The Framing of Games and the Psychology of Play

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ABSTRACT

Psychological game theory can provide rational-choice-based framing effects; frames influence beliefs, beliefs influence motivations. We explain this theoretically and explore empirical relevance experimentally. In a 2×2 design of one-shot public good games we show that frames affect subject's first- and second-order beliefs, and contributions. From a psychological game-theoretic framework we derive two mutually compatible hypotheses about guilt aversion and reciprocity under which contributions are related to second- and first-order beliefs, respectively. Our results are consistent with either.

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1. Introduction

Experiments in psychology and economics have shown that the framing of decisions may matter to preferences and choice (cf. Pruitt 1967; Selten and Berg 1970). This may reflect a failure by decision makers to exhibit "elementary requirements of consistency and coherence", as found by Tversky and Kahneman (1981) in a classic paper. Our main objective is to theoretically articulate, and experimentally illustrate, a further reason why framing may matter. We make no reference to irrationality. Framing may influence play in games by influencing motivation that depends on beliefs, about choices and beliefs, in subtle ways.

Our message partly echoes the insight that focal points may influence coordination, as first noted by Schelling (1960) and explored experimentally by Mehta et al. (1994). The idea is that a strategic situation may possess cues that influence *beliefs about others' choices*, which in turn may have bearing on a person's rational choice. We push beyond this observation as follows: If players are emotional or care for the intentions and desires of others, then framing may influence behavior independently of how beliefs about others' choices change. Frames may influence *beliefs about others' beliefs*, which in itself may influence such a person's choice even if his or her belief about others' actions is given.

The upshot is that framing may play a special role in *psychological games*, as defined by Geanakoplos et al. (1989) and Battigalli and Dufwenberg (2009). These structures differ from standard games in that payoffs depend on beliefs (about choices and beliefs), not just actions. A body of recent work (cited in more detail below) in experimental economics and behavioral theory argues that psychological games are needed to capture some important forms of motivation, like reciprocity or guilt aversion (a desire not to let others down).

In psychological games, motivation depends on beliefs directly, so if beliefs are changed motivation may flip too. The key contribution of this paper is to tie this observation in with framing effects: frames may influence beliefs, which spells action in psychological games. We propose to understand this as a two-part process: (i) frames move beliefs, and (ii) beliefs shape motivation and choice. The hypotheses we will derive based on psychological game theory entail specific statements about (ii). As regards (i) no comprehensive theory exists yet. We discuss some relevant conjectures based on what has been reported in the economic and psychological literature but leave a thorough theory development for future research.

Section 2 provides theoretical elucidation regarding the potential relevance of our approach to framing effects; Sections 3-5 set the stage for and report results on an experiment designed to explore the empirical relevance. We choose a public good game as our workhorse and use a 2×2 design which varies the framing along the dimensions of 'valence' and 'label' (described in more detail below). From a psychological game-theoretic framework we derive two mutually compatible hypotheses about guilt aversion and reciprocity under which contributions are related to second- and first-order beliefs, respectively. Our results are consistent with either. As regards the impact of our frames we do not have preconceived hypotheses based on theory, but our results are in part at odds with previous findings (in particular, contributions are higher under a neutral label than under a community label). These latter results may be of some independent interest to the experimental literature on framing in public goods (and social dilemma) games; in Section 6 we discuss and compare results.

2. Framing effects in psychological games

Part of our message is reflected in the literature on focal points. Schelling noted that in some games certain choices are ‘focal’, which may facilitate coordination. A classic example involves two persons meeting in New York City: going to Grand Central Station may be focal.

Here focal points are created by properties possessed by a strategy, but one can also imagine how focal points are similarly created by framing. Consider the two following games:

The let's-get-7 game:

	a	***b***
a	(9, 9)	(0, 8)
b	(8, 0)	(7, 7)

The let's-get-9 game:

	a	***b***
a	(9, 9)	(0, 8)
b	(8, 0)	(7, 7)

Are these games the same? They have player sets, strategy sets, and payoff functions in common. However, their names differ, and different names may trigger different beliefs in the players' minds. They may, for example, coordinate on different equilibria in the two cases.[1]

In the let's-get-*x* games, frames shape beliefs and beliefs influence behavior, ultimately because of what beliefs tell a player about a co-player's choices. However, the link from frames to beliefs to actions need not rely on perceptions of others' behavior. Our next example will show how a frame may influence a player's beliefs and behavior, and yet it is from the outset inconceivable that any other player's behavior could change. Consider a dictator game: Player 1 chooses how to divide a sum of money, say $1000, between himself and player 2 who has no choice except to *accept* that division. Now assume that player 1 suffers from guilt (an emotional response) if he gives 2 less than he believes 2 expects; player 1 is *guilt averse*.[2] Finally, imagine that one ran an experiment on this game, with the twist of calling it by different names in different treatments. Say that the game was referred to as either

- *The let's-split-a-grand game*, or

[1] The let's get 7 and let's get 9 games are so-called stag-hunt games, amply discussed for the intriguing coordination problem embodied. This matters e.g. to theories of equilibrium selection (e.g., Harsanyi and Selten 1988, Carlsson and van Damme 1993); examinations of the impact of communication (e.g., Aumann 1990, Charness 2000, Clark et al. 2001), and the impact of learning (e.g., Crawford 1995). We thus add framing to this list of topics.

[2] Guilt aversion is introduced in more detail, including references to relevant previous work, in Section 4.

- *The German tipping game*.

Imagine that most subjects make the equal split in the first case, that most subjects give away just small change in the second case, and that this happens because the dictator subjects hold different beliefs about what recipients expect to get in the two cases. This illustrates how a frame could influence a player's beliefs, which influence his motivation, which influences his behavior, despite there being no strategic uncertainty about what other players do.

We have two more comments about this example. First, the motivation described is non-standard in the sense that it cannot be modeled using traditional game theory. To see this, note that in traditional (normal form) games player *i* has a utility of the form

$$u_i: A \to \mathbb{R}, \qquad (1)$$

where A is the set of strategy profiles. In the dictator game, $A = A_1 \times A_2 = [\$0, \$1000] \times \{accept\}$, where A_1 and A_2 are the players' strategy sets. This formulation, whether used to model selfishness or some other-regarding motivation (like altruism, or inequity aversion) predicts a uniquely defined set of best responses for *i*.[3] By contrast, in the example, the guilt averse player 1's set of best responses depends on his beliefs about 2's beliefs. Hence (1) is not a rich enough specification to handle this case. Instead one must move to utilities of the form

$$u_i: A \times M_i \to \mathbb{R}, \qquad (2)$$

where M_i is *i*'s beliefs (about choices and beliefs), somehow described. Thus we need to move from standard games to so-called psychological games, as introduced by Geanakoplos et al. (1989) and further developed by Battigalli and Dufwenberg (2009).

[3] Examples: If the dictator is selfish, then his set of best responses is {\$0}; if his objective is to minimize the difference between his payoff and the recipient's, then his set of best responses is {\$500}; if his objective is to maximize the maximum payoff to one of the players, then his set of best responses is {\$0, \$1000}.

Our second comment relates to (2) and the extent to which that specification is actually more general than is borne out by the example involving the guilt averse dictator. That example involves, for player 1, no strategic uncertainty whatsoever about what player 2 chooses. (2) is, however, not limited to that case but allows that, as frames change, so do beliefs of any order, including beliefs about others' strategies. What comes out are framing effects that have a hybrid quality: frames may influence a player's beliefs, which influence his motivation directly *as well as* his beliefs of others' choices, and all of this influences his behavior. All those links from frames to beliefs to actions are what we have in mind as framing effects in psychological games.[4]

3. Public goods games

As a vehicle of investigation we wish to select a public goods game, since framing effects have already been documented in this context. Public good games represent many economically important situations that require the agents' voluntary cooperation so it is important to understand how frames affect voluntary cooperation. Linear public good games also have the advantage of being rather simple, which helps make psychological game-theoretic analysis tractable (cf. Section 4). Selfish players have a dominant strategy to free ride, *i.e.*, subjects' optimal behavior is independent of others' behavior. Yet, numerous experiments have shown that many people do not play accordingly (see the surveys in Ledyard 1995; Zelmer 2003; Gächter and Herrmann 2009;

[4] It should be clarified that by framing effects we mean how given descriptions affect choices & beliefs, *not* how players in a game conceptualize strategies (as *e.g.* in "variable frame theory"; see Bacharach 1993; Bacharach and Bernasconi 1997). To get a perspective on the distinction, consider what Kahneman (2000, p. xiv), has to say (about him, Tversky, and framing): "A significant and perhaps unfortunate early decision concerned the naming of the new concept. For reasons of conceptual and terminological economy we chose to apply the label 'frame' to descriptions of decision problems at two levels: the formulation to which decision makers are exposed is called a frame and so is the interpretation that they construct for themselves. Thus, framing is a common label for two very different things: an experimental manipulation and a constituent activity of decision making. Our terminological parsimony was helpful in securing the acceptance of the concept of framing, but it also had its costs. The use of a single term blurred the important distinction between what decision makers do and what is done to them: the activities of editing and mental accounting on the one hand and the susceptibility to framing effects on the other."

and Chaudhuri, forthcoming). In particular, although previous work has not made connection to psychological games, there is evidence that subjects' choices may depend on their beliefs.[5] Thus, since our argument is that frames may influence beliefs and beliefs may affect motivations and thereby behavior, public good experiments are well-suited for our purposes.

We consider a game with the following structure: Each of three players simultaneously chooses how to allocate twenty monetary units between a 'private' and a 'public' account. The sum of what the players contribute to the public account is multiplied by 1.5, to determine its total value. A player's earnings is the sum of whatever he or she puts in the private account, plus one third of the total value of the public account. The situation can be represented as a normal form game $G=(A_i,\ \pi_i)_{i\in N}$ such that $N=\{1,2,3\}$ is the player set, $A_i = \{0,1,\ldots,20\}$ is the strategy set of player i, and $\pi_i\colon \times_{j\in N} A_j \rightarrow \mathbb{R}$ is i's monetary payoff function defined by

$$\begin{aligned}\pi_i(a_1, a_2, a_3) &= 20 - a_i + (1/3)\cdot(3/2)\cdot(a_1 + a_2 + a_3) = \\ &= 20 - a_i + \tfrac{1}{2}\cdot(a_1 + a_2 + a_3). \qquad (3)\end{aligned}$$

All experimental treatments are set up to implement that structure. The treatments differ only in their frames. We take inspiration from some previous work on framing in social dilemma-type games. A common distinction concerns whether frames change reference points (with regard to where the endowment is allocated initially) or just use different wordings. We refer to these as 'valence framing' and 'label framing', respectively.

Valence framing concerns whether the same essential information is put in a positive or negative light (Levin et al. 1998). Several studies have looked at valence framings in public good provision. In the standard public good experiment subjects are endowed with some money, which

[5] For instance, Croson (2007); Gächter and Herrmann (2009); and Fischbacher and Gächter (2010) show that in (repeated) one-shot experiments a subject's contribution is often highly positively correlated with the subject's beliefs about others' contributions. This result anticipates one of our hypotheses (H_2) below.

they can keep for themselves or contribute to a public good. Call this situation a *GIVE treatment*. Thus, any contribution to the public good is a positive externality for all other players by definition of a public good. Another framing is to endow the group with the resources and to allow the group members to withdraw resources; call this a *TAKE treatment*. A common result is that in the GIVE treatment contributions to a repeatedly played public good are higher than in the TAKE treatment (cf. Fleishman 1988; Andreoni 1995; Sonnemans et al. 1998; Willinger and Ziegelmeyer 1999; Cookson 2000; Park 2000).[6]

Label framing is involved if subjects are confronted with alternative wordings, but objectively equivalent material incentives and unchanged reference points (see, e.g., Elliott et al. 1998, who call this a "pure framing effect"). Ross and Ward (1996) and Liberman et al. (2004) report one of the best-known labeling effects. In their experiments a simple prisoners' dilemma game was either called the "Community Game", or the "Wall Street Game". Cooperation rates were significantly higher under the former frame than under the latter.[7] In our experiment we study label framing by comparing a so-called "Community game" ('Gemeinschaftsexperiment' in German) with a neutrally-framed game. We call the corresponding treatments *COMMUNITY* and *NEUTRAL*.

Previous studies have either looked at valence framing or at label framing, but we study both simultaneously (see Section 5). And most importantly, we move beyond the existing

[6] Some related (psychological) studies using one-shot experiments comprise Brewer and Kramer (1986); McCusker and Carnevale (1995); van Dijk and Wilke (2000); Brandts and Schwieren (2007); and Cubitt et al. (forthcoming-a); Cubitt et al. (forthcoming-b). Overall, the evidence for framing effects in social dilemma games is more mixed than in decision-theoretic experiments (Levin et al. 1998; Kühberger et al. 2002). See also Goerg and Walkowitz (2010) who report subject pool effects in related framing experiments.

[7] Ellingsen et al. (2011) replicate this finding comparing a 'stock market game' with a 'community game'. Using a public goods game, Rege and Telle (2004) similarly played a one-shot experiment and found weakly significantly higher contributions under a "community" frame than under a neutral frame. Further studies on label frame effects comprise Pillutla and Chen (1999); Burnham et al. (2000); Abbink and Hennig-Schmidt (2006); Cronk (2007); Cronk and Wasielewski (2008). See Gächter et al. (2009) for a natural field experiment on label framing.

literature on framing by eliciting first- and second-order beliefs so that we can test hypotheses based on psychological game theory which can embrace framing effects. We discuss this latter topic next.

4. Guilt aversion and reciprocity

Most of applied economic theory depicts decision makers as 'selfish', in the sense that they care only about their own monetary payoffs. In the context of the public good game we consider, this would correspond to assuming that (3) (or a similar formulation modified to control for risk-aversion) can describe players' preferences. By contrast, a rich body of experimental evidence suggests that decision makers often have more complex objectives, and in particular that they somehow care about what others get or do or hope to achieve. Theoretical models have been proposed, with the objective to model such social preferences, and some such models build on psychological game theory.[8] We focus on two of these – guilt aversion and reciprocity – and use them to derive testable implications that we subsequently address in the experiment.

4.1. Guilt aversion....

...is dislike of giving others less than they expect. Battigalli and Dufwenberg (2007) develop general theory; our specification is similar to their notion of "simple guilt:"[9] Let b_{ij} denote i's 'first-order belief' about j's choice (i,j=1,2,3; $i\neq j$); b_{ij} is the mean of a probability distribution i has over A_j. Let c_{iji} denote i's 'second-order belief' about b_{ji}; c_{iji} is the mean of a

[8] For discussions of the experimental evidence as well as of many models, see Fehr and Gächter (2000); Camerer (2003, Ch. 2); and Sobel (2005). Battigalli and Dufwenberg (2009) survey models that use psychological game theory.

[9] Huang and Wu (1994), Dufwenberg and Gneezy (2000), Dufwenberg (2002), Charness and Dufwenberg (2006), and Bacharach et al. (2007) consider similar sentiments in trust games. In motivating their concepts, Battigalli and Dufwenberg (2007) cite work in social psychology by Baumeister et al. (1994) and Tangney (1995).

probability measure i has over the possible values of b_{ji}. Assume that i suffers from guilt to the extent that he puts less in the public account than the average of what he believes his two co-players believe he puts in the public account. Formally, his utility function u_i* can be defined by

$$u_i^*(a_1, a_2, a_3, c_{iji}, c_{iki}) = 20 - a_i + \tfrac{1}{2}\cdot(a_1 + a_2 + a_3) - \gamma_i \cdot \max\{0, (c_{iji} + c_{iki})/2 - a_i\} \qquad (4)$$

where $i, j, k = 1, 2, 3$; $i \neq j \neq k \neq i$, and where $\gamma_i \geq 0$ is a parameter measuring i's degree of guilt aversion. If $\gamma_i = 0$, (4) has the same RHS as (3) and $a_i = 0$ is a dominant strategy. If $0 < \gamma_i < ½$, the RHS of (4) changes, but $a_i = 0$ is still a dominant strategy. However, if $\gamma_i > ½$ very different possibilities come alive: i's (belief dependent) best response is $a_i = (c_{iji} + c_{iki})/2$.

With reference to (1) and (2), note that (4) has the form $u_i: A \times M_i \to \mathbb{R}$ rather than $u_i: A \to \mathbb{R}$. $G^* = (A_i, u_i^*)_{i \in N}$ is a psychological game.

4.2. Reciprocity...

...is a desire to get even, to respond to perceived wrongdoings with revenge and to reward others' kindness. Rabin (1993) develops a theory of reciprocity, which makes the meaning of words like 'kindness' precise. Rabin argues that kindness depends on what a player believes about others' choices, as this can capture a player's 'intentions'. Moreover, reciprocal motivation depends in general on beliefs about kindness, and hence on beliefs about beliefs since kindness depends on beliefs. Psychological game theory is again called for.

Rabin's objective is to call attention to central qualitative aspects of reciprocity, and he restricts attention to two-player normal form games. Dufwenberg and Kirchsteiger (2004) and Falk and Fischbacher (2006) provide extensions that allow for more players (and which also consider extensive games). We draw on the former model. Applied to our game, the utility of player i is given by u_i** defined by

$$u_i^{**}(a_1, a_2, a_3, b_{ij}, b_{ik}) = 20 - a_i + \tfrac{1}{2}\cdot(a_1 + a_2 + a_3) + Y_i\cdot(\kappa_{ij}\cdot\lambda_{iji} + \kappa_{ik}\cdot\lambda_{iki}) \quad (5)$$

where again i, j, k = 1, 2, 3; $i \neq j \neq k \neq i$, and where the last term, which captures how i is motivated by reciprocity, is in need of further explanation. $Y_i \geq 0$ is a constant measuring i's sensitivity to reciprocity; κ_{ij}, κ_{ik}, λ_{iji}, and λ_{iki} depend on i's choice or beliefs: κ_{ij} represents i's kindness to j – it is positive (negative) if i is kind (unkind); λ_{iji} represents i's belief about how kind j is to i – it is positive (negative) if i believes that j is kind (unkind). κ_{ik} and λ_{iki} have analogous interpretations. (5) captures reciprocity by making it in i's interest to match the signs of κ_{ij} and λ_{iji}, and of κ_{ik} and λ_{iki}, *ceteris paribus*.

We need to calculate κ_{ij}, λ_{iji}, κ_{ik}, and λ_{iki}. This turns out to be (more) straightforward (than analogous calculations in many other games). Although in general games kindness depends on beliefs this is not the case in the public good game because there is a one-to-one link between a player's choice and his kindness. Independently of the co-players' choices, there is a one-to-one link between a player's choice and his impact on the other players' monetary payoffs. Player i's kindness to j [or k] is the difference between what i actually gives to j [or k] and the average of the maximum (=20) and minimum (=0) that i could give to j [or k]. We get $\kappa_{ij} = \kappa_{ik} = a_i - 10$. To get λ_{iji}, note first that this is i's belief about $\kappa_{ji} = a_j - 10$, so just replace a_j by b_{ij} in the RHS of that expression; instead of $\kappa_{ij} = a_i - 10$ we get $\lambda_{iji} = b_{ij} - 10$. Similarly, we get $\lambda_{iki} = b_{ik} - 10$. All in all, we can re-write the RHS of (5) to get (5'):

$$\begin{aligned} & 20 - a_i + \tfrac{1}{2}\cdot(a_1 + a_2 + a_3) + Y_i\cdot[(a_i - 10)\cdot(b_{ij} - 10) + (a_i - 10)(b_{ik} - 10)] = \\ & = 20 - a_i + \tfrac{1}{2}\cdot(a_1 + a_2 + a_3) + Y_i\cdot[(a_i - 10)\cdot(b_{ij} + b_{ik} - 20)]. \qquad (5') \end{aligned}$$

If $b_{ij}+b_{ik}–20 \leq 0$, (5') is maximized by $a_i=0$ regardless of Y_i. The interpretation is that i does not consider j and k to be, on average, kind, so there is no reason for i to sacrifice payoff to help j and k. If $b_{ij}+b_{ik}–20 > 0$, then (5') is maximized by $a_i = 20$ if Y_i is large enough and by $a_i = 0$ if Y_i is small enough. (Besides these cases there are additional combinations of b_{ij}, b_{ik}, and Y_i that make i indifferent between all his strategies.) The formulation joins the above one on guilt aversion in that what is a best response depends on i's beliefs, although different beliefs matter this time.

With reference to (1) and (2), note that (5) (based on (5')) has the form u_i: $A \times M_i \rightarrow \mathbb{R}$ rather than u_i: $A \rightarrow \mathbb{R}$. $G^{**}=(A_i, u_i^{**})_{i \in N}$ is a psychological game.

4.3. Hypotheses

Our experiment is set up to test the two theories presented in Sections 4.1 and 4.2, and to check whether framing matters. Since utilities (4) and (5') include beliefs in their domains, the theories can be directly tested if one observes beliefs. Our design allows us to elicit some beliefs relevant to this task.[10] We describe the procedure for belief elicitation in detail in Section 5. We formulate our hypotheses with reference to choices and beliefs of individual players, rather than in terms of some equilibrium that would give predictions for players jointly. If we focused on equilibria, we would run the risk of incorrectly rejecting a valid insight about motivation only because people did not coordinate well. Our approach is consistent with the theory in Sections 4.1

[10] Dufwenberg and Gneezy (2000), Bhatt and Camerer (2005), Charness and Dufwenberg (2006), Bacharach et al. (2007), Vanberg (2008) and Ellingsen et al. (2010) also measure beliefs in experiments with the purpose of connecting to psychological game theory (in the Bhatt and Camerer case the purpose is mainly broader). It is furthermore interesting to note that Ross and Ward (1996, p. 108) who conducted the framing study we discussed in Section 3.2, made some remarks which may be taken to indicate their interest in our approach. They call for further research on how a label influences the way subjects feel they ought to play and how a label changes their expectations about how the other player would choose to play. The authors conjecture that a frame may even alter subjects' beliefs about how the other player would expect them to play.

and 4.2, where we merely discussed properties of an individual player's best responses rather than equilibrium.[11]

Hypothesis H_1 concerns guilt aversion. Recall that if $\gamma_i < ½$ then i's best response is $a_i = 0$ even if $(c_{iji} + c_{iki})/2 > 0$; if $\gamma_i > ½$ then i's best response is to match his or her second-order beliefs: $a_i = (c_{iji} + c_{iki})/2$.[12] Our design allows us to measure and observe the second-order beliefs $(c_{iji} + c_{iki})/2$, but γ_i is not observed. We rely on our choice and belief data to get a testable prediction. The theory, as described, implies that $a_i \in \{0, (c_{iji} + c_{iki})/2\}$ with $a_i = (c_{iji} + c_{iki})/2$ whenever $a_i > 0$. We test a somewhat weaker prediction (involving positive correlation rather than equality between a_i and $(c_{iji}+c_{iki})/2$). If the prediction holds true this would support the idea that the guilt aversion theory is approximately (rather than exactly) correct. We separate subjects with $a_i = 0$ & $(c_{iji}+c_{iki})/2 > 0$, for whom we 'know' that $\gamma_i < ½$, and the others:

H_1: $a_i = 0$ & $(c_{iji}+c_{iki})/2 > 0$ ***or*** there is a positive correlation between a_i and $(c_{iji}+c_{iki})/2$.

To determine if we can support H_1, we perform a one-sided test of the null hypothesis of zero correlation between a_i and $(c_{iji}+c_{iki})/2$ considering only those i for which it is *not* the case that $a_i = 0$ & $(c_{iji}+c_{iki})/2 > 0$.

Hypothesis H_2 concerns reciprocity. We measure the first-order beliefs b_{ij} and b_{ik}. However, as with γ_i for the case of guilt aversion, Y_i is unobservable so again we have to make a few assumptions to derive a testable prediction. Recall from Section 4.2 that with reciprocal motivation the predicted choices are either 0 (implied when $(b_{ij} + b_{ik})/2 \leq 10$) or 20 (implies $(b_{ij} +$

[11] Moreover, since the experiment involves a *one-shot* game, with no chance for learning, it would seem extreme to assume that people would be able to make correct predictions about one another.

[12] If $\gamma_i=½$ then anything is a best response for i but we ignore this possibility.

b_{ik})/2 > 10).[13] Again we test a somewhat weaker prediction (involving positive correlation rather than the bang-bang 0-20 split of a_i depending on $(b_{ij} + b_{ik})/2$). If the prediction holds true this would support the idea that the reciprocity theory is approximately (rather than exactly) correct. H_2 invokes one more proviso. Consider subjects who exhibit $a_i = 0$ and $(b_{ij} + b_{ik})/2 = 20$. We 'know' that Y_i is so low that they would never reciprocate kindness with kindness. The following hypothesis treats these subjects separately (cf. the '$a_i = 0$ & $(c_{iji}+c_{iki})/2 > 0$' part of H_1):

H_2: $a_i = 0$ & $(b_{ij}+b_{ik})/2 = 20$ ***or*** there is a positive correlation between a_i and $(b_{ij}+b_{ik})/2$.

To examine H_2, we perform a one-sided test of the null of zero correlation between a_i and $(b_{ij}+b_{ik})/2$ considering only those i for which it is *not* true that $a_i = 0$ & $(b_{ij}+b_{ik})/2 = 20$.

Note that hypotheses H_1 and H_2 differ with respect to the beliefs involved. Guilt aversion operates via second-order beliefs whereas reciprocity works on first-order beliefs. Note also that our experiment is not set up to test guilt aversion against reciprocity; in our game the two theories do not necessarily imply mutually inconsistent testable predictions.

In addition to H_1 and H_2 we examine framing effects, *i.e.* whether choices and first- and second-order beliefs differ by treatment. Here we have no preconceived theory to guide us, so we perform two-sided tests. Of course, it would not be unreasonable to expect certain patterns of framing effects based on previous experimental work (recall the discussion in Section 3) and scholarly discussions. We discuss how our results compare to these earlier findings in Section 6.

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[13] We here ignore the possibility that (for certain combinations of Y_i, b_{ij}, and b_{ik}) i may be indifferent between all his choices. This time the assumption may not be quite as innocuous as the analogous assumption in the case of guilt aversion (cf. footnote 12) since the indifferences would not solely depend on the exogenous parameter Y_i (in analogy to the γ=½ case) but also on the first-order beliefs b_{ij}, b_{ik} which would be endogenously determined if we applied some equilibrium concept. However, as explained in the text, we do not apply any equilibrium concept.

5. The experiment

5.1. Design

Subjects were randomly assigned to groups of three people and each subject was endowed with 20 'Taler' (the experimental currency). We employ a 2×2 factorial design, which consists of two label and two valence frames. In the NEUTRAL labeling, whenever the instructions or the decision screens refer to the experiment we speak of "the experiment". In the COMMUNITY labeling, whenever we refer to the experiment we name it "the community experiment".[14]

The valence frame entails describing the game as a 'give-some' or a 'take-some' game. The GIVE frame corresponds to the standard public good setting given in (3). The instructions explain carefully that (i) the Talers the subject keeps for herself generate an "income from Taler kept"; (ii) the Talers the subject contributes to a project of her group create an "income from the project"; (iii) the subject's total income is the sum of both kinds of income.

In the TAKE frame, subjects can take Talers from a "project", the public good. The parameters were chosen to make the monetary payoff function in the TAKE frame equivalent to the GIVE situation. Therefore, the project consists of 60 Talers. Each subject i can take $t_i \in \{0,1,...,20\}$ Talers from the project and the payoff function under the TAKE frame is given by

$$\pi_i(t_1, t_2, t_3) \quad = t_i + ½\cdot(60 - (t_1 + t_2 + t_3)) \qquad (6)$$

Note that (6) describes the same monetary payoff function as (3), since $t_i = 20 - a_i$.

Table 1 summarizes our 2×2 design.

[14] The name of the game was changed at four places in the instructions, once on the screen of the computerized control questions, once on the decision screen for contributing to (taking from) the project, twice on each of the decision screens for first and second order belief elicitation.

Table 1
Our 2×2-design – experimental treatments.

Treatment name	Valence frame	Label Frame	Independent observations
GIVE-NEUTRAL	GIVE	NEUTRAL	66
GIVE-COMMUNITY	GIVE	COMMUNITY	51
TAKE-NEUTRAL	TAKE	NEUTRAL	72
TAKE-COMMUNITY	TAKE	COMMUNITY	66

We ran the experiments in the Bonn Laboratory for Experimental Economics. All sessions were computerized, using the software z-Tree (Fischbacher 2007). In total, 255 people participated, almost all undergraduate students from Bonn University majoring in law, economics and other disciplines. We conducted 15 sessions (four in each of GIVE-NEUTRAL, TAKE-NEUTRAL and GIVE-COMMUNITY and three in TAKE-COMMUNITY) with 18 or 15 participants, respectively.

The above public good problem was explained to the subjects in the instructions (see Appendix A). We took great care to ensure that subjects understood the game and the incentives. After subjects had read the instructions, for which they had plenty of time, they had to answer four control questions that tested their understanding of the decision situation in the different treatment conditions (with wordings adapted to the treatments, see Appendix A). We did not proceed until all subjects had answered all questions correctly.

Subjects then had to make their strategic choices. We next asked them to guess the sum of their co-players' contributions, and the sum of their co-players' guesses. For both guesses subjects were paid €20 each if their guesses were exactly correct, and nothing otherwise. These guesses form the basis of our measurement of $(b_{ij}+ b_{ik})/2$ and $(c_{iji}+ c_{iki})/2$.[15] When subjects made

[15] The incentives provided do not exactly provide incentives for means-revelation, as would seem relevant to the theory in Section 4. A quadratic-scoring rule would theoretically provide such incentives but is also more difficult for subjects to comprehend. We chose our belief-elicitation protocol because it is simple and easy to explain. Our

their give or take decisions they did not yet know about the subsequent estimation tasks. We decided on this timing of events because we did not want subjects' choices of contributions to be influenced by what choice they thought might facilitate correct subsequent guesswork. Subjects played the game only *once* without being informed about their income before the end of the experiment. Thus, all decisions are strictly independent.

We recruited subjects by campus advertisements that promised a monetary reward for participation in a decision-making task. In each session, subjects were randomly allocated to the cubicles, where they took their decisions in complete anonymity from the other participants. All participants were informed fully on all features of the design and the procedures. Sessions lasted about 1 hour. A Taler was worth an equivalent of €0.50. On average subjects earned €15.20 (roughly $15 at the time of the experiment).

5.2. Results on framing effects

Our analysis consists of two parts. First, we investigate how our frames affect beliefs and contributions. We then turn to our main focus: the test of guilt aversion and reciprocity (H_1 and H_2). To make the data analysis between our TAKE and GIVE treatments comparable we express everything in the size of the public good (*i.e.*, what people contribute to the public good in the GIVE treatments, or what subjects leave in the public good in the TAKE treatments).

Result 1 concerns how our frames affected beliefs.

Result 1. *The frames strongly affected first- and second-order beliefs.*

idea is to get a rough-but-meaningful estimate of the participants' first- and second-order beliefs. We refer to Andersen et al. (2007) for a penetrating discussion about the pros and cons of various belief elicitation methods, and Gächter and Renner (2010) for the role of incentives in belief elicitation in public goods experiments.

Support. Fig. 1a and b, Fig. 2a and 2b, and Tables 2 and 3 provide the main support for Result 1. Fig. 1a shows the mean first-order beliefs (*i.e.*, $(b_{ij}+b_{ik})/2$) and the confidence bounds. Fig. 1b documents the distribution of first-order beliefs in all four treatments.

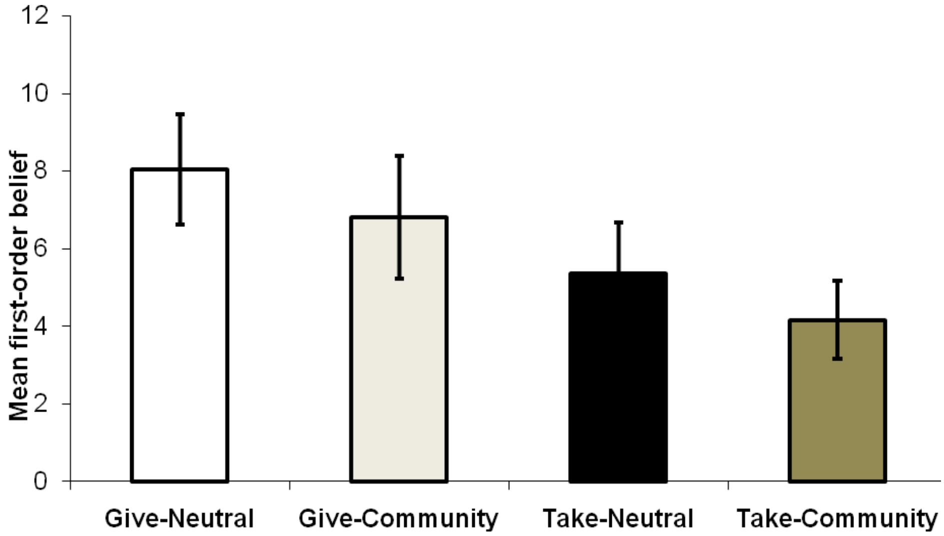

Fig. 1a. Mean first-order beliefs (and confidence intervals) for each treatment.

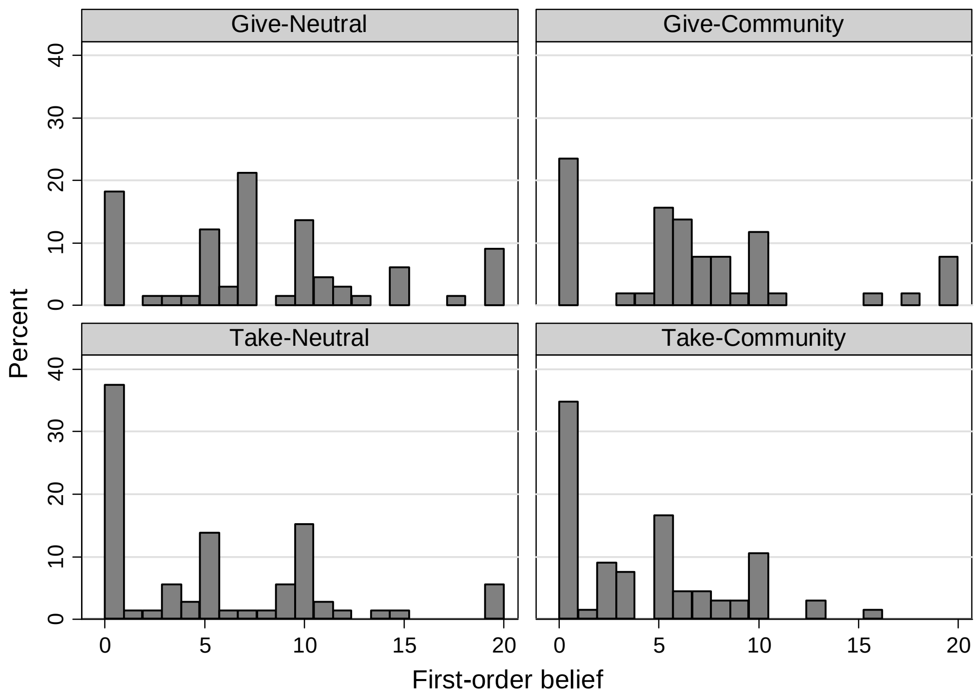

Fig. 1b. Histogram of first-order beliefs for each treatment.

We find that mean first-order beliefs vary between 8 tokens in GIVE-NEUTRAL and 4.2 tokens in TAKE-COMMUNITY. The medians (standard deviations) of first-order beliefs are as follows. GIVE-NEUTRAL: 7.5 (5.8); GIVE-COMMUNITY: 6.0 (5.6); TAKE-NEUTRAL: 5.0 (5.6); TAKE-COMMUNITY: 3.0 (4.1). A non-parametric Kruskal-Wallis test strongly rejects the null hypothesis that the first-order beliefs from our four treatments stem from the same distribution ($\chi^2(3) = 18.38$, p=0.0004). Table 2 documents the results (p-values) of pair wise Wilcoxon rank sum tests for all six possible treatment comparisons.

Table 2.
p-values of pair wise Wilcoxon rank sum tests (two-tailed) comparing first-order beliefs.

	Give-Neutral	Give-Community	Take-Neutral
Give-Community	0.1555		
Take-Neutral	0.0045	0.1259	
Take-Community	0.0001	0.0088	0.3881

We also find that first-order beliefs are significantly higher in the pooled GIVE-treatments than in the pooled TAKE-treatments (means 7.5 vs. 4.8; p=0.0001, Wilcoxon signed ranks test, two-sided). If we pool the data according to label (that is, disregarding valence), we find that first-order beliefs are weakly significantly *lower* under the COMMUNITY frame than under the NEUTRAL frame (means 5.3 vs. 6.6; p=0.0740, Wilcoxon signed ranks test, two-sided). A robust regression of first-order beliefs on dummies for valence and label confirms that first-order beliefs are significantly lower in the TAKE-treatments than in the GIVE-treatments and weakly significantly lower under a COMMUNITY frame than under a NEUTRAL frame.

Fig. 2a depicts the means and confidence bounds of the *second-order beliefs* (*i.e.*, $(c_{iji}+c_{iki})/2$). Fig. 2b illustrates the distribution of second-order beliefs in each treatment. The medians (standard deviations) of second-order beliefs are as follows. GIVE-NEUTRAL: 9.5 (5.5); GIVE-COMMUNITY: 6.2 (5.5); TAKE-NEUTRAL: 5.0 (5.5); TAKE-COMMUNITY: 5.0 (4.4). We find that the distributions of second-order beliefs are as well strongly and highly significantly affected by the frames (Kruskal-Wallis test, $\chi^2(3) = 21.97$, $p = 0.0001$).

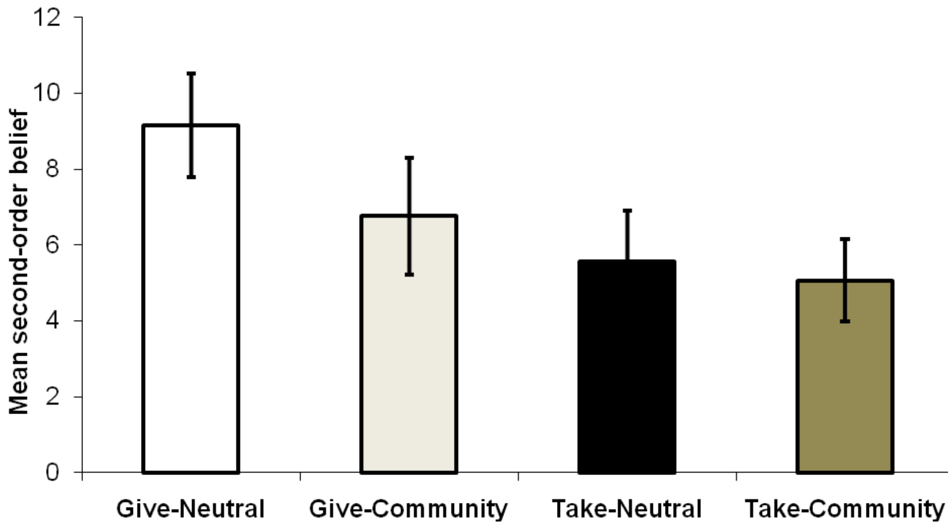

Fig. 2a. Mean second-order beliefs (and confidence intervals) for each treatment.

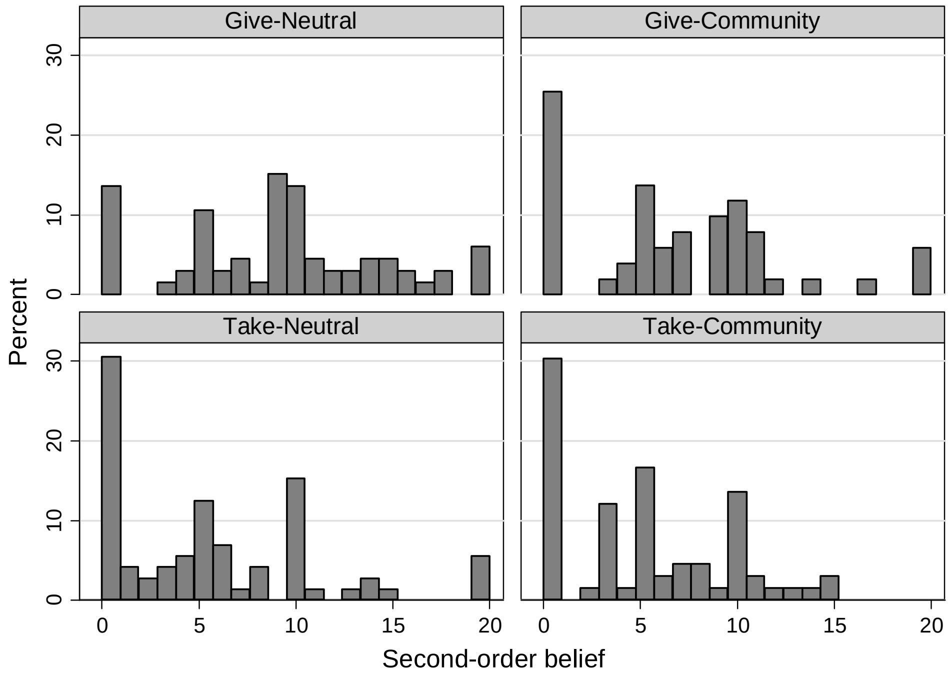

Fig. 2b. Histogram of second-order beliefs for each treatment.

Table 3 documents the results (p-values) of pair wise Wilcoxon rank sum tests for all six possible treatment comparisons.

Table 3.
p-values of pair wise Wilcoxon rank sum tests (two-tailed) comparing second-order beliefs.

	Give-Neutral	Give-Community	Take-Neutral
Give-Community	0.0189		
Take-Neutral	0.0001	0.1735	
Take-Community	0.0000	0.1124	0.8777

We also find that second-order beliefs are significantly lower in the pooled GIVE-treatments than in the pooled TAKE-treatments (means 8.1 vs. 5.3; p=0.0000, Wilcoxon signed ranks test, two-sided). If we pool the data according to label, we find that second-order beliefs, like first-order beliefs are weakly significantly *lower* under the COMMUNITY frame than under the NEUTRAL frame (means 7.3 vs. 5.8; p=0.0537, Wilcoxon signed ranks test, two-sided). A robust regression of second-order beliefs on dummies for valence and label confirms that second-order beliefs are significantly lower in the TAKE-treatments than in the GIVE-treatments but finds that second-order beliefs are significantly lower (p=0.040) under a COMMUNITY frame than under a NEUTRAL frame.

We now turn to framing effects in contributions. Result 2 records our findings.

Result 2. *The frames affected contributions but less strongly than beliefs.*

Support. Fig. 3a and 3b and Table 4 provide the support for Result 2. Mean contributions are highest under GIVE-NEUTRAL and lowest under TAKE-COMMUNITY. The median contributions (standard deviations) are as follows. GIVE-NEUTRAL: 4.5 (6.6); GIVE-COMMUNITY: 0.0 (6.4);

TAKE-NEUTRAL: 0.0 (0.7); TAKE-COMMUNITY: 0.0 (4.5). A Kruskal-Wallis test suggests weakly significant differences between treatments ($\chi^2(3)=6.66$, $p=0.0837$).

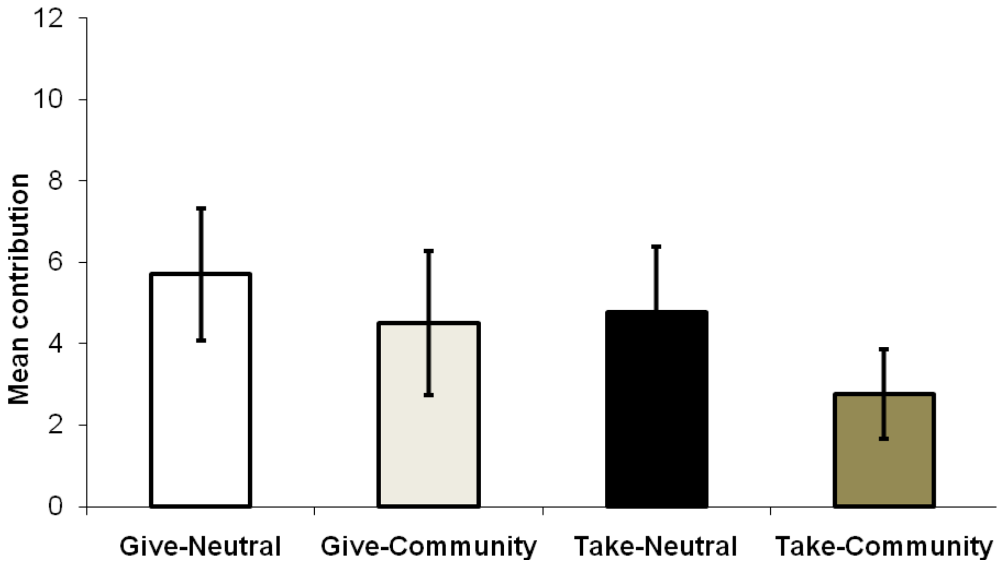

Fig. 3a. Mean contributions (and confidence intervals) for each treatment.

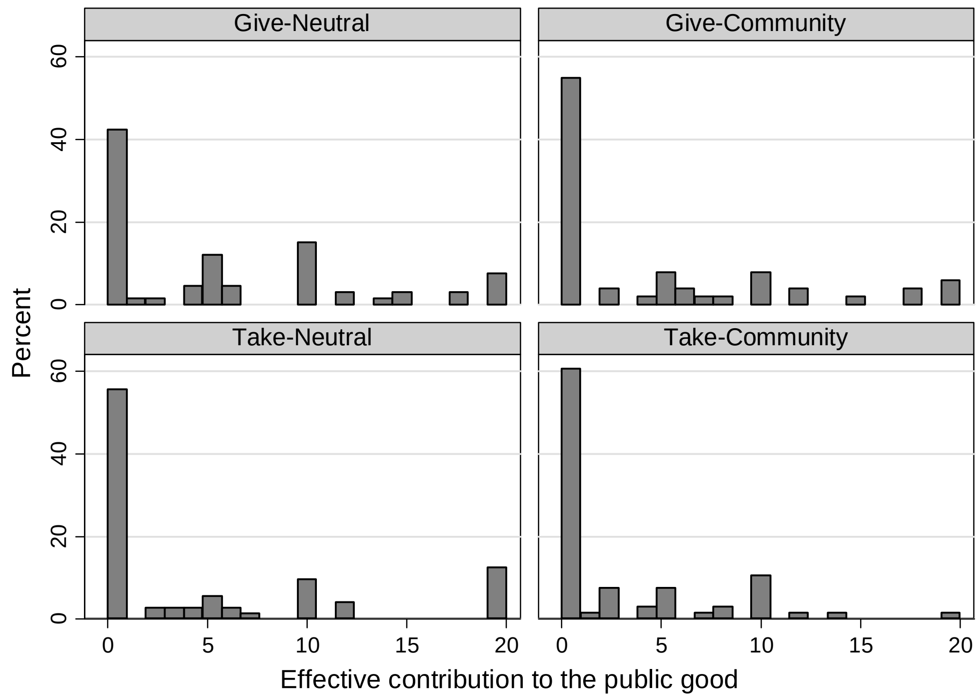

Fig. 3b. Histogram of contributions for each treatment.

Table 4
p-values of pair wise Wilcoxon rank sum tests (two-tailed) comparing contributions.

	Give-Neutral	Give-Community	Take-Neutral
Give-Community	0.2315		
Take-Neutral	0.2065	0.9595	
Take-Community	0.0076	0.2588	0.2253

Table 4 shows that all pair wise comparisons, except one, turn out to be insignificant. If we pool the data according to the valence dimension we find that contributions are weakly significantly lower in the pooled GIVE-treatments than in the pooled TAKE-treatments (means 5.2 vs. 3.8; p=0.0649, Wilcoxon signed ranks test, two-sided). If we pool the data according to label, contributions are weakly significantly lower under the COMMUNITY frame than under the NEUTRAL frame (means 5.2 vs. 3.5; p=0.0606, Wilcoxon signed ranks test, two-sided). A robust regression of contributions on dummies for valence and label finds that contributions are weakly significantly lower in the TAKE-treatments than in the GIVE-treatments (p=0.097) but finds that contributions are significantly lower (p=0.034) under a COMMUNITY frame than under a NEUTRAL frame.

In summary, there can be no doubt that frames affect first- and second-order beliefs, as well as contributions (although framing effects appear weaker in contributions than in beliefs). It is potentially surprising that the COMMUNITY frame has lowered beliefs and contributions relative to the NEUTRAL frame. We will comment on this finding in Section 6.

5.3. Results on the link between beliefs and contributions

We will now turn our attention to the behavioral link between beliefs – which we have shown to be strongly affected by the frames – and behavior. Specifically, we will test our two main hypotheses H_1 and H_2, on guilt aversion and reciprocity, respectively.

Result 3 records the result concerning guilt aversion.

Result 3. *The data support the guilt aversion hypothesis H_1.*

Support. Fig. 4 and Table 5 contain the evidence in favor of Result 3.

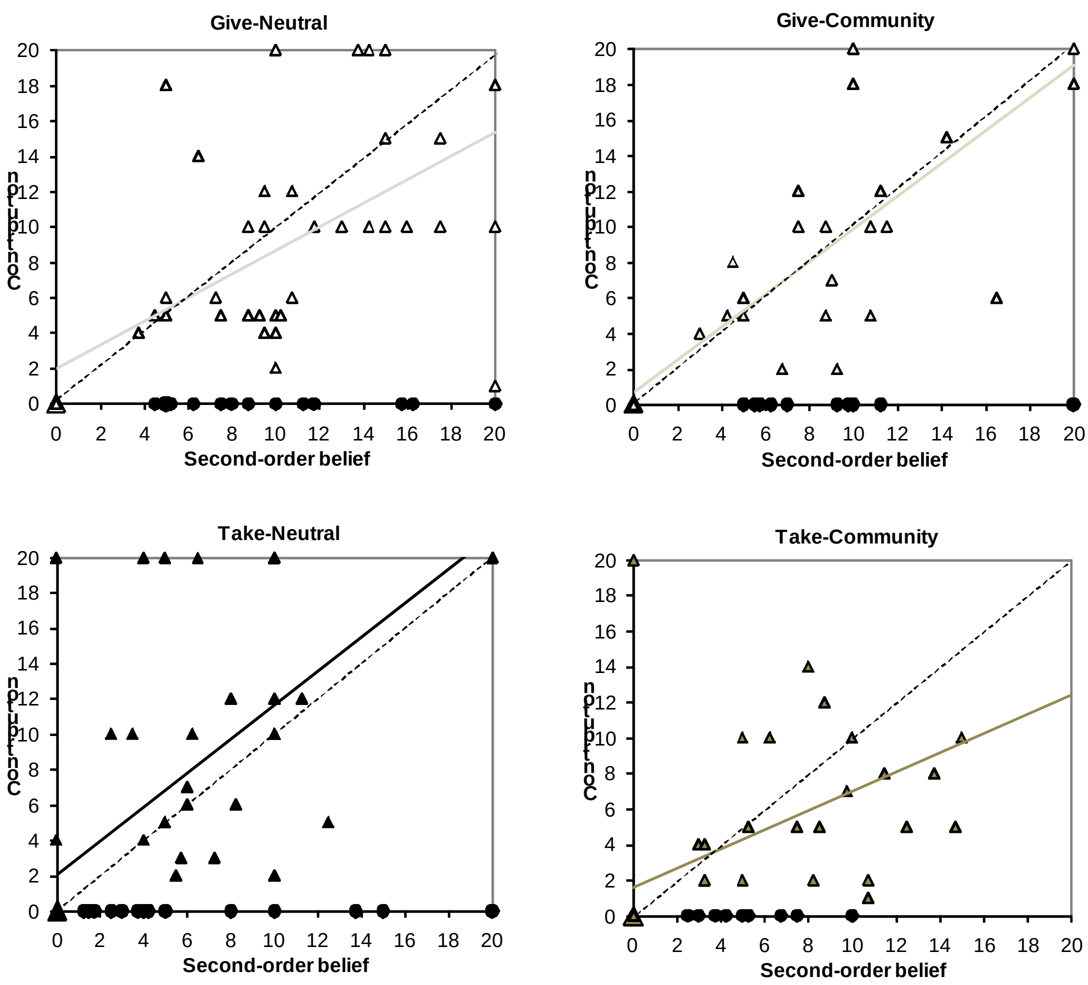

Fig. 4. Contributions and second-order beliefs for each treatment.

Fig. 4 provides a graphical illustration of the guilt aversion hypothesis. In this Fig. we depict contributions as a function of the second-order beliefs (*i.e.*, $(c_{iji}+ c_{iki})/2$). The symbols represent combinations of contributions and second-order beliefs per treatment. The size of symbols is proportional to the underlying number of observations. Our hypothesis is that for subjects who contribute non-zero amounts contributions and second-order beliefs are positively correlated. We therefore distinguish in Fig. 4 between zero contributions for positive second-order beliefs (indicated as filled circles on the *x*-axes) and the other contributions (indicated as triangles). The bold line is the trend line of the relationship between contributions and second-order beliefs (excluding the observations $a_i=0\&(c_{iji}+ c_{iki})/2>0$).

Fig. 4 shows, first, that many subjects chose zero contributions even if they reported positive second-order beliefs: The fraction of subjects with positive second-order beliefs and zero contributions is very similar across all treatments ($\chi^2(3)=0.29$, p=0.96) and ranges from 27.8 percent in TAKE-NEUTRAL to 31.8 percent in TAKE-COMMUNITY. Second, contributions and second-order beliefs of subjects other than those who have a zero contribution despite a positive second-order belief are positively correlated in all four treatments.[16]

Table 5 corroborates this finding econometrically. Contributions and second-order beliefs are highly significantly positively correlated (t-values > 4.5). Yet, the explained variance differs between treatments as the Fig. shows and as the regressions show formally. In GIVE-COMMUNITY, for instance, $R^2 = 0.66$, whereas in TAKE-COMMUNITY $R^2 = 0.31$.

When we test whether the regression coefficients are significantly different across treatments, we find that the constants are the same across treatments ($F(3,172) = 1.08$; p = 0.359).

[16] This result can be compared to findings in Dufwenberg and Gneezy (2000), Bhatt and Camerer (2005), and Charness and Dufwenberg (2006) concerning similar choice – second-order belief correlation in other games.

The slopes, however, differ significantly across treatments ($F(3,172) = 2.94$, $p = 0.035$), which implies that the frame affects the relationship between second-order beliefs and contributions.

Table 5
Testing the guilt aversion hypothesis.

	Dependent variable: Contributions			
	GIVE-NEUTRAL	GIVE-COMMUNITY	TAKE-NEUTRAL	TAKE-COMMUNITY
Second-order beliefs	0.669***	0.922***	0.959***	0.544***
	(0.130)	(0.105)	(0.118)	(0.119)
Constant	1.957*	0.644	2.035**	1.527*
	(1.069)	(0.404)	(0.896)	(0.876)
Observations	47	36	52	45
R-squared	0.38	0.66	0.45	0.31

Notes: 1. OLS-regression; Robust standard errors in parentheses.
2. * significant at 10%; ** significant at 5%; *** significant at 1%.
3. Zero contributions for positive second-order beliefs are excluded.

We turn now to reciprocity and H_2, which concerns the relation between a subject's contribution and his or her *first-order beliefs*. Fig. 5 provides a graphical illustration. We distinguish between subjects who contribute nothing despite a first-order belief $(b_{ij}+ b_{ik})/2 = 20$; (indicated by filled circles on the *x*-axes), and the others (indicated by triangles). The size of symbols is proportional to the number of observations. The bold line is again the trend line (excluding observations a_i=0&$(b_{ij}+ b_{ik})/2 = 20$).

Result 4. *The data support the reciprocity hypothesis H_2.*

Support. Fig. 5 and Table 6 provide the support for Result 4.

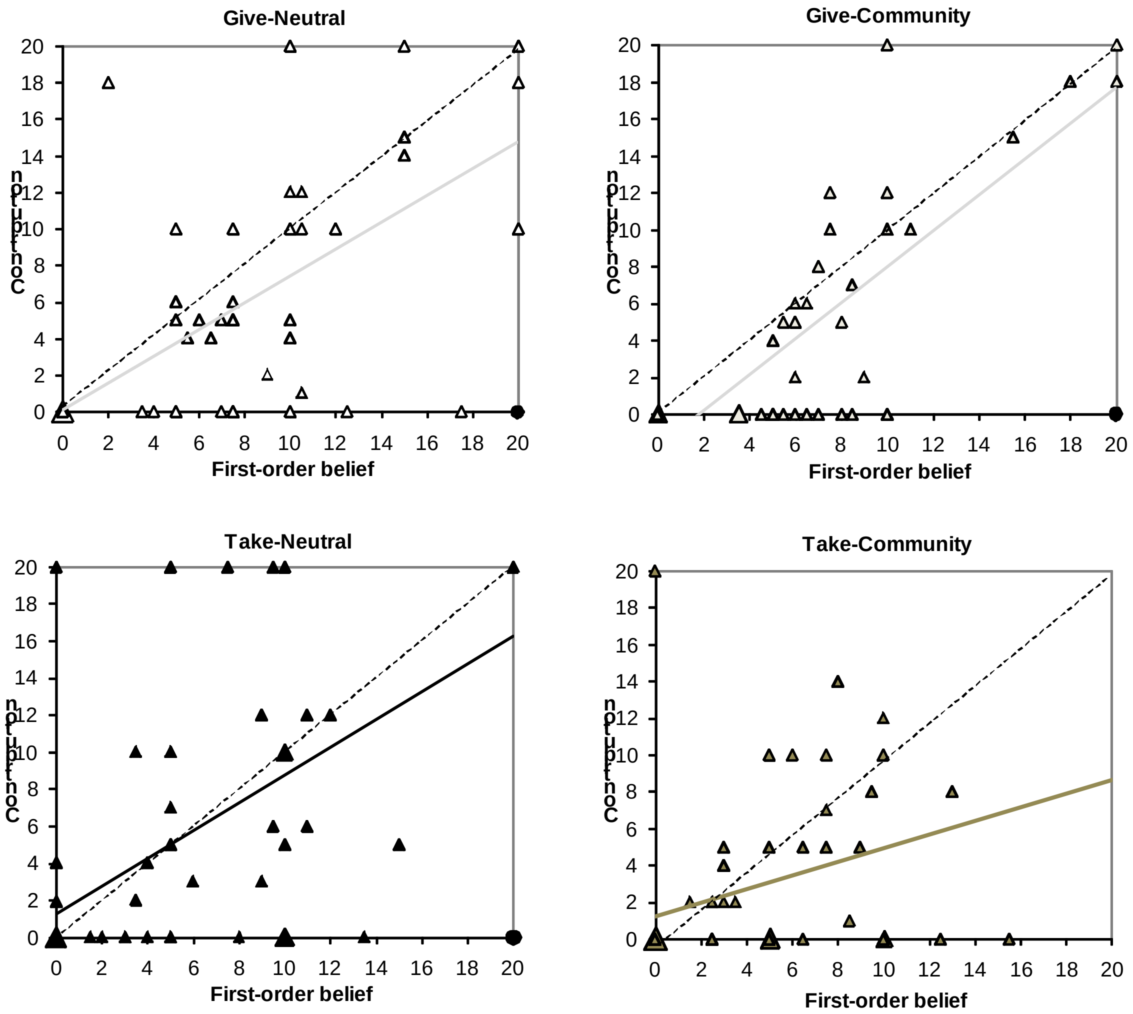

Fig. 5. Contributions and first order beliefs for each treatment.

First, across all treatments, four participants contributed nothing despite holding an average first-order belief = 20. Second, as predicted by our reciprocity hypothesis H_2, contributions and first-order beliefs of the remaining subjects are on average positively correlated. The trend line follows the diagonal quite closely in all treatments (except TAKE-COMMUNITY).

Table 6 corroborates these findings econometrically. We again confine our attention to subjects other than those who have a zero contribution despite an average first-order belief = 20. We find that all first-order belief coefficients are significantly positive (t-values vary between 14.4 in GIVE-COMMUNITY and 2.49 in TAKE-COMMUNITY).[17] Again, the explained variance differs between treatments. The R^2 is highest in GIVE-COMMUNITY (0.66) and lowest in TAKE-COMMUNITY ($R^2 = 0.12$). In other words, the link between first-order beliefs and contributions is tightest in GIVE-COMMUNITY and loosest in TAKE-COMMUNITY.

Table 6
Testing the reciprocity hypothesis.

	Dependent variable: Contributions			
	GIVE-NEUTRAL	GIVE-COMMUNITY	TAKE-NEUTRAL	TAKE-COMMUNITY
First-order beliefs	0.735***	0.973***	0.752***	0.371**
	(0.115)	(0.067)	(0.128)	(0.149)
Constant	0.022	-1.771***	1.187	1.230*
	(0.895)	(0.503)	(0.723)	(0.705)
Observations	65	50	70	66
R-squared	0.40	0.66	0.31	0.12

Notes: 1. OLS-regression; Robust standard errors in parentheses.
2. * significant at 10%; ** significant at 5%; *** significant at 1%.
3. Zero contributions for average first-order beliefs = 20 are excluded.

When testing for the regression coefficients in Table 6 to be different from one another, we find the slopes to differ significantly between treatments ($F(3,243) = 5.02$; $p = 0.002$). The constants are highly significantly different from one another ($F(3,243) = 5.88$; $p = 0.001$) as well.

[17] We also ran regressions with all data, that is, by not excluding subjects i for whom $a_i = 0$ & $(b_{ij}+b_{ik})/2 = 20$. Naturally, coefficients of first-order beliefs are lower if we include all data. However, in no treatment did significance change substantially (all significance levels of the variable 'First-order belief' remain at the levels indicated in Table 6). We have applied the same analysis to the variable 'Second-order belief' and got corresponding results (see Table 5).

Thus, frames shift both the level and the slope of the relationship of first-order beliefs and contributions.

In summary, our results show that frames affect beliefs and beliefs affect contributions. This finding can be embraced by psychological game theory, and indeed individual subject data on choices and beliefs exhibit support for psychological-game based theories of guilt aversion and reciprocity. This is the main finding of this section.

One may ask, however, (*a*) to what extent first- and second-order beliefs are correlated and (*b*) what their relative influence on contributions is. The answer to question (*a*) is that first- and second-order beliefs are indeed strongly positively correlated in all treatments (Spearman correlation coefficients are between 0.61 and 0.85, all $p<0.0001$). This is not surprising: For instance, an agent who believes that others contribute a lot might conjecture that these high contributors contribute a lot because they expect others (including the agent) to contribute a lot as well. The potential presence of a 'false consensus effect' might add to this reasoning.

To answer question (*b*) we run a regression of contributions on first- and second order beliefs simultaneously (using all data). We find that in all treatments except TAKE-COMMUNITY second-order beliefs lose significance; first-order beliefs are highly significant in both GIVE treatments, and weakly significant in TAKE-NEUTRAL. Interestingly, in TAKE-COMMUNITY, first-order beliefs lose significance and second-order beliefs become significant. That is, according to these results, reciprocity determines contributions in the GIVE treatments, whereas in TAKE-NEUTRAL reciprocity is considerably weaker and guilt aversion might drive contributions in TAKE-COMMUNITY. Two caveats on these results are in order. First, it is in the nature of reciprocity and guilt aversion that they are *not* mutually independent hypotheses. Our main goal, however, was to analyze whether framing influences beliefs at all. To this end, we not only measured first-order beliefs but also considered second-order beliefs. Second, due to the (inevitably) high correlation of first- and second-order beliefs the exact findings of the relative importance of first- and second-order beliefs have to be taken with caution.

6. The impact of our frames – some discussion, a new experiment, and concluding remarks

In our paper we used label frames and valence frames to study previously used forms of framing in one comparable design and to put our main theoretical argument on a comprehensive empirical basis of how frames influence beliefs and contributions. We have no preconceived theory yet regarding the impact of our frames. Our results may shed light on the direction of such a theory.

We found first- and second-order beliefs (and contributions) to be higher with a GIVE frame than with a TAKE frame, in line with findings from other experiments quoted in Section 3. These and our own results are consistent with the concept of *decision-induced focusing* (van Dijk and Wilke 2000). This concept rests on the idea that subjects are focused on the decision they are explicitly asked to make (*contribute* under the GIVE frame and *take* under the TAKE frame). A frame induces an initial focus in the sense that participants having to decide on how much to give are more focused on the part of their endowment they contribute than on the part of their endowment they keep for themselves. The reverse holds for the take decision.

As to the label frame, first- and second-order beliefs (and contributions) are higher with a NEUTRAL than with a COMMUNITY frame. We had no hypothesis that people should contribute more under a COMMUNITY frame than under a neutral frame. Previous evidence suggests that this might be a likely outcome; in particular as ‘Community’ (and hence the COMMUNITY frame) is positively connoted in general (Scott and Marshall 2009).[18] Although the latter holds for most

[18] The experiments that suggest a cooperation-enhancing effect of a community frame are typically prisoner’s dilemma games comparing a “community game” with a “Wall Street game” (Ross and Ward 1996); Liberman et al.

Western countries, in Germany the picture looks different. The term 'Gemeinschaft' we used to evoke the label frame in line with the previous experiments underwent a change in connotation from positive to negative during the last century (Opielka 2004) fostering individualistic behavior instead.[19]. Our paper shows that previous findings are not necessarily robust: community frames *can* lead to *less* rather than more cooperation.

The general point we want to make is as follows. Since our experiments were one-shot games, subjects had no other possibility than to infer others' behavior and expectations from their life experiences. Imagine a student in a dorm (his 'community') experiencing that others behave individualistically, never voluntarily clean the common rooms like bathroom and kitchen and free ride at parties by hardly ever contributing drinks and snacks. This student may believe that others contribute nothing or only peanuts in an experiment presented under a COMMUNITY frame! A frame may serve as a cue on comparable social situations and these cues may be subject-pool dependent (see Goerg and Walkowitz 2010 for evidence that suggests this possibility). Thus, a community-frame may induce some subject pools to contribute less than under a neutral frame (and to hold respective first- and second-order beliefs) if for most subjects the community cue is associated with low cooperation/individualistic behavior; for others the opposite may hold.

We tested this idea by replicating our experiment in the GIVE-treatments with 48 subjects from the University of St. Gallen. St. Gallen is a very small Swiss university (about 6000 students) with a strong corporate identity, where students from the very beginning are socialized into the "University of St. Gallen community" (most students are also members in at least one of

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2004) or a "Stock Market game" (Ellingsen et al. 2011). In public goods games, the existing evidence is less clear. Rege and Telle (2004) ran a public good experiment similar to ours with a neutral frame and a "community frame" Moreover, Rege and Telle arguably use a much stronger frame than we do (compare their instructions with ours) and still the framing effect they observe is only weakly significant (one-sided Mann-Whitney test, p=0.09, n=20 in each treatment; see Table 1, p. 1633).

[19] 'Gemeinschaft' became an ideological key concept after World War I and was rejected from the political and sociological vocabulary after World War II (Stråth 2001). Even today, 'Gemeinschaft' is frequently associated with authoritarian and oppressive values (Reese-Schäfer 2001).

the more than 70 student organizations).[20] Note that Switzerland did not experience the change in connotation of 'Gemeinschaft' as Germany did. By contrast, the University of Bonn is a huge and much more anonymous university with no strong community-spirited corporate identity at the time of the experiment. We used exactly the same protocol, instructions, software and incentives like in the Bonn experiments. Both subject pools were also similarly composed as to students' majors.

As conjectured, we found no significant subject pool differences in the NEUTRAL frame. The COMMUNITY frame, however, induced significantly higher first-, second-order beliefs, and contributions of St. Gallen subjects compared to Bonn students; results are given in more detail in Appendix B. The new experiments support the main point of this paper: frames influence beliefs and beliefs influence behavior

To sum up, we argue that psychological-game theoretic models can accommodate framing effects in games, without reference to bounded rationality or cognitive biases. Framing effects can be understood as a two-part process where (i) frames move beliefs, and (ii) beliefs shape motivation and choice. Guilt aversion and reciprocity theory furnish specific statements about (ii), for which we have found empirical support. We have not proposed and tested any theory as regards (i), but our results contribute to understanding the subtle interplay between framing, beliefs and choices. A challenge for future work is to develop a theory of framing that can explain also (i).

The research described here may actually offer insights that carry beyond framing effects. Consider, for example, whether promises foster trust and cooperation (as studied by *e.g.* Charness and Dufwenberg 2006), whether cues of social norms influence norm compliance (Cialdini et al.

[20] The community spirit is exceptionally strong in St. Gallen, as the second author knows from his years at St. Gallen. This spirit is also reflected in a strong and very active alumni network which is one of the oldest of its king in Europe (see http://www.unisg.ch/en/UeberUns/HSGAlumni.aspx).

1990; Cronk 2007; Cronk and Wasielewski 2008; Keizer et al. 2008) or whether legal rules despite weak material incentives can influence citizens' behavior by influencing motives or focal points (as in *e.g.* Gneezy and Rustichini 2000; McAdams and Nadler 2005; Galbiati and Vertova 2010). A two-part process like (i) & (ii) may be relevant to these issues too: Cues of social norms, laws, and promises might shift people's beliefs about *others'* behavior and beliefs and thereby change own motivations and behavior. Insights that hold concerning framing effects may then have analogs for those other contexts, so what is at stake may be a deepened understanding of how circumstances shape human interaction quite generally.

Appendix A: Experimental instructions

Note: Text in brackets denotes the [GIVE treatments]. The experiments were originally written in German.

Instructions to the (community) experiment

Welcome to the *(community)* experiment

General information on the *(community)* experiment

You are now participating in an economic experiment which is financed by the European Union. If you read the following explanations carefully, you'll be able to earn a considerable amount of money – depending on your decisions. Therefore it is important to actually read the instructions very carefully.

The instructions are for your private information only**. During the experiment it is not allowed to communicate with other participants in any way.** If you have questions, please consult us.

During the experiment, we will not talk about Euro, but about Taler. Your total income will first be calculated in Taler. The total amount of Taler that you have accumulated during the experiment will be converted into Euro at the end of the experiment at an exchange rate of

1 Taler = 0.50 Euro~~s~~

At the end of the experiment, you will be paid the total amount of Taler earned during the experiment and converted into Euro **in cash**.

At the beginning of the experiment, all participants will be randomly divided into groups of three. Besides you, there will be two more members in your group. **You will neither learn before nor after the experiment, who the other persons in your group are**.

The experiment consists of only one task. You have to decide **how many Taler you take from [contribute to] a project of your group and how many Taler you leave in the project [keep for yourself].** On the following pages we will describe the exact course of the experiment. At the end of this introductory information we ask you to do several control exercises which are designed to familiarize you with the decision situation.

The decision in the (*community*) experiment

At the beginning of the first stage, there are **60 Taler** in a project of your group [every participant receives an "endowment" of **20 Taler]**. You then have to decide how many of these 60 Taler you take from the project for yourself or how many you leave in the project. [You then have to decide how many of these 20 Taler you contribute to the project or how many you keep for yourself.] Each participant can take up to **20 Taler** from the project [can contribute up to 20 Taler]. The two other members of your group have to make the same decision. They can also either take Taler from the project for themselves or leave Taler in the project. [They can also either contribute Taler to the project or keep Taler for themselves.] You and the other members of the group can choose any amount to be taken [contribution] between 0 and 20 Taler.

Every Taler that you take from the project for yourself [do not contribute to the project] automatically belongs to you and will be paid to you, converted by the exchange rate given above, at the end of the experiment.

The following happens to the Taler that are not taken from [that are contributed to] the project: The project's value will be multiplied by 1.5 and this amount will be **divided equally among all three members of the group**. If for instance 1 Taler is not taken from [is contributed to] the project, the Taler's value increases to 1.5 Taler. This amount is divided equally among all three members of the group. Thus every group member receives 0.5 Taler.

Your income from the project rises by 0.5 Taler if you take one Taler less from [contribute one Taler more to] the project. At the same time, the income of the other two members of the group also rises by 0.5 Taler, because they receive the same income from the project as you do. Therefore, if you take one Taler less from [contribute one Taler more to] the project the income from the project with regard to the whole group increases by 1.5 Taler. It also holds that your income rises by 0.5 Taler if another group member takes one Taler less from [contributes one Taler more to] the project.

After all three members of the group have made their decisions about the amounts they take from [their contributions to] the project the total income achieved by each participant is determined.

How is your income calculated from your decision?

The income of every member of the group is calculated in the same way. The income consists of two parts:

(1) the Taler that somebody takes [keeps] for himself/herself **("income from Taler taken [kept]"**)
(2) the **"income from the project"**. The income from the project is
1.5 × (60 - sum of all Taler taken from the project)/3 =
0.5 × (60 - sum of all Taler taken from the project)
[1.5 × (sum of all Taler contributed to the project)/3 =
0.5 × (sum of all Taler contributed to the project)].

Therefore your total income will be calculated by the following formula:

Your total income =

Income from Taler taken [kept] + Income from project =

(Taler taken by you) + 0.5 × (60 - sum of all Taler taken from project)

[(20 – Taler you contributed to project) + 0.5 × (sum of all Taler contributed to project)]

If you take all 20 Taler from [do not contribute anything to] the project, your "income from Taler taken [kept]" is 20. If you take [contribute] for instance 10 Taler from [to] the project, your "income from Taler taken [kept]" is 10. At the same time, the total sum of Taler left in [contributed to] the project decreases [increases] and so does your "income from the project".

In order to explain the income calculation we give some examples:

- If each of the three members of the group takes 20 Taler from [contributes 0 Taler to] the project, all three will receive an "income from Taler taken [kept]" of 20. Nobody receives anything from the project, because no one left [contributed] anything. Therefore, the total income of every member of the group is 20 Taler.
  *Calculation of the total income of every participant:(20) + 0.5 * (60-60) = 20*
  [*Calculation of the total income of every participant:(20 – 0) + 0.5 * (0) = 20*]
- If each of the three members of the group takes 0 [contributes 20] Taler there will a total of 60 Taler left in [contributed to] the project. The "income from Taler taken [kept]" is zero for everyone, but each member receives an income from the project of 0.5 * 60 = 30 Taler.
  *Calculation of the total income of every participant:(0) + 0.5 * (60-0) = 30*
  [*Calculation of the total income of every participant:(20 – 20) + 0.5 * (60) = 30*]
- If you take 0 [contribute 20] Taler, the second member 10 and the third member 20 [0] Taler, the following incomes are calculated.
  - Because the second and third member have together taken 30 Taler [you and the second member have together contributed 30 Taler], everyone will receive 0.5 * 30 = 15 Taler from the project.
  - You took 0 [contributed all your 20] Taler from [to] the project. You will therefore receive 15 Taler in total at the end of the experiment.
  - The second member of the group also receives 15 Taler from the project. In addition, he receives 10 Taler "income from Taler taken [kept]" because he took [contributed only] 10 Taler from [to] the project [Thus, 10 Taler remain for himself], and he receives 15 + 10 = 25 Taler altogether.
  - The third member of the group, who took all Taler [did not contribute anything], also receives the 15 Taler from the project and additionally the 20 Taler "income from Taler taken [kept]", which means 20 + 15 = 35 Taler altogether.

  *Calculation of your total income: (0) + 0.5 * (60-30) = 15*
  *Calculation of the total income of the 2^{nd} group member: (10) + 0.5 * (60-30) = 25*
  *Calculation of the total income of the 3^{rd} group member: (20) + 0.5 * (60-30) = 35*
  [*Calculation of your total income: (20 – 20) + 0.5 * (30) = 15*
  *Calculation of the total income of the 2^{nd} group member: (20 – 10) + 0.5 * (30) = 25*

*Calculation of the total income of the 3rd group member: (20 – 0) + 0.5 * (30) = 35*]

- The two other members of your group take 0 [contribute 20] Taler each from [to] the project. You take all Taler [do not contribute anything]. In this case the income will be calculated as follows:
  *Calculation of your total income (amount taken 20): (20) + 0.5 * (60-20) = 40*
  Calculation of the total income of the 2nd and 3rd group member (amount taken 0):
  *(0) + 0.5 * (60-20) = 20*
  [*Calculation of your total income (contribution 0): (20 – 0) + 0.5 * (40) = 40*
  Calculation of the total income of the 2nd and 3rd group member (contribution 20):
  *(20 – 20) + 0.5 * (40) = 20*]

When making your decision you will see the following screen:

Please make the decision on the amount to be taken by you [your contribution] in the *(community)* experiment now.

In the project, there are [Your endowment] 60 [20]
The amount to be taken by you from [Your contribution to] the project…..

You will make your decision on a screen like the one above and enter into the blank space how many Taler you take from [contribute to] the project.

After you have made your decision please press the OK-button. As long as you did not press the button you can change your decision anytime.
The experiment will be carried out **once**.

Control questions for the (community) experiment

The questions are hypothetical and serve for your understanding the income calculation only. In the lower left corner you find a button to activate the calculator.

Question 1: Each member of the group can take up to 20 Taler [Each member of the group is endowed with 20 Taler]. Each member of the group – including yourself –takes all 20 Taler from [do not contribute anything to] the project.
What is, in Taler,

- your total income from the experiment?
- the total income from the experiment of each of the other two member of the group?

Question 2: Each member of the group can take up to 20 Taler [Each member of the group is endowed with 20 Taler]. You take 0 Taler [contribute all 20 Taler]. The other two member of the group also take 0 Taler [contribute all 20 Taler].
What is, in Taler,
- your total income from the experiment?
- the total income from the experiment of each of the other two member of the group?

Question 3: Each member of the group can take up to 20 Taler [Each member of the group is endowed with 20 Taler]. You take 17 Taler [contribute 3 Taler]. The second member of the group takes 10 Taler and the third member of the group takes 3 Taler [contributes 10 Taler and the third member of the group contributes 17 Taler].
What is, in Taler,
- your total income from the experiment?
- the total income from the experiment of the second member of the group?
- the total income from the experiment of the third member of the group?

Question 4: Each member of the group can take up to 20 Taler [Each member of the group is endowed with 20 Taler]. You and the second member of the group take 0 Taler each [contribute 20 Taler each]. The third member of the group takes 20 Taler [contributes 0 Taler].
What is, in Taler,
- your total income from the experiment?
- the total income from the experiment of the second member of the group?
- the total income from the experiment of the third member of the group?

First order belief statement (text of questions)

After you have taken your decision in the (*community*) experiment we would like to ask you for the following statement:

Please estimate how many Taler **the other two members of the group have taken from [contributed to] the project in total**.

If you estimated the correct amount you will be paid **20 EURO**.

Example 1:

You estimate that the other two members of the group took [contributed] 31 Taler from [to] the project. In fact, both members took [contributed] 19 and 12 Taler. Your estimation was correct and you will be paid **20 EURO**

Example 2:

You estimate that the other two members of the group took [contributed] 17 Taler from [to] the project. In fact, both members took [contributed] 12 and 6 Taler. Your estimation was wrong and you will be paid **0 EURO**

(Note that your estimation must be a number between 0 and 40 including these numbers.)

Estimated amount taken by [contribution of] the other two group members in the *(community)* experiment in total:

Second order belief statement (text of questions)

Each member in your group has estimated in the same way as you did how many Taler in total the other two members of the group took from [contributed to] the project.

Please estimate now the sum of amounts the other two group members **stated** as estimation in the (*community*) experiment.

If you estimated the correct amount you will be paid **20 EURO**.

Example 1:

You estimate that the other two members of the group stated an estimation of 57 Taler. In fact, the second member stated 31 and the third member stated 26 Taler as estimation.

Your estimation was correct and you will be paid **20 EURO**

Example 2:

You estimate that the other two members of the group stated an estimation of 42 Taler. In fact, the second member stated 17 and the third member stated 21 Taler as estimation.

Your estimation was wrong and you will be paid **0 EURO**

(Note that your estimation must be a number between 0 and 80 including these numbers.)

Estimated sum of amounts the other two group members stated as estimation in the *(community)* experiment:

Appendix B: The St. Gallen Experiments

Table B1

Results of a replication experiment in St. Gallen.

	Contributions			First-order beliefs			Second-order beliefs		
	G-N	G-C	*p*	G-N	G-C	*p*	G-N	G-C	*p*
Bonn	5.7	4.5	0.232	8.1	6.8	0.156	9.2	6.8	0.019
St. Gallen	6.8	10.4	0.104	8.9	10.6	0.119	8.1	9.7	0.219
p	0.216	0.002		0.173	0.001		0.592	0.013	

p refers to the p-value of a two-sided Wilcoxon rank sum test.

In St. Gallen, using a two-sided test, contributions and first-order beliefs are marginally insignificantly higher under the community frame than under the neutral frame. If one entertains an alternative hypothesis that contributions, as well as first- and second-order beliefs will be higher under a community frame then the results support this hypothesis at $p<0.10$ for contributions and first-order beliefs but not for second-order beliefs. In NEUTRAL, we find a marginally insignificant support for guilt aversion. In COMMUNITY, the support for the guilt aversion and the reciprocity hypotheses is very similar than in the Bonn subject pool. With regard to the relationship between contributions and beliefs in the St. Gallen subject pool we find only marginally insignificant support for guilt aversion in NEUTRAL. In COMMUNITY, the support for the guilt aversion and the reciprocity hypotheses is very similar in both subject pools.

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