. In comparison, we use the mean-shift concept to study how x^* changes when the DM's beliefs about a particular recipient's valuation-distribution shifts to the right.

2.2 Choice behavior under interpersonal uncertainty

We investigate the case of unbiased utilitarian preferences, which means the utility the DM receives from allocating $x \in [0, 100]$ to the ingroup and $(100 - x)$ to the outgroup is $u_{UTIL} = v_1 x + v_2(100 - x)$. As v_1, v_2 are random variables, she maximizes expected utility over the potential utilitarian outcomes:

$$EU(x) = E_{v_1 \sim f_1, v_2 \sim f_2} U\left(v_1 x + v_2(100 - x)\right) \tag{1}$$

where $U' > 0$ and $E_{v_i \sim f_i}$ denotes the expectation with respect to f_i.

Given this setup, the optimal allocation depends crucially on the response to uncertainty as characterized by U, and on the belief distributions f_1 and f_2. We will generally assume that $U'' < 0$ which implies that the DM dislikes higher variance over potential utilitarian outcomes. If both f_1 and f_2 are degenerate with different expected values, the DM will allocate 100 to the recipient with the higher expected value.[7] If both distributions are non-degenerate, Theorem 1 provides the optimal solutions and serves as our prediction for both the *social* and *non-social* decisions we later employ in our experiments.

Theorem 1. *Suppose DM i has unbiased utilitarian preferences and is risk-averse ($U'' < 0$). If f_1 and f_2 are non-degenerate, independent probability distributions, then*
i) Equal division: If $v_1 \overset{d}{=} v_2$ (i.e, $f_1 = f_2$) then i's optimal allocation is $x^* = 50$.
ii) Ingroup favoritism: If f_2 is a mean preserving spread of f_1, then i's optimal allocation is $x^* \in (50, 100)$.
iii) Comparative statics over x^*: Suppose the valuations of the two groups are distributed as v_1 and $c + v_2$ for some constant c and independent random variables $v_1 \sim f_1, v_2 \sim f_2$. Under arbitrary CARA preferences[8], or under CRRA coefficient< 1, the optimal allocation satisfies $dx^*/dc \leq 0$.

For the proof, see the Appendix. Part (i) follows from symmetry: a risk-averse DM hedges against interpersonal uncertainty by allocating equally among ex-ante symmetric recipients. (ii) shows that ceteris paribus, if the DM perceives a higher interpersonal uncertainty about one of the recipients, she allocates more to the other recipient. Accordingly, a DM who perceives higher interpersonal uncertainty about the outgroup member will allocate more

[7]In the trivial case of degenerate distributions with equal expected value, the optimal allocation is non-unique, as the DM is indifferent between all possible allocations.

[8]For a utility function $U(w)$, the coefficient of absolute risk aversion (ARA) is defined as $r_1(w) = \frac{-U''}{U'}$ and relative risk aversion (RRA) is defined as $r_2(w) = \frac{-wU''}{U'}$. CARA and CRRA imply r_1 and r_2 are constant respectively.

money to the ingroup, even if they believe that on average, ingroup and outgroup members benefit equally from receiving money. Similarly, a DM who perceives higher interpersonal uncertainty about other's utility than their own utility will allocate more money to themselves, even if they care about others equally and think that on average, everyone benefits equally from money. This motivates our experiments studying the ingroup versus outgroup paradigm and the self versus other paradigm in Sections 3 and 4. Note that in (ii) we use the assumption of equal expected values simply as a benchmark: our key insight is that interpersonal uncertainty can generate ingroup favoritism despite equal expected values.

Finally, part (iii) shows that the DM would decrease the allocation to the ingroup (or the allocation to herself in the dictator game) if her belief about the outgroup's valuation mean-shifts to the right.[9] For example, if a DM perceives mean-shifted interpersonal uncertainty when allocating a recipient's earned money compared to allocating windfall money (thus, perceiving higher c in the former case), then she would keep less for herself (lower x^*) in the former case. This motivates our experiments studying the giving versus taking paradigm in Section 5.

Will every commonly used welfare criterion deliver the results of Theorem 1 under the right parameters given our assumptions about interpersonal uncertainty? In Appendix D, we show that Rawlsian preferences are insensitive to higher interpersonal uncertainty. We will use this result later in a robustness analysis to show that people respond to our induced incentives in the expected direction.

Relation to preferences. The economic literature generally interprets ingroup favoritism as an expression of ingroup preferences, modeled as a higher utility weight for ingroup compared to outgroup members (e.g., Tabellini, 2008). In psychology, it is often interpreted as an expression of moral values (e.g., Graham et al., 2013). Similarly, various explanations for the fact that people allocate more, but not all of the endowment to themselves in dictator games have been brought forward (e.g., Capraro et al., 2024). Most of these models either implicitly or explicitly assume that DMs weight their own utility differently than others' utility. However, aversion to interpersonal uncertainty is sufficient to generate ingroup favoritism or self-favoring behavior, differential utility weights are no longer necessary. Importantly, our framework does not imply the absence of social preferences. To the contrary, the described patterns of prosocial behavior emerge precisely because people have social preferences: they care about others' utility, but as this utility is unobserved, they face uncertainty.

[9]Under extreme risk aversion, when c increases, the marginal return from the states with high v_2 is so low that on the margin, DMs might prefer to allocate more to v_1 to safeguard their utility in the states where v_2 is low.

3 Ingroup versus outgroup paradigm

We start by studying ingroup versus outgroup decisions before expanding to further prosocial decisions in later sections. Subsections 3.1 and 3.2 describe how we use social/ non-social decisions and synthetic groups respectively to establish the role of interpersonal uncertainty in ingroup versus outgroup decisions.

3.1 Social and non-social decisions

3.1.1 Experimental design

The experimental sessions using the ingroup-outgroup paradigm feature two distinct decision situations: *social* decisions, which are standard allocation tasks commonly used in the literature, and *non-social* decisions, which eliminate social preference motivations from the social decisions while preserving the inherent interpersonal uncertainty about others' utility.

***Ingroup social* decisions.** For the ingroup versus outgroup paradigm, the *Ingroup social* decision is a "bystander" money-allocation game – one of the standard experimental decision tasks used to identify differential attitudes towards ingroup and outgroup member (e.g., Chen and Li, 2009; Enke et al., 2022). First, each subject answers three questions: (i) selecting their top three hobbies from a provided list, (ii) indicating their position on the political spectrum, and (iii) specifying their religious affiliation (if any). Next, they participate in a game that features three individuals, a decision-maker (DM), one individual who shares a social group with the DM (ingroup member), and another individual who is a member of a different group from the DM (outgroup member). The DM is asked to allocate a fixed reward $\$M$ between the ingroup and outgroup member. In total, DMs face three of such allocation decisions. Specifically, they allocate the reward between (i) someone who "shares your interests/hobbies" versus "has different interests/hobbies than you", (ii) someone who "shares your political views (e.g., a fellow left-winger, or a fellow right-winger, etc.)" versus someone who "has different political views than you" and (iii) someone who "shares your religious beliefs (e.g., a fellow Christian, or a fellow atheist, etc.)" versus someone who "has different religious beliefs than you".[10] The degree to which DMs allocate more money to the respective ingroup member reveals their degree of ingroup favoritism.[11]

***Ingroup non-social* decisions.** Our main contribution is to design and implement a novel decision situation, the *non-social* decision. In this decision, we remove any other-regarding

[10] We use the wording of Enke et al. (2022).

[11] Particularly, ingroup favoritism is identified independent of the decision-maker's self-interest. Past research has shown that behavior in such bystander allocation games shows a high test-retest correlation, works equally well when posed hypothetically and incentivized, and is highly correlated with related psychological questionnaires (Enke et al., 2022).

motivations by removing any consequences the DM's decision has to other individuals. Instead, the DM's choice solely determines their own payoff. Specifically, DMs split $\$M$ between an ingroup and outgroup member, using the same groups as in *social*, and the DM's payoff Π is determined by the following formula:

$$\Pi\left(x_{in}, x_{out}\right) = x_{in} \cdot v_{in}/M + x_{out} \cdot v_{out}/M.$$

where x_{in} is the money split in favor of the ingroup member, and $x_{out} = M - x_{in}$ is the reward split in favor of the outgroup member. The values v_{in} and v_{out} denote how much the ingroup and outgroup members value the M reward, as elicited by the researchers, but unknown to the DM. To scale the incentive, the valuation is divided by M, representing an individual's valuation per unit of the reward medium.

This payoff function induces utilitarian preferences because we incentivize the DMs to maximize the sum of the valuations, weighted by the allocations made in their favor. Since DMs do not know the actual valuations of the matched individuals, such interpersonal uncertainty transforms the *social* decision into an uncertain subjective lottery choice. At the same time, because the valuation is elicited over the same reward medium that is distributed in the *Ingroup social* decision, we retain the interpersonal uncertainty inherent in the *Ingroup social* decision. Importantly, the ingroup and outgroup member's valuations enter the utilitarian payoff function symmetrically, so any differences in allocations are driven by differences in uncertainty about the valuations. We can thus use the comparison of the *Ingroup social* and *Ingroup non-social* decision to assess whether responses to interpersonal uncertainty generate ingroup favoritism.

Eliciting valuations. For robustness, the *social* and *non-social* decisions were run using two environments in separate sessions, labeled *Gift card* and *Effort*, that varied what the v_{in} and v_{out} corresponded to.

In the *Gift card* session, subjects allocated and split $M = \$100$ in the *social* and *non-social* tasks, respectively. In the *social* tasks, the allocated money is sent to the ingroup and outgroup member six weeks from the date of the experiment in the form of Amazon gift card money.[12] In the *non-social* tasks, the valuations v_{in} and v_{out} used to incentivize the DMs corresponded to the ingroup and outgroup recipients' respective willingness to pay (WTP_{in} and WTP_{out}) for a $100 Amazon gift card to be received in six weeks. The elicited WTPs measured subjects' present-day dollar valuation of the delayed gift card money using a standard incentivized multiple-price-list (MPL) procedure.[13]

To understand how the DMs were incentivized using the WTPs in the *non-social* decisions, suppose the DM split $40 and $60 in favor of the ingroup and outgroup member,

[12] Amazon gift card money was used to ensure that subjects' valuations differed meaningfully from the dollar value of the gift card. The 6-week delay was used to introduce additional variation in subjects' valuations.

[13] Subjects made a series of binary decisions between (i) receiving a $100 Amazon gift card in six weeks and (ii) receiving a monetary amount today, which increased across decisions. We enforced single switching by automatically filling the list above and below subjects' choices.

respectively. If the elicited WTP_{in} and WTP_{out} were 80 and 60, then the DM's payoff would be

$$\Pi(40, 60) = 40 \cdot 80/100 + 60 \cdot 60/100 = 68.$$

Instead, if the WTP_{in} and WTP_{out} were 60 and 80 respectively, the payoff would become 72. Since DMs did not know the exact WTP_{in} and WTP_{out}, they faced interpersonal uncertainty about it.

In the *Effort* session, subjects allocated and split $\$M = 10$ in the *social* and *non-social* tasks, respectively. The *Non-social* decision of the *Effort* environment closely mimics the non-social decision of the *Gift card* environment, with one difference: here, the valuations v_{in} and v_{out} correspond to the recipient's willingness-to-work (WTW) for the $10 bonus payment.

To elicit WTW for the ingroup and outgroup members, each recipient faced a series of binary choices between (i) completing a required number of real effort tasks to receive the $10 bonus and (ii) opting out. Each real effort task required moving 30 sliders to the middle position within a 60-second time limit, following the method of Gill and Prowse (2012, 2019). Similar to the WTP elicitation, the WTW was presented in a multiple-price-list format, with the required number of completed tasks ranging from 0 to 30 in increments of 2. A recipient's WTW was defined as the number of tasks at which they first switched from preferring to complete the tasks to opting out.

Minimizing inattention and confusion. A principal concern when interpreting behavior in the *non-social* decisions is that subjects are inattentive to the incentive structure or misunderstand the parameters of the decision. We employ several measures to mitigate the scope for these confounding factors. First, before completing the *non-social* decisions, decision-makers complete the valuation task themselves. That is, they face the WTP or WTW elicitation depending on whether they are in the *Gift card* or *Effort session*, which familiarizes them with the WTP/WTW calculation for the incentive. Second, we included several comprehension questions that test whether DMs understood that the *non-social* decisions only have consequences for themselves, not for the other individuals. If they made errors in their first attempt, they were informed that their answers were incorrect and that they needed to try again. If they made errors again, we explained their mistakes to them and highlighted the correct answers. This procedure makes the distinction between *non-social* and *social* decisions particularly salient. Third, to further minimize inattention, we include an explicit disclaimer on the *non-social* decision screens that states "Reminder: your choice only determines your own payment, it does not affect the two individuals." On the decision screen, we also provided DMs with the option to revisit the instructions.

Procedure. We first ran an experimental session in the *Gift card* environment, and then afterwards a session using the *Effort* environment. Within each session, we randomized the order of decisions. Half of the decision-makers first face the *social* decision and then the valuation task and *non-social* decision. The other half first face the valuation task and *non-social* decision, and then subsequently the *social* decision. We did not announce beforehand that other decisions would follow the initial decisions, therefore minimizing the scope for contagion from one treatment to the other. This design allows us to analyze within-subject behavior, and compare behavior between-subject by only looking at the first set of decisions.

Data. In total, 240 subjects participated in the ingroup experiment, with 121 subjects first facing the *Ingroup social* decision and 119 subjects first facing the *Ingroup non-social* decision. We ran the experimental session with the *Gift card* environment with 119 subjects, while 121 subjects faced the *Effort* environment. For this and all further experiments, we used Prolific to recruit online participants living in the US. All experiments were preregistered, see Appendix K for details. We used oTree (Chen et al., 2016) for programming the graphical user interface. Subjects spent a median of 10 to 12 minutes in the experiments and received as compensation the equivalent of an hourly wage between $10 and $12 per hour. In the *Effort* environment (and subsequent experiments) that use WTWs), one out every ten subjects had one of their decisions implemented with real consequences (between-subject random incentivized system).[14] In the *Gift card* environment (and subsequent experiments) that use WTPs), one subject out of all participating subjects had one of their decisions implemented.

3.1.2 Results

We start with the between-subject comparison of the *social* and *non-social* decisions. As the results for the *Gift card* and *Effort* environments are quantitatively almost identical, we pool across both.[15] See Appendix C for separate results.

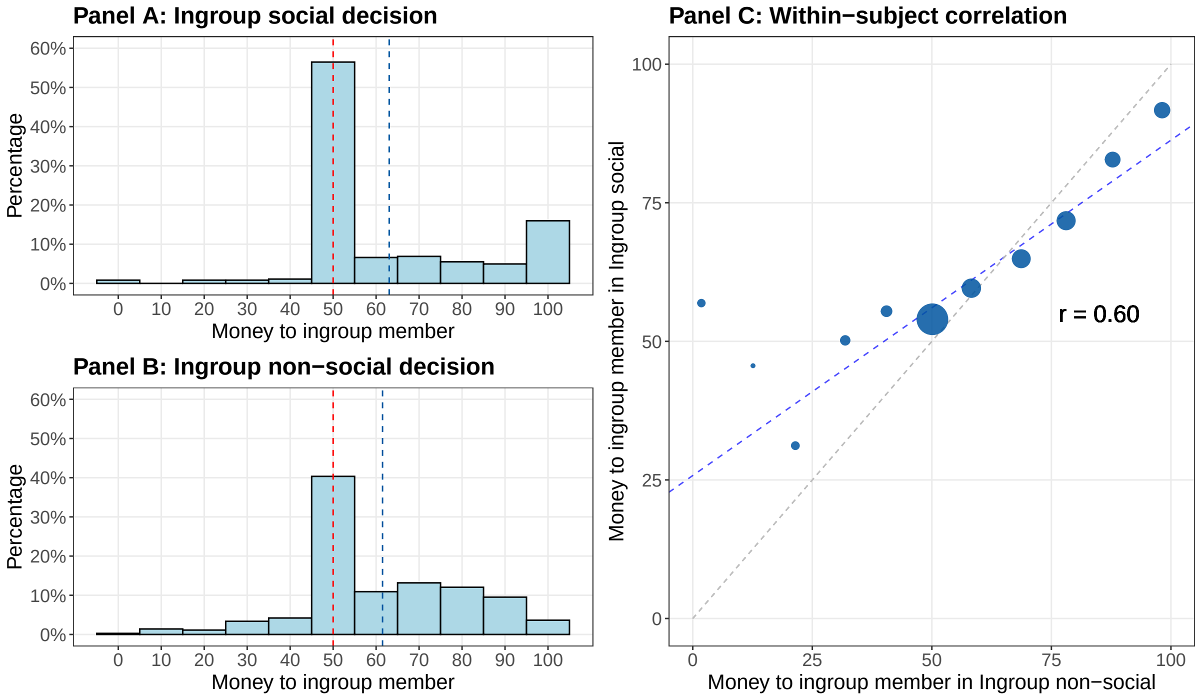
***Ingroup social* decisions.** In the *Ingroup social* decisions, subjects allocate on average $57.75, $70.66, and $60.73 to the ingroup member when they share the same interests/hobbies, the same political views, or the same religious beliefs, respectively. In all three cases, we can reject the hypothesis of no ingroup-favoritism ($p < 0.001$, one-sample Wilcoxon tests). Figure 1 panel A displays the distribution pooled over the three decisions, which replicates the typical distributional pattern found in the literature (e.g., Enke et al., 2022). In 44% of the decisions, subjects display ingroup-favoritism by allocating strictly more than 50% to the ingroup. Outgroup-favoritism is found in 5% of decisions, and in the remaining 51%, subjects allocate 50/50. In total, 71% of subjects display ingroup-favoritism in at least one decision.

***Ingroup non-social* decisions.** Importantly, a similar pattern emerges in the *Ingroup non-social* decisions. Here, subjects allocate on average $58.61, $64.60, and $61.29 when splitting in favor of ingroup members sharing the same interests/hobbies, same political views,

[14]In a meta-analysis, Umer (2023) shows that in the context of dictator games paying a subset instead of all subjects does not significantly change behavior.

[15]We multiply the *Effort* decisions by 10 to ensure a common scale with the *Gift card* decisions.

Figure 1: Main results ingroup versus outgroup decisions



Notes: **Panel A and B:** Histogram of *Ingroup social* (Panel A) and *Ingroup non-social* (Panel B) decisions. The x-axis denotes the amount of money (out of $100) allocated to the ingroup member instead of the outgroup member. The red line denotes the even split, the blue line the average allocation. In Panel A, the decisions have consequences for the ingroup and outgroup members. In Panel B, the decisions have consequences only for the decision-makers, with their payoff depending on the ingroup and outgroup member's valuation of money. **Panel C:** Binned scatter plot of *Ingroup social* and *Ingroup non-social* decisions. The blue line displays the linear fit of regressing *Ingroup social* on *Ingroup non-social* decisions. The correlation coefficient is $r = 0.60$. In all panels, the binwidth is 10. Decisions are pooled across the three groups (shared hobbies/interests, political views, and religious beliefs), displaying $n = 363$ (Panel A), $n = 357$ (Panel B), and $n = 720$ (Panel C) decisions by 121, 119 and 240 subjects, respectively.

and same religious beliefs. As before, we find significant ingroup-favoritism in all three cases ($p < 0.001$, one-sample Wilcoxon tests), even though the decisions have no consequences for ingroup or outgroup members. See Panel B of Figure 1 for the distribution of the pooled decisions. In 59% of the *Ingroup non-social* decisions, subjects display ingroup-favoritism by allocating strictly more than 50% to the ingroup. Outgroup-favoritism is found in 12% of decisions, and in the remaining 29%, subjects allocate 50/50.

Comparing *Ingroup social* and *non-social*. We cannot reject that average ingroup allocations are equal between *Ingroup social* and *non-social* decisions at the 5% level in any of the three cases ($p = 0.15$ for hobbies/interests, $p = 0.06$ for political views, $p = 0.15$ for religious beliefs, unpaired Wilcoxon tests). Thus, our *non-social* setup where decisions have no consequences for either group member produces similar average ingroup favoritism as the standard *social* setup. When comparing distributions, the most notable difference between the two decisions is the extent to which subjects display either maximal or no ingroup favoritism, i.e., give the entire endowment to the ingroup member or allocate 50/50. Of the *social* decisions, 15% display maximal, and 51% no ingroup favoritism, compared to 3% and 29% in *non-social*, respectively.

Within-subject comparison. Next, we compare behavior between *Ingroup social* and *non-social* on the individual level by including also the second set of decisions of each subject. We replicate the previously reported between-subjects results also within-subject, see Appendix E.1. Importantly, we find no evidence for order effects, supporting the validity of our within-results (see Appendix F for details). This allows us to correlate behavior in *Ingroup social* with *non-social*. Panel C of Figure 1 displays the distribution of each individual social and non-social decision pair in a binscatter-plot. As the figure shows, the two are significantly related: ingroup favoritism in *Ingroup non-social* predicts ingroup favoritism in *Ingroup social*, with a correlation coefficient of $r = 0.60$ ($p < 0.001$).[16] Therefore, the same subjects that display ingroup favoritism when decisions have consequences for others also display it when their decisions solely affect their own payoff, with the payoff depending on other's WTPs.

Result 1. *We find ingroup-favoritism in Ingroup non-social, which retains interpersonal uncertainty but removes any consequences for ingroup or outgroup members. The distribution of behavior is similar to Ingroup social, which features consequences, and decisions in the two situations are strongly correlated on the individual level.*

3.1.3 Comprehension and Robustness

Our main results show a high degree of similarity between the *Ingroup social* and *Ingroup non-social* decisions. If subjects are confused or do not pay attention to the *non-social* incentives, they may treat the *non-social* decisions as *social* decisions. This, in turn, would artificially increase the similarity between the two types of decisions.

To test if a lack of comprehension falsely drives our results, we sort subjects based on their responses to the comprehension questions. Pooling decisions across the three social groups, subjects with at most one error allocate \$62.32 in *Ingroup social* and \$60.90 in *Ingroup non-social* to the ingroup member. Subjects with more than one error allocate \$64.07 and \$62.50, respectively. The averages remain significantly different from the 50/50 benchmark, in all of the three following cases: for the pooled data, for each social group individually, and when considering other sample splits based on the comprehension performance (see Appendix Figure B.1).

To test further and systematically for the influence of confusion and inattention, we designed three variations of the *Ingroup non-social* decisions: the *Ingroup incentive*, *Outgroup incentive*, and *Non-social minimum* treatments.

[16] The correlation is not driven by subjects who display no or maximal ingroup favoritism, as excluding both types of decisions (or either) yields correlations of similar or even stronger magnitude.

Design. The first two treatments vary the weights put on the ingroup and outgroup members' WTPs in the payoff function used to incentivize subjects' choices. In *Outgroup incentive*, we increase the weight on the outgroup member's WTP to be three times as high as the ingroup member's WTP:

$$\Pi\left(x_{in}, x_{out}\right) = x_{in} \cdot WTP_{in}/100 + 3 \cdot x_{out} \cdot WTP_{out}/100$$

Similarly, in *Ingroup incentive* we increase the weight on the ingroup member's WTP to be three times as high as the outgroup member's WTP:

$$\Pi\left(x_{in}, x_{out}\right) = 3 \cdot x_{in} \cdot WTP_{in}/100 + x_{out} \cdot WTP_{out}/100$$

Theoretically, the first incentive induces outgroup favoritism, while the second increases ingroup favoritism relative to the *Ingroup Non-social* incentive, which features symmetric weights. In a third treatment, we instead induce an incentives which according to our framework eliminates favoritism in either direction. Specifically, in the *Non-social minimum* treatment, we incentivize a Rawlsian welfare function. Here, subjects' payoffs are calculated as:

$$\Pi\left(x_{in}, x_{out}\right) = \min\{x_{in} \cdot WTP_{in}/100, x_{out} \cdot WTP_{out}/100\}$$

Thus, we incentivize them to choose the allocation that maximizes the utility of the worse-off recipient, irrespective of group affiliation.[17]

Other than the incentives, all aspects of the decisions in the three treatments are identical to the *Ingroup non-social* decisions. Hence, if subjects are inattentive or confused about the *Non-social* incentives so that they erroneously think they face the *Ingroup social* choice instead, we should observe ingroup favoritism in all three treatments. We should also see ingroup favoritism if subjects, facing a potentially complex maximization problem, blindly reuse their heuristics from *social* choices.

Results. Compared to an average ingroup giving of $60.89 across our social groups in *Ingroup non-social* (Section 3.1.2), subjects give on average $42.16 to the ingroup member in *Outgroup incentive*, $67.98 in *Ingroup incentive*, and $51.31 in *Ingroup non-social minimum*, each time a significant difference (all $p < 0.001$, unpaired Wilcoxon test). Hence, as predicted, ingroup favoritism flips to outgroup favoritism in the first, increases in the second and vanishes in the third case.[18] Not only averages, but also the distributions of choices fundamentally change. For instance, in *Ingroup non-social minimum*, the distribution is now symmetric around the 50/50. For details, see Appendix G.

These results show that subjects are clearly responsive to the *non-social* incentives: chang-

[17]As we show in Appendix D, even if the WTP distribution for the outgroup is a mean-preserving spread of the ingroup's WTP distribution and subjects are risk-averse, the predicted optimal choice under Rawlsian preferences and given our assumptions on interpersonal uncertainty is $x_{in} = x_{out} = 50$, implying no favoritism in either direction.

[18]For *Ingroup non-social minimum* we can no longer reject that average ingroup giving is different from the 50/50 split ($p = 0.31$, $p = 0.13$ and $p = 0.95$ respectively for the three social groups, one-sample Wilcoxon tests).

ing a single number in the payoff function flips behavior from ingroup to outgroup favoritism, while introducing a minimum-function leads to a symmetric allocation distribution without any favoritism. Accordingly, limited attention, confusion, or the use of heuristics cannot explain the strong ingroup-favoritism we find in our *Ingroup non-social* choices. In fact, our robustness treatments allow us to zoom into the behavior of subjects who are likely inattentive or confused about the incentives, which we estimate to be a small minority. Among those subjects, ingroup favoritism is, if anything, less prevalent relative to the main experiment (see Appendix G for details). This provides yet another piece of evidence that limited comprehension is not driving *non-social* ingroup favoritism.

3.2 Synthetic groups

According to our conceptual framework from Section 2, even if ingroup and outgroup members are perceived to have equal valuations on average, interpersonal uncertainty drives ingroup favoritism through a two-part mechanism: (1) subjects perceive greater uncertainty for the outgroup than the ingroup, and (2) they are averse to higher uncertainty. In Section 6, we directly measure interpersonal uncertainty to test and validate the first part of the mechanism. In this section, we assess the second part and measure subjects' risk attitudes toward interpersonal uncertainty using synthetic groups that objectively induce interpersonal uncertainty.

3.2.1 Experimental design

In a new treatment (*Ingroup uncertainty*) with 120 subjects, DMs faced seven randomly ordered allocation decisions. In each decision, DMs were endowed with $10 to allocate between Group A and Group B. Each group consisted of two recipients who were participants of an earlier study in which their willingness-to-work (WTW) was elicited (see Section 3.1.1 for details).

DMs were informed that after their allocation decision, a randomly chosen recipient from each group would receive the money allocated to that respective group. Between decisions, we systematically varied (i) uncertainty over the recipients' WTW within each group and (ii) their ingroup/ outgroup affiliation. This yielded four different decision types where the DMs were *informed* about the following WTW/ group information:

1. *Uncertainty without group information* decision: the two recipients of Group A have the same WTW of 12, while the recipients of Group B have a WTW of 4 and 22, respectively. Thus, while the recipient who eventually gets the money from Group A would have a fixed WTW of 12, the recipient receiving the money from Group B could have a WTW 4 or 22, and DMs knew this. Hence, the DMs face higher interpersonal uncertainty about the WTW of Group B recipients (see Definition 1 in Section 2).

2. *Group information without uncertainty* decision (×2)[19]: the two recipients of Group A are ingroup members, while the two recipients of Group B are outgroup members. Moreover, all four recipients have the same WTW of 12.
3. *High uncertainty on ingroup members* decision (×2): the two recipients of Group A are ingroup members, one having a WTW of 4 and the other of 22. The two recipients of Group B are outgroup members, both having a WTW of 12. Hence, the ingroup has a higher WTW variation.
4. *High uncertainty on outgroup members* decision (×2): the two recipients of Group A are ingroup members, both having a WTW of 12. The two recipients of Group B are outgroup members, one having a WTW of 12 and the other of 22. Hence, the outgroup has the higher WTW variation.

The *uncertainty without group information* treatment reveals DMs' attitude towards higher uncertainty about WTWs without the confound of ingroup preferences. Because the expected value of WTWs is higher in Group B[20], DMs who still allocate more to Group A reveal their aversion to the uncertainty in WTWs, and hence their risk aversion. The *group information without uncertainty* decision, on the other hand, reveals ingroup favoritism in the absence of interpersonal uncertainty. The last two decision-situations reveal the extent to which interpersonal uncertainty influences ingroup favoritism. When presenting the WTW and social group information, we randomized the group's position on the screen (left or right) and which information was presented first, balancing the presentation of the two pieces of information.

Importantly, DMs knew that WTW reflects recipients' *stated* willingness, not their actual exerted effort. This feature ensured that fairness considerations based on exerted effort did not influence their decisions.[21]

3.2.2 Results

Figure 2 displays the distribution of choices. Starting with Panel A, we observe that the majority of subjects are risk-averse towards interpersonal uncertainty even in the absence of group information: 54% allocate more than 50/50 to the group with lower WTW variance, 27% allocate 50/50 and a minority of 19% allocate more to the group with the higher WTW variance. On average, subjects allocate \$6.00 to the group with lower WTW variance, which

[19]The "×2" indicates that there were two decisions of this type, one involving shared hobbies and the other involving shared political views as group identity. We excluded religious beliefs, as previous results suggested similar behavior, and we aimed to minimize additional decisions.

[20]Intrinsically, this argument holds when recipients' value of \$10 is directly equal to their WTWs, as well as when recipients' valuation is equal to an increasing and convex disutility function of the WTW. The latter assumption is well supported by empirical evidence on real effort tasks (see e.g., Gill and Prowse, 2019).

[21]Recipients knew there was a 50% chance they would complete their selected WTW tasks and a 50% chance they would not work but might later receive money from DMs who observed their WTW. Only the latter group was matched with DMs in the *Ingroup Uncertainty* experiment. Thus, none had worked based on their WTW choices—a fact clearly communicated to DMs.

is significantly more than the 50/50 benchmark ($p < 0.001$, one-sample Wilcoxon tests).

In the case where all recipients have the same WTW (Panel B), subjects allocate on average \$5.74 to the ingroup (pooling the decision across both social groups), which is significantly different from the 50/50 split ($p < 0.01$, one-sample Wilcoxon test). This quantifies the extent to which ingroup preferences drive ingroup favoritism since interpersonal uncertainty about WTWs is absent in this decision.

Panels C to D then document how interpersonal uncertainty being higher in the ingroup or the outgroup changes the magnitude of ingroup favoritism. The amount allocated to the ingroup increases from \$5.74 to \$6.37 when the outgroup is more uncertain (has higher variation in WTWs), and decreases to \$4.89 when the ingroup is more uncertain (both $p < 0.001$ compared to the no uncertainty decision, paired Wilcoxon tests). Moreover, changing the uncertainty changes the entire distribution of choices. When the outgroup has the higher WTW variance, the modal (62%) DM displayed ingroup favoritism, while 12% displayed outgroup favoritism and 26% had the 50/50 split. Once the recipients of both groups have equal WTWs, the model subject (66%) now chooses the 50/50 split. Here, only a minority of 29% and 5% strictly favor the ingroup and outgroup, respectively. Lastly, when the ingroup has the higher WTW variance, the modal subject (40%) switches to outgroup favoritism, while 31% of choices show ingroup favoritism and 29% are 50/50 choices. These results establish that responses to interpersonal uncertainty causally influence the extent of ingroup favoritism.

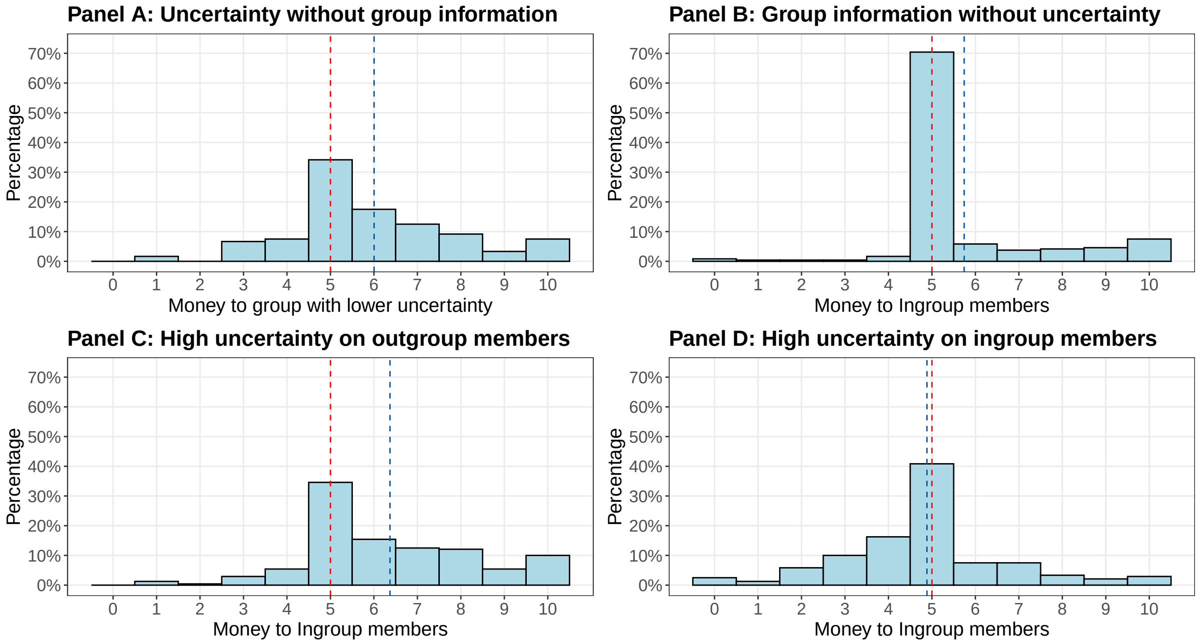
Information choice. After the seven allocation decisions, we included an eighth decision where DMs, without knowing group membership or WTW, could choose to learn about one of those before allocating money. This decision reveals whether group membership or recipients' valuation primarily drives DM's choices. Overall, 81% of subjects chose to learn about WTW variation, indicating a preference for information about uncertainty over social group membership. For details, see Appendix H.

3.2.3 The quantitative importance of interpersonal uncertainty

Next, using the data from the previous section, we quantify the relative importance of interpersonal uncertainty and ingroup preferences in driving ingroup favoritism, using a reduced-form analysis, a type analysis, and a structural model of prosocial decision-making.

Reduced form analysis. To estimate the effects of uncertainty and preferences on ingroup preferences, we use the following model: $alloc_{i,d} = c_0 + c_1 unc_d + \varepsilon_{i,d}$, in which $alloc_{i,d}$ denotes the allocation to the ingroup by individual i in decision d. We normalize the variable by subtracting 5 from the actual giving so that the 50/50 split benchmark implies $alloc_{id} = 0$. The variable unc_d is equal to 1 for decisions with *Higher WTW uncertainty on outgroup members*, equal to -1 for decisions with *Higher WTW uncertainty on ingroup members*, and equal to 0 when uncertainty is absent for both groups. Thus, c_1 measures how much the

Figure 2: The causal effect of interpersonal uncertainty on allocation decisions



Notes: **Panel A:** The x-axis denotes the amount of money (out of $10) allocated to the group with a lower variation in willingness-to-work (WTW). In **Panels B to D**, the x-axis denotes the amount allocated to the group whose members share a social group with the decision-maker instead of the group whose members are from a different social group. In Panel B, all group members have the same WTW. In Panel C, the outgroup has the higher WTW variation. In Panel D the ingroup has the higher variation. The red line denotes the even split, the blue line the average allocation. In all panels, the binwidth is 10. Decisions are pooled across two social groups (shared hobbies/interests and political views), displaying $n = 120$ (Panel A) and $n = 240$ (Panel B to D) decisions made by 120 subjects.

allocation is affected by uncertainty in either direction. Accordingly, ingroup preferences are measured by the constant c_0 that captures how much more subjects allocate to the ingroup on average in the absence of interpersonal uncertainty ($unc_d = 0$).

We find that both ingroup preferences and interpersonal uncertainty significantly influence behavior. Pooled across groups, the coefficient on preferences is $c_0 = 0.666$, and the coefficient on uncertainty is $c_1 = 0.742$, both being significant at the 0.001 level (see Appendix Table A.1).

When we run the regression separately based on the group identity, we find that the influence of ingroup preferences on behavior is stronger for political views ($c_0^{Pol} = 0.964$) than hobbies/interests ($c_0^{Hobb} = 0.367$), while the influence of uncertainty is similar in both cases ($c_1^{Pol} = 0.720$ and $c_1^{Hobb} = 0.764$, respectively). These results demonstrate that, depending on the social group studied, the influence of uncertainty on behavior can be stronger or weaker than the influence of preferences.

Subject-level type analysis. We further exploit the within-subject structure to identify distinct behavioral types. We say a subject reveals a *group-based preference* if they choose a different allocation than 50/50 in *at least one* of the two decisions that provided *group information without uncertainty*. We say that a subject *responds to interpersonal uncertainty* if, for both social groups (interest and political views), their *outgroup uncertainty* decision was different from their *ingroup uncertainty* decision.[22] With this categorization, we find that 20% of subjects neither respond to uncertainty nor display a group preference. 33% of subjects respond to uncertainty but do not display a group preference, while 17% do not respond to uncertainty but display a group preference. Finally, 31% both respond to uncertainty and display a preference. Hence, interpersonal uncertainty is relevant for 64% of all subjects, while group preferences are relevant for 48%.

A complementary approach to the previous reduced form analysis is the use of a structural model, explained next.

Structural model setup. Suppose the representative DM has to distribute M units between two individuals 1 and 2, whose group identity can take one of three values: $G(i) \in \{in, out, \emptyset\}$, where $\emptyset$ means unknown. Suppose the DM believes that the valuations of money received by the two individuals 1 and 2 are distributed as f_1 and f_2 respectively, and suppose $x_{IU}(f_1, f_2, \gamma)$ is the choice that maximizes the expected (utilitarian) utility (see equation 1) given the two distributions. To parameterize risk aversion, we assume CRRA utility $u(w) = \frac{w^{1-\gamma}}{1-\gamma}$, with γ as the risk aversion parameter. In our experiment, under the assumption that the valuation of money is measured as WTW, f_1 and f_2 is either the degenerate lottery $L_1 = (12, 1)$ (tasks) or the 50-50 lottery $L_2 = (h = 22, 0.5; l = 4, 0.5)$. Under these distributions and under CRRA risk-preferences, x_{IU} has the following closed form solution:

$$x_{IU}\left(f_1 = (m,1), f_2 = (h, 0.5; l, 0.5), \gamma\right) = \frac{M \cdot h \left(\frac{m-l}{h-m}\right)^{\frac{1}{\gamma}} - M \cdot l}{(m-l) + (h-m)\left(\frac{m-l}{h-m}\right)^{\frac{1}{\gamma}}}$$

Finally, we assume that the DM's optimal allocation to individual 1 in observation j is as follows:

$$x_{1j} = \begin{cases} \frac{M}{2} + b + \varepsilon_j & \text{if } f_1 = f_2, G(1) = in, G(2) = out \\ x_{IU}\left(f_1, f_2, \gamma\right) + \varepsilon_j & \text{if } f_1 \neq f_2, G(1) = G(2) \\ a_{IU} \cdot x_{IU}\left(f_1, f_2, \gamma\right) + a_{ING} \cdot \left(\frac{M}{2} + b\right) + \varepsilon_j & \text{if } f_i \neq f_o, G(1) = in, G(2) = out \end{cases}$$

In the first case of symmetric interpersonal uncertainty, the ingroup preference factor b alone determines the allocation. The normal noise parameter $\varepsilon_j \sim N(0, \sigma^2)$ is is i.i.d across observations. In the second case of symmetric group information, interpersonal uncertainty alone determines the final allocation. When we have a conjunction of the former two cases, the optimal allocation combines the influence of both factors: $a \lesseqgtr 1$ quantifies if the influence of the corresponding channel shrinks ($a < 1$), stays unchanged ($a = 1$), or expands ($a > 1$) when both factors are present.

[22]Thus, we use a more conservative identification criterion for the response to uncertainty, because we require subjects to respond to uncertainty across both pairs of choices. In contrast, for identifying group-based preferences only one choice needs to be different from the "no favoritism" benchmark. In total, 79% of subjects respond to at least one change in uncertainty from ingroup uncertainty to outgroup uncertainty.

Structural model results. We jointly estimate $\gamma, b, a_{IU}, a_{ING}, \sigma$ to maximize the likelihood of the observed data. We estimate a CRRA parameter of $\gamma = 0.374$[23] and the extent of pure ingroup preference to be $b = 0.741$. We estimate a weight of $a_{IU} = 0.739$ on interpersonal uncertainty and a weight of $a_{ING} = 0.336$ on ingroup preferences. Thus, when both factors operate simultaneously, the estimated influences of interpersonal uncertainty and ingroup preferences diminish to 74% and 34% of their respective influences when they operated in isolation. For more details on the estimation, see Appendix Table A.2.

This sub-additive feature inherent in the estimates ($a_{IU}, a_{ING} < 1$) helps one interpret our results from the *social* and *non-social* decisions in light of the reduced-form results from the *Ingroup uncertainty* treatment. One might (incorrectly) think that the quantitative similarity between the *social* and *non-social* decisions implies that interpersonal uncertainty is sufficient to explain *all* observed prosocial behavior, which would be at odds not only with the previous literature but also with our results in the *Group information without uncertainty* decision. However, the sub-additivity feature explains that when one compares a treatment where both factors are present to one where only interpersonal uncertainty matters, the influence of interpersonal uncertainty in the latter treatment expands and thus partly compensates for the lack of group preferences.

4 Self versus other paradigm (Dictator game)

Our experimental design naturally extends to choices involving tradeoffs between one's own utility versus the utility of others (self versus other decisions), as does the idea that interpersonal uncertainty shapes behavior in these tradeoffs.

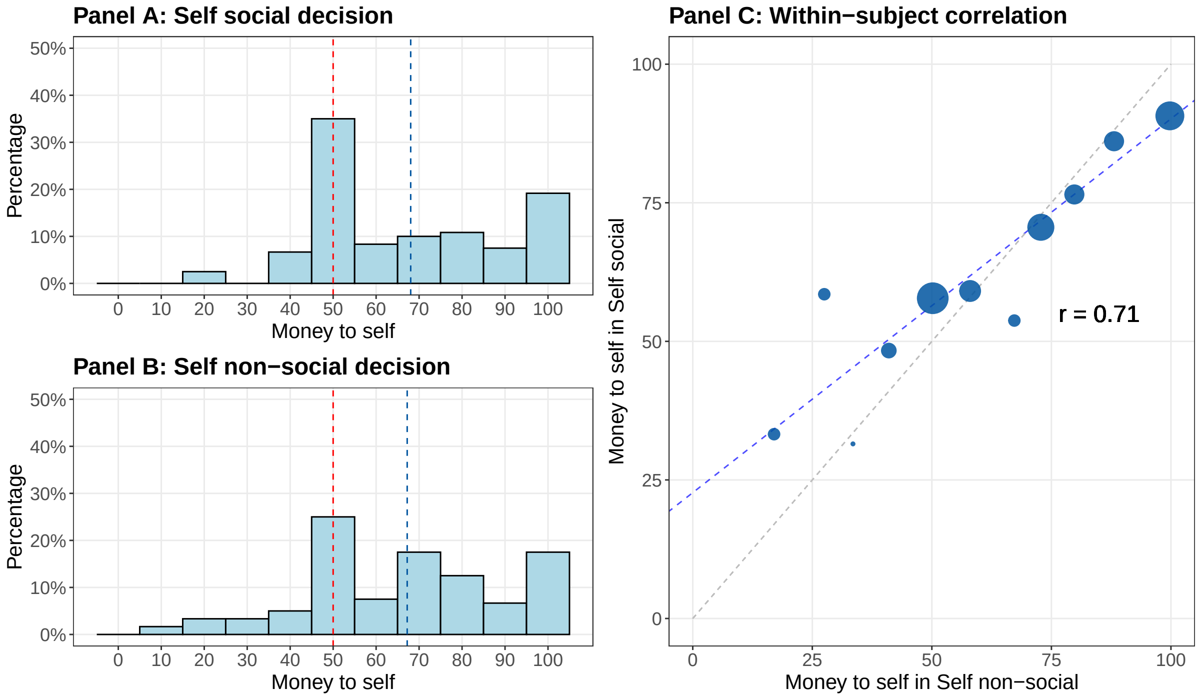
4.1 Experimental design

Similar to the ingroup versus outgroup case, DMs face a *Self social* and a *Self non-social* decision, in randomized order. Before the *Self non-social* decision, they also complete the valuation task for $100 Amazon gift card money received 6 weeks later.

***Self social* decision.** For the *Self social* decision, we endow decision-makers with $100 which they can allocate between themselves and another individual they have been matched with (without any information about group affiliations). The allocated money is paid out to both parties in the form of Amazon gift card money, six weeks from the date of the experiment. Hence, the *Self social* decision is the standard dictator game: it has consequences for the DM as well as the other individual.

[23] This implies a higher risk-aversion towards interpersonal uncertainty than towards monetary risk. For comparison, across 16 studies employing the Gneezy and Potters (1997) investment task over money, which our setup mimics, Crosetto and Filippin (2016) report an average CRRA parameter $\gamma = 0.3$.

Figure 3: Main results self versus other decision



Notes: **Panel A and B:** Histogram of the *Self social* (Panel A) and *Self non-social* (Panel B) decision. The x-axis denotes the amount of gift card money (out of \$100) that subjects allocate to themselves instead of another individual. The red line is the even split, the blue line the average allocation. In Panel A, the decision has consequences for the subjects and the other individuals. In Panel B, the decision has consequences only for the subjects, with their payoff depending on their and the other individual's WTP for the gift card. **Panel C:** Binned scatter plot of the *Self social* and *Self non-social* decision. The blue line displays the linear fit of regressing the *Self social* on the *Self non-social* decision. The correlation coefficient is $r = 0.71$. For all three panels, the binwidth is 10. Displayed are $n = 61$ (Panel A), $n = 59$ (Panel B) and $n = 120$ (Panel C) decisions.

***Self non-social* decision.** In the *Self non-social* decisions, decision-makers split \$100 between themselves and another individual, and we remove any social consequences like we did in *Ingroup non-social* decisions. That is, neither the DM, nor the matched participant receive the money that is split. Instead, only DM's themselves receive a reward based on the following formula:

$$\Pi\left(x_{self}, x_{other}\right) = x_{self} \cdot WTP_{self}/100 + x_{other} \cdot WTP_{other}/100$$

where x_{self} and x_{other} are the amounts allocated to self and to the matched individuals respectively, and WTP_{self} and WTP_{other} are their respective WTP for the gift card. Decision-makers are thus incentivized to maximize the sum of their WTP and the WTP of the other individual they are matched with, with both WTPs receiving equal weight. All other elements match the ingroup versus outgroup setting. In total, 120 subjects faced the *Self social* and *Self non-social* decisions.

4.2 Results

***Self social* decision.** In *Self social*, subjects allocate on average \$69.05 to themselves, thereby allocating significantly more to themselves compared to the equal split ($p < 0.001$, one-sample Wilcoxon test). Figure 3 panel A displays the distribution, which replicates the typical pattern of dictator game behavior found in the literature (Engel, 2011). In total, 61% of subjects allocate more money to themselves, 3% allocate more to the other person, and 36% implement the 50/50 split.

***Self non-social* decision.** In *Self non-social*, subjects allocate on average \$64.12 to themselves, again a significant deviation from the equal split ($p < 0.001$, one-sample Wilcoxon test). As Figure 3 panel B shows, the distribution is also similarly shaped as in the *Self social* case. In total, 58% of subjects allocate more money to themselves, 17% allocate more to the other person, and 25% implement the 50/50 split.

Comparing *Self social* and *non-social*. Allocations in the *Self non-social* setting closely replicate the behavior we observe in *Self social*. Statistically, we cannot reject that the average amount that subjects allocate to themselves is equal across *social* and *non-social* decisions ($p = 0.27$, unpaired Wilcoxon test). Similarly, we cannot reject that the distribution of allocations is equal across the two decisions ($p = 0.39$, Kolmogorov-Smirnov test). These results also replicate within-subject. Figure 3 panel C binscatter-plots each individual's *social* and *non-social* decision pair. The two decisions are highly correlated at the individual level, with a correlation coefficient of $r = 0.71$ ($p < 0.001$). Hence, the *Self non-social* decision strongly predicts the *Self social* decision.

Robustness. To show that people are attentive to the *non-social* incentives in the self versus other setting, we use the same the incentive treatment as in the ingroup versus outgroup setting (Section 3.1.3) and apply it to the current setting. Our results are similar: subjects understand the incentives and react to them as hypothesized. We provide the results in Appendix Section I.

Result 2. *Self non-social choices replicate the self-favoring behavior found in Self social choices. The distributions are similar and strongly correlated on the individual level.*

5 Giving versus taking paradigm

The previous literature primarily finds that redistribution behavior is merit-based: people redistribute less from initial endowments if these endowments are earned compared to generated by chance (Cappelen et al., 2020). In particular, in the context of dictator games, several studies (discussed in the introduction) show that if the initial endowment was earned instead of being windfall, then dictators increase their allocation towards the individual earning the endowment. This behavior is typically attributed to fairness preferences (e.g., Tungodden and Cappelen, 2019), fairness-based social norms (Krupka and Weber, 2013), or the role of property rights (Oxoby and Spraggon, 2008).

Interpersonal uncertainty offers a belief-based alternative explanation: if DMs believe that on average, the recipient's disutility from losing earned money exceeds their utility from gaining money (i.e., a gain-loss asymmetry), then DMs would perceive *mean-shifted* interpersonal uncertainty (see Definition 1) for recipients who have earned the endowment compared to recipients who have not. Thus, as suggested by result (iii) of Theorem 1, a simple utilitarian motive under uncertainty would also lead to the same asymmetry between giving and taking environments. Our next treatments test this channel of mean-shifted interpersonal uncertainty.

5.1 Experimental design

Following the typical setup of the literature, we alter our dictator game from a giving environment to a taking environment. DMs face a *Taking social* decision and a *Taking non-social* decision. In both *Taking* decisions, DMs are matched to a previous participant who has earned \$100 for participating in a previous study, scheduled to be paid in 6 weeks from the study day. In total, 123 subjects participated in this experiment.

***Taking social* decision.** In the *social* variant, the DM decides whether to take some or all of the money that the other participant has earned for themselves, adapting the design of Oxoby and Spraggon (2008). The chosen allocation is then implemented with consequences for the DM and the other participant.

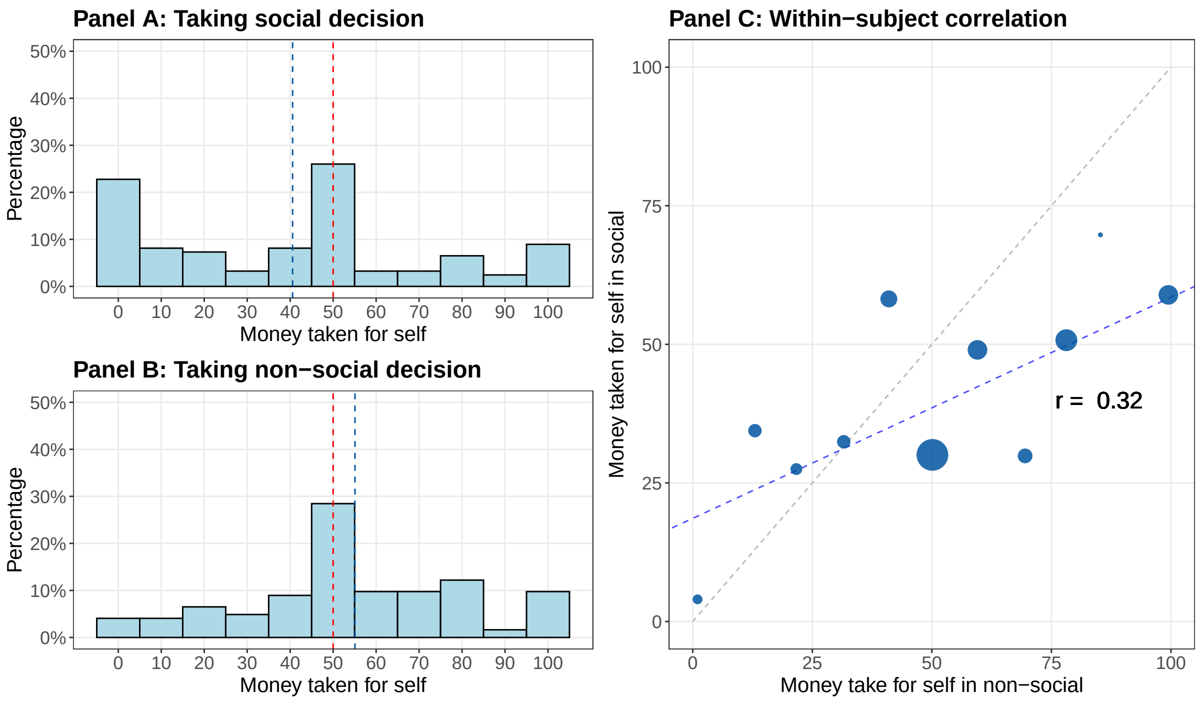
***Taking non-social* decision.** In the *non-social* variant, we replicate the setup described in Section 3 with one key difference: because the other participant already earned the \$100 that was up for splitting, the DM's utilitarian incentives were calculated using the other participant's willingness-to-accept (WTA) for gift card money, instead of their WTP. Thus the DM's payment depended on their own WTP and the matched participant's WTA. Specifically, the incentive for the DM is as follows:

$$\Pi\left(x_{self}, x_{other}\right) = x_{self} \cdot WTP_{self}/100 + x_{other} \cdot WTA_{other}/100$$

with x_{self} and x_{other} denoting the money DMs allocate to themselves and the other individual respectively, WTP_{self} is their own WTP and WTA_{other} is the other individual's WTA for the gift card money.

After the DMs participated in the MPL that elicits their WTP, we explained to them the following details about matched participants: First, the matched participants earned the \$100 gift card through their participation. Then, we asked them whether they would be willing to give away the gift card in exchange for an immediately payable monetary amount. We ask this question for different amounts of the immediately payable money, using an

Figure 4: Giving versus taking results



Notes: **Panel A and B:** Histogram of the *Taking social* (Panel A) and *Taking non-social* (Panel B) decision. The x-axis denotes the amount of gift card money (out of $100) that subjects allocate to themselves instead of another individual. The red line denotes the even split, the blue line the average allocation. In Panel A, subjects' decision has consequences for themselves and the other individual. In Panel B, the decision has consequences only for the subjects, with their payoff depending on their WTP and the other individual's WTA for the gift card. **Panel C:** Binned scatter plot of the *Taking social* and *Taking non-social* decision. The blue line displays the linear fit of regressing *Taking social* on the *Taking non-social* decision. The correlation coefficient is $r = 0.32$. For all three panels, the binwidth is 10. Displayed are $n = 123$ decision-pairs by 123 subjects.

MPL, to elicit their WTA. The DMs are already familiar with the MPL-elicitation method at this point. We emphasize to DMs that the only difference between their's and the matched participant's elicitation is, instead of having the option to receive the gift card, the matched participants already 'owned' the gift card and had the opportunity to sell it.

Multiple studies have found that WTA is, on average, higher than WTP (e.g., Camerer, 1995), and hence WTA>WTP is a well-established empirical pattern. Our central hypothesis is that, if DMs also anticipate the WTA-WTP gap as mean-shifted interpersonal uncertainty, then utilitarianism provides a novel foundation for differences in giving and taking (Theorem 1). In particular, under WTA>WTP, we predict that the amount allocated to the matched participant should increase (compared to the giving paradigm) not only in *Taking social*, but also in *Taking non-social*. Further, because *Taking non-social* does not feature any scope for fairness attitudes, we can separate our channel from a fairness channel.

5.2 Results

Comparing *Taking* to the *Giving* setting. We find that subjects allocate significantly less money to themselves in the *Taking* compared to the *Giving* setting of Section 4. Comparing *Self social* with *Taking social* decisions, we see a significant decrease of $27.48 in the amount subjects allocate to themselves, using the within-subject data controlling for the order (see Appendix Table A.3 column (1) for details). We thus replicate the common finding of aversion to taking from earned endowments in the literature with our *social* decisions. When comparing *Self non-social* with *Taking non-social* decisions, we also find a significant decrease of $12.08 in the amount subjects allocate to themselves (Appendix Table A.3 column (2)). Therefore, incentivizing DMs with the other individuals' WTA instead of their WTP induces DMs to allocate less to themselves. Yet, the decrease in allocation to the self from the *Giving* to the *Taking* setting is smaller in the *non-social* case compared to the *social* case.

Comparing *Taking social* and *Taking non-social*. Figure 4 displays the comparison. Panel A shows the distribution of choices in the *Taking social* decision, where 26% of subjects allocate more money to themselves, 51% allocate more to the other person, with the remaining 23% allocating the even split. In the *Taking non-social* decision, displayed in Panel B, 46% allocate more money to themselves, 29% allocate more to the other person, and 24% split evenly. We see a significant within-subject correlation of $r = 0.32$ ($p < 0.001$) between *Taking social* and *Taking non-social* (Panel C of Figure 4). Thus, taking behavior in the *social* decision correlates with the *non-social* decision that does not feature taking (not even in how the instructions were framed). Contrary to the other settings, these decisions differ in average allocations ($p < 0.001$, unpaired Wilcoxon test), and distributions ($p < 0.01$, Kolmogorov-Smirnov test). These results suggest that *social* decisions are also driven by motives that are absent in the *non-social* decisions.

A potential motive comes from the observation that 22% of subjects choose to take $0 for themselves in *Taking social*, while only 3% do so in *Taking non-social*. In contrast, in *Self social* and *Self non-social*, not a single subject chooses to give everything to the other individual. This pattern suggests that fairness preferences are also at work, e.g., some subjects have a strong libertarian fairness view (Alma et al., 2020) or adhere to a deontological motive that it is not permissible to take money from someone (Bénabou et al., 2024). Interestingly, those subjects refusing to take any money completely explain the gap between *Taking social* and *Taking non-social*. If we focus only on subjects who take more than $0 for themselves in *Taking social*, we can no longer reject the equality of average giving between *Taking social* and *Taking non-social* ($p = 0.22$, unpaired Wilcoxon test)[24] and distributions become more similar ($p = 0.09$, Kolmogorov-Smirnov test), see Appendix Figure B.4. Similarly, the within-subject correlation increases to $r = 0.45$.

Beliefs about WTA-WTP differences. A necessary condition our hypotheses and results is that subjects indeed perceive a positive difference in the utility impact of taking earned

[24]Note that this effect is not mechanical because we remove both *social* and *non-social* decisions due to the within-subject structure of our data.

money and giving windfall money, i.e., in other's WTA and WTP. To validate this assumption, we asked subjects whether they generally think that a person's WTA for the gift card is higher, lower or equal to the WTP. In total, 46% of subjects believe WTA to be higher than WTP, 29% believe WTP to be higher, and 24% believe both to be equal. Thus, subjects believe WTA>WTP on average. For robustness, in the *IU belief measurement* treatment (for details, see the next section), we directly elicited subject's beliefs about both the average WTP and WTA valuations of others. On average, subjects reported a $8.00 higher WTA than WTP ($91.43 compared to $83.43), a significant difference ($p < 0.001$, paired Wilcoxon-test). In total, for 64% of subjects their WTA estimate is higher than the WTP estimate, for 20% the reverse holds, and for 16% both are equal.

Result 3. *Subjects allocate more money to the other person when allocating the other person's earned money (Taking social) than when allocating windfall money (Self social). The allocations are ranked similarly in Self non-social with Taking non-social.*

6 Measuring perceived interpersonal uncertainty

In this section, we describe how a simple survey question can be used to directly measure perceived interpersonal uncertainty across individuals and decision scenarios. We use this measure to test a central hypothesis of our framework: that subjects perceive higher uncertainty for outgroup members versus ingroup members, and for others versus themselves. Additionally, we demonstrate how this measure predicts prosocial decisions, underscoring its potential as a valuable tool for understanding prosocial behavior.

6.1 Measurement

Elicitation. After the *Ingroup social* (Section 3.1.1) and *Self social* (Section 4.1) decisions, we asked decision-makers the following question, separately about each recipient:

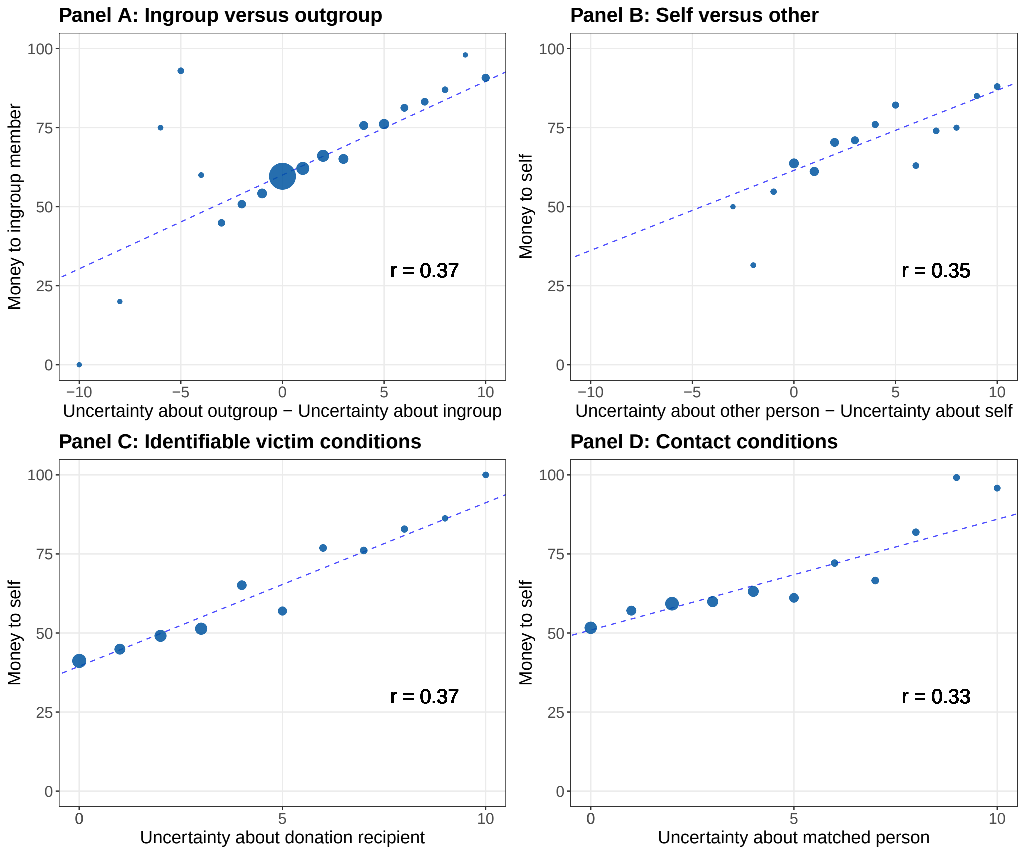
> "How certain are you about how much [the recipient] would value [their bonus reward]?"

The question asked about outgroup and ingroup recipients in *Ingroup social* decisions (Section 3.1.1) or self and other recipients in *Self social* decisions (Section 4.1). The bonus reward concerned the object allocated in the previous allocation decision, being Amazon gift card money or cash in the *Gift card* and *Effort* environment, respectively. Subjects responded on an 11-point Likert scale from *Very uncertain* to *Very certain*. We recode the variable so that higher values indicate greater uncertainty. We then construct the following individual-level measure of *relative uncertainty*:

$$\begin{aligned}\text{Relative Uncertainty} = {} & \text{Uncertainty about Outgroup (or Other's) Valuation} \\ & - \text{Uncertainty about Ingroup (or Own) Valuation}\end{aligned}$$

This method offers a straightforward way to measure subjective interpersonal uncertainty and allows for testing whether subjects perceive systematic differences between recipients.

Figure 5: Association between reported interpersonal uncertainty and allocation decisions



Notes: Binned scatter plots showing the relationship between reported interpersonal uncertainty and decision-making across different contexts: *Ingroup social* decisions (Panel A), *Self social* decisions (Panel B), *Identifiable victim* intervention (Panel C), and *Contact* intervention (Panel D). The binwidth is 1. In each panel, the linear regression fit is shown with the blue dotted line, and correlation coefficients are displayed. **Panel A:** The x-axis shows the difference in valuation uncertainty between ingroup and outgroup members, and the y-axis shows money allocated to the ingroup member. $n = 720$ decisions from 240 subjects, pooled across three social groups and two environments (*Gift card* and *Effort*). **Panel B:** The x-axis shows the difference in valuation uncertainty between the the dictator game recipient and oneself, and the y-axis shows the amount allocated to self. $n = 120$ decisions from 120 subjects. **Panel C:** The x-axis shows uncertainty about the recipients of the GiveDirectly donation, and the y-axis shows money allocated to oneself. $n = 304$ decisions from 304 subjects pooled across treatment and control groups. **Panel D:** The x-axis shows uncertainty about the matched person, and the y-axis shows money allocated to oneself. $n = 298$ decisions from 298 subjects pooled across treatment and control groups.

Results. In *Ingroup social*, subjects perceive higher uncertainty about valuations of outgroup members than ingroup members. Measured in Likert scale points, this difference is 0.76 in the case of hobbies/interests, 1.20 in case of political views, and 0.73 in case of religious beliefs. All differences are significantly different from zero ($p < 0.001$, paired Wilcoxon tests). With respect to the distribution of differences at the individual level, in 32% of cases, subjects report higher uncertainty for the outgroup; in 8% they report higher uncertainty for the ingroup and in the remaining 59% cases, subjects report no difference.

Similarly, in *Self social*, subjects perceive on average 2.59 Likert-scale points higher uncertainty for the other person's valuation than their own, which is again significantly different from the no difference benchmark ($p < 0.001$, paired Wilcoxon tests). In total, 72% of subjects report a higher uncertainty about the other person's valuations, 6% report a higher uncertainty about their own valuation, and 23% report no difference.

Further, differences in interpersonal uncertainty predict allocation decisions in both *Ingroup social* and *Self social*. As shown in Figure 5 in the form of binned scatter plots, higher uncertainty about the outgroup's valuation relative to the ingroup's valuation predicts stronger ingroup favoritism (Panel A, $r = 0.37$, $p < 0.001$), and higher uncertainty about the other individual's valuation relative to own valuation predicts stronger giving to self (Panel B, $r = 0.35$, $p < 0.001$).

6.2 Robustness

We designed a robustness treatment, *IU belief measurement* ($n = 120$), to address two potential concerns: (1) the possibility that prior allocation decisions influenced uncertainty elicitation, and (2) the risk that subjects conflated uncertainty with mean beliefs. *IU belief measurement* had no allocation decisions. Instead, subjects first learned how valuations were measured for past participants, then guessed the average valuations of past participants, and afterwards reported their interpersonal uncertainty. This process ensures a clear distinction between average valuations and uncertainty. For example, in the ingroup versus outgroup case, subjects first reported average estimates

> Consider individuals who [share your interests/hobbies / have different interests/hobbies than you]. On average, how much do you think they value [their bonus reward]?

and then reported their interpersonal uncertainty about both ingroup and outgroup, as in Section 6.1.

We replicate our patterns from the main treatment. For the ingroup versus outgroup case, subjects again report higher uncertainty about outgroup members for all three social groups (0.81 points higher for hobbies/interests, 0.93 for political views, and 0.66 for religious beliefs, each $p < 0.01$, paired Wilcoxon tests).[25] Similarly, in the self versus other case, subjects again perceive higher uncertainty over the other person's valuation relative to their own (3.11 points higher, $p < 0.001$, paired Wilcoxon test).[26]

[25]Moreover, we cannot reject that the distribution of beliefs elicited without prior allocation decision is the same as elicited with prior decision (all $p > 0.10$, Kolmogorov-Smirnov test).

[26]Regarding beliefs about mean valuations, subjects report ingroup members to have valuations of $87.85 (hobbies/interests), $89.64 (political views), and $89.14 (religious beliefs). For outgroup members, they report valuations of $88.20, $86.69, and $87.85. Thus, on average, subjects' beliefs do not differ between ingroup and outgroup ($p = 0.90$, $p = 0.06$, and $p = 0.37$, paired Wilcoxon tests), and are well calibrated, as the actual average WTP observed in the experiment is $87. The average belief about mean valuations in the self versus other case is $83.43, whereas the actual WTP is $86.69. Thus, on average, subjects believe others to have a slightly lower WTP than themselves ($p = 0.03$, paired Wilcoxon test).

As an additional validation exercise, at the end of *IU belief measurement*, we presented subjects with two artificial groups featuring exogenously induced WTP distributions, where one was a mean-preserving spread of the other. Subjects then reported their perceived interpersonal uncertainty for each group. Overall, 74% (87% respectively) of subjects report strictly (weakly) higher interpersonal uncertainty about the first group, validating the sensitivity of the Likert-scale measure. See Appendix J for details.

A discussion on motivated beliefs. One might wonder if the differences in interpersonal uncertainty are entirely driven by *motivated reasoning*. Under this theory, the extent and direction of motivated manipulation of beliefs should depend on how such manipulation would serve one's preferences (e.g., ingroup bias). This has clear predictions for our experiments: subjects in *Ingroup social* should be more motivated to harbor higher uncertainty about the outgroup's valuation compared to those in *IU belief measurement*. However, we find no such differences in beliefs. In fact, subjects perceive no mean difference in ingroup versus outgroup valuations, which is contrary to what one would expect under motivated reasoning. Further, in our *non-social* tasks, manipulating one's own beliefs results in lower payoffs. This feature thus discourages motivated belief distortions, yet subjects' revealed choice patterns indicate higher uncertainty about the outgroup.

6.3 Changing interpersonal uncertainty

Our results so far demonstrate how self-reported interpersonal uncertainty tracks and predicts prosocial decisions *across* different recipients *within* the same decision situation. Next, we assess whether it also predicts changes in behavior across behavioral interventions, focusing on two prominent interventions: the *identifiable victim effect* and the *contact effect*.

The identifiable victim effect describes the increase in giving when information about a specific, identified individual is provided, compared to general information about a large group (see Lee and Feeley, 2016, for a meta-analysis). The contact effect describes the empirical finding that individuals exhibit greater prosocial behavior towards others after engaging in some form of social interaction (see Clochard, 2024; Lowe, 2025, for recent meta-analyses).

We hypothesize that identifiable victim interventions reduce interpersonal uncertainty by providing concrete details about an individual, making their needs and circumstances easier to imagine with greater confidence. Similarly, social interactions in contact interventions offers firsthand insights into others' life and experiences, directly reducing uncertainty about their preferences and circumstances. This, coupled with our main hypothesis that lower interpersonal uncertainty leads to higher prosocial actions, immediately predicts how these behavioral interventions would shape behavior. In our subsequent experiment, we will test whether self-reported interpersonal uncertainty predicts the effects of these interventions on prosocial behavior; if the data confirm our expectations, it would suggest that part of their effectiveness stems from reducing uncertainty. More broadly, this would point to a new mechanism—interpersonal uncertainty—that helps explain the malleability of prosocial behavior under different interventions.

Design. Each of the two interventions–contact and identifiable victim–features two conditions, a treatment and a control condition. In the two *Contact* conditions, subjects are matched with another individual. In the *Contact control* condition, subjects then play a dictator game, allocating $100 between themselves and their matched individual. In *Contact treatment*, subjects interact with their matched individual prior to allocating the money. Specifically, subjects are given five ice-breaker-type questions (Example: “What’s a memorable experience that has shaped who you are today?”). They choose three questions to answer, and their responses are shared with their matched individual. In turn, the matched individual’s answers to the same questions are shown to the subject. This procedure simulates contact through a conversational exchange.

In the two identifiable victim (IV) conditions, subjects allocate $100 between themselves and recipients living in Malawi through a donation to the charity GiveDirectly. In both the control and treatment conditions, subjects first receive a general introduction about the charity and Malawi. In the *IV control* condition, they then receive some general information about the recipients in Malawi. In *IV treatment*, they receive similar informational content but through the first-hand account from a specific, identified Malawi recipient who shared their story on the GiveDirectly website.

In each condition, we elicit subjects’ interpersonal uncertainty after their allocation decision. Specifically, in the contact condition we elicit interpersonal uncertainty about their matched partner and in the identifiable victim conditions about the recipients in Malawi. In total, 602 subjects participated in the experiment, 149 each in *Contact treatment* and *Contact control*, and 152 each in *IV treatment* and *IV control*.

Results. First, we replicate the effectiveness of the interventions on increasing prosocial behavior. While subjects in *Contact control* allocate $69.04 to themselves, in *Contact treatment* giving to self decreases to $53.48 ($p < 0.001$, two-sample Wilcoxon test). In *IV control*, subjects allocate $56.70 to themselves, which decreases to $48.74 in *IV treatment* ($p = 0.046$, two-sample Wilcoxon test).

Importantly, we find that both interventions also significantly influence perceived interpersonal uncertainty. Average interpersonal uncertainty about the matched partner in contact control is 3.22 Likert points, which decreases to 2.68 in contact treatment ($p = 0.034$, two-sample Wilcoxon test). Similarly, while average uncertainty about the recipients in *IV control* is 3.14, it decreases to 1.97 in *IV treatment* ($p < 0.001$, two-sample Wilcoxon test). Moreover, our measure of interpersonal uncertainty predicts the extent of self-favoritism in both instances, as displayed in Figure 5, Panels C and D (identifiable victim: $r = 0.37$, $p < 0.001$, contact: $r = 0.33$, $p < 0.001$).

In summary, both interventions not only increase giving but also significantly decrease perceived uncertainty, providing insight into how these interventions may promote prosocial behavior by reducing interpersonal uncertainty.

7 Conclusion

In this paper, we provide a conceptual framework and implement a series of experiments documenting how interpersonal uncertainty bolsters ingroup favoritism, weakens altruistic giving, and shapes redistributive behavior. We show that a significant degree of heterogeneity in prosocial behavior, both within a given decision setting and between different settings, is driven by people's differential response to interpersonal uncertainty. As a consequence, precise identification of social preferences from prosocial behavior requires explicit accounting for interpersonal uncertainty. Otherwise, depending on the nature of interpersonal uncertainty, parameters of social preferences may be over- or underestimated. We also demonstrate an experimental design to disentangle uncertainty from preferences: a researcher can exogenously vary interpersonal uncertainty to explicitly measure and control for it. For instance, in our experiment, we provide subjects with information so that interpersonal uncertainty switches between recipients, or is balanced among recipients.

Finally, our framework supports the idea that prosocial behavior is malleable. Under the assumption of "exposure reduces interpersonal uncertainty", it helps explain the dynamics of prosocial behavior in response to intergroup contact created by spatial proximity (Bursztyn et al., 2024), shared classes (Rao, 2019), shared living (Corno et al., 2022), sports events (Mousa, 2020; Lowe, 2021) and attending youth camps (Ghosh et al., 2024). Indeed, we provide evidence that a stylized contact intervention not only increases prosocial behavior, but also decreases interpersonal uncertainty. Similarly, our conceptual framework and results vindicate how people's degree of favoritism towards specific groups varies based on their closeness (Fong and Luttmer, 2009), salience of shared experiences (McLeish and Oxoby, 2011), or (perceived) similarity (Goeree et al., 2010) to ingroup members. Overall, our results suggest that targeting and reducing interpersonal uncertainty could foster prosocial behavior, bridge animosities, and decrease intergroup conflict.

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Appendix: Proofs

Proof of Theorem 1. For simplicity, whenever possible we will write $E_{v_i \sim f_i}$ simply as E_{f_i}. From the utility expression, we get

$$\begin{aligned}\frac{d}{dx}EU(x) &= E_{f_1,f_2}\left((v_1-v_2)U'\left(v_1x+v_2(100-x)\right)\right)\\ \frac{d^2}{dx^2}EU(x) &= E_{f_1,f_2}\left((v_1-v_2)^2U''\left(v_1x+v_2(100-x)\right)\right)<0\end{aligned}$$

as $U''<0$ and $f_1, f_2 \geq 0$. $\frac{d^2}{dx^2}EU(x)$ being strictly positive implies that $\frac{d}{dx}EU(x)=0$ must be obtained at a unique point. Evaluating the first derivative at $x=50$, we get

$$\frac{d}{dx}EU(x)|_{x=50} = E_{f_1,f_2}(v_1-v_2)U'\left(50v_1+50v_2\right) \tag{2}$$

(i) When f_1 and f_2 are identical, then we can also rewrite

$$\begin{aligned}\frac{d}{dx}EU(x) &= E_{v_1\sim f_2}E_{v_2\sim f_1}(v_1-v_2)U'\left(v_1x+v_2(100-x)\right)\\ &= E_{v_2\sim f_2}E_{v_1\sim f_1}(v_2-v_1)U'\left(v_2x+v_1(100-x)\right)\\ &= E_{f_1,f_2}(v_2-v_1)U'\left(v_2x+v_1(100-x)\right)\end{aligned}$$

where the first step integrates v_1 over f_2 and v_2 over f_1 instead, the second step interchanges the names of variables (v_1 and v_2) of integration. The last step interchanges the order of integration. Evaluating the final expression at $x=50$, we get

$$\frac{d}{dx}EU(x)|_{x=50} = E_{f_1,f_2}(v_2-v_1)U'\left(50v_1+50v_2\right) \tag{3}$$

Equations 2 and 3 together imply $\frac{d}{dx}EU(x)|_{x=50} = -\frac{d}{dx}EU(x)|_{x=50} = 0$.

(ii) When f_2 is a mean-preserving spread of f_1, then there exists a random variable $z \sim f_z$ with zero expectation conditional on any given value of v_1, such that v_2 has the same distribution as v_1+z, or in other words, $v_2 =^d v_1+z$. Therefore, we can replace v_2 by a variable w_1+z where w_1 and v_1 both have identical distribution f_1.

$$\frac{d}{dx}EU(x) = E_{v_1\sim f_1}E_{w_1\sim f_1}E_{z|v_1,w_1}(v_1-w_1-z)U'\left(v_1x+(w_1+z)(100-x)\right) \tag{4}$$

$$\frac{d}{dx}EU(x)|_{x=50} = E_{f_1}E_{f_1}E_{z|v_1,w_1}(v_1-w_1-z)U'\left(50v_1+50w_1+50z\right) \tag{5}$$

Because $E_{f_1}E_{f_1}$ is integrating with respect to two identical independent distributions, we can interchange their variable names (w_1 and v_1) in Equation 5:

$$\frac{d}{dx}EU(x)|_{x=50} = E_{f_1,f_1}E_{z|v_1,w_1}(w_1-v_1-z)U'\left(50v_1+50w_1+50z\right) \tag{6}$$

Adding equations 5 and 6, and then using law of iterated expectations:

$$\begin{aligned}
2\frac{d}{dx}EU(x)|_{x=50} &= -E_{f_1,f_1}\left(E_{z|v_1,w_1}2zU'\left(50v_1+50w_1+50z\right)\right)\\
&> -E_{f_1,f_1}\left(E_{z|v_1,w_1}2zU'\left(50v_1+50w_1\right)\right)\\
&= -E_{f_1,f_1}U'\left(50v_1+50w_1\right)\left(E_{z|v_1,w_1}2zf_z(z|v_1)dz\right)\\
&= 0
\end{aligned}$$

The inequality uses the fact: $zU'\left(50v_1+50w_1+50z\right) < zU'\left(50v_1+50w_1\right)$ for both $z>0$ and $z<0$. The last step follows from the fact that $E_{z|v_1,w_1}z=0$. Therefore, $\frac{d}{dx}EU(x)|_{x=50} > 0$, and thus, the optimal allocation $x^* > 50$. Next,

$$\begin{aligned}
\frac{d}{dx}EU(x)|_{x=100} &= E_{f_1}E_{f_1}E_{z|v_1,w_1}(v_1-w_1-z)U'\left(100v_1\right)\\
&= E_{f_1}E_{f_1}U'\left(100v_1\right)E_{z|v_1,w_1}(v_1-w_1-z)\\
&= E_{f_1}E_{f_1}U'\left(100v_1\right)\left(v_1-w_1\right)\\
&= E_{f_1}E_{f_1}U'\left(100w_1\right)\left(w_1-v_1\right)\\
&= \frac{1}{2}E_{f_1}E_{f_1}[U'\left(100w_1\right)\left(w_1-v_1\right)+U'\left(100v_1\right)\left(v_1-w_1\right)]\\
&= \frac{1}{2}E_{f_1}E_{f_1}(U'(100w_1)-U'(100v_1))(w_1-v_1)\\
&< 0
\end{aligned}$$

Step 1 replaces $x=100$ into the expression of $\frac{d}{dx}EU(x)$ derived at the beginning of the proof. Step 2 uses that $U'\left(100v_1\right)$ is independent of z. Step 3 uses $E_{z|v_1,w_1}z=0$. Step 4 uses the property that v_1, w_1 are drawn i.i.d from f_1, and hence those two variable names can be interchanged. Step 5 uses the average of the two expressions from the previous lines. The last step uses the property that U' is decreasing.

As $\frac{d}{dx}EU(x)|_{x=100} < 0$, the concavity of the expression implies that $\frac{d}{dx}EU(x)=0$ must be obtained at some $50<x<100$.

(iii) The first derivative of the objective function, evaluated at x^*, should be zero.

$$E_{f_1,f_2}(v_1-v_2-c)U'(x^*v_1+(100-x^*)(v_2+c))=0 \tag{7}$$

First, taking the implicit derivative of the last equation w.r.t c, and then re-arranging:

$$E_{f_1,f_2}[-U'+(v_1-v_2-c)^2\frac{dx^*}{dc}U''+(v_1-v_2-c)(100-x^*)U'']=0$$

Next, we re-arrange and then bound $\frac{dx^*}{dc}$ in 6 steps as explained below. Under CARA,

$$\begin{aligned}
\frac{dx^*}{dc} &= \frac{E_{f_1,f_2} - U'}{-E_{f_1,f_2}(v_1+c-v_2)^2U''} + \frac{E_{f_1,f_2}(v_1-v_2-c)(100-x^*)U''}{-E_{f_1,f_2}(v_1+c-v_2)^2U''} \\
&= \frac{E_{f_1,f_2}{-U'}}{-E_{f_1,f_2}(v_1+c-v_2)^2U''} + \frac{E_{f_1,f_2}(v_1-v_2-c)(100-x^*)\times\frac{U''_{100}}{U'_{100}}U'}{-E_{f_1,f_2}(v_1+c-v_2)^2U''} \\
&= \frac{E_{f_1,f_2}{-U'}}{-E_{f_1,f_2}(v_1+c-v_2)^2U''} + \frac{(U''_{100})(100-x^*)}{U'_{100}}\frac{E_{f_1,f_2}(v_1-v_2-c)U'}{-E_{f_1,f_2}(v_1+c-v_2)^2U''} \\
&= \frac{E_{f_1,f_2}{-U'}}{-E_{f_1,f_2}(v_1+c-v_2)^2U''} + \frac{(U''_{100})(100-x^*)}{U'_{100}} \times \frac{0}{-E_{f_1,f_2}(v_1+c-v_2)^2U''} < 0
\end{aligned}$$

The second step utilizes the assumption of constant absolute risk aversion: $\frac{U''}{U'} = \frac{U''_{100}}{U'_{100}}$, and hence, $U'' = \frac{U''_{100}}{U'_{100}}U'$. The third step simply reorganizes the numerator in the second additive term. The fourth step uses equation 7 to set $E_{f_1,f_2}(v_1-v_2-c)U'$ to zero. The last step uses $U' > 0, U'' < 0$.

Under CRRA preferences,

$$\begin{aligned}
\frac{dx^*}{dc} &= \frac{E_{f_1,f_2}[-U' + (v_1-v_2-c)(100-x^*)U'']}{-E_{f_1,f_2}(v_1+c-v_2)^2U''} \\
&= \frac{E_{f_1,f_2}[-U' - (x^*v_1 + (100-x)(v_2+c))U'' + 100v_1U'']}{-E_{f_1,f_2}(v_1+c-v_2)^2U''} \\
&= \frac{E_{f_1,f_2}[-U' + rU' + 100v_1U'']}{-E_{f_1,f_2}(v_1+c-v_2)^2U''} \\
&= \frac{E_{f_1,f_2}[-(1-r)U' + 100v_1U'']}{-E_{f_1,f_2}(v_1+c-v_2)^2U''}
\end{aligned}$$

The third step utilizes $r < 1$. In the last expression, the numerator is negative as $r < 1, v_1 \geq 0, U'' < 0$ and the denominator is positive, which concludes the proof. □

ONLINE APPENDIX

A Additional tables

Table A.1: The influence of changes in interpersonal uncertainty on ingroup favoritism

	Dependent variable: Allocation to ingroup					
	Both groups pooled		Political views		Hobbies/interests	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant (Ingroup pref.)	0.666^{***}	0.741^{***}	0.964^{***}	0.898^{***}	0.367^{***}	0.584^{***}
	(0.104)	(0.132)	(0.140)	(0.186)	(0.101)	(0.130)
Interpersonal unc.	0.742^{***}		0.720^{***}		0.764^{***}	
	(0.115)		(0.121)		(0.127)	
Higher unc. ingroup		-0.856^{***}		-0.622^{***}		-1.090^{***}
		(0.144)		(0.178)		(0.178)
Higher unc. outgroup		0.629^{***}		0.819^{***}		0.438^{***}
		(0.135)		(0.187)		(0.154)
Subjects	120	120	120	120	120	120
Observations	720	720	360	360	360	360
R^2	0.095	0.096	0.080	0.081	0.121	0.129

Notes: The table shows OLS estimates. The dependent variable is the amount allocated to the ingroup (out of $10), subtracted by five. "Interpersonal uncertainty" is equal to 1, 0, or -1 when the decision has *High uncertainty on ingroup members*, *Group information without uncertainty*, and *High uncertainty on outgroup members* respectively. "Higher uncertainty ingroup" is equal to 1 when the decision has *High uncertainty on ingroup members* (*High uncertainty on outgroup members*) and zero otherwise. In columns (1) and (2), decisions are pooled across both social groups (political views and hobbies/interests) that define the ingroup and outgroup. In columns (3) and (4), only decisions involving groups based on political views are considered, while in columns (5) and (6) only decisions involving groups based on hobbies/interests are considered. Standard errors (in parentheses) are clustered at the subject level. Significance levels: $^{*}p<0.1$, $^{**}p<0.05$ and $^{***}p<0.01$.

Table A.2: Structural estimation results (Section 3.2.3)

	Main model (1)
γ	0.374***
	(0.016)
b	0.741***
	(0.121)
σ	1.881***
	(0.046)
a_{IU}	0.739***
	(0.152)
a_{ING}	0.336**
	(0.133)
LL	-1718
Akaike's IC	3445
Bayesian IC	3469

Notes: γ*,* b*, and* σ *are the CRRA parameter, measure of ingroup preferences, and the standard deviation of the noise term* ε *respectively.* a_{IU} *and* a_{ING} *quantify the importance of interpersonal uncertainty (IU) and ingroup preferences on the optimal allocation choice when both factors are present. See Section 3.2.3 for details. "LL" denotes the maximized Log-Likelihood, "Akaike's IC" is the Akaike's information criterion and "Bayesian IC" the Bayesian information criterion. Significance levels:* **p<0.1,* ***p<0.05 and* ****p<0.01.*

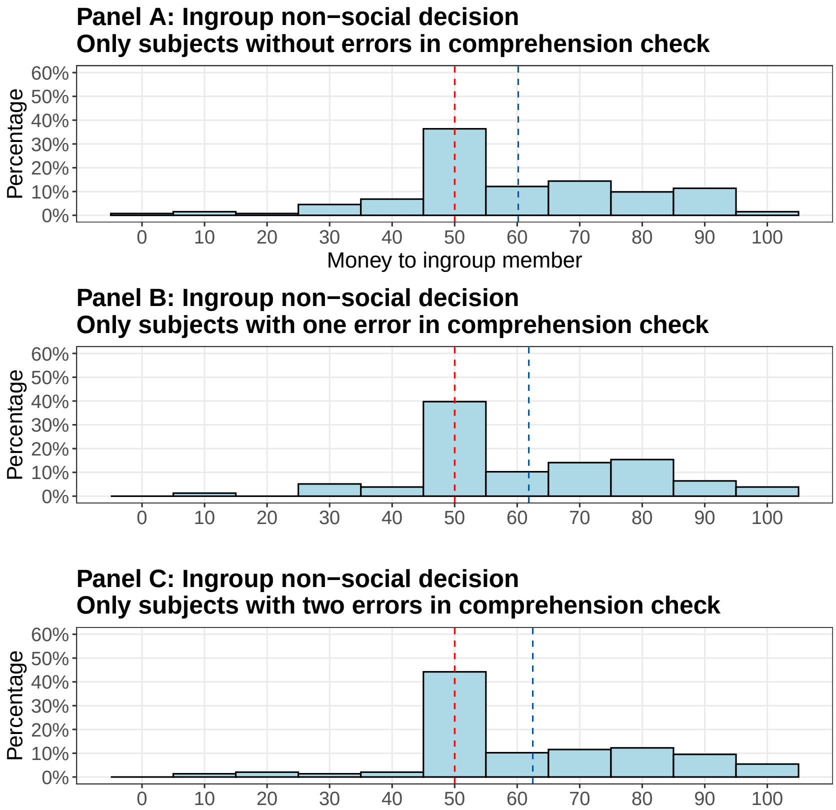
Table A.3: Dictator game allocations under giving setting versus taking setting

	Dependent variable: Allocation to self	
	Social decision	*Non-social decision*
	(1)	(2)
Constant (Giving setting)	68.050***	66.193***
	(2.719)	(2.634)
Taking setting	−27.481***	−12.077***
	(3.529)	(3.114)
Order: *social* decision first	−0.001	2.046
	(3.545)	(3.114)
Observations	243	243
R^2	0.201	0.061

Notes: The table shows OLS estimates. The dependent variable is the amount subjects allocate to themselves (out of $100) in the *Self social* (1) and *Self non-social* decision (2). "Taking setting" is an indicator equal to one if the decision means taking earned money away. "Order: *social* decision first" is an indicator equal to one if subjects faced the *social* before the *non-social* decision. Robust standard errors in parentheses. Significance levels: *p<0.1, **p<0.05 and ***p<0.01.

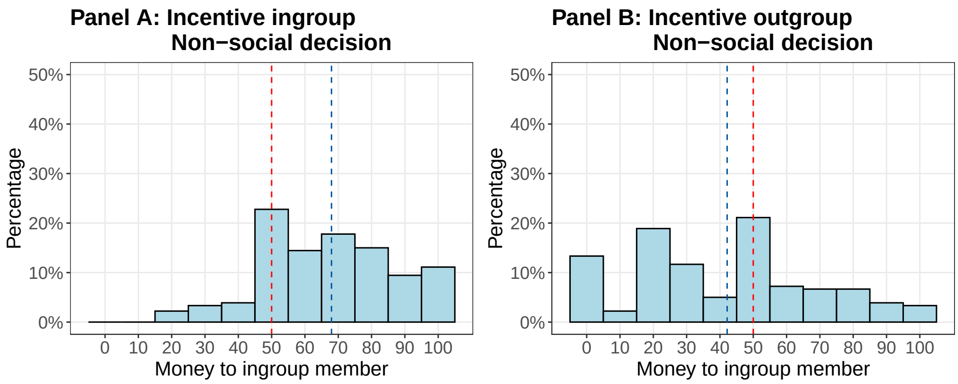
B Additional figures

Figure B.1: Incentive ingroup and Incentive outgroup robustness treatment results



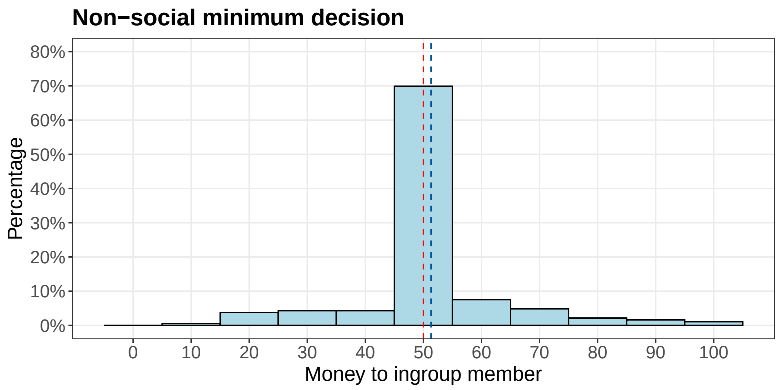
Notes: Histogram of *Ingroup non-social* decisions. The x-axis denotes the amount of money (out of $100) allocated to the ingroup member instead of the outgroup member. The red line denotes the even split, the blue line the average allocation. The decisions have consequences only for the decision-makers, with their payoff depending on the ingroup and outgroup member's valuation of money. In all panels, the binwidth is 10. Decisions are pooled across the three groups (shared hobbies/interests, political views, and religious beliefs).

Figure B.2: Incentive ingroup and Incentive outgroup robustness treatment results



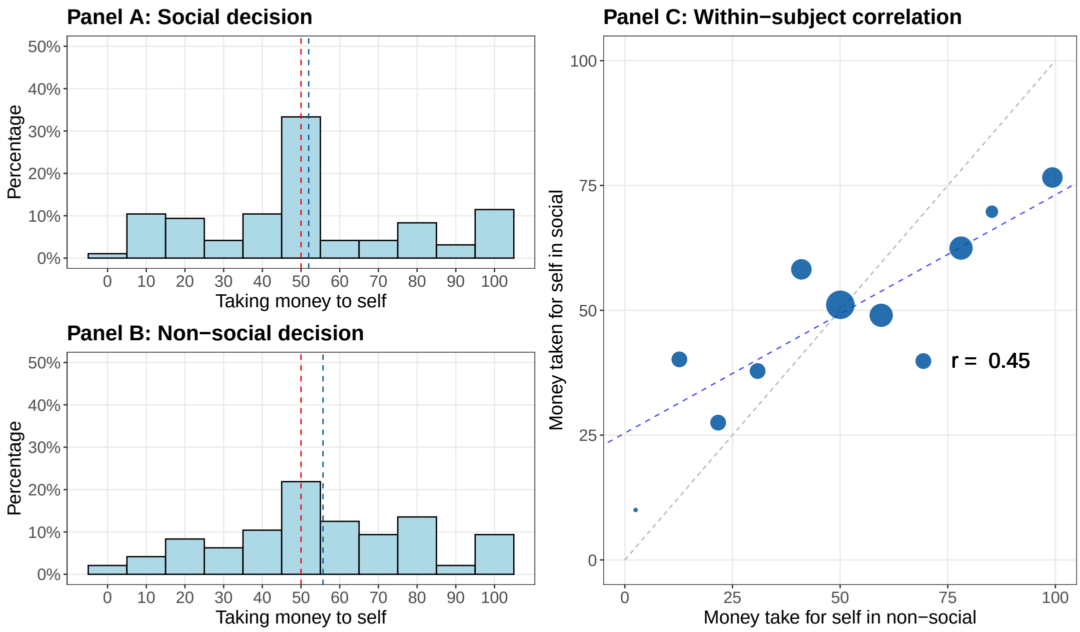
Notes: **Panel A and B:** Histogram of *Incentive ingroup* (Panel A) and *Incentive outgroup* (Panel B) decisions. The x-axis denotes the amount of gift card money (out of $100) that subjects allocate to the ingroup member instead of the outgroup member. Subjects incentive is to maximize the weighted sum of the in- and outgroup members WTP. In Panel A, the ingroup receives three times the weight, in Panel B, the outgroup receives three times the weight. The red dotted line denotes the even split benchmark, the blue dotted line the average allocation. For both panels, the binwidth is 10. Decisions are pooled across the three groups (shared hobbies/interests, political views, and religious beliefs), each panel thus displays $n = 180$ decisions by 60 subjects.

Figure B.3: *Non-social minimum* robustness treatment results



Notes: Histogram of *Non-social minimum* decisions. The x-axis denotes the amount of gift card money (out of $100) that subjects allocate to the ingroup member instead of the outgroup member. Subjects incentive is to maximize the minimum of the in- and outgroup member's WTP weighted with subjects' allocation. The red dotted line denotes the even split benchmark, the blue dotted line the average allocation. For both panels, the binwidth is 10. Decisions are pooled across the three groups (shared hobbies/interests, political views, and religious beliefs), each panel thus displays $n = 186$ decisions by 62 subjects.

Figure B.4: Giving versus taking results excluding non-takers



Notes: See Figure 4 for details on the variables. Compared to Figure 4, we excluded subjects that take nothing from the other individual in *Taking social*. Thus, displayed are $n = 96$ decisions by 96 subjects.

C Separate results for the Gift card and Effort environment of the Ingroup paradigm

In Section 3.1.2, we pooled our results across the *Gift card* and *Effort* environment. In this Section, we report the results from both environments separately as was preregistered. This allow us to jointly assess whether (i) our results depend on the medium used for allocations and the valuation task (willingness-to-pay for a gift card versus willingness-to-work for bonus payments) and (ii) whether varying the implementation probability influences choices (paying one per session versus paying one out of every ten subjects).

In the following, we report the results from the *Gift card* environment in the text and supply the results from the *Effort* environment in brackets.

***Ingroup social* decisions.** In the *Ingroup social* decisions, subjects allocate on average \$57.48 (\$58.00), \$71.05 (\$70.03), and \$61.61 (\$59.80) to the ingroup member when they share the same interests/hobbies, the same political views, or the same religious beliefs, respectively. In all cases, we can reject the hypothesis of no ingroup-favoritism ($p < 0.01$, one-sample Wilcoxon tests). In 46% (51%) of the decisions, subjects display ingroup-favoritism by allocating strictly more than 50% to the ingroup. Outgroup-favoritism is found in 8% (3%) of decisions, and in the remaining 46% (45%) of cases, subjects allocate 50/50. In total, 73% (73%) of subjects display ingroup-favoritism in at least one decision.

***Ingroup non-social* decisions.** In both environments, a similar pattern emerges in the *Ingroup non-social* decisions. Here, subjects allocate on average \$56.86 (\$60.02), \$65.02 (\$64.20), and \$60.81 (\$60.17) when splitting in favor of ingroup members sharing the same interests/hobbies, same political views, and same religious beliefs. As before, we find significant ingroup-favoritism in all cases ($p < 0.01$, one-sample Wilcoxon tests). In 61% (54%) of the *Ingroup non-social* decisions, subjects display ingroup-favoritism by allocating strictly more than 50% to the ingroup. Outgroup-favoritism is found in 11% (9%) of decisions, and in the remaining 28% (37%), subjects allocate 50/50.

Comparing *Ingroup social* and *non-social*. We cannot reject that average ingroup allocations are equal between *Ingroup social* and *non-social* decisions in any case at the 5% level, with p-values of $p = 0.59$ ($p = 0.77$) for hobbies/interests, $p = 0.22$ ($p = 0.06$) for political views, and $p = 0.38$ ($p = 0.68$) for religious beliefs using unpaired Wilcoxon tests.

Within-subject comparison. We also find no substantial difference in the within-subject relationship of *Ingroup social* and *non-social* between the *Gift card* and *Effort* environment. The correlation is highly significant in both cases, with a correlation coefficient of $r = 0.53$ ($r = 0.68$).

Overall, our results are quantitatively very similar across both environments. This suggests that our results are not specific to either the use of gift cards or effort tasks. Moreover, our results are insensitive towards variations in the probability that decisions are implemented with real consequences.

D Rawlsian preferences under interpersonal uncertainty

In Section 2, we showed that utilitarianism generates patterns of prosocial behavior given certain assumptions on interpersonal uncertainty. This raises the question of whether every commonly used welfare criterion delivers similar patterns under the right parameters given our assumptions. Here, we show that Rawlsian preferences – one of the most discussed welfare criterion – are insensitive to interpersonal uncertainty. Under Rawlsian preferences, only the utility of the least well-off recipient matters. In our context, Rawlsian preferences mean the utility individual i receives from allocating x to the ingroup member and $(100-x)$ to the outgroup member is $u_{RAWLS} = \min\{v_1 x, v_2(100-x)\}$. As Theorem 2 shows, a decision-maker will then split the money equally independent of interpersonal uncertainty.

Theorem 2. *Suppose individual i has Rawlsian preferences. Then irrespective of i's risk attitude ($U'' \leq 0$ or $U'' \geq 0$), her optimal allocation is $x^* = 50$, in both the following cases, i) $f_1 = f_2$, and, ii) f_2 is a mean preserving spread of f_1.*

Proof of Theorem 2. As v_1, v_2 are random variables, i's expected utility from allocating x to the outgroup is:

$$EU(x) = E_{v_1 \sim f_1, v_2 \sim f_2} \min\{v_1 x, v_2(100-x)\}$$

For any $x \in [0, 50) \cup (50, 100]$,

$$\min\{v_1(100-x), v_2 x\} + \min\{v_1 x, v_2(100-x)\} \leq v_1(100-x) + v_1 x = 100 v_1$$

with strict inequality whenever $v_1 \neq v_2$.[27]

Similarly, $\min\{v_1(100-x), v_2 x\} + \min\{v_1 x, v_2(100-x)\} \leq 100 v_2$ with strict inequality whenever $v_1 \neq v_2$. Putting these two inequalities together, we get

$$\min\{v_1(100-x), v_2 x\} + \min\{v_1 x, v_2(100-x)\} \quad \leq \quad \min\{100 v_1, 100 v_2\}$$

with strict inequality whenever $v_1 \neq v_2$. Next, using $f_1 = f_2$,

$$\begin{aligned} EU(x) &= E_{v_1 \sim f_1, v_2 \sim f_2} \min\{v_1 x, v_2(100-x)\} \\ &= E_{v_1 \sim f_1, v_2 \sim f_2} \min\{v_1(100-x), v_2 x\} \end{aligned}$$

Therefore, for any $x \in [0, 50) \cup (50, 100]$,

$$\begin{aligned} EU(x) &= \frac{1}{2} \times E_{v_1 \sim f_1, v_2 \sim f_2} \left(\min\{v_1 x, v_2(100-x) + \min\{v_1(100-x), v_2 x\}\right) \\ &< \frac{1}{2} \times E_{v_1 \sim f_1, v_2 \sim f_2} \min\{100 v_1, 100 v_2\} \\ &= E_{v_1 \sim f_1, v_2 \sim f_2} \min\{50 v_1, 50 v_2\} \end{aligned}$$

[27] If $x = 50$, then strict inequality does not hold under $v_1 < v_2$.

The first inequality becomes strict as $v_1 \neq v_2$ with positive probability in the integration. This proves part (i), and a similar proof works for part (ii) after v_2 is replaced with $w_1 + z_1$ like in the proof of Theorem 1.

□

E Within-subject analyses

The results covered in the main text were obtained using a between-subject design, where we only used the first set of decisions each subject faced. In the following, we repeat our analyses using all of the subjects' decisions. In general, our between-subject results replicate well in the within-subject analyses. As in the main text, we pool across the *Gift card* and *Effort* environment.

E.1 Ingroup versus outgroup paradigm main results

***Ingroup social* decisions.** In the within-subject case, subjects allocate on average $58.62 if their ingroup members share the same interests/hobbies, $68.51 if political views are shared, and $60.92 if religious beliefs are shared. In all three cases, we can reject the hypothesis of no ingroup favoritism ($p < 0.001$, one-sample Wilcoxon tests). In 52% of the decisions, subjects display ingroup favoritism by allocating strictly more than 50% to the ingroup. Outgroup favoritism is found in 6% of decisions, and in the remaining 42%, subjects allocate 50/50. In total, 75% of subjects display ingroup favoritism in at least one decision.

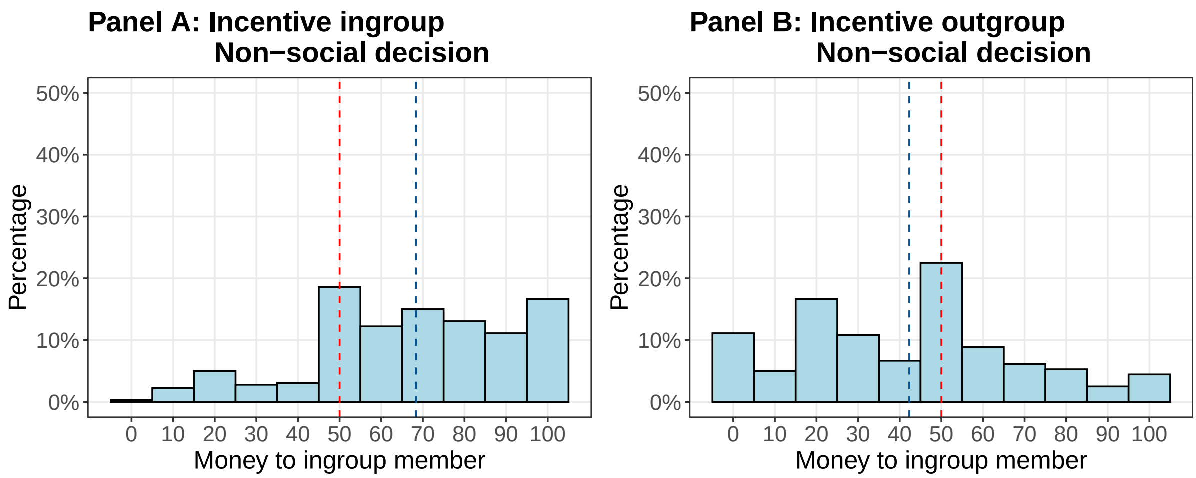
***Ingroup non-social* decisions.** In the *Ingroup non-social* decisions, subjects allocate on average $59.08 to their ingroup members sharing the same interests/hobbies, $63.65 if political views are shared an $60.18 if religious beliefs are shared. Again, we can reject the hypothesis of no ingroup favoritism ($p < 0.001$, one-sample Wilcoxon tests) in all three cases. In 54% of the decisions, subjects display ingroup favoritism by allocating strictly more than 50% to the ingroup. Outgroup favoritism is found in 11% of decisions, and in the remaining 35%, subjects allocate 50/50.

Comparing *Ingroup social* and *non-social*. Comparing average ingroup allocations between *Ingroup social* and *non-social* within-subject reveals that we cannot reject equality in two of the three cases ($p = 0.77$ for hobbies/interests, $p = 0.003$ for political views, $p = 0.92$ for religious beliefs, paired Wilcoxon tests).

E.2 Ingroup versus outgroup setting incentive robustness

Table E.1 displays the treatment of *Outgroup incentive* relative to *Ingroup incentive* effects separately for the within-subject and between-subject effects pooled across the three groups.

Figure E.1: Ingroup incentive within-subject



Notes: See Figure B.2 for details on the variable definitions. Compared to Figure B.2, this Figure displays the results using all decisions from subjects. Each panel thus displays $n = 360$ decisions by 120 subjects.

As displayed, the effect is similar in both the within- and between-subject comparison. Regarding the within-subject effects in the social groups individually, when the ingroup is incentivized, average ingroup allocations increase from $58.47 to $67.22 for hobbies/interests ($p < 0.001$, unpaired Wilcoxon tests), from $64.00 to $72.57 for political views ($p < 0.001$), and from $58.97 to $65.22 for religious beliefs ($p = 0.01$) compared to *Ingroup non-social*. Conversely, in *outgroup incentive*, allocations to the ingroup decrease to $37.76 for hobbies/interests, to $46.89 for politics and to $42.21 for religious beliefs (all three $p < 0.001$). As in the between-subject comparison, we again see outgroup favoritism in the *Outgroup incentive* decisions. The pooled average is $42.29, which is significantly different from the even split ($p < 0.001$, one-sample Wilcoxon test). See Figure E.1 for the distributions, which once again show that the shift in average giving is driven by shifts in the distributions.

E.3 Self versus others setting main results

***Self social* decision.** In the within-subject case of the *Self social* decision, subjects allocate on average $68.05 to themselves, thus displaying significant self-regarding behavior relative to the equal split ($p < 0.001$, one-sample Wilcoxon test). In total, 62% of subjects allocate more money to themselves, 9% allocate more to the other person, and 29% implement the 50/50 split.

***Self non-social* decision.** In the *Self non-social* decision, subjects allocate on average $67.23 to themselves, again displaying significant self-regarding behavior ($p < 0.001$, one-sample Wilcoxon tests). In total, 66% of subjects allocate more money to themselves, 13% allocate more to the other person, and 21% implement the 50/50 split.

Table E.1: Treatment effect of the incentive treatment in the ingroup versus outgroup setting

	Dependent variable:	
	Allocation to ingroup member	
	Within-subject (1)	Between-subject (2)
Outgroup incentive	-26.047^{***}	-25.817^{***}
	(3.163)	(3.547)
Constant (*Ingroup incentive*)	68.333^{***}	67.978^{***}
	(1.937)	(2.083)
Subjects	120	120
Observations	720	360
R^2	0.211	0.231

Notes: The table shows OLS estimates. The dependent variable in columns (1) and (2) is the amount subjects allocate to themselves (out of $100) in the *Ingroup incentive* and *Ingroup incentive* treatments. "Outgroup incentive" is a dummy equal to one if the incentive for the decision gave three times the weight on the outgroup member's WTP, and equal to zero if the incentive gave three times the weight on the ingroup member's WTP. In column (1), all decisions are used, in (2) only the first decisions. Standard errors (in parentheses) are clustered at the subject level. Significance levels: *p<0.1, **p<0.05 and ***p<0.01.

Comparing *Self social* and *non-social*. In the between-subject comparison, we also cannot reject equality of average allocations between *Self social* and *non-social* ($p = 0.69$, paired Wilcoxon tests). Similarly, we cannot reject that the pooled distributions are equal ($p = 0.95$, Kolmogorov-Smirnov test).

F Analyzing order effects

A potential concern for the validity of the within-subject results for the *social* and *non-social* decisions (Appendix E) is contagion across conditions. As subjects facing the first set of decisions were not aware that a second set would follow, this naturally cannot influence our between-subject analysis presented in the main paper that only uses the first set of decisions. However, subjects may adjust their choice in the subsequent *non-social* decisions to mimic the *social* decisions, potentially biasing the individual-level analyses. Such adjustment could lead to artificially high similarity between the two decisions, and thus artificially high correlations. Because we randomized the order of decisions, we can directly assess this concern by testing for order effects. Overall, we find no evidence that the order influences subjects' behavior, as we show in the following in detail.

F.1 Ingroup versus outgroup paradigm

For the *Ingroup non-social* decisions, the pooled average allocations to the ingroup are $61.50 when elicited before, and $60.45 when elicited after the *social* decisions. For hobbies/interests, *Ingroup non-social* the averages are $58.61 and $59.54 ($p = 0.94$, unpaired Wilcoxon test), for political views $64.60 and $62.73 ($p = 0.49$), and for religious beliefs $61.29 and $59.10 ($p = 0.25$). Thus, the averages are invariant to the order. We also cannot reject the null that distributions are invariant to the order ($p = 0.78, p = 0.60, p = 0.39$, Kolmogorov-Smirnov tests). Moving to the *Ingroup social* decisions, average allocations are $63.05 when *Ingroup social* is elicited first, and $62.31 when elicited after the *non-social* decisions. Again, decisions generally do not differ substantially. For hobbies/interests *Ingroup social* the averages are $57.75 and $59.50 ($p = 0.04$, unpaired Wilcoxon test), for political views $70.66 and $66.32 ($p = 0.26$), and for religious beliefs $60.73 and $61.12 ($p = 0.21$).

F.2 Self versus other paradigm

In the case of the *Self non-social* decisions, subjects allocate $64.12 to themselves when the decision is before the *Self social* decision, and $70.25 when the decision comes afterward, an insignificant difference ($p = 0.12$, unpaired Wilcoxon test). In the case of the *Self social* decisions, subjects allocate $69.05 to themselves when the decision is before the *Self non-social* decision, and $67.02 when the decision comes afterward, again an insignificant difference ($p = 0.61$). In addition, we can reject the null that the distributions are invariant to the order at the 5% level for *Self non-social* ($p = 0.08$ Kolmogorov-Smirnov tests) and at any conventional level for *Self social* ($p = 0.54$ Kolmogorov-Smirnov tests).

F.3 Giving versus taking paradigm

In the case of the *Taking non-social* decisions, subjects allocate $56.00 to themselves when the decision is before the *Taking social* decision, and $54.05 when the decision comes afterward, an insignificant difference ($p = 0.49$, unpaired Wilcoxon test). In the case of the *Taking social* decisions, subjects allocate $39.52 to themselves when the decision is before the *Taking non-social* decision, and $41.51 when the decision comes afterward, again an insignificant difference ($p = 0.52$). In addition, we cannot reject the null that the distributions are invariant to the order both for *Taking non-social* ($p = 0.45$ Kolmogorov-Smirnov tests) and *Taking social* ($p = 0.73$ Kolmogorov-Smirnov tests).

G Further details on the robustness treatments of Section 3.1.3

This section provides more details on the results of the robustness treatments that are described in Section 3.1.3.

We start with the between-subject comparison of *Outgroup incentive* versus *Ingroup incentive* by focusing on behavior in the first-assigned choices. We find that subjects respond to changes in the induced utilitarian incentives: Compared to an average ingroup giving of $60.89 across our social groups in *Ingroup non-social* (Section 3.1.2), subjects give on average $42.16 to the ingroup member in *Outgroup incentive* and $67.98 in *Ingroup incentive*, a significant difference (both comparisons $p < 0.001$, unpaired Wilcoxon test). In particular, behavior switches to outgroup favoritism in *Outgroup incentive*, as the average is significantly smaller than the even split ($p < 0.001$, one-sample Wilcoxon test). Regarding the distributions, 54% of subjects in *Outgroup incentive* and 10% in *Ingroup incentive displaying outgroup favoritism*, while 33% and 72% display ingroup favoritism, respectively (see Appendix Figure B.2 for the corresponding histograms). This significant shift in the distributions (p < 0.01, Kolmogorov-Smirnov test) shows that the changes in the averages are not driven by a minority of subjects, but a substantial fraction.

A within-subject analysis reveals that subjects change their behavior in 81% of decisions following the incentive change between the two treatments. Accordingly, in 19% of decisions are subjects unresponsive to changes in the incentives, indicating inattention or confusion. Comparing the behavior in these situations to the main experiment's *Ingroup social*, both average ingroup giving ($60.84 compared to $63.38) and the fraction of choices displaying ingroup favoritism (34% of decisions compared to 46%) is lower, while 50/50 splits are more frequent (60% to 46%).

Next, we turn to the *Ingroup non-social minimum* treatment. As predicted, we find that favoritism in either direction is eliminated under the Rawlsian incentive. On average, subjects allocate $51.31 to the individual sharing their interests/hobbies, $52.85 to the individual sharing political views and $49.77 to the individual sharing religious beliefs. Hence, the treatment did not only significantly reduce ingroup favoritism relative to *Ingroup non-social* (in all three cases $p < 0.01$, unpaired Wilcoxon tests), but eliminated it altogether, as we can no longer reject that average ingroup giving is different from the 50/50 split ($p = 0.31$, $p = 0.13$ and $p = 0.95$ respectively, one-sample Wilcoxon tests). See Appendix Figure B.3 for the distribution, which further demonstrates that subjects respond strongly to the induced incentives in the expected direction: the percentage of decisions that implement exactly a 50/50 split increases from 32% in *ingroup non-social* to 58% *Ingroup non-social minimum*.

These results provide evidence against limited attention or confusion driving our results of the previous section. Changing a single number in the Utilitarian incentive formula reverses the direction of favoritism from ingroup to outgroup favoritism, while moving to

Rawlsian incentives eliminates any favoritism. Moreover, in those cases where choices indicate inattention or confusion about the incentives, ingroup favoritism is, if anything, less prevalent relative to the main experiment.

H Ingroup information decision

In this section, we discuss the design and results of an additional decision that was added to the end of the *Ingroup uncertainty* treatment described in Section 3.2.1.

Design. After making the seven decisions that exogenously informed subjects which group had ingroup affiliation and/or which group had a higher WTW-variance, subjects made an eighth and final allocation decision. In this decision, they were not given any information that distinguished one group from the other ex-ante. They were only informed that the two groups were different: (i) both recipients of one group (which group was unspecified) shared their hobbies/interests (or shared their political views), while both recipients of the other group did not, and (ii) both recipients of one group (which group was unspecified) had a WTW of 12, while the two recipients of the other group had a WTW of 4 and 22. However, ex-ante, they did not know which group had the ingroup members, or which group had a lower variance in WTW, or if ingroup members had lower/ higher WTW variance.

Subjects then could choose to learn one of the two dimensions along which the groups differed. That is, they could either learn which group contained only ingroup members and which contained only outgroup members, or, they could learn which group had WTW variation and which had not. We balanced the presentation of both pieces of information by randomizing the order in which the information was introduced and displayed for the choice. Which information subjects choose reveals which factors are of primary importance in their decision process.

Results. We find that 81% of subjects choose to learn about the WTW information, and only 19% choose to learn the ingroup-outgroup information. Accordingly, in our setting, subjects prefer receiving information about interpersonal uncertainty over information about social group membership, indicating its relevance for decisions.

Information choice type analysis. We further use subjects' preference towards receiving information about the recipients' WTWs or group affiliations to validate our type categorization that we develop in Section 3.2.3. We compare the fraction of subjects choosing the WTW information instead of the group affiliation information across our four behavioral types. In total, 92% of subjects who respond to uncertainty but display no group preference choose the WTW information. This fraction decreases to 78% for those who respond to uncertainty and reveal a group preference, and decreases further to 50% for those who reveal a group preference but do not respond to uncertainty. Hence, our categorization predicts subjects' information choices in the expected direction.

I Self versus others setting incentive treatment

Design. As in the ingroup case, we vary the incentive subjects face when making the *Self non-social* decisions. In *Self incentive*, the weight on the DM's own WTP is three times as high as the other individuals WTP. The DM's payoff thus becomes:

$$\Pi\left(x_{self}, x_{other}\right) = 3 \cdot x_{self} \cdot WTP_{self}/100 + x_{other} \cdot WTP_{other}/100$$

In *Other incentive* we increase the weight put on the other individual's WTP to be three times as high as the DM's WTP:

$$\Pi\left(x_{self}, x_{other}\right) = x_{self} \cdot WTP_{self}/100 + 3 \cdot x_{other} \cdot WTP_{other}/100$$

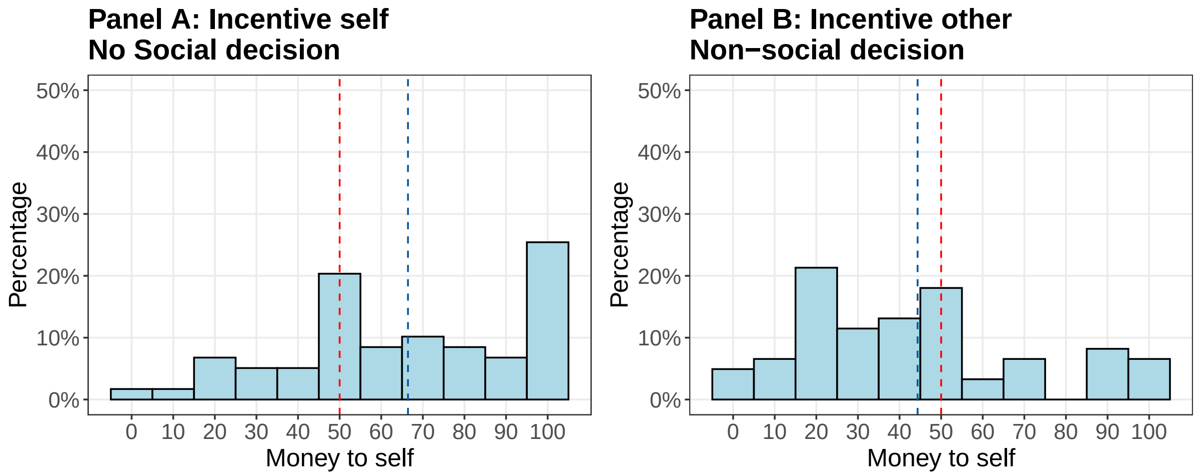
Results. Inducing these incentives changes people's behavior in the *non-social* decision. See Table I.1 for the within-subject and between-subject treatment effect. In both cases lead the change in incentives to a significant change in the amount subjects allocate to themselves, they allocate \$19.50 in the within and \$22.08 in the between-subject comparison less to the themselves when the incentives are higher for the other participant. Figure I.1 displays the distributions in the between-subject case. The fraction of subjects allocating more than 50% of the endowment to themselves increases from 33% in *Other incentive* to 63% in *Self incentive*, while the fraction of subjects allocating more money to the other participant decreases from 50% to 22%. The distributions are significantly different from each other ($p < 0.001$, Kolmogorov-Smirnov test.

Using the within-subject comparison shows that 83% of subjects change their allocation behavior between *Self incentive* and *Other incentive*. Among those 17% subjects that are unresponsive to the incentive change, 33% allocate more to themselves, a substantially lower fraction than the 58% in the main *Self non-social* case. In total, 38% choose the equal split, and 29% allocate more to the other participant. Taking the behavior of these unresponsive subjects as indicative of inattention or confusion, it appears that such factors are associate with subjects allocating less to themselves. This result thus provides suggestive evidence that our replication of significantly more self-giving in *Self social* using the *Self non-social* decisions is not driven by inattentive or confused subjects.

J Validation of the uncertainty measure

Our self-reported interpersonal uncertainty measure is intended to proxy whether subjects perceive higher interpersonal uncertainty of one group over another, as defined in Definition 1 in Section 2. However, it could be the case that subjects instead only report their perception

Figure I.1: Self versus other incentive



Notes: Histogram of *Self incentive* (Panel A) and *Other incentive* (Panel B) decisions. The x-axis denotes the amount of gift card money (out of $100) that subjects allocate to themselves instead of another individual. Subjects incentive is to maximize the weighted sum of their own and another individuals WTP. In Panel A, subjects own WTP receives three times the weight, in Panel B, the other individual's WTP receives three times the weight. The red dotted line denotes the even split benchmark, the blue dotted line the average allocation. For both panels, the binwidth is 10. Only the first decision is used for each subject. Panel A displays $n = 59$ decisions by 59 subjects, Panel B displays $n = 61$ decisions by 61 subjects.

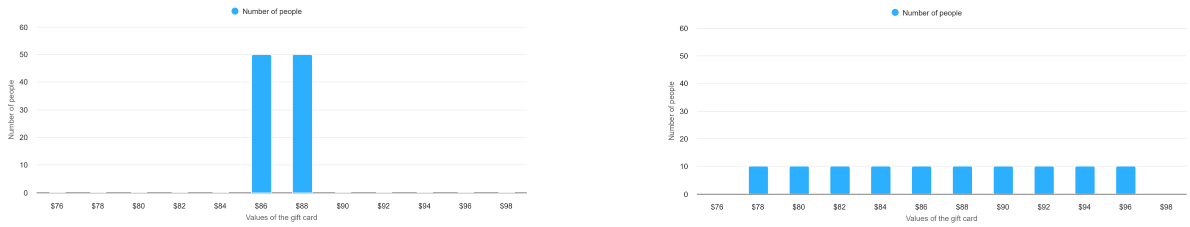
Table I.1: Treatment effect of the incentive treatment in the self versus other setting

	Dependent variable:	
	Allocation to self	
	Within-subject (1)	Between-subject (2)
Other incentive	-19.500^{***}	-22.079^{***}
	(3.468)	(5.045)
Constant (*Self incentive*)	65.625^{***}	66.424^{***}
	(2.563)	(3.592)
Subjects	120	120
Observations	240	120
R^2	0.108	0.140

Notes: The table shows OLS estimates. The dependent variable is the amount subjects allocate to themselves (out of $100) in the *Other incentive* and *Self incentive* treatments. "Other incentive" is an indicator equal to one if the incentive for the decision gave three times the weight on the other person's WTP, and zero if the incentive gave three times the weight on the subject's own WTP. In column (1), all decisions are used, in (2) only the first decisions. Standard errors (in parentheses) are clustered at the subject level. Significance levels: *p<0.1, **p<0.05 and ***p<0.01.

about mean differences or concepts unrelated to uncertainty. In this section, we validate that our measure is indeed sensitive to those changes in interpersonal uncertainty captured by our definition. To do so, we provide subjects with two objective WTP distributions, one being

Figure J.1: Distributions shown to subjects



(a) Distribution with low variance

(b) Distribution with high variance

a mean-preserving spread of the other, and investigate the impact on the answers subjects give to our measure.

Design. At the end of the *Ingroup belief measurement* and *Self/other belief measurement* treatments, we showed subjects two figures. Each figure displayed a frequency distribution of the WTP values of 100 fictitious individuals. In one, 50 individuals had a WTP of \$86 and 50 a WTP of \$88 (low variance distribution). In the other were 10 individuals for each of the 10 values between \$78 and \$96 (high variance distribution). See Figure J.1 for the figures shown to subjects. We also provided these values to subjects in text format below the figures. The high variance distribution is a mean-preserving spread of the low variance one, having the same mean but a lower variance. For each figure, subjects were asked the following about the group displayed in the figure: "Suppose we randomly pick one of the 100 people from this group. How certain are you about how much the randomly chosen person would value the Amazon gift card money?" Subjects could respond on an 11-point Likert scale from *Very uncertain* to *Very certain*, and we re-code the variable so that higher values indicate higher uncertainty. The text and measurement thus closely mirror our self-reported interpersonal uncertainty measure.

Results. We find that subjects report different uncertainty across the two distributions. On average, they report an uncertainty of 3.46 Likert-scale points for the low variance distribution, and an uncertainty of 5.80 points for the high variance distribution, a significant difference ($p < 0.001$, paired Wilcoxon-test). On the individual level, 74% of subjects report a higher uncertainty for the high variance distribution compared to the low variance distribution, 13% report no difference, and the remaining 13% report more uncertainty for the low variance distribution. Thus, subjects are sensitive to changes in WTP distributions in the expected direction.

K Research transparency

All experiments covered in the paper were preregistered at aspredicted.org. The preregistrations include details on the experimental design, the planned sample size, exclusion criteria, hypotheses, and the main analyses. Table K.1 provides an overview over the treatments and links to the respective pre-registrations.

Table K.1: Overview over treatments

Label	N	Covered in	Link to preregistration
Ingroup social & *Ingroup non-social Gift card environment*	119	Section 3	https://aspredicted.org/H81_KQ5
Ingroup effort social & *Ingroup effort non-social Effort environment*	121	Section 3	https://aspredicted.org/53G_PNJ
Ingroup incentive & *Outgroup incentive*	120	Section 3.1.3	https://aspredicted.org/H81_KQ5
Ingroup minimum	62	Section 3.1.3	https://aspredicted.org/J7H_W8R
Ingroup uncertainty	120	Section 3.2	https://aspredicted.org/53G_PNJ
Self social & *Self non-social*	120	Section 4	https://aspredicted.org/ZMF_CD9
Self incentive & *Other incentive*	120	App. Section I	https://aspredicted.org/ZMF_CD9
Self taking social & *Self taking non-social*	123	Section 5	https://aspredicted.org/RT4_TQB
IU belief measurement	120	Sections 5.2, 6	https://aspredicted.org/T7X_747
Contact and *Identifiable victim* interventions	602	Section 6	https://aspredicted.org/37tq-7skc.pdf

Our experimental implementation followed closely the pre-registration. In particular, we implemented the experimental design and sample size exactly as specified in the pre-registration. Similarly, we employed the exclusion criteria as pre-registered: we specified to exclude any subject who did not complete the experiment. This lead to the exclusion of 22 subjects in the *Ingroup social* and *Ingroup non-social* treatments, 28 in the *Ingroup incentive* and *Outgroup incentive*, 6 in the *Ingroup minimum*, 13 in the *Ingroup effort social* and *Ingroup effort non-social*, 15 in *Ingroup uncertainty*, 22 in *Self social* and *Self non-social*, 23 in *Self incentive* and *Other incentive*, 25 in *Self taking social* and *Self taking non-social*, 4 in *IU belief measurement* and 6 in the *Contact* and *Identifiable victim* interventions. The sample sizes reported in Table K.1 are the final sample sizes used in all analyses of the paper after excluding the previously mentioned numbers of subjects.

K.1 Deviations from the pre-registration

The *Gift card* and *Effort* environments of the *Ingroup social* and *Ingroup non-social* treatments were pre-registered separately (the *Effort* environment as a robustness check for the *Gift card* environment). In the main text, we pool both environments together. In Appendix Section C, we report the separate results, as pre-registered. In addition, the pre-registrations for the *Ingroup social* and *Ingroup non-social Gift card* treatments as well as the *Self social* and *Self non-social* treatments contain another set of treatments labeled *Group info* and *Self info*. These treatments are not part of this paper and their results are available upon request because the design is superseded by the *Ingroup uncertainty* experiment.[28] The analyses contained in Section 6.1 were pre-registered as exploratory analyses. The structural model of Section 3.2.3 was not pre-registered.

L Experimental instructions

The instructions of all experiments can be found in the following Open Science Framework (OSF) repository:
https://osf.io/tcp3d/?view_only=27899531990048e4b608d64b13528236

[28]The omitted treatments show that providing subjects with information on the WTP of the recipients significantly changes their allocation behavior both in *Ingroup social* and *Self social*. However, in contrast to the *Ingroup uncertainty* experiment, this information manipulation does not directly manipulate interpersonal uncertainty and is potentially confounded by experimenter demand effects.