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# Accounting for preferences and beliefs in social framing effects

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Past experiments show systematic differences in contributions to public goods under various framing conditions. Several explanations of these differences have been presented. Some suggest that social frames affect subjects' preferences, while others suggest that framing changes subjects' beliefs about others, and thus in turn affects behavior. In this paper, we test the effect of framing on the level of contributions in a series of public goods games designed to separate the impact of preferences from beliefs in shaping cooperative decisions. This is achieved by implementing a social value orientation measure to elicit social preferences from decision makers, which are then analyzed in concert with reported beliefs about others' cooperation and own contribution decisions from the linear public goods games. While we find mixed results on framing effects, our study demonstrates that preferences and beliefs are significant predictors of cooperation. Furthermore, the degree to which they influence cooperation is either strengthened or weakened by framing.

## KEYWORDS

beliefs, cooperation, framing, public goods game, social value orientation (SVO)

## 1. Introduction

Understanding the determinants of cooperation, and especially how the framing of a choice situation can impact the realized cooperation, has been a long-term focus in the experimental social sciences.<sup>1</sup> Numerous studies have examined the impact of framing effects in social dilemmas using various methods, such as manipulating game labels (the focus of this paper), and emphasizing positive or negative externalities associated with contributions made toward public goods (Andreoni, 1995; Cookson, 2000; van Dijk and Wilke, 2000; Khadjavi and Lange, 2015; Isaksen et al., 2019; Martinsson et al., 2019). The evidence from these studies is mixed. For example, while Liberman et al. (2004) find that cooperation is significantly higher when the game is labeled as "Community" instead of "Wall Street" game, this result was confirmed by Ellingsen et al. (2012) and Columbus et al. (2020). However, other studies such as Rege and Telle (2004), Eriksson and Strimling (2014), Engel and Rand (2014), and Tsikas (2018) did not find any significant framing effect. Some studies using comparable labels found effects in the opposite direction (Brandts and Schwieren, 2009; Dufwenberg et al., 2011; De Haan and Van Veldhuizen, 2015). For a more comprehensive

1 The term framing is often, perhaps typically, applied to risky decision contexts contrasting gains and losses (Tversky and Kahneman, 1981). In this paper, we use the term "framing" more broadly to refer to the names or descriptions that are applied to otherwise identical choice situations. This broader usage of the term is consistent with Rabin (1998).

discussion of these studies, Section 2 of this paper provides a comprehensive analysis of the literature on label framing effects in social dilemmas.<sup>2</sup>

These diverse results may be better understood and organized by identifying the relevant drivers of the variability of cooperation induced by different framings. Two dominant conjectures have emerged in the literature. First, some suggest that frames affect preferences (McCusker and Carnevale, 1995; van Dijk and Wilke, 2000; Weber et al., 2004). This would mean that cooperation changes as a result of the preference change. A second conjecture is that frames affect beliefs about others' behavior and thereby change expectations of cooperation. Two studies using label framing in their experiments have suggested this hypothesis (Dufwenberg et al., 2011; Ellingsen et al., 2012). For example, Ellingsen et al. (2012) report results from a simultaneous and sequential prisoner's dilemma game labeled either the "Community" or "Stock Market Game". While beliefs could only be manipulated by frames in the simultaneous game, and social preferences should affect behavior whether decisions are made simultaneously or sequentially, the authors point to the lack of framing effect observed in the sequential game as evidence that frames influence beliefs but not preferences. Consistent with these results, Dreber et al. (2012) find that preferences are robust to superficial labeling in dictator games (while beliefs can play little or no role in this game).

We present an experiment that is designed to be comprehensive and able to differentiate between these potential explanations. Under four different framings, we assess social preferences via the Social Value Orientation (SVO) slider measure method (Murphy et al., 2011), cooperation and beliefs about others' contributions in a one-shot public goods game based on the strategy method (Fischbacher et al., 2001), and cooperation and beliefs in a repeated public goods game with group re-matching. We analyze the effect of framing the social dilemma as a social interaction (Community Game), a market transaction (Wall Street Game), and a human-environmental interaction (Environment Game). The latter was chosen as one natural application of framing is the domain of environmental decision-making, where a low cost framing manipulation could be useful in nudging people toward collectively beneficial choices and pro-environmental behavior. We also introduce a neutrally framed social dilemma, simply called "Game" and use it as a baseline treatment.

The objective of our research is two-fold: to investigate how framing affects cooperative behavior and to pinpoint its origin, whether it stems from preferences or beliefs. The results of our study also have potential important implications for policymakers who seek to promote cooperation and discourage free-riding in different settings, such as in public health to promote vaccinations,

in environmental preservation to adopt pro-environmental habits, and in workplaces to cultivate teamwork and collaboration among employees. By understanding if and how framing could be useful, policymakers could design interventions that effectively leverage this mechanism to promote desired outcomes. For example, if framing effects stem from preferences, identifying intrinsically prosocial individuals and appealing to their values could be a powerful tool for policymakers. On the other hand, if framing effects arise from beliefs, interventions aimed at updating everyone's beliefs could be recommended.

With respect to framing effects, we find that subjects in a repeated public goods game contribute more if set in a Community or positive frame than when participating in a Wall Street or negative frame. Yet, this result does not hold for unconditional contributions, nor did framing influence the pattern of conditional cooperators as elicited by the strategy method.

Analyzing the possible channels driving framing effects, we find that social preferences and beliefs about others contributions are both significant determinants of cooperation in the repeated game, but their relative importance varies substantially by frame. The most striking finding is that the association between social preferences and contributions appears strongest in the Community frame, while it seems that the Wall Street frame led subjects to disregard their social preferences, yielding low predictability of linear models for unconditional contributions and allowing for a steep downturn in contributions observed in the repeated game.

The remainder of the paper is organized as follows. Section 2 gives a brief overview of studies that investigate the effect of label framing on cooperation. Section 3 describes the experimental methods and procedures. Section 4 reports results, and Section 5 concludes with a discussion.

## 2. Literature and research hypotheses

### 2.1. Overview of the literature

Table 1 summarizes papers reporting label framing effects or the absence of such effects in social dilemma games. The table highlights studies that compare a framing intervention to a control (non-framed) condition, which is common practice in meta-analyses. Yet, the most frequent form of comparison in this literature involves two framing conditions, i.e., comparison between a positive frame (Community or Teamwork) and a negative frame (Wall Street, Stock Exchange, Banker, Paying Taxes/Tax Avoidance). Therefore, we also include these studies here. Furthermore, the table indicates whether differences in cooperation were found at the level of 0.1, 1, or 5% and the direction of the effect.

All reported games involve decisions about real money. We also code if the social dilemma took the form of a prisoner's dilemma (PD) game or a multi-player public goods game (PGG), and which group size was used. Furthermore, the sample of papers includes both one-shot and repeated games, and we indicate the number of rounds or iterations (R) (1 or more), and in case of iteration we indicate if a partner or stranger matching design was used (P or S in parentheses). Finally, the table also indicates sample size ( $N$ ).

<sup>2</sup> Furthermore, see Gächter et al. (2009) for a natural field experiment on label framing, Böhm and Theelen (2016) for studying the interaction effect of a positive outcome label and a negative externality frame and Goerg and Walkowitz (2010) studying cross-country differences of framing effects. Besides, framing effects have also been studied in other game forms such as dictator, trust, and bribery games (Burnham et al., 2000; Abbink and Hennig-Schmidt, 2006; Cronk, 2007; Cronk and Wasieleski, 2008; Goerg and Walkowitz, 2010; Alt et al., 2018; Korenok et al., 2018; Chang et al., 2019; Fiedler and Hillenbrand, 2020).

TABLE 1 Summary of experiments on label framing effects.

References	Design	Group	Rounds	N	Comparison	Diff	Sig.	Effect
Samuels and Ross (1993)	PD	2	7(P)	NR	Community:Wall Street	NR*	NR	+
Lieberman et al. (2004)	PD	2	7(P)	48	Community:Wall Street	+34.6	1%	+
Rege and Telle (2004)	PGG	10	1	40	Community:Control	+20.7	MS	+
Brandts and Schwiieren (2009)	PGG	4	1	93	Community:Stock Exchange	-0.5	NR	-
Dufwenberg et al. (2011)	PGG	3	1	117	Community:Control	NR	NS	-
Ellingsen et al. (2012)	PD	2	1	448	Community:Wall Street	+18.5	1%	+
Engel and Rand (2014)	PD	2	1	204	Contribution:Control	NR	NS	+
De Haan and Van Veldhuizen (2015)	PD	2	1	52	Community:Banker	-8.9	NR	-
Eriksson and Strimling (2014)	PGG	4	1	528	Teamwork:Paying Taxes	+8.7	MS	+
Tsikak (2018)	PGG	4	1	95	Tax Avoidance:Control	-2	NS	-
Columbus et al. (2020)	PD	2	1	204	Community:Stock Exchange	+10.7	NR	+

\*The original experiment by Samuels and Ross (1993) is reported in Ross and Ward (1996): "...subjects in the Community Game to cooperate more than twice as much..." (p. 107). NS, not significant. MS, missed significance:  $0.05 \leq p < 0.10$ . NR, not reported. Diff, observed difference in average cooperative choices (in % in PD games) or average contributions (as % of endowment in PGG games).

In summary, the literature provides mixed evidence on label framing effects in social dilemma games. The initial evidence of Samuels and Ross (1993) and Liberman et al. (2004) has also been shown by Ellingsen et al. (2012) and Columbus et al. (2020), while other papers report effects that missed significance (Rege and Telle, 2004; Eriksson and Strimling, 2014). All other studies present null results (Brandts and Schwiieren, 2009; Dufwenberg et al., 2011; Engel and Rand, 2014; Tsikak, 2018). Notably, most studies reporting null results provide a comparison between a control condition and a framing intervention. For a more comprehensive treatment of the issue in our experiment, we decided to include a control group besides the two most common framing treatments (Community and Wall Street) in order to not only examine the effect between framing interventions, but also the effect of the framing intervention in comparison to a control condition.

Furthermore, we see that label framing effects are generally weaker in multi-player public goods games than in simple 2-player prisoner's dilemma games. Yet, the former has only been studied in one-shot interactions, while there is no evidence on what happens as interactions are repeated. However, from other framing studies using positive-negative externality frames, we know that framing effects are strong and pronounced with repetition (Andreoni, 1995; Sonnemans et al., 1998; Willinger and Ziegelmeyer, 1999; Park, 2000; Fujimoto and Park, 2010). For this reason, we investigate label framing in both a one-shot public goods game and a repeated game, where the basic parameters are identical to those in the one-shot condition. The detailed experimental design is presented in Section 3.

## 2.2. Research hypotheses

Here, we provide a brief overview of previous research and use it to develop a series of hypotheses that can be empirically tested in our analysis.

Previous studies that compared the effectiveness of a Community framing with a Wall Street (or Stock Exchange) framing have shown that on average, more contributions are made in the former. All studies that have incorporated a control or neutral condition along with a framing intervention have reported no significant effect. For an overview, see Table 1. On the basis of these findings, we propose the following two hypotheses:

**Hypothesis 1:** The use of a Community framing leads to higher contributions compared to a Wall Street framing.

**Hypothesis 2:** There is no significant difference in contributions between Community, Wall Street and Environment framing, as compared to a Neutral framing.

Beliefs about others' behavior and social preferences are frequently related to cooperation in social dilemmas. For example, research has shown that individuals who believe more in the prosocial behavior of others are more likely to cooperate themselves (Fischbacher and Gächter, 2010). Similarly, individuals with more prosocial social value orientation are also more likely to exhibit cooperative behavior in public goods games (Ackermann and Murphy, 2019). This implies proposing the following hypothesis:

**Hypothesis 3:** Individual contributions in public goods games are positively associated with both beliefs about others' contributions and social preferences.

Furthermore, there exists some research indicating that the effect of beliefs and social preferences on contributions will be moderated by the framing of the game, such that certain types of framing may amplify or attenuate the relationship between these factors and behavior. For instance, De Dreu and McCusker (1997) find that social preferences (SVO) were more predictive (i.e., prosocials cooperated more) when the social dilemma was framed as a public good vs. a resource dilemma.

**Hypothesis 4:** Pro-social types exhibit more cooperation when the game is positively framed as the "Community Game" compared to negative framing as the "Wall Street Game".

### 3. Materials and methods

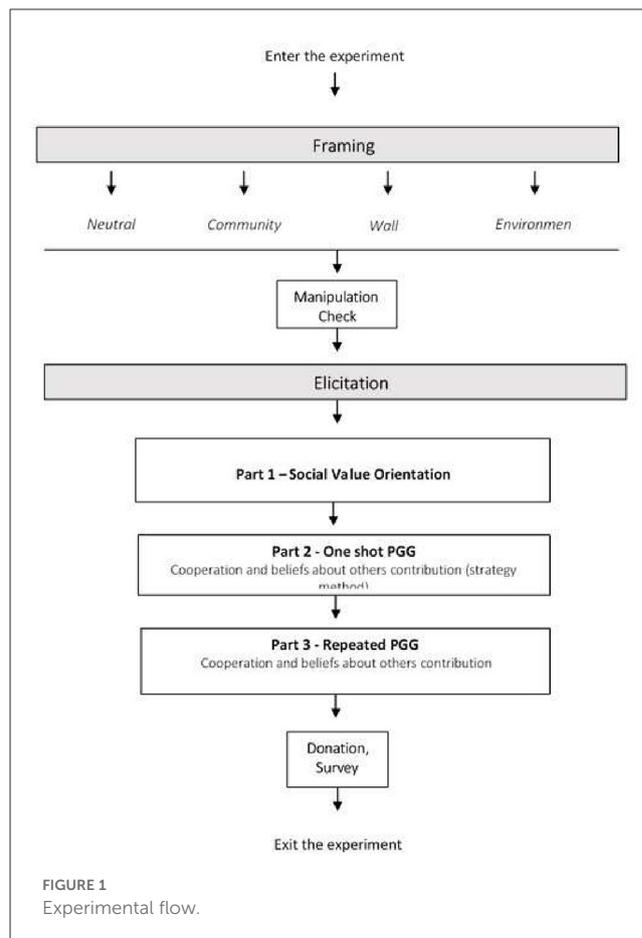
Every experimental session comprises three main components, including a Social Value Orientation (SVO) test to elicit social preferences (Part 1), a one-shot public goods game (PGG) (Part 2), and a repeated PGG (Part 3) to elicit cooperation and beliefs about others' cooperation. The SVO measure provides a standardized, validated and easy-to-administer way of quantifying individual differences in social preferences (Murphy and Ackermann, 2015), while the Public Goods Game provides a standardized method to measure cooperation in a controlled experimental setting. Also, both games allow us to manipulate the social context of the game in order to study framing effects. To ensure comparability with other seminal studies on framing and address contemporary dilemmas on environmental conservation, we conducted four experimental framings: Community and Wall Street, as well as Environment, alongside a Neutral framing for comparison purposes.

In total, 188 subjects participated in the experimental sessions, which were conducted at the ETH Decision Science Laboratory (DeSciL) (in December 2013). In total, we conducted 8 sessions (two sessions per treatment) with a total of 44 participants in Neutral and 48 each in the Community, Wall Street and Environment treatment. The experiment was computerized and controlled via z-Tree and the research was conducted in English (which is a common practice in DeSciL), while participants were screened for language comprehension ability prior to their participation. Ethical clearance was obtained by the DeSciL Lab as precondition for lab usage.<sup>3</sup> It is acknowledged that none of the subjects had participated previously in a public goods experiment. The experimental sessions lasted approximately 2 h and participants earned on average CHF 34 (approximately USD 37) in addition to their CHF 10 (USD 11) show up payment. An example of the experimental instructions for the neutral game can be found in [Supplementary material](#). [Figure 1](#) summarizes the experimental flow.

#### 3.1. General procedures and incentives

The experiment applied a between-subjects design with four framing treatments: Neutral, Community, Wall Street, and Environment. The frame was implemented as the title of the experiment and presented when explaining the decision tasks to the subjects at the beginning of an experimental session. Also, the title of the experiment was displayed on the front page of the instruction sheets, in the heading of every subsection in the instructions, and repeatedly mentioned in the instructions of all sub-parts. To initially verify that subjects had attended to the experimental frame, each subject was required to indicate the "name of the session" on the computer before the decision-making phase of the experiment started. This served as an attention check and a way to verify that subjects had at least a minimal level of awareness of the particular label that was used for the experimental session, and

<sup>3</sup> This study has not been preregistered. We would like to clarify that experiments were conducted in 2014–15, when preregistration was not as common in experimental economics as it is today.



thus may induce framing. Apart from this framing information, the experimental procedure was identical under all four conditions.

The experiment consisted of three main tasks, which were conducted in the following order: a social preference experiment via the SVO slider measure, a one-shot public goods game using the strategy method, and a 10 round repeated public goods game with re-matching (i.e., stranger matching).<sup>4</sup> All choice tasks were incentivized, and it was clearly stated that the different tasks of the experiment were independent of each other. Feedback on earnings and outcomes of each choice task were only provided after completion of the entire experiment, except for the experimental block with the repeated public goods game, in which results from each round were available to players. For that reason, we also did not randomize the order of the SVO and the one-shot game where no outcome information was provided with the repeated game, as feedback provided in this part could have affected tasks taking place afterward.

<sup>4</sup> The experiment also included a donation decision to an environmental charity which took place at the end of each experimental session. Here, participants could choose to transfer a portion of their experimental earnings to a carbon offset project. The results of this donation are not part of the analysis of this paper, but are contained in a separate paper. Briefly, we find that SVO, but not public goods game behavior nor environmental preferences, is the clearly better predictor of real world donations.

## 3.2. Measures

### 3.2.1. Social preferences

Subjects' social preferences were assessed with the SVO slider measure (Murphy et al., 2011) as implemented in terms of a z-Tree module (Crosetto et al., 2012). The measure consists of 15 joint payoff allocation questions yielding a single index of an individual's social preference on a continuous scale spanning competitiveness (i.e., maximizing advantageous inequality), individualism (i.e., narrow self-interest), prosociality (i.e., maximizing efficiency), and altruism (i.e., maximizing the other person's payoff). See [Supplementary Figure 1 in Supplementary material](#) for an example item. Subjects were informed that their choice in one (out of 15) randomly selected item would affect their own payoff, as well as the payoff of some other randomly selected subject, but they were not informed which decision would be paid until the end of the experiment, of course. The self-/other pairings were neither disclosed nor reciprocal, eliminating the opportunity for strategic decision-making by subjects in this task. All this was common knowledge.

### 3.2.2. Public goods games (PGG)

We apply the framework of Fischbacher and Gächter (2010) to observe cooperation preferences and implement both a strategy version of the public goods game and a (subsequent) repeated public goods game in which we also elicit beliefs about other's contributions. While in their original study, Fischbacher and Gächter (2010) tested whether contributions can be explained by cooperation preferences (i.e., some are free-riders while others are conditional cooperators) and/or by subject's beliefs about how others will behave, in our experiment, we also include a separate measure of social preferences (see previous paragraph), which allows us to discern among different explanatory variables in accounting for contributions across different framings.

- Strategy Method-PGG

First, subjects played a standard linear public goods game with belief elicitation and the strategy method (Fischbacher et al., 2001). Each subject was randomly matched with three other subjects to form a group of four and was provided with an endowment of 20 points, of which subjects could then contribute any proportion to a group account. This contribution decision we refer to as the unconditional contribution. The total contribution to the group account was multiplied by 1.6 and the product was distributed evenly among the four group members. During their unconditional contribution decision, subjects were required to report the average amount they believed the other three members of their group would contribute. The elicitation of their beliefs was incentivized using a proper scoring rule.<sup>5</sup>

<sup>5</sup> A proper scoring rule yields incentives to accurately report beliefs (Gächter and Renner, 2010), yet incentives were kept low (i.e., maximum was worth less than half the show-up fee) to avoid hedging (Blanco et al., 2010). Specifically, a correctly reported belief yielded the subject 40 additional points; a belief that deviated by 1 point earned 32 additional points; a deviation by 2 points earned 24 additional points, and zero points otherwise.

After making the unconditional contribution and belief inputs, subjects completed the strategy method in which they indicated their conditional contributions, that is, how much they would contribute given each possible average integer contribution of group members over the interval 0–20 inclusive. This we implemented to assess subject's types (i.e., free rider, conditional contributor, etc.). For payment, we follow the procedure as in the original study of Fischbacher and Gächter (2010). Here, one of the four group members was randomly selected as the conditional contributor whose relevant contribution was the respective entry in from the strategy method, while the unconditional contributions became relevant for the other three group members.

- Repeated-PGG

Second, subjects played 10 rounds of a repeated public goods game with identical characteristics as the previous game (the group size was 4, multiplier was 1.6, each subject received an endowment of 20 points each round). This time, however, the game was repeated for 10 rounds and subjects were randomly re-matched into new groups of four players each round.<sup>6</sup> Besides selecting the number of points they would contribute to the group account in a particular round, participants also indicated the average number of points they believed their other group members would contribute in that round, again as a concurrent and incentivized belief elicitation task. In addition, after each round, subjects received information feedback about their and their group's outcomes in that round.

### 3.2.3. Questionnaire

Finally, subjects completed a short questionnaire with standard sociodemographic questions, an environmental preferences measure, i.e., the New Environmental Paradigm (NEP) by Dunlap (2008),<sup>7</sup> and a free answer question about their impressions of the experiment. Then, they were paid their earnings and excused from the laboratory privately one at a time.

## 4. Results

We start by presenting descriptive results of the social preference measure. Note that out of the 188 subjects in total, ten subjects showed intransitive choice patterns in the SVO Slider Measure, which is an indicator of random responding. However, the following results are robust to the inclusion or exclusion of these subjects,

<sup>6</sup> Please note that in the repeated public goods game with stranger matching, subjects participate in different groups in each period, and thus each session represents an independent observation.

<sup>7</sup> The NEP is frequently used to measure environmental attitudes. It consists of a series of statements that reflect different aspects of environmental attitudes, such as the belief in the importance of protecting the environment and the belief that humans have a responsibility to prevent environmental damage.

so we report the results based on the total sample of 188 subjects.

## 4.1. Social preferences

From a subject's pattern of choices in the SVO slider measure, a continuous score can be computed reflecting the weight the subject attaches to the outcome of the other in relation to his or her own outcome. The score is often represented in terms of an angular degree, such that an angle of  $0^\circ$  corresponds to narrow self-interest and an angle of  $45^\circ$  indicates perfect prosociality, meaning that a decision maker attaches the same weight to the outcome for another person as the decision maker attaches to his or her own outcome, which is isomorphic to a coefficient of 1 in a simple joint utility model (see [Murphy et al., 2011](#); [Murphy and Ackermann, 2015](#) for details). A negative angle indicates spitefulness (i.e., pay to punish), meaning that a person would be willing to pay to decrease the other person's payoff.

[Figure 2](#) presents a violin plot depicting the distributions of the SVO angles. Apart from a statistically significant but small difference in the distribution of social preferences between the Environment and Neutral frames (KS-test,  $p = 0.042$ ; Wilcoxon rank-sum test,  $p = 0.033$ ), no significant differences between treatments were observed. This result indicates that social preferences were largely unaffected by the experimental framing.

## 4.2. Strategy method-PGG

First, we aim to clarify whether framing exerts any effect on behavior and initially focus on a comparison of unconditional

contributions in the unframed treatment (Neutral) vs. the framed treatments (Community, Environment, Wall Street). [Figure 3](#) reports the average level of unconditional contributions between treatments. On average, we observe contributions of around 50–55% of the endowment in all treatments, which is slightly higher than generally reported in the literature (around 40%, see [Kocher et al., 2008](#)). The means and standard deviations of contributions—beliefs are as follows: Neutral: 10.48 (5.98)–10.91 (4.95), Community: 11.19 (7.47)–10.56 (6.16), Environment 11.88 (6.20)–10.79 (5.60), and Wall Street: 11.48 (5.58)–10.98 (5.17). We do not observe statistically significant differences between neutral and framed versions of the public goods game, neither with respect to unconditional contributions nor with respect to beliefs (two-sample Mann–Whitney test). Moreover, we cannot reject the hypothesis that contribution as well as beliefs in the framing treatments are the same at any conventional level. Results of the Mann–Whitney tests are reported in [Table 2](#). While the results obtained align with our second hypothesis, which suggests that framing interventions do not significantly impact (unconditional) contributions in comparison to a neutral condition, the results do not provide support for Hypothesis 1, which proposed that Community framing would result in more contributions than Wall Street framing.

Second, we analyze the patterns of conditional contributions using the information provided by the strategy method, controlling for beliefs about others' contributions. The main advantage of the strategy method is that cooperative preferences are measured independent of subject's beliefs, and therefore, significant differences in conditional contributions across treatments suggest that framing affects (cooperative) preferences rather than beliefs about other's contributions.

[Figure 4](#) shows subjects' average conditional contributions from the strategy method graphically. Overall, we observe a positive average contribution to the public good when others give zero

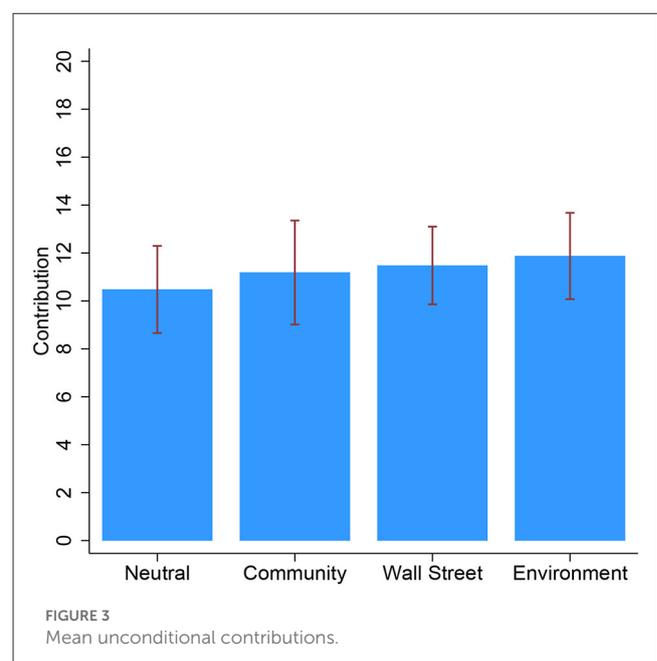
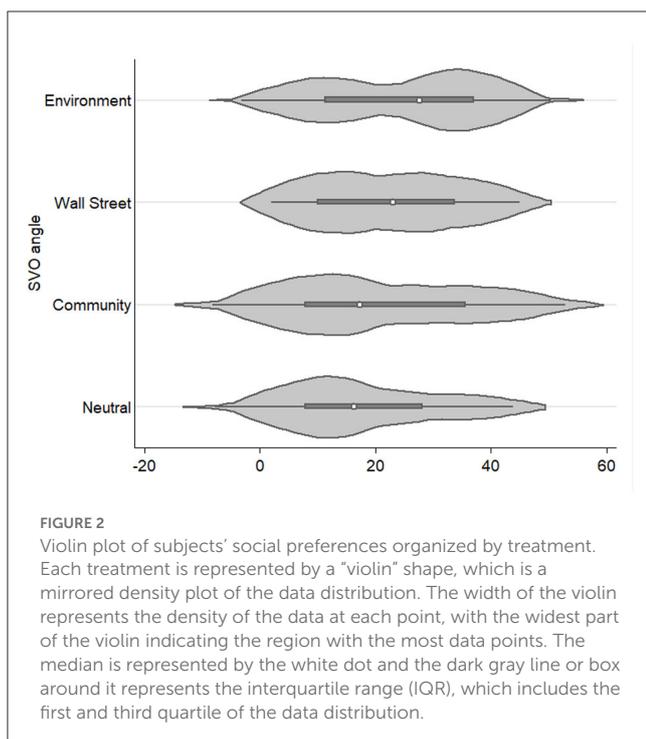
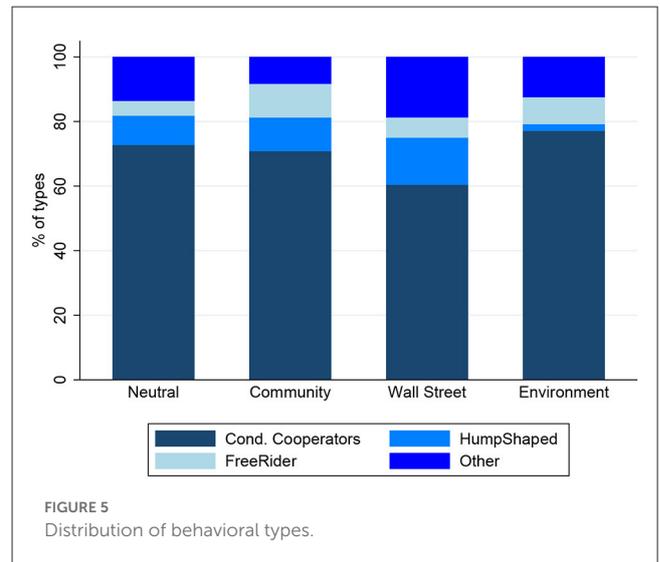
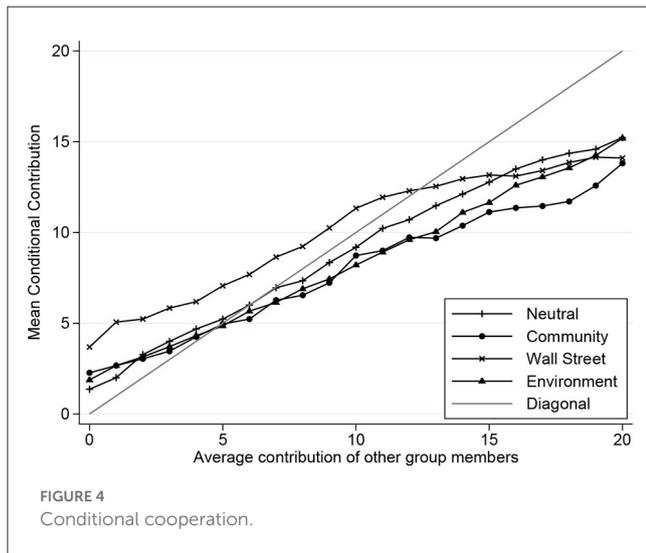


TABLE 2 Mann–Whitney tests (*p*-values) for contributions (beliefs).

	Neutral	Community	Wall street	Environment
Neutral	-	0.731 (0.631)	0.416 (0.219)	0.278 (0.767)
Community		-	0.727 (0.175)	0.595 (0.754)
Wall street			-	0.717 (0.165)



across all framings, indicating strong cooperative tendencies across all treatments. Subjects in the Neutral treatment are closest to the perfectly conditionally cooperative (45°) diagonal line. Interestingly, Wall Street participants conditionally contribute in excess of the contribution matching for others' contribution for levels 0–12 (while those in the other three treatments conditionally contribute less in these fields) and so appear relatively generous compared to the conditional contribution behavior in the other treatments. While we find a significant difference in the opposite direction as hypothesized in Hypothesis 1 when comparing the Community and Wall Street framing treatments ( $p = 0.041$ ) based on the average conditional contribution of each subject, we, however, do not observe any significant differences in comparisons between all other treatments, which supports Hypothesis 2.<sup>8</sup> This finding can be interpreted as an indication that framing can have an effect on individual willingness to conditionally cooperate, even if beliefs about others' contributions are controlled for.

Next, we check whether the same result holds true for the distribution of behavioral types in the subject population. We follow convention (Fischbacher et al., 2001) by categorizing subjects into four types on the basis of their choices in the strategy method: Conditional cooperators, Hump-shaped contributors, Free riders, and Others.<sup>9</sup> The bars in Figure 5 show the frequency of the different behavioral types in all treatments of

the experiment. For more details, see also [Supplementary Table 1](#) in [Supplementary material](#) reporting the exact distribution of types and their average unconditional contribution and belief for each treatment. We see that distribution of types is apparently very similar across treatments, while conditional cooperator represents the modal category, comprising between 60.4 percent (Wall Street) and 77.1 percent (Environment) of the subjects. Using a Pearson Chi-square test, we find that the distribution of types does not differ across treatments [ $\chi^2(9) = 8.5201, p = 0.483$ ]. Please note that while framing did not affect the distribution of behavioral types, this does not contradict differences in conditional contributions (as shown in Figure 4). Subjects may be categorized as the same type, however, they still can have different stated profiles and thus differences in conditional contributions may arise.

To summarize, we find that cooperative preferences in the strategy game are largely unaffected by framing. Observed differences in distribution of types and average unconditional contributions are both small and insignificant.

#### 4.2.1. Relationship between contributions, preferences, and beliefs

To understand whether preferences and beliefs are closely related to contributions, we first consider the correlation between

<sup>8</sup> We use Mann–Whitney Tests. The other corresponding *p*-values are  $p = 0.371$  (Neutral vs. Community),  $p = 0.606$  (Neutral vs. Environment),  $p = 0.442$  (Neutral vs. Wall Street),  $p = 0.743$  (Community vs. Environment),  $p = 0.155$  (Wall Street vs. Environment).

<sup>9</sup> Conditional cooperators are subjects with contributions that have either a significant increasing slope or show a monotonically increasing pattern. Hump-shaped subjects increase their contribution up to a maximum and decrease it thereafter. Free riders contribute zero in any case. Remaining subjects fall into Others.

TABLE 3 Explaining unconditional contributions.

	Neutral	Community	Wall street	Environment	Overall
Belief	1.12 (0.17)***	1.48 (0.18)***	1.18 (0.30)***	1.26 (0.12)***	1.31 (0.09)***
SVO	0.13 (0.04)**	0.09 (0.05)	0.04 (0.08)	0.10 (0.05)*	0.10 (0.03)***
Community					1.60 (0.91)
Wall street					-0.40 (1.05)
Environment					1.48 (0.87)
Constant	-3.96 (1.85)*	-5.22 (1.58)**	-2.83 (3.86)	-3.43 (1.68)*	-5.25 (1.12)***
R <sup>2</sup>	0.71	0.86	0.38	0.79	0.72
N	44	48	48	48	188

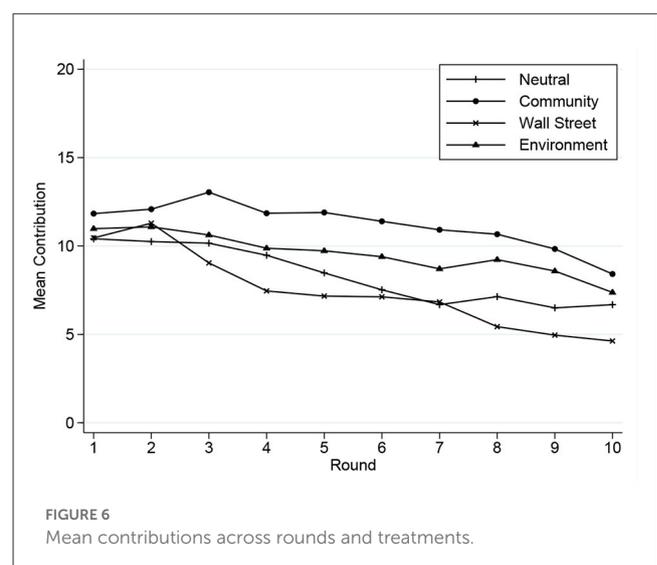
Tobit regressions accounting for contribution levels being censored at 0 and 20. Robust standard errors in parentheses. The  $R^2$  refers to the squared correlation between predicted and observed contribution levels. The symbol \* indicates significance at 5%; \*\*significance at 1%; \*\*\*significance at 0.1%.

those measures. We find that (unconditional) contributions and beliefs are significantly correlated across all treatments ( $p < 0.01$  for all frames), yet subjects' contributions are much better explained by their beliefs in the Neutral, Community and Environment frames (all Spearman's correlation coefficients are at least 0.83) than in the Wall Street frame (0.66). The relationship between social preferences and contributions also varies across frames. The correlation between social preferences and contributions is large (0.64,  $p < 0.01$ ) in the Community and Neutral frame (0.51,  $p < 0.01$ ), and rather low in the Environment (0.25,  $p = 0.088$ ) and Wall Street frame (0.21,  $p = 0.141$ ). Overall, these findings are in line with our hypothesis that contributions are positively associated with both beliefs about others' contributions and social preferences.

The regression analysis in Table 3 corroborates the findings from the correlation analysis, showing that beliefs and social preferences (denoted as SVO) are significant predictors of contributions in the Neutral, Community and Environment frames, while predictive power is substantially weaker in the Wall Street frame, where social preferences lack significant predictive capacity all together. Social preferences and beliefs explain at least 71 percent of the variance in contribution levels across all frames, except for the Wall Street frame, in which only 38 percent of the variance in contributions is explained. This relatively lower explanatory power of preferences and beliefs may either indicate that the subjects' behavior is noisier in the Wall Street frame compared to the other frames, or it may indicate that at least one important variable—such as misperception (Fosgaard et al., 2017) or higher-order beliefs (Dufwenberg et al., 2011), perhaps—that we have not assessed plays an important role under this particular frame.

### 4.3. Repeated-PGG

Figure 6 reports the results of the repeated public goods game across all treatments. First, we see that contributions in the first round of the repeated game do not differ significantly across treatments, which in fact corresponds to our findings from unconditional contributions in the strategy game. Second, we find that the commonly observed decline in contributions



observed from first to last round is steepest in the Wall Street frame, with a decline of 56 percent from 10.5 in Round 1 to 4.6 in Round 10. Across all rounds, mean contributions were highest in the Community (11.19) and lowest in the Wall Street (7.44) frame and mean contributions in these two frames differ significantly from each other [Wilcoxon-rank sum test (WRS),  $p = 0.001$ ]. Contributions also differ comparing Community vs. Neutral (8.33) ( $p = 0.008$ ), and do not differ in Community vs. Environment (9.56) ( $p = 0.081$ ). We thus confirm the seminal result by Andreoni (1995) that positive framing significantly increase contributions in finitely repeated public goods games, and our results also support our hypothesis that the use of a Community framing leads to an increase in contributions. This suggests that individuals are more likely to cooperate and contribute to a public good when they perceive themselves as part of a community or group with shared interests and goals, as opposed to viewing the situation as a competitive, individualistic one.

Taking a look at the subjects' expectations (beliefs) in the different treatments tells a similar story. Table 4 reports round 1 and average beliefs (as well as contributions) across all rounds. WRS tests with mean beliefs reveals significant

TABLE 4 Mean contributions and beliefs across treatments.

	Mean contributions		Mean beliefs	
	Round 1	All rounds	Round 1	All rounds
Neutral	10.41 (5.97) <sup>a</sup>	8.33 (4.52) <sup>b,c</sup>	10.64 (5.11) <sup>a</sup>	9.64 (1.99) <sup>a</sup>
Community	11.83 (7.56) <sup>a</sup>	11.19 (5.81) <sup>a</sup>	11.02 (6.44) <sup>a</sup>	11.85 (2.82) <sup>a</sup>
Wall Street	10.46 (6.80) <sup>a</sup>	7.44 (5.37) <sup>c</sup>	11.19 (4.69) <sup>a</sup>	9.02 (2.35) <sup>b</sup>
Environment	10.98 (6.04) <sup>a</sup>	9.56 (4.38) <sup>a,b</sup>	10.54 (5.60) <sup>a</sup>	9.97 (2.16) <sup>b</sup>

Standard deviations in parentheses. Divergent superscripts within columns indicate significant differences with Bonferroni adjusted  $p$ -value ( $p < 0.05$  divided by the number of comparisons) indicated by Wilcoxon rank-sum tests.

differences such that on average subjects in Community treatment hold higher beliefs than subjects in Wall-Street ( $p < 0.001$ ), Neutral (9.64) ( $p < 0.001$ ), and Environment (9.97) ( $p = 0.002$ ).

#### 4.3.1. Relationship between contributions, preferences, and beliefs

Next, we analyze to what extent social preferences and beliefs explain contribution behavior in the repeated public goods game. Tables 5, 6 inform about the predictive power of social preferences and beliefs on contribution levels in the first round of the game and on average contribution levels throughout the 10-rounds, respectively. Clearly, we find that beliefs are the strongest predictor across treatments, irrespective of whether we analyze only first-round contributions or contributions averaged across all 10 rounds. While social preferences do not predict subjects' contributions in the first round, they add significant predictive power explaining average contributions across the repeated game for the Community frame only (see Table 6).<sup>10</sup> Overall, these findings provide support for our hypothesis that there is a strong relationship between contributions, beliefs, and social preferences.

We now look at the link between contributions and preferences in more detail by analyzing contributions of subjects with different social preferences types. For this, we categorize all subjects in two idealized SVO types according to their choices in the SVO Slider Measure, namely prosocials (SVO angles between  $22.45^\circ$  and  $57.15^\circ$ ) and individualists (SVO angles between  $-12.04^\circ$  and  $22.45^\circ$ ). On the basis of this categorization, 52.7 percent of all subjects are individualistic, and 47.3 percent are prosocial.

Overall, we find that prosocial subjects in the Community frame maintain the highest average contribution level of any social preference group in any of the frame conditions. Figure 7 illustrates that framing predominantly affected subjects with a prosocial SVO,

whose cooperation rates are remarkably high and stable in the repeated Community frame relative to the other three frames, while subjects with an individualistic SVO show the commonly observed decline of cooperation over the course of the repetition in all treatments.

In fact, while prosocial subjects' contributions in the Community frame decline by only 12.2 percent from an average of 76.2 percent of their endowment in Round 1 to 66.9 percent in Round 10, average contributions of prosocial subjects in the Wall Street frame decline by 52.1 percent (from 49.4 percent of their endowment in Round 1 to 28.5 percent in Round 10). This suggests that the Community frame had mainly an effect on prosocial subjects, but not on individualistic ones. This finding is corroborated by the results of a regression analysis indicating a significant interaction between SVO angles and the round number on contributions in the repeated game in the Community frame, but not in the other frames (see Table 6). This suggests that the positive framing (Community frame) had a positive impact on the cooperation of prosocial individuals, which is in line with our hypothesis.

## 5. Discussion

The purpose of this study was to clarify to what degree previously found frame-dependent differences in cooperation levels can be attributed to a preference pathway, or a belief pathway, or both. Our results indicate that framing affects the extent to which contributions are dependent on preferences and beliefs. This highlights that framing may have an impact on the relative importance of preferences and beliefs in informing contributions. In what follows, we explain and discuss our main results in more detail.

First, it is notable that we do not find a framing effect on unconditional contributions nor on the classification of behavioral types (elicited with the help of the strategy method). While this is in line with null results obtained by others (Brandts and Schwioren, 2009; Dufwenberg et al., 2011), we would like to acknowledge that our design slightly differs from theirs, as we are the first one using a strategy version of the public goods game.<sup>11</sup> We also recognize that our sample size is relatively small, and we may not have enough statistical power to detect the effects of the treatment.

10 One thing worth keeping in mind here is that social preferences (SVO) are used as a static predictor—i.e., SVO was measured only once at the beginning of the experiment—, while beliefs are updated and measured in every round, and thus used as a dynamic predictor. Hence, the predictive power of social preferences is likely underestimated because there is evidence that social preferences may be updated over the course of a repeated interaction as well (Ackermann and Murphy, 2019), presumably because the behavior of others may be interpreted as a revelation of their types, and these revelations may then affect reciprocal reactions (Ackermann et al., 2016).

11 For a comprehensive overview of framing effects in this study, please see Supplementary Table 2 in the Appendix.

TABLE 5 Explaining contributions in the first round of the repeated game.

	Neutral	Community	Wall street	Environment	Overall
Belief	1.21 (0.14)***	1.51 (0.18)***	1.75 (0.29)***	1.15 (0.14)***	1.37 (0.09)***
SVO	0.07 (0.04)	0.04 (0.05)	0.05 (0.06)	0.05 (0.05)	0.06 (0.02)**
Community					2.05 (0.93)*
Wall street					-0.89 (0.91)
Environment					0.72 (0.89)
Constant	-3.61 (1.45)*	-3.99 (1.68)*	-9.78 (3.16)**	-2.04 (1.69)	-5.24 (1.07)***
R <sup>2</sup>	0.79	0.85	0.69	0.66	0.76
n	44	48	48	48	188

Tobit regressions accounting for contribution levels being censored at 0 and 20. Robust standard errors in parentheses. The R<sup>2</sup> refers to the squared correlation between predicted and observed contribution levels. The symbol \* indicates significance at 5%; \*\*significance at 1%; \*\*\*significance at 0.1%.

TABLE 6 Explaining average contributions across 10 rounds in the repeated game.

	Neutral	Community	Wall street	Environment	Overall
Belief	0.72 (0.06)***	0.71 (0.04)***	0.71 (0.05)***	0.75 (0.05)***	0.72 (0.02)**
SVO	0.18 (0.44)***	0.10 (0.02)***	0.12 (0.05)*	0.03 (0.04)	0.096 (0.00)**
Round	-0.051 (0.15)	-0.52(0.08)***	-0.35 (0.11)**	-0.40 (0.12)**	-0.35 (0.05)***
SVOxRound	-0.007 (0.01)*	0.012 (0.00)***	0.003 (0.00)	0.00 (0.00)	0.005 (0.00)*
Community					0.88 (0.75)
Wall street					-1.12 (0.75)
Environment					0.09 (0.75)
Constant	-6.95 (0.95)	2.15 (1.13)	-0.49(1.46)	-0.49(1.46)	0.88 (0.74)
R <sup>2</sup>	0.42	0.51	0.41	0.37	0.45
n	440	480	480	480	1,880

OLS regressions. Robust standard errors (clustered on sessions) in parentheses. The R<sup>2</sup> refers to the squared correlation between predicted and observed contribution levels. The symbol \* indicates significance at 5%; \*\*significance at 1%; \*\*\*significance at 0.1%.

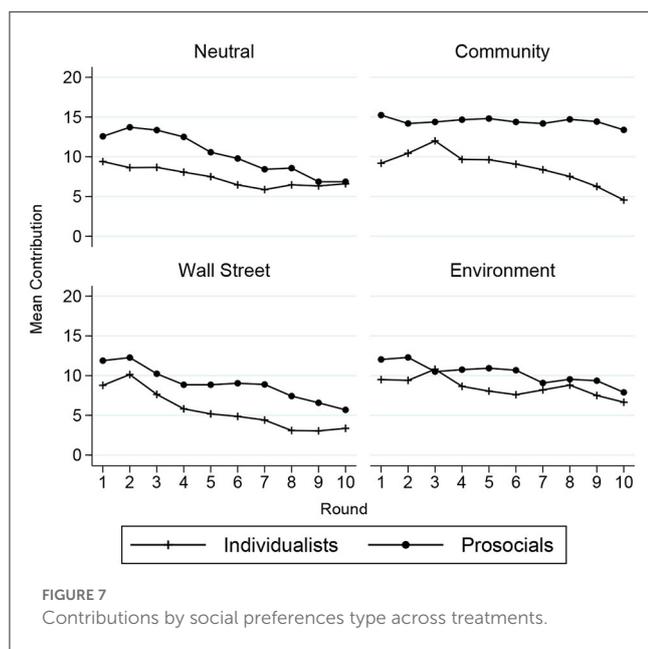


FIGURE 7 Contributions by social preferences type across treatments.

Second, we observe a remarkably lower association between the two independent variables—social preferences and beliefs—on

unconditional contributions in the Wall Street frame compared to the other three frames. This means that in the Wall Street frame, a linear model taking into account social preferences and beliefs does not yield a good fit to the data. One explanation for this could be that due to the Wall Street framing, a further predictor may become important, such as misperception or higher-order beliefs (i.e., beliefs about the beliefs of the other players). Previous evidence suggests that higher-order beliefs may indeed be affected by framing (Dufwenberg et al., 2011), but the question to what extent this is the case under a Wall Street frame is not clearly answered yet, and our data do not allow us to test this potential explanation explicitly.

Third, our experimental results indicate a framing effect that unfolds and reveals itself over the course of the repeated game, resulting in higher contributions in the Community as compared to the Wall Street (and Neutral) frame across rounds. This means that positive framing and repeated game structure only jointly support high levels of contributions. Our design allows us to identify that the positive framing effect of the Community treatment is driven mainly by subjects for whom SVO indicates prosocial preferences as those manage to sustain high levels of cooperation over the course of the game, while prosocials in the other experimental treatments display a typical declining trend of average contributions. One explanation for the observation that prosocial

subjects in the Community frame sustain high cooperation levels notwithstanding that neither their preferences nor their beliefs or first-round contributions had been affected by the use of different labels may be that the Community frame somehow activated (or increased) their prosocial identity (Bowles, 1998; Tett and Guterma, 2000). That is, the Community frame may not have made subjects more prosocial, but may have increased the already prosocial subjects' tendencies to act consistently according to their intrinsic prosocial preferences, irrespective of what others do. This explanation would be consistent with the pattern of results we observe. If the contributions of individualists—who may cooperate at the beginning of the repeated game mainly out of strategic considerations—decline over the course of the game while the contributions of prosocials stay high until the end, then both types would act more in line with their baseline social preferences at the end of the game as compared to the beginning of the game; and this is exactly what we find in the Community frame.

Our analysis thus suggests that subjects tended to act consistently with their social preferences particular in the Community frame, while the Wall Street frame induced subjects to disregard their revealed social preferences when making choices. Nevertheless, with caution, we interpret our results to suggest that a Community frame can serve as an effective and low cost promoter of cooperation, at least in an iterated setting and for a substantial portion of decision makers.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving human participants were reviewed and approved by Decision Science Laboratory | ETH Zurich. The patients/participants provided their written informed consent to participate in this study.

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## Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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## Conflict of interest

Since 1 May 2022, EB has been employed by Frontiers Media SA. EB declared her affiliation with Frontiers and the handling editor states that the process nevertheless met the standards of a fair and objective review. RM is employed by Morningstar Investment Management.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/frbhe.2023.1147492/full#supplementary-material>

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