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Understanding Cooperation in an Intertemporal Context

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Abstract

In today's highly complex economic environment, cooperation among individuals is crucial for organizational and societal success. Most of the situations in which cooperation is required involve costly efforts whose consequences play out over time. Here, we provide a systematic and comprehensive analysis of cooperation in an intertemporal context. In a first study, we show that cooperation is substantially reduced when the benefits of cooperation are shifted towards the future, and increased when the costs are delayed. An analysis of the underlying behavioral mechanisms reveals that the change in cooperation can be explained by (i) a shift in the beliefs about others' actions, (ii) a shift in the willingness to conditionally cooperate, and (iii) an individual's degree of impatience. We further demonstrate that social norms are unaffected by the timing of consequences, indicating that the shifts in conditional cooperation are due to a change in norm compliance rather than the norm itself. In a second study, we demonstrate that the amount of economic incentives needed to close the cooperation gap are substantial, thereby providing policy makers with a useful estimate for conducting cost-benefit analyses.

Keywords: Cooperation; time preferences; incentives; social norms; experiment

JEL Classification Numbers: H41; D63; C92.

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1 Introduction

Cooperation among individuals is vital for the success of organizations and societies alike. Situations in which cooperation is required exist at all levels of human society, ranging from team production and collaborations across firms, to the maintenance of natural resources and the provision of public goods. Most of these situations involve a time dimension, forcing people to make intertemporal trade-offs between costs and benefits that occur at different points in time. Think, for instance, of the problem of climate change. In order to fight global warming, there is a need for immediate costly efforts such as reducing CO_2 emissions, but the rewards from these efforts, e.g., in form of better environmental conditions, are only realized in the future. Likewise, when providing informational public goods such as writing articles or product reviews online (Chen et al., 2010; 2019) or when providing FAIR data (findable, accessible, interoperable, and reusable; Wilkinson et al. (2016)), which is crucial for the scientific progress in both academia and the industry, the costs of providing these services (e.g., in form of time spent) arise immediately, while the benefits to others accrue only over time.

Other situations involve delayed costs rather than delayed benefits. Think, for instance, of public goods such as schools or hospitals that are provided by the government. Oftentimes, such projects are financed on credit, which means that while the benefits of these public goods can be enjoyed in the present, the costs of repaying the loan arise only in the future. Similarly, when helping a co-worker solving a problem, this may not only create immediate benefits for the co-worker and the organization as a whole, but may also cause costs to the helper that only occur in the long-run, e.g., because the time spent could have been used to work on projects that are beneficial for future promotions. Finally, there may also be situations in which both the costs and the benefits occur delayed. This is the case, for instance, in the context of crowdfunding where many platforms such as www.kickstarter.com offer the option to pledge a donation, i.e., donors can state their willingness to financially support a project, but actual payments only have to be made in the future, once the funding goal is reached.

As diverse as these examples may seem, they can all be viewed as special cases of a more general social dilemma problem, in which individual and collective interest are at odds, and in which the costs and benefits of cooperation are not necessarily realized immediately or at the same time. While previous research has provided many important insights into the understanding of cooperation across various contexts (e.g., Ostrom, 1990; Gintis et al., 2005; Van Lange et al., 2014), this literature has left the factor of time rather unexplored, despite its relevance for many real-world problems.

In this paper, we aim at filling this gap by providing a systematic analysis of cooperation in an intertemporal context. To this end, we examine how the timing of costs and benefits affects cooperative behavior, and shed light on the underlying behavioral mechanisms. Uncovering the mechanisms through which cooperation is affected in such contexts is crucial not only from a scientific point of view, but it is also important from a management perspective because policy interventions aimed at fostering cooperation need to consider the channels through which behavior is affected. For instance, while shifts in beliefs about others' actions could relatively easy be overcome with appropriate belief management, e.g., via communication or reputation systems, changes in deep underlying preferences require different, more long-lasting, solution strategies.

To study these questions, we run a series of laboratory and online experiments, which allow us to tightly manipulate the timing of decision and the timing when consequences realize, a feature that is hard to achieve in the field (see Chen et al. (2020) for the usefulness of the experimental method in providing behavioral insights that can help improve management practices and market design). We base our analysis on a standard linear public goods game, an experimental version of a collective action problem. We employ a 2×2 between-subjects design, in which we vary when the costs and benefits of cooperation realize, either "immediately" (in 1 day) or delayed (in 12 months).

Within this simple setup, we separately measure individuals' beliefs about others' actions as well as their attitudes towards reciprocity, a fundamental force behind the evolution of cooperation and human sociality (Trivers, 1971; Axelrod and Hamilton, 1981; Bowles and Gintis, 2013). We additionally study the role of norms (Elster, 1989; Cialdini et al., 1990; Bicchieri, 2006; Krupka and Weber, 2013), which haven been shown to guide behavior in a variety of social contexts.[1] As recently argued by Fehr and Schurtenberger (2018), a large variety of behavioral regularities with regard to human cooperation can be explained by a significant share of individuals adhering to a social norm of conditional cooperation.[2] At the same time, social norms have been shown to be context-dependent, which can explain why people behave pro-socially in some contexts but not in others. Importantly, delaying the costs or benefits of cooperation may affect only some or all of these factors. Furthermore, a shift in each of these components alone can have a direct effect on behavior, but there may also be non-trivial interaction effects between them, which can either reinforce or attenuate

[1]In laboratory experiments, social norms have been shown to predict behavior in, e.g., dictator games (Krupka and Weber, 2013), gift-exchange games (Gächter et al., 2013), oligopoly games (Krupka et al., 2017), and trust and ultimatum games (Kimbrough and Vostroknutov, 2016).

[2]See Kimbrough and Vostroknutov (2016) and Kölle et al. (2020) for direct evidence on the importance of norm-following for cooperation.

the overall effect. This, in turn, makes it necessary to study and evaluate each of these effects in isolation.

Our results reveal that, compared to a situation without any delay, (i) delaying the benefits of cooperation significantly decreases contribution rates, (ii) delaying the costs of cooperation significantly increases contributions, (iii) that the magnitude of these effects is the stronger the lower an individual's degree of patience, which we elicit incentive-compatibly at the end of the experiment, and (iv) that when both costs and benefits are delayed to the same extent, cooperation rates are very similar compared to the situation without any delay. Our decomposition of the behavioral mechanisms behind cooperation reveals that the observed shift in contributions can be explained by a combination of two factors: a shift in beliefs about how much others contribute, and a shift in the willingness to cooperate conditional on others' contributions. That is, even when controlling for the effects of time delay on beliefs, we find that participants become less willing to reciprocate others' contributions when the benefits of cooperation are delayed. The reversed pattern is observed when the costs of cooperation are delayed. In this case, individuals display an increased tendency to match others' contributions. These shifts in conditional cooperation can thereby not be explained by differences in what is considered to be socially appropriate behavior. In fact, the results from our social norms elicitation reveal that the norm of conditional cooperation is equally strong across all treatments, suggesting that it is a shift in norm compliance rather than the norm itself that can explain the differences in conditional cooperation.

Recent policy proposals to foster cooperation build on the power of reciprocity in combination with economic incentives (Rand et al., 2014; MacKay et al., 2015). In a second study, we test this idea in our intertemporal public goods context. In particular, we ask by how much economic incentives have to be adjusted in order to close the gap in contributions when delaying the costs or benefits of cooperation. Our results reveal that these amounts are substantial. In the case of delayed benefits, we find that economic incentives need to be increased by 92% to raise contributions up to case without any delay. When costs rather than benefits are delayed, in contrast, economic incentives can be decreased by 52%. The relatively large magnitude of these effects can thereby be explained by fact that the delay affects beliefs and preferences, which both affect behavior. These numbers are informative, as they can provide managers and policy makers with a benchmark of how much funds they need to invest in order to restore cooperation to the levels without any delay, which is useful for conducting cost-benefit analyses.

Our paper contributes to two so far largely unrelated strands of the literature. On the one hand, our paper relates to the large literature on collective action problems (Olson, 1965; Hardin, 1968; Ledyard, 1995; Cornes and Sandler, 1996; Ostrom, 2000; Gächter and Herrmann, 2009; Rand and Nowak, 2013), which, however, so far has left the question of how the timing of costs and benefits affects cooperation rather unexplored. On the other hand, our paper relates to the long-standing literature studying intertemporal choice. This literature, however, has almost exclusively studied behavior in the context of individual decision making, in the absence of strategic interdependencies (see Frederick et al., 2002, for an overview).[3]

We are aware of only very few studies that combine these two types of decision contexts. For example, in Jacquet et al. (2013) the authors study a repeated threshold public goods game in which they vary whether reaching a predetermined target yields benefits that are realized the next day, in 7 weeks, or in the far future (by planting trees for future generations). They find that cooperation decreases the later the benefits of cooperation realize. Similarly, Deck and Jahedi (2015a) study the effects of delayed payments on behavior in a Prisoner's Dilemma and a Stag-Hunt Game. Using a classroom experiment, they find that delaying the benefits by two weeks significantly reduces cooperation rates.[4] Further related are the studies by Fehr and Leibbrandt (2011) and Davis et al. (2016) who both separately measure individuals' time preferences and cooperation behavior in a social dilemma game without any delayed payments. In line with the results from our baseline treatment, they find that a subject's degree of impatience and their general degree of cooperativeness are largely unrelated. Interestingly, however, Fehr and Leibbrandt (2011) find that time preferences measured in the lab predict cooperation behavior outside the lab in a situation that entails an intertemporal component. In particular, they find that more patient fisherman use more sustainable fishing instruments that are less likely to exploit the collectively used fishing grounds. Similar evidence is provided by Boonmanunt et al. (2020) who show that time preferences elicited in the lab predict replenishment behavior in the field.

Apart from several methodological differences across our and these former studies, we provide new insights along several important dimensions. First, in contrast to previous studies, we not only consider the case of delayed benefits but also study the cases when either only costs or both costs and benefits are delayed. Second, we uncover the behavioral mechanisms behind these effects by investigating the interplay between subjects' degree of

[3]Notably, a handful of papers have investigated discounting behavior in social contexts different from ours, such as dictator games (Kovarik, 2009; Dreber et al., 2016; Kölle and Wenner, 2018) or charitable giving (Breman, 2011; Andreoni and Serra-Garcia, 2017). These studies are different from ours as agents in these papers do not face any strategic uncertainty, i.e., outcomes do not depend on the actions of others.

[4]They further study the role of delayed benefits on bidding behavior in a first and a second-price auction. In both cases they find that delaying payments to the future leads to a significant decrease in bids. In contrast to that, delaying the payment of the prize in a contest game seem to have little impact on behavior, as shown by Deck and Jahedi (2015b).

impatience, their beliefs about others' contributions, and their preferences towards (conditional) cooperation. This is particularly relevant for managers and policy makers trying to foster cooperation in these settings, as targeting behavior via beliefs or preferences require very different behavioral strategies. Finally, we demonstrate how the time factor affects social norms of cooperation, and provide an estimate of how much economic incentives are needed to offset the cooperation gap in situations with and without delay, an exercise which (to the best of our knowledge) has not yet been done.

2 The general setup & theoretical considerations

As a workhorse for studying cooperation in an intertemporal context, we use a standard linear public goods setting. Consider a group of n individuals. Each individual is given a budget of m tokens which they can either contribute to a public good, c_i, or use for their private consumption, x_i, subject to the budget constraint $x_i + c_i = m$. Using this simple setup, we experimentally vary when the payoffs from the private consumption and the public good are realized: either "immediately" (with a small front-end delay of 1 day to minimize the effects due to present bias) or delayed (in 12 months) (see Section 3.4 below for details on the payment procedures). The present value of individual i's income stream from their private consumption and the consumption of the public good can then be written as

$$\pi_i = I_x x_i + I_c \theta \cdot \sum_{j=1}^{n} c_j \tag{1}$$

where the parameter θ denotes the marginal per capita return (MPCR). To capture the timing of when payoffs from the private and the public good are realized, I_x and I_c are indicator functions defined by

$$I_x = \begin{cases} 1 & \text{if } x_i \text{ is realized immediately} \\ \delta_i & \text{otherwise} \end{cases} \qquad I_c = \begin{cases} 1 & \text{if } c_i \text{ is realized immediately} \\ \delta_i & \text{otherwise} \end{cases}$$

and where δ_i denotes individual i's discount factor. We assume $0 \leq \delta_i \leq 1$. Thus, for $\frac{I_x}{n} < \theta I_c < I_x$, we have a social dilemma situation in which there is a trade-off between individual and social payoff maximization.

We experimentally study this basic decision situation in a 2×2 between-subjects design, leading to a total of four treatments (see Table 1 for an overview). In our baseline treatment, *NowNow*, we consider a situation in which the benefits from the private and the public good are realized immediately ($I_x = I_c = 1$). This treatment serves as our first benchmark as it reflects the scenario studied by most previous literature. As a second benchmark, in *LaterLater* ($I_x = I_c = \delta_i$), we consider a situation in which the benefits from the private and the public good are realized with a delay of 12 months. This treatment allows us to study whether people discount the costs and benefits of cooperation to the same extent or whether there are differences between these two. Our remaining two treatments entail an asymmetry with regard to at which points in time the payments from the private and the public good are realized. In *NowLater* the costs of cooperation, i.e., the forgone private consumption, are realized immediately, while the benefits of cooperation, i.e., the payments from the public good, are delayed ($I_x = 1, I_c = \delta_i$). In treatment *LaterNow*, in contrast, the benefits of cooperation are realized immediately, while the costs of cooperation (in form of foregone private consumption) have to be borne only in the future ($I_x = \delta_i, I_c = 1$).

To provide some intuition for how the timing of costs and benefits affects the incentives to contribute to the public good, in the following we derive theoretical predictions based on a number of different models. Under the standard assumption that individuals are fully rational and only interested in maximizing their own (discounted) monetary payoffs, inserting the budget constraint into (1) and taking the first derivative with respect to c_i yields the following first-order conditions:

$$\frac{\partial \pi_i}{\partial c_i} = \begin{cases} -1 + \theta & \text{if } x_i \text{ and } c_i \text{ are realized immediately} \\ -1 + \delta_i \theta & \text{if } x_i \text{ is realized immediately and } c_i \text{ delayed} \\ -\delta_i + \theta & \text{if } x_i \text{ is realized delayed and } c_i \text{ immediately} \\ -\delta_i + \delta_i \theta & \text{if } x_i \text{ and } c_i \text{ are realized delayed} \end{cases} \tag{2}$$

In each row, the first term denotes the (discounted) marginal costs of contributing to the public good, while the second term denotes the (discounted) marginal benefits of contributing to the public good. Given the range of values for θ and δ_i, it is straightforward to see that the dominant strategy for individual i is to free-ride and contribute nothing to the public good ($c_i = 0$) in all cases, except when x_i is realized delayed, c_i is realized immediately, and δ_i is sufficiently low. In this case, if $\delta_i < \theta$, the benefits of cooperation outweigh the discounted costs, and full cooperation ($c_i = m$) becomes the dominant strategy. Hence, under the assumption of pure self-interest, we do not expect any differences across treatments *NowNow*, *NowLater*, and *LaterLater*, but contributions are expected to be higher for those individuals in *LaterNow* who are sufficiently impatient. Formally, we have:

$$c^*_{NowNow} = c^*_{NowLater} = c^*_{LaterLater} = 0 \quad \text{and} \quad c^*_{LaterNow} = \begin{cases} 20 & \text{if } \delta_i < \theta \\ 0 & \text{if } \delta_i \geq \theta \end{cases} \tag{3}$$

		Benefits from public good	
		"Immediate" *(in 1 day)*	Delayed *(in 12 months)*
Benefits from private consumption (costs of cooperation)	"Immediate" *(in 1 day)*	*NowNow*	*NowLater*
	Delayed *(in 12 months)*	*LaterNow*	*LaterLater*

Table 1: Experimental treatments.

There is now, however, plenty of evidence indicating that many people are not solely motivated by their own monetary payoffs, but that they also care about fairness and the well-being of others. In particular, evidence from numerous studies shows that people often cooperate even in anonymous one-shot games without communication, where mechanisms that can support cooperation, such as reputation or punishment do not apply (see Zelmer, 2003; Gächter and Herrmann, 2009; Chaudhuri, 2011, for reviews of the literature). A variety of models of other-regarding preferences (e.g., Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000; Charness and Rabin, 2002; Dufwenberg and Kirchsteiger, 2004; Falk and Fischbacher, 2006) have been established that can explain social behavior observed in the laboratory and in the field (see Sobel, 2005; Fehr and Schmidt, 2006; Cooper and Kagel, 2016, for excellent overviews).

In Appendix B, we analyze to what extent the predictions above change if we incorporate some form of social preferences. We consider two different type of models, one that incorporates concerns for altruism and warm glow of giving (Andreoni, 1989; Anderson et al., 1998), and one that allows for the possibility that players dislike inequality (Fehr and Schmidt, 1999). Despite their very different nature, both models make similar qualitative predictions. In particular, both models predict that compared to the case without any delay, contributions are expected to be lower when the benefits of cooperation are delayed, and they are expected to be higher when the costs of cooperation are delayed. The intuition for this result is straightforward. If people discount future payoffs, delaying the benefits of cooperation makes cooperation more expensive (relative to private consumption), thereby decreasing an individual's incentive to contribute. As a consequence, stronger non-pecuniary incentives, e.g., in form of altruism of inequity aversion, are needed to make cooperation optimal from an individual point of view, especially for low levels of δ_i. Reversely, when the costs rather than the benefits are delayed, this increases the marginal incentives for cooperation. As a result, cooperation can be sustained even for lower degrees of altruism or inequity aversion.

Finally, if both the benefits from the private and the public good are delayed, the degree of non-pecuniary incentives needed to sustain cooperation is the same as in the no delay case. The reason is that delaying all payments does not affect the marginal trade-off between contributing or not because δ enters both sides of the equation and, hence, cancels out.

Despite these similarities, both models differ with regard to the predicted contribution patterns, and neither of them is fully consistent with the existing empirical evidence on cooperation behavior. Specifically, while the altruism model can explain positive contributions if concerns for warm glow and/or altruism are sufficiently strong, such contributions are predicted to be independent of others' contributions. This is inconsistent with the evidence that most people are conditional cooperators who are only willing to cooperate if others do so, too. The model by Fehr and Schmidt (1999) can account for such behavior, although it also fails to capture the full picture. In particular, due to its linearity, the model makes an extreme prediction: depending on an individual's degree of guilt towards advantageous inequality, an individual finds it optimal to either free-ride completely or to match others' contributions perfectly. In contrast to that, previous evidence from cooperation behavior in public goods experiments have shown that many people are imperfect conditional cooperators, i.e., they are generally willing to contribute more the more others contribute, but typically fall short in matching others' contributions to the full extent (see e.g., Fischbacher and Gächter, 2010).In Section 4.3., we introduce and discuss the predictions of a social norms model as proposed by Fehr and Schurtenberger (2018), which can account for these behavioral regularities.

3 The Experiment

Our experiment consists of three parts. In Part 1 and 2 of the experiment, subjects play two versions of a one-shot linear public goods game based on the decision situation described above. Subjects are matched into groups of $n = 4$, and each group member is given an endowment of $m = 20$ tokens. In both parts, group members have to decide how many (if any) of their 20 tokens they want to contribute to a group project (Voluntary Contribution Mechanism (VCM)). Tokens contributed are doubled and shared equally among all four group members, irrespective of their individual contribution decisions, i.e., $\theta = 0.5$. Hence, while each token contributed to the public good is worth 0.5 monetary units (MU) for each group member, each token not contributed is worth 1 MU to the individual, thus creating the classical free-rider problem. For Part 1 and 2 of the experiment, subjects are randomly assigned to one of the four experimental treatments described above, *NowNow*, *NowLater*, *LaterNow*, or *LaterLater* (compare Table 1). In Part 3, which is identical across all treatments, we elicit a proxy for subjects' time preferences by asking them to make a series of decisions involving a trade-off between smaller-sooner and larger-later rewards. In the following, we describe each of the three parts in more detail.

3.1 Part 1: Elicitation of cooperation attitudes

Previous literature has highlighted the importance of both cooperation preferences and beliefs for explaining cooperation outcomes (Fischbacher and Gächter, 2010; Fischbacher et al., 2012; Gächter et al., 2017). The reason is that people who differ in their ex-ante attitudes towards cooperation can ex-post make the same cooperation decision. To see why, consider a 'conditional cooperator' who is willing to cooperate only if they believe others do so too. But there may also be 'free riders' who never want to contribute to the public good irrespective of their beliefs how much others contribute. A conditional cooperator who believes that others do not contribute and a person with a free rider attitude both contribute nothing: their ex-post behavior is observationally equivalent, despite different ex-ante attitudes. Thus, if cooperation is a function of attitudes and beliefs, the challenge is to separate them empirically. We achieve this separation by following the 'ABC of cooperation' approach as introduced by Gächter et al. (2017), which separately measures an individuals' attitude towards (conditional) cooperation (A), their beliefs about others' cooperation (B), and their contribution decision (C).

To elicit cooperation attitudes, in Part 1 of our experiment we use the design introduced by Fischbacher et al. (2001), which employs a variant of the strategy method (Selten, 1967). This design elicits an individual's willingness to cooperate as a function of other group members' cooperation by controlling for beliefs. Participants play a one-shot version of the game and are asked to make an unconditional and a conditional contribution decision. In the unconditional decision, participants choose one contribution level. In the conditional decision, participants are asked to fill in a table in which they have to indicate their contribution decision for each possible (rounded) average contribution of the other three group members. To guarantee incentive compatibility, in each group a random mechanism selects three members for whom the unconditional decision is payoff-relevant and one member for whom the conditional decision is payoff-relevant. For this participant, the conditional decision is calculated according to the (rounded) average unconditional decision of the other three group members. The incentive-compatibly elicited attitudes are a proxy for cooperation preferences in the sense that they measure people's willingness to pay for conditional cooperation. Previous studies have shown that on average people are conditionally cooperative, but that there is pronounced heterogeneity in cooperation attitudes across individuals (Fischbacher et al., 2001; Chaudhuri, 2011; Gächter et al., 2017).

3.2 Part 2: Elicitation of beliefs and cooperation outcomes

In Part 2 of our experiment, subjects play a one-shot direct-response public goods game in which all group members have to simultaneously decide on their contributions. To avoid any spillover effects between parts, at the beginning of Part 2, we randomly re-matched individuals into groups using a perfect-stranger matching protocol. Furthermore, information about Part 1 behavior was only given at the very end of the experiment.

After subjects decided on their contribution, they were asked for their beliefs about the average contribution of the other three group members. Beliefs were elicited as "most likely intervals" using the Most Likely Interval elicitation rule (MLI) method proposed by Schlag and van der Weele (2015). In this method, subjects are asked – in an incentive-compatible way – to state an interval in which the others' average contribution are believed to belong. The interval is stated by specifying an upper bound U and a lower bound L. The monetary incentives are such that subjects are paid whenever the true realization lay in the stated interval, but payments are strictly decreasing in the width of the reported interval, i.e., subjects face a trade-off between the chance of their guess being correct and receiving higher earnings in case the guess was correct.[5]

The advantage of this method compared to eliciting beliefs as point estimates (as usually done in these type of games) is that it not only allows to collect beliefs about general tendencies, i.e., whether cooperation is believed to be high or low, but to also get a measure for the underlying precision/uncertainty of people's beliefs. Narrow intervals correspond to high precision (low uncertainty), while wide intervals are an expression of low precision (high uncertainty). This is interesting because it allows us to investigate whether changing the timing of costs and benefits in our public goods setting not only shifts beliefs about others' cooperation levels, but also affects the perceived strategic uncertainty about the other group members' behavior. This could be the case because adding the time dimension introduces an additional layer of complexity to the decision problem - contributions now not only depend on a person's cooperativeness but also on their degree of patience - which, in turn, could increase the uncertainty about others' behavior.

[5]Specifically, payments are calculated according to the following function, where $\bar{c}_{-i}$ denotes the realization of the others' average contribution: $\pi_i^{belief}(L, U, \bar{c}_{-i}) = 0.25 \times (20 - (U - L))$ if $\bar{c}_{-i} \in [L, U]$, and 0 otherwise. The parameter 0.25 was chosen to calibrate the earnings from the belief elicitation and the decisions in the public goods game. $20 - (U - L)$ ensures that if subjects specified the whole action space as their interval (and hence their guess would be always correct), earnings are 0. See Schlag and van der Weele (2015) for more details and a discussion of the theoretical properties of the MLI method.

3.3 Part 3: Elicitation of time preferences

In Part 3 of the experiment, we elicit a proxy for individuals' time preferences. As argued in Section 2, we expect the size of our treatment effects to vary depending on subjects' degree of impatience - they should be large for very impatient subjects and small for very patient subjects - which is why they serve as an important control variable.

We elicit subjects' time preferences using a choice list design (Coller and Williams, 1999; Harrison et al., 2002; Andersen et al., 2008).[6] In our choice list, we ask subjects to choose between twenty smaller-sooner and larger-later rewards. All twenty choices were presented in a table similar to Table A1 in Appendix A. The smaller-sooner reward was a fixed payment of €50. The larger-later reward increased from €51.25 in the first row to €75 in the last row (in increments of €1.25). As in the case of our public goods game, sooner rewards were paid with a small delay of one day, while later rewards were paid with a delay of 12 months.

From the row in which a subject switches from the smaller-sooner to the larger-later reward, we can obtain an index of impatience. In particular, the more often an individual chooses the larger-later reward, i.e., the less money is necessary to induce them to wait 12 months, the more patient they are. Moreover, under the assumption of locally linear utility and annual compounding, an individual's switching point provides a bound on their discount rate. If, for example, a risk-neutral subject prefers the immediate payment for all amounts up to 60 Euro and then switches to the later option for all following choices, we can infer that their annual discount rate lies between 20% and 22.5%, or, alternatively, $0.8 \leq \delta \leq 0.83$.

3.4 Procedures

At the beginning of the experiment, subjects were informed about the three-part nature of the experiment. We did not, however, reveal any specific information about the details of each of the three parts. Instead, subjects were first introduced to the basic decision situation of the public goods game. They then had to successfully complete a comprehension test consisting of several questions about the comparative statics of the game as well as the timing of their payments (see Appendix C.1 for an English version of the instructions including screenshots of the experiment as well as a copy of the control questions). After that, the instructions for

[6]One potential disadvantage of the choice list method is that it implies inconsistent time preferences if subjects switch more than once between the smaller-sooner and larger-later rewards. In our sample this is not the case as we observe a very high rate of consistency: 98% of subjects exhibit a unique switching point from the smaller-sooner to the larger-later reward. For the remaining four subjects, we use the midpoint of the first and the last row in which they switch to the larger-later option as the switching point. All results are robust to alternative specifications or exclusion of these subjects.

Part 1 were distributed and read aloud. Once all subjects finished Part 1, we distributed and read aloud instructions for Part 2. At the end of Part 2, groups were dissolved and subjects received instructions for Part 3. As before, no information about behavior of others was revealed. At the end of the experiment, subjects then received detailed information about the results from each part. Subjects' earnings were determined by the sum of their payoffs from Part 1 and Part 2. For Part 3, in each session we randomly selected one subject for payment, and for this subject the earnings from Part 3 were added to the remaining earnings from Part 1 and 2. In addition, each subject received a show-up fee of €4. On average, subjects earned about €18.30, and sessions lasted about one hour.

We recruited a total of $n = 248$ (*NowNow*: $n = 64$, *NowLater*: $n = 64$, *LaterNow*: $n = 56$, *LaterLater*: $n = 64$) students from various disciplines using the online recruiting software ORSEE (Greiner, 2015) and computerized the experimental sessions using z-Tree (Fischbacher, 2007). In the recruitment email, it was explicitly stated that subjects would receive parts of their payment via bank transfer and that they therefore need to be willing to share their bank information with us. Nothing, however, was mentioned about the possibility of delayed payments. This was done to avoid any effects due to self-selection into our experiment (apart from being willing to receive payments via bank transfer).

One major challenge when studying intertemporal choices is to make all choices equivalent except for their timing. In particular, transaction costs associated with experimental payments have to be held constant across all time periods. We undertook several precautionary measures to equate transaction costs as much as possible. Most importantly, all sooner and later payments were made via bank transfer at the same day of the experiment.[7] That is, irrespective of the timing of the payment, all payments were transmitted to the bank at the same time by one of the authors. While sooner payments were initiated "immediately", later payments were arranged as *scheduled payments* in which we specified the exact date in the future when the actual transfer had to be carried out. Subjects were fully informed about all these procedures and that they would receive an email with a confirmation of both transfers within two days after the experiment. Subjects were further told that bank transfers typically take at least one working day. These procedures not only ensure similarity in physical transaction costs, but also makes sooner and later payments equally credible. In addition, at the end of the experiment all subjects received a written "payment agreement form", which listed all payments at every point in time a subject would receive. It also entailed a subject's bank information and email-address, as well as the full contact information

[7] The show-up fee of €4 was paid in cash at the end of the experiment. This was required by the internal rules of the laboratory.

and the signature of one of the authors.[8] Hence, subjects had the possibility to contact us at any time in case of any problem with regard to their payments.

By introducing a small front-end delay of one day, we further aimed at limiting the scope for immediacy effects and present bias. Indeed, recent evidence suggests that present bias only occurs when payments are truly immediate, and that adding a small delay to immediate payments is sufficient to prevent present bias to occur (see Andreoni and Sprenger, 2012; Balakrishnan et al., 2020). Our results are hence best understood as being mainly driven by long-run exponential discounting (Laibson, 1997; O'Donoghue and Rabin, 1999; Frederick et al., 2002). In any case, since the payment procedures are exactly the same across all treatments, this should not affect our treatment comparisons. For the later payment we chose a delay of 12 months (i) to make the delay meaningful as in many of the real-world examples discussed above, and (ii) to avoid any seasonal effects that could arise if subjects have preferences for receiving money in a certain month, e.g., before Christmas or holidays.

4 Results

We start our analysis by comparing cooperation levels in the one-shot direct-response game in Part 2 of our experiment, and by testing the extent to which contributions depend on individuals' degree of impatience (Part 3). In Section 4.2, we then use the subjects' responses from the remaining parts of the experiment to investigate the extent to which the observed differences can be explained by individuals' attitudes towards cooperation (Part 1) and their beliefs about others' contributions (Part 2). In Section 4.3, we present the design and the results from our norm-elicitation experiment, which we conducted to shed light on the observed patterns of conditional cooperation.

4.1 The effects of delayed costs and benefits on cooperation

The main effects of delay on cooperation are summarized by Figure 1, depicting contribution levels for each of our four treatments. The figure reveals that the timing of the costs and benefits of cooperation has a strong and significant effect on the levels of cooperation. In our baseline treatment, *NowNow*, average contributions (bars) amount to 9.6, which is very much in line with the results of previous studies, which typically observe cooperation rates

[8] A copy of this from can be found in Appendix C. Note that it was made clear to participants that their information will solely be used for transaction purposes, and that after all payments have been made, this data will be deleted. All participants were fine with these procedures and gave us their informed consent to participate in the study.

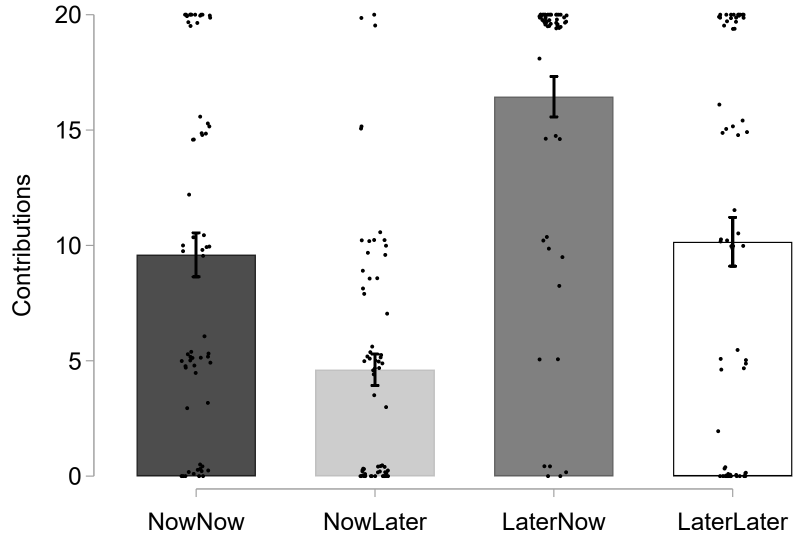

Figure 1: Average contributions (bars, ± 1 s.e.m.) and individual contributions (jittered dots) in the one-shot direct-response game in Part 2.

between 40% and 50% of the social optimum (see Zelmer, 2003, for an overview). When the benefits of cooperation are delayed but the costs are immediate (*NowLater*), we observe a significant and substantial decrease in contributions to 4.6, 52% less than in *NowNow* (Mann-Whitney U (MWU) test, $p < 0.001$).[9] In the case of delayed costs but immediate benefits (*LaterNow*), in contrast, contributions significantly increase by 71% to 16.4 (MWU test, $p < 0.001$). While this change in contributions seems (in absolute terms) somewhat larger than in *NowLater*, the difference between the two is not statistically significant (F-test, $p = 0.398$). Finally, when both the costs and the benefits of cooperation are delayed to the same extent (*LaterLater*), we observe contribution levels that are very similar and statistically indistinguishable from the amounts observed in *NowNow* (MWU test, $p = 0.801$), suggesting that the costs and benefits of cooperation are discounted to the same extent. Very similar results are obtained when considering the unconditional contributions in Part 1 of the experiment.[10]

To provide some more detail, Figure 1 further shows the distribution of individual contributions as depicted by the small (jittered) dots. As can be seen, in our baseline treatment cooperation levels span quite evenly across low and high contributions: 22% of the subjects chose to contribute nothing, 13% chose to contribute 10, and 25% chose to contribute their

[9]Throughout the paper we use non-parametric tests whenever possible. All results are robust to using parametric t-tests. If not stated otherwise, all reported p-values correspond to two-sided tests.

[10]Here, average contributions amount to 9.95, 5.59, 16.70, and 12.03 in *NowNow*, *NowLater*, *LaterNow*, and *LaterLater*, respectively. Pairwise comparisons reveal that all these differences are statistically significant (MWU, all $p < 0.001$), except the one between *NowNow* and *LaterLater* ($p = 0.092$).

entire endowment. A very similar distribution is observed in *LaterLater*, where the fraction of subjects contributing 0, 10, and 20 amount to 32%, 13%, and 33%, respectively. In contrast to that, we observe a clear shift towards free-riding when the benefits of cooperation are delayed (*NowLater*). In this case, most subjects (46%) did not contribute anything, while only 5% chose to contribute their entire endowment. When the costs rather than the benefits of cooperation are delayed (*LaterNow*), an opposite shift is observed. In this case, 71% of all subjects contribute the maximum amount, while only 9% free-ride completely (see Table A2 in Appendix A for further details).

To shed some light on the underlying heterogeneity in contributions, we can rely on the results from Part 3 of our experiment, in which each individual had to choose between twenty smaller-sooner and larger-later rewards (compare Table A1 in Appendix A). In particular, we can use the number of late choices as a proxy for an individual's time preference; the more often they choose the larger-later reward (i.e., the less money they demand as a compensation for delaying the €50 payment by one year), the more patient they are.[11] Intuitively, we would expect our treatment manipulation to have the strongest impact for those subjects who are very impatient, while it should have little or no impact on the subset of individuals who do not discount at all. The reason is that delaying the benefits of cooperation decreases the marginal incentives to contribute, and this decrease is the stronger the more heavily an individual discounts future payments. Delaying the costs of cooperation, in contrast, makes cooperation more attractive (by decreasing the marginal incentives for private consumption), and this effect is the stronger the more impatient the individual.

These predictions are borne our by the data. In particular, we find that when the benefits of cooperation are delayed (*NowLater*), there is a significant positive relationship between subjects' degree of patience and their level of contributions (Spearman's rank correlation: $\rho = 0.39, p = 0.002$). At the same time, we find that when costs rather than benefits are delayed (*LaterNow*), there is a significantly negative correlation between an individual's degree of patience and their contribution decision ($\rho = -0.55, p < 0.001$). Finally, we find that when the costs and benefits of cooperation are realized at the same time, there is no significant correlation between an individual's degree of impatience and their contribution

[11] As discussed in Section 3.3, we can also use the row in which a subject switches from the smaller-sooner to the larger-later reward to calculate bounds on their discount rate. The median discount rate falls in the range of 30 to 32.5%, which is very much in line with findings from previous studies using a similar design. For example, in a representative sample of 1000 German adults, Dohmen et al. (2010) find a median annual discount rate between 27.5 and 30%. Similarly, Harrison et al. (2002) report an average annual discount rate of 28.1%. Furthermore, we find no significant differences in our time preference measure across the four treatments (Kruskal-Wallis test, $p = 0.301$). We take this as evidence that the randomization into treatments worked, and that having experienced different versions of the public goods game in Part 1 and 2 of the experiment had no effect on behavior in Part 3 (see also Figure A1 in Appendix A)

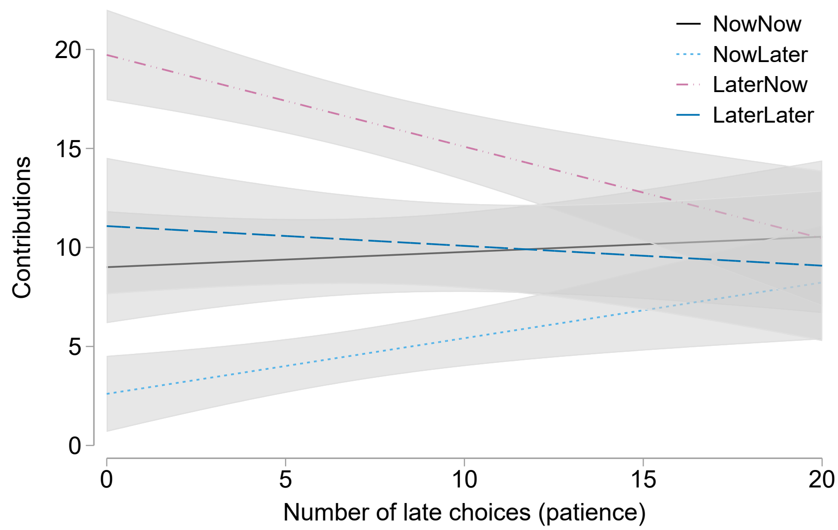

Figure 2: Fitted lines from linear regressions including a 95% confidence interval.

behavior, neither in *NowNow* ($\rho = 0.04, p = 0.746$) nor in *LaterLater* ($\rho = -0.11, p = 0.400$). This indicates that there is no direct link between cooperativeness and (im)patience per se, which is in line with previous evidence (Fehr and Leibbrandt, 2011; Davis et al., 2016).

Figure 2 illustrates the implication of these results on the levels of cooperation. It depicts fitted lines (including 95% confidence intervals) from OLS regressions using contribution decisions as the dependent variable and the number of late choices as independent variable (compare Table A3 in Appendix A). The figure confirms that the differences in contributions between our baseline treatment and *NowLater* and *LaterNow* are particularly large among the most impatient subjects.[12] We summarize these findings in our first result:

> **Result 1:** *Compared to the situation in which the costs and benefits of cooperation are realized immediately, delaying the benefits of cooperation significantly decreases contribution levels, while delaying the costs of cooperation significantly increases contributions. The shift in contributions is thereby particularly pronounced among the most impatient subjects. Delaying both the costs and the benefits, in contrast, has no discernible effect on contributions.*

[12]To test this visual impression more rigorously, we divide our sample into three equally large subgroups depending on their degree of (im)patience. In particular, we classify a subject as a low, medium, or high patience type if the number of their larger-later choices lies in the bottom, intermediate, or upper tercile of the overall distribution. Redoing our analysis from above reveals that cooperation differences between our two asymmetric treatments and *NowNow* are large and highly significant for subjects classified as having low patience (*NowLater*: -6.0 tokens, *LaterNow*: +11.0 tokens, MWU tests, both $p < 0.005$), but that these differences become much smaller and insignificant for subjects being classified as having high patience (*NowLater*: -3.3 tokens, *LaterNow*: +1.7 tokens; MWU tests: both $p > 0.204$).

4.2 Explaining cooperation differences

The next step in our analysis is to shed light on the underlying behavioral mechanisms behind the observed differences. In particular, we are interested in whether the gap in contributions can be explained by a shift in beliefs about others' contributions, a shift in cooperation attitudes, or a combination of both. Distinguishing these underlying mechanisms is important, because it allows to identify whether the timing of costs and benefits has an effect on people's deep underlying preferences towards cooperation, or whether, in principle, the observed gap in cooperation can be eliminated through appropriate belief management. The insights from this analysis can thus inform managers and policy makers by shedding light on which solution mechanisms are best suited for promoting cooperation.

We start by investigating how the timing of costs and benefits affects beliefs about others' contributions. The results of our belief elicitation are summarized in Figure 3. It shows for each treatment, the average belief interval - determined by the upper and the lower bound - and the average midpoint of the interval, as depicted by the horizontal line. The figure reveals several interesting observations. First, it shows that the location of the beliefs follows the ordering of contributions (compare Figure 1). While beliefs in *NowNow* and *LaterLater* are very similar, subjects in *NowLater* are more pessimistic about others' contributions and in *LaterNow* they are more optimistic about others' contributions. This visual impression is corroborated by non-parametric tests. The null hypothesis of equality of the distribution of beliefs is clearly rejected using the lower bound, the upper bound, or the midpoint of the belief interval (Kruskal-Wallis tests, all $p < 0.001$). Pairwise treatment comparisons reveal highly significant differences across all comparisons (MWU test, all $p < 0.001$), except for comparisons between *NowNow* and *LaterLater*, which are always insignificant (all $p > 0.302$).[13]

[13]Interestingly, we find these effects to be attenuated or amplified depending on subjects' time preferences. That is, while in *NowNow* and *LaterLater* we find no systematic relationship between a subject's degree of impatience and their beliefs about others' contributions - in both cases the Spearman's rank correlation coefficient is close to zero and not statistically significant (both $p > 0.189$) - when either the costs or the benefits of cooperation are delayed, we observe a significant relationship between an individual's degree of impatience and their beliefs about others' contributions. In *NowLater*, we find that more patient subjects are significantly more optimistic about others' contributions (Spearman's rank correlation: $\rho = 0.31, p = 0.013$). On the contrary, in *LaterNow* we observe more patient subjects to hold significantly lower beliefs about others' contributions ($\rho = -0.32, p = 0.017$). One potential explanation for these findings is the so-called *false consensus effect* (Ross et al., 1977) according to which people tend to overestimate the extent to which others think the same way as they do. In particular, if subjects expect others to be similarly (im)patient than themselves, given the significant relationship between time preferences and contribution behavior, this can explain why beliefs about others' contributions and impatience are correlated, too. The relationship between impatience and beliefs is, however, less pronounced than the one observed between impatience and contributions (see Figure A2 in Appendix A).

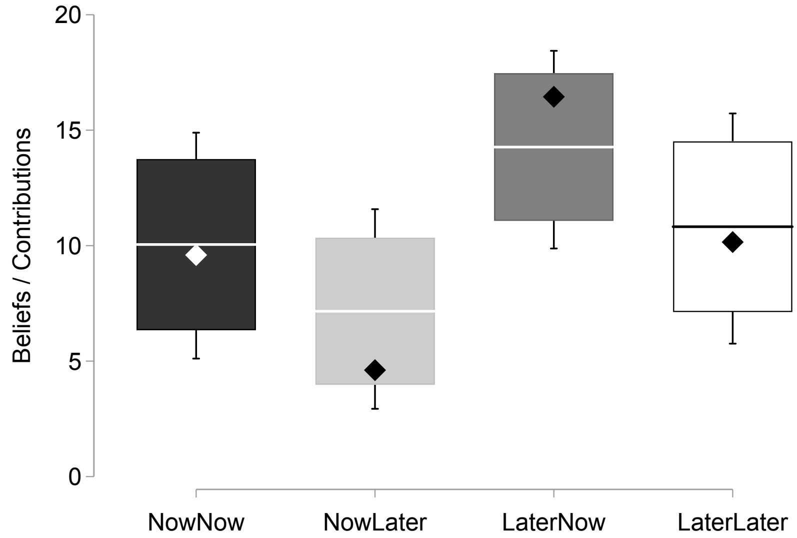

Figure 3: Belief intervals (± 1 s.e.m.) and contributions (diamonds) in Part 2.

Second, we find that the width of the belief interval, which we use as a proxy for subjects' uncertainty about others' contribution behavior, is very similar across treatments (Kruskal-Wallis test, $p = 0.277$). This suggests that adding an additional layer of complexity to the decision problem by delaying the costs and/or the benefits of cooperation, does not significantly affect strategic uncertainty.

Third, we observe that the shifts in beliefs alone are not sufficient to explain the differences in contributions across treatments. To illustrate this, Figure 3 also depicts mean contributions as displayed by the diamonds. In both *NowNow* and *LaterLater*, we find contributions to be well aligned and not significantly different from the midpoint of the belief interval (Signrank test, both $p > 0.308$). The ratio between average contributions and the average midpoint of the belief interval amount to 0.95 and 0.94, respectively, which are not significantly different from each other (MWU test, $p = 0.494$). In the other two treatments, in contrast, contributions systematically deviate from that midpoint (Signrank test, both $p < 0.001$). In *NowLater*, we observe contributions close to the lower bound of the belief interval, yielding a contribution-belief ratio of only 0.64, significantly lower than the one in *NowNow* (MWU test, $p < 0.001$). In *LaterNow*, in contrast, we find contributions to be close to the upper bound of the belief interval; the ratio between contributions and beliefs amounts to 1.15, significantly higher than in *NowNow* (MWU test, $p = 0.004$).

One potential explanation for these differences is that introducing an asymmetry to the timing when payments realize makes it harder for subjects to predict others' behavior. That is, while in the two symmetric treatments subjects might have well-calibrated beliefs about others' behavior, in the two asymmetric treatments, despite anticipating the direction of the shift in contributions, subjects may underestimate the magnitude of this effect, e.g., because they believe others to be more patient than they actually are. An alternative explanation is that delaying the costs or benefits of cooperation has, on top of its effect on beliefs, a direct effect on subjects' cooperation attitudes, i.e., their willingness to reciprocate others' contributions. Although we have some evidence that speaks in favor of the second explanation, based on this data alone, we cannot rule out one explanation or the other.[14] Instead, to test for this more rigorously, we rely on the data from Part 1 of our experiment, in which we elicited subjects' preferences towards cooperation using the strategy method. The advantage of this method is that by allowing subjects to condition their own contributions on the other group members' contributions, the decision becomes (from a game-theoretic perspective) sequential and, hence, does not exhibit any strategic uncertainty. This, in turn, allows us to investigate the role of cooperation preferences (in the sense of a willingness to pay for cooperation) without the confounding factor of endogenous beliefs.

The results from the strategy method are summarized in Figure 4. Panel A depicts the average conditional contribution schedules separately for each treatment. Two things stand out from this figure. First, we observe a similar strong positive slope of conditional contributions across all our treatments. Second, there is a pronounced vertical shift in the contribution schedules.

To quantify these effects, we rely on regression analysis in which we use subjects' conditional contribution decisions as dependent variable, and others' average contributions, treatment dummies, as well as interaction terms between the latter two as independent variables. The results from this regression are reported in Table A4 in Appendix A. They confirm that there are no significant differences across treatments with regard to the slopes of the average schedule (as indicated by the insignificant interaction terms), but that there are significant shifts in contribution levels (as indicated by the significant treatment dummies). Compared to *NowNow*, subjects contribute on average 1.6 tokens less when the benefits of cooperation are delayed, and 3 tokens more when the costs of cooperation are delayed. Both of these

[14]Evidence in favor of the second explanation comes from two sources. First, we find no pronounced treatment differences with regard to the accuracy of beliefs as measured by the number of cases in which the actual average contributions of the other group members lay within the stated belief interval. Overall, beliefs are correct in 52% of the cases, with no significant differences across treatments (*NowNow*: 50%, *NowLater*: 53%, *LaterNow*: 61%, and *LaterLater*: 47%; $\chi^2(3) = 2.50$, $p = 0.476$). Second, if the mismatch between contributions and beliefs were solely driven by inaccurate beliefs, this effect should be uncorrelated with individuals' time preferences. Instead, in *NowLater* we find a significant positive correlation between a subject's degree of impatience and the ratio between their own contributions and their beliefs about others' contributions (Spearman's rank correlation: $\rho = 0.41, p = 0.001$), while in *LaterNow* this relationship is significantly negative ($\rho = -0.33, p = 0.014$).

effects are statistically significant ($p = 0.015$ and $p = 0.020$, respectively). In *LaterLater*, in contrast, the treatment dummy is close to zero and statistically insignificant ($p = 0.666$), confirming that when both costs and benefits of cooperation are delayed, behavior is very similar compared to the case without any delay. Before providing more details on these results and their underlying mechanisms, we summarize our findings as follows:

> **Result 2:** *The shifts in contributions across treatments can be explained by a combination of two effects: a shift in beliefs about others actions and a shift in cooperation preferences. Relative to the case without delay, delaying the benefits of cooperation leads to a significant decrease in subjects' beliefs about others' contributions and a decrease in their willingness to match those contributions. Delaying the cost of cooperation, in contrast, leads to a significant increase in subjects' beliefs as well as their willingness to match others' contributions. Delaying both costs and benefits of cooperation, instead, has no discernible effect, neither on beliefs nor on cooperation preferences.*

What can explain the differences in the average conditional contribution schedule? As a first step, we demonstrate that the observed shifts are indeed triggered by the delay. That is, we find that in *NowLater* conditional contributions are significantly negatively correlated with an individual's degree of impatience (Spearman's rank correlation: $\rho = -0.31, p = 0.012$), while the opposite holds for *LaterNow* ($\rho = 0.53, p < 0.001$). No such relationships are observed for the other two treatments (*NowNow*: $\rho = -0.03, p = 0.839$; *LaterLater*: $\rho = -0.05, p = 0.692$), confirming our results from Part 2 (see above). Interestingly, however, in none of the four treatments time preferences have a systematic effect on the slope of an individual's conditional contribution vector (all $\rho < 0.20$ and all $p > 0.124$).[15] This indicates that a subject's degree of impatience is uncorrelated with their general attitude towards cooperation, i.e., whether being willing to reciprocate others' contributions or not, a finding we will come back to below.

As a second step, we take a closer look at the heterogeneity that underlies Figure 4A. We follow previous literature (Fischbacher et al., 2001; Fischbacher and Gächter, 2010; Fischbacher et al., 2012; Gächter et al., 2017) and classify a participant as a (i) *'conditional cooperator'* if their contribution schedule exhibits a (weakly) monotonically increasing pattern, or if the Spearman correlation coefficient between their schedule and the others' average contribution is positive and significant at $p < 0.01$; (ii) *'free rider'* if they never contribute

[15] The slope is obtained from individual OLS regressions with own conditional contributions as the dependent variable and others' average contributions as independent variable.

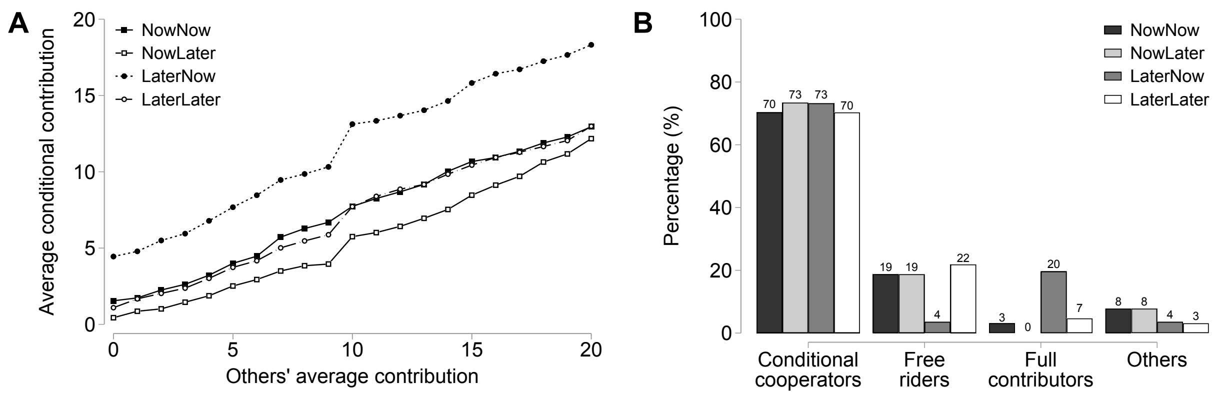

Figure 4: Panel A: Average conditional contribution schedule in Part 1 of the experiment. Panel B: Distribution of cooperation types.

anything irrespective of how much the others contribute, or (iii) *'full contributor'* if they contribute maximally in all cases. We refer to the remaining subjects as *'others'*.

The results of this classification are shown in Panel B of Figure 4. They reveal a remarkably similar distribution of types across treatments. In particular, the fraction of subjects classified as conditional cooperators is almost identical in all four treatments, varying between 70% and 73% ($\chi^2(3) = 0.28$, $p = 0.964$). Also the fraction of the other types is very similar across treatments, except for *LaterNow* where, compared to the other three treatments, we find a significantly lower fraction of free riders (χ^2-tests, all pairwise comparisons $p < 0.011$) and a significantly higher share of full contributors (χ^2-tests, all pairwise comparisons $p < 0.012$).[16]

As we have shown in Section 2, such shift is expected under the standard model of narrow self-interest if individuals are very impatient. That is, when the costs are delayed and $\delta_i < \theta$, then the marginal benefits outweigh the discounted marginal costs and, hence, contributing the maximum amount becomes a dominant strategy (compare equation (3)).[17] Evidence in support for this prediction comes from our individual time preference measure. Specifically, in *LaterNow* we find that subjects classified as full contributors show very high degrees of discounting; on average they choose the larger-later reward in only 2.1 out of the 20 cases, which is significantly lower than the average of 8.3 we observe for all other types (MWU

[16]The differences between the remaining three treatments (*NowNow*, *NowLater*, and *LaterLater*) are all very small and not statistically significant, neither for free riders ($\chi^2(2) = 0.26$, $p = 0.877$) nor for full contributors ($\chi^2(2) = 2.87$, $p = 0.238$).

[17]A similar prediction can be derived using a model of altruism, which under certain conditions, i.e., if the concerns for altruism are sufficiently strong, also predicts full contributions as the optimal solution. As we show in Appendix B, this condition can be fulfilled more easily in *LaterNow*, as delaying the costs of cooperation makes free-riding less attractive.

test, $p = 0.006$). No such difference is observed in the other treatments. This suggests that the relatively large fraction of full contributors in *LaterNow* can indeed be explained by a significant amount of selfish but very impatient individuals.

One implication of these results is that delaying the costs or the benefits of cooperation has relatively little impact on subjects' general attitude towards cooperation. In particular, adding an intertemporal component to the public goods problem seems to not destroy the general principle of reciprocity, as indicated by a similar steep slope of the conditional contribution schedule and a similar high fraction of participants being classified as conditional cooperators. At the same time, however, we observe that the willingness to match others' contributions is diminished when the benefits of cooperation are delayed, and increased when costs are delayed. To better understand this finding, in the following, we more closely investigate the contribution patterns of conditional cooperators, which constitute the by far largest group. Previous studies have shown that there is large heterogeneity within this group; while some are willing to perfectly match others' contributions in all instances, some others are so-called 'imperfect conditional cooperators', who are willing to match others' contributions only to a certain extent.

We find that in *NowNow*, only 18% of all conditional cooperators match others' contributions perfectly. On average, conditional contributions amount to 8.82 tokens, which is significantly less than 10, the (average) required amount for perfect conditional cooperation (Signrank test, $p = 0.012$). Hence, we find that also in our sample conditional cooperators exhibit on average a small but significant self-serving bias. More importantly, we find that this self-serving bias becomes substantially stronger in treatment *NowLater*. In this case, the fraction of perfect conditional cooperators drops to 13% and average conditional contributions amount to only 7.22 tokens, which is significantly less than in *NowNow* (MWU test, $p = 0.008$). When costs rather than benefits are delayed (*LaterNow*), in contrast, we find that subjects match others' contributions almost perfectly; average conditional contributions amount to 10.00 tokens, which is not significantly different from ten (Signrank test, $p = 0.749$) and (weakly) significantly higher than the amounts observed in *NowNow* (MWU test, $p = 0.095$). Finally, when both the costs and the benefits are delayed, conditional contributions are very similar and not significantly different from the ones observed in *NowNow* (8.36 vs. 8.82, MWU test, $p = 0.627$).[18] We summarize these findings in our third result:

> **Result 3:** *Delaying the benefits of cooperation causes a parallel downward shift in conditional contributions, which is primarily driven by an increased self-serving bias among 'conditional cooperators'. Delaying the costs of cooperation causes a*

[18] The fraction of perfect conditional cooperators amount to 27% in both in *LaterNow* and *LaterLater*.

parallel upward shift in conditional contributions, which is due to a combination of two factors: (i) a shift from 'free rider' to 'full contributor' types, and (ii) an increased willingness of 'conditional cooperators' to match others' contributions.

Previous literature has proposed various theories of social preferences that can explain patterns of (imperfect) conditional cooperation (see our discussion in Section 2 and in Appendix B). Examples range from outcome-based models such as altruism and inequity aversion, to intention-based models of reciprocity, to models of conformism and guilt. Given this large variety of possible underlying motivations, disentangling between every single of them is beyond the scope of this paper (see Miettinen et al., 2020, for a recent exercise along these lines). Instead, in the following, we focus on one particular mechanism that recently has received much attention within economics and related fields: *Social norms*, i.e., collectively recognized rules of behavior that define which actions are viewed as socially appropriate. Numerous recent studies have demonstrated the power of social norms in explaining social behavior across many different contexts (see, e.g., Krupka and Weber, 2013; Gächter et al., 2013; Kimbrough and Vostroknutov, 2016; Krupka et al., 2017). Most related to our context is a study by Fehr and Schurtenberger (2018), which argues that a large variety of behavioral regularities with regard to human cooperation can be explained by a significant share of individuals adhering to a social norm of conditional cooperation. To provide a direct test of this conjecture, and to test whether differences in social norms can explain the shifts in conditional cooperation we observe across our four settings, we ran an additional online experiment in which we elicited social norms separately for each treatment.

4.3 Social norms of conditional cooperation

The procedure of the online experiment was as follows. At the beginning of the experiment, participants were randomly assigned to one of the four treatments (between-subjects design). They then received instructions explaining the general public goods game, the strategy method experiment to elicit conditional contributions, and the timing of the payments. To check for their understanding of the decision situation, each subject had to correctly answer the same set of control questions as participants in our laboratory experiment. After that, they were introduced to the norm-elicitation task. To elicit social norms, we use the well-established design by Krupka and Weber (2013). In this task, participants are asked to evaluate the social appropriateness of actions on a six-point scale ranging from 1: "Very socially inappropriate" to 6: "Very socially appropriate". In our experiment, we asked participants to rate the social appropriateness of actions that were available to subjects in our strategy-method experiment. In particular, participants were asked to evaluate how socially appropriate they think it is to contribute $c \in [0, 1, 2, \cdots, 20]$ tokens conditional on others' contributing on average 0, 5, 10, 15, or 20 tokens, respectively.[19]

The evaluation of actions was incentivized. Participants were told that, at the end of the experiment, one of the possible scenarios they had evaluated would be selected at random, and that their response in this situation would be compared to those of all other participants. If a participant's appropriateness rating was the same as the modal response, then that participant would earn €10; otherwise they would earn nothing (see Appendix C.2 for an English copy of the experimental instructions). As argued by Krupka and Weber (2013), this gives participants an incentive to reveal their perception of what is commonly regarded as appropriate or inappropriate behavior, rather than their own personal judgment. This is important because social norms are collectively recognized rules of behavior, rather than personal opinions about behaviors (e.g., Elster, 1989; Ostrom, 2000).

The experiment was programmed using the software Qualtrics. Student participants from various disciplines were recruited using the online recruiting software ORSEE (Greiner, 2015). For the recruitment we used the same subject pool as in our main experiment, but only participants who had not taken part in any of our previous sessions were allowed to participate. We collected data from a total of $n = 374$ participants (*NowNow*: $n = 93$, *NowLater*: $n = 93$, *LaterNow*: $n = 95$, *LaterLater*: $n = 93$). Participants earned on average €8.11 (including a €2.50 show-up fee) for sessions that lasted around 25 minutes.

How can these elicited norms help explain behavior in our context? To illustrate this, we briefly sketch the social norms approach as proposed by previous literature (Krupka and Weber, 2013; Kimbrough and Vostroknutov, 2016; Fehr and Schurtenberger, 2018). This approach assumes (i) the existence of a norm that is defined in terms of a specific behavior, and (ii) that on top of being motivated by material self-interest, individuals have an intrinsic desire to comply with the norm. In the most general form, decision-maker i's utility function can be written as:

$$u_i(\pi, a_k) = V_i(\pi_i(a_i, a_{-i})) + \gamma_i N(a_i|a_{-i}) \tag{4}$$

where the function $V_i(.)$ represents the value the individual places on the monetary payoffs $\pi_i(a_i, a_{-i})$ that result from selecting action a_i given the actions of the other individuals, a_{-i}. The second term of the utility function captures the preference for norm compliance. The social norm function $N(.)$ assigns to each of the possible actions available to the decision

[19] Given the large number of possible combinations of own and others' contributions in the strategy method ($21^2 = 441$), we decided to restrict the number of evaluations to a few selected cases that we deemed to be the most important ones.

maker a degree of appropriateness or inappropriateness that reflects the norm in the relevant group. Note that the social appropriateness of an action a_i may depend on social and contextual influences, such as the behavior of others a_{-i}. Thus, if for an action a_i there is collective recognition that the action constitutes "norm-consistent" behavior, then $N(.) > 0$. If there is joint recognition that an action constitutes "norm-inconsistent" behavior, then $N(.) < 0$. The parameter γ_i measures the extent to which the decision-maker cares about conforming to norms. Decision-makers who care about norm compliance ($\gamma_i > 0$) enjoy a positive utility by selecting actions that are viewed as socially appropriate, whereas they suffer a dis-utility from actions that are inappropriate. For the context of cooperation, Fehr and Schurtenberger (2018) propose the following specific functional form:

$$u_i = \pi_i - \gamma_i(c_i - c^*)^2 \tag{5}$$

where c_i corresponds to the individual's contribution and c^* describes the contribution norm. As before, the parameter γ_i captures an individual's strength of desire to conform to the social norm, and the term $\gamma_i(c_i - c^*)^2$ denotes the psychological costs of deviating from the norm. From this it becomes clear that individuals face a trade-off between maximizing their own monetary payoff and adhering to the social norm. That is, while higher contributions c_i are costly and thus reduce an individual's material payoff π_i, if c_i is below the norm c^*, an increase in c_i reduces the costs of non-conformity $\gamma_i(c_i - c^*)^2$. The model implies that individuals with a very low γ_i ($\gamma_i \approx 0$) will always choose the payoff-maximizing action of defection (as our free rider type from above), while those with a sufficiently large γ_i will cooperate and obey to the norm c^*. Furthermore, if γ_i is positive but sufficiently small, individuals will not obey the norm perfectly, but reduce their contributions somewhat below c^*, which implies imperfect conditional cooperation.

As we show in more detail in Appendix B, this model yields straightforward predictions with regard to the expected levels of contributions across our four treatments. In particular, under the assumptions that the norm utility flows immediately, i.e., at the time when the decision to contribute is made, that δ_i and γ_i are equally distributed across treatments, and that c^* is the same across all conditions, the model predicts $c_i^{LaterNow} > c_i^{LaterLater} > c_i^{NowNow} > c_i^{NowLater}$. The intuition for this result is similar to the one for the social preference models as discussed in Section 2. If people discount future payoffs, i.e., $\delta_i < 1$, delaying the benefits of cooperation makes cooperation more expensive (relative to private consumption), thereby decreasing an individual's pecuniary incentive to contribute. As a consequence, a stronger desire for norm compliance is needed to make an individual willing to contribute as much as the norm describes. Put differently, since delaying the benefits reduces the material incentives for cooperation, when holding constant the desire for norm compliance, γ_i, an individual is predicted to contribute less compared to the case without any delay. When the costs of cooperation are delayed, in contrast, cooperation becomes relatively cheaper. As a result, cooperation levels equal to the social norm can be sustained even for lower degrees of the willingness to comply with the norm.

Of course, these predictions change if, for instance, delaying the costs or the benefits of cooperation has a direct effect on what is considered to be socially appropriate behavior. In fact, the aim of our norm-elicitation experiment is to empirically identify the social norm c^*, and to test whether it is treatment-specific. This, in turn, allows us to understand whether the observed shifts in conditional cooperation can be explained by a shift in social norms or by a shift in the degree to which individuals are willing to comply with the norm. Such shifts could arise, for example, because the time factor may provide individuals with a reasonable excuse to be more selfish, which, in turn, may make non-compliance less socially inappropriate.

Our main results are summarized by Figure 5, plotting the mean appropriateness ratings assigned to each possible contribution decision, separately for all five levels of others' average contributions. Following the approach of Krupka and Weber (2013), mean appropriateness ratings are calculated by transforming subjects' responses into evenly-spaced numerical scores using the following scale: very socially inappropriate = -1; inappropriate = -0.6; somewhat socially inappropriate = -0.2; somewhat socially appropriate = 0.2; socially appropriate = 0.6; very socially appropriate = 1 (see Figure A3 in Appendix A for the full distribution of appropriateness ratings for each scenario). The panel on the right bottom shows all data combined, expressed as a function of the deviation from others' contributions in the strategy method.

Figure 5 reveals that there is a very strong social norm of conditional cooperation as indicated by the pronounced spike in mean appropriateness ratings when perfectly matching others' contribution. This pattern is thereby very consistent across all scenarios, even when others contribute nothing. Our results further show that the more a contribution deviates from others' contributions, the less socially appropriate this action is considered to be. This effect is particularly pronounced for negative deviations, i.e., when contributing less than others, but it is also present for positive deviations, although to a lesser extent. Regression analysis reveals that the difference in slopes between positive and negative deviations is statistically significant (see Table A5 in Appendix A). Finally and most importantly, we find very little systematic differences in the social appropriateness ratings across our four treatments. In particular, irrespective of the timing of costs and benefits, we find that

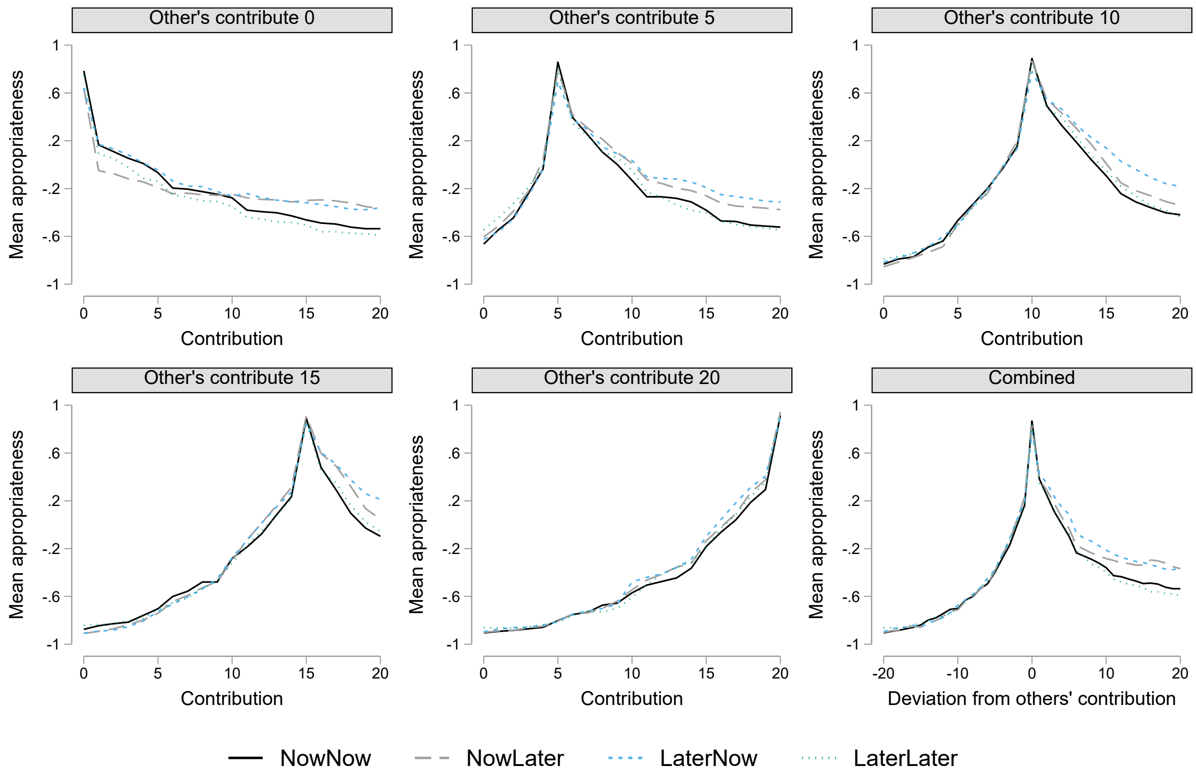

Figure 5: Social appropriateness of contributions depending on the deviation from others' contributions, by treatment.

contributing the same amount as the other group members is always the most socially appropriate action, and that deviating from others' contributions leads to a very similar decrease in social appropriateness ratings across treatments. This is confirmed by regression analysis as shown in Table A5 in Appendix A.

What do these results imply for our findings from above? First, we note that the strong social norm of conditional cooperation is, together with the argument by Fehr and Schurtenberger (2018) that a significant share of individuals adhere to norms, consistent with the observation that a large majority of subjects in our sample are conditional cooperators. To directly demonstrate the power of social norms in explaining the behavioral patterns in our strategy-method experiment, we follow the econometric approach by Krupka and Weber (2013) and related papers and use conditional logit regressions (McFadden, 1974) to estimate the weights decision-makers place on the material payoff and the social norm component of their utility function. Specifically, we assume that individuals choose according to a logistic choice rule, where the likelihood of choosing any action, a, depends on the relative utility of that action compared to all other actions.

	(1)	(2)	(3)
Discounted monetary payoff	0.159***	0.427***	0.400***
	(0.020)	(0.036)	(0.019)
Norm rating		2.664***	2.913***
		(0.130)	(0.193)
Norm rating (st. dev.)			2.611***
			(0.194)
Observations	26040	26040	26040
Subjects	248	248	248
Log likelihood	-3656.728	-2789.165	-2505.337
Bayesian IC	7323.624	5598.665	5041.175

Notes: Models 1 and 2: Conditional (fixed effects) logit regressions. Model 3: Mixed logit regression. The dependent variable is the chosen action in the strategy-method experiment, which takes value 1 for the contribution that was chosen, and 0 for the other possible contributions that were not chosen. Discounted payoffs are calculated according to equation (1), using the implied δ_i from Part 3 of the experiment. The dataset comprises choices from all $n = 248$ subjects who participated in our strategy-method experiment. We only include those choices for which we have social appropriateness ratings, i.e., conditional contributions in case others contribute 0, 5, 10, 15, or 20 tokens, on average. Standard errors clustered at the subjects level are in parentheses. Significance levels * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: Conditional logit estimation of choice determinants in the strategy-method experiment.

To show that a norm-augmented model better captures the data in our strategy-method experiment than a standard selfish model, in our first specification we assume that an individual's utility only depends on one's own discounted monetary payoff, i.e., we impose the restriction that $\gamma_i = 0$ in equation (4). To calculate discounted monetary payoffs for each available action, we use an individual's discount factor, δ_i, as derived from their switching point in the choice list in Part 3 of the experiment. In our second specification, we remove the restriction on γ_i, and thus allow an individual's utility to not only depend on monetary payoffs but also on an action's social appropriateness, as elicited by our social norms experiment. Our third specification is the same as the previous one, except for the fact that we estimate it using a mixed logit model (Train, 2003), which allows for heterogeneity in norm compliance across individuals.

The results from these regressions are reported in Table 2. In all specifications, we find that the coefficient for the own discounted payoff is positive and significant, indicating that subjects are more likely to choose actions with higher discounted payoffs. The results of the second and third model further show that also the coefficient for the appropriateness rating is positive and statistically significant, confirming that actions that are deemed more appropriate are chosen more often. When comparing the first two models, we find that adding the norm ratings increases the model's predictive fit as measured both by the likelihood ratio and the Bayesian information criterion (BIC). This latter result is further confirmed by Figure A4 in Appendix A, which depicts the predicted frequencies of choices by each of the two models next to the actual choice rates in our experiment. Finally, model (3) reveals that the standard deviation of the norm coefficient is highly significant, confirming that there is substantial heterogeneity in preferences for norm compliance across individuals. For instance, when comparing the individual-level estimates across the different cooperation types, we find that subjects classified as 'conditional cooperator' have on average a large positive estimated norm compliance parameter of 3.82, while subjects classified as 'free rider' exhibit on average an estimated norm compliance parameter that is close to zero (-0.18). Furthermore, when comparing the average of the estimated individual parameters across treatments, we find it to be very similar across treatments *NowNow* (2.83), *NowLater* (2.56), and *LaterLater* (2.62), but slightly higher for *LaterNow* (3.71).

Our finding of a similarly strong norm of cooperation across treatments implies that the observed shifts in conditional contributions cannot be explained by different views about what constitutes socially appropriate behavior. Instead, it suggests that adding an intertemporal component to our cooperation problem causes a shift in norm compliance. Specifically, relative to the case without any delay, delaying the benefits of cooperation leads to less norm compliance, while delaying the costs of cooperation triggers the opposite effect. Both of these effects are well in line with the predictions of the social norms model as described above. As the results of our regression analysis reveals, this is not necessarily due to the fact that subjects change the degree to which they care about norms (although in *LaterNow* we observe some increased sensitivity to norms). Instead, the shift in norm compliance can be explained by the fact that delaying the consequences of the contribution decision alters the material incentives for cooperation and, thus, the trade-off between the pecuniary and non-pecuniary (norm compliance) component of the utility function, which, in turn, affects behavior. We summarize these observations in our fourth result:

> **Result 4:** *There is a similarly strong social norm of conditional cooperation irrespective of the timing of the costs and benefits of cooperation, indicating that the observed shifts in conditional cooperation are due to shifts in norm compliance rather than the norm itself.*

5 What economic incentives are needed to close the cooperation gap?

So far we have shown how the timing of costs and benefits affects cooperation and its underlying behavioral mechanisms. One important question from a policy perspective is to understand which tools and solution mechanisms are best suited for promoting cooperation. Recent policy proposals have build on the power of reciprocity in combination with economics incentives (Rand et al., 2014; MacKay et al., 2015), and such proposals have already been successfully implemented in the field. For instance, matched fundraising schemes in which individual donations are topped up by a large donor, are becoming an increasingly popular strategy among nonprofit organizations to increase charitable giving (Eckel and Grossman, 2003; Karlan and List, 2007; Huck and Rasul, 2011). Here, we test by how much economic incentives need to be adjusted in order to close the gap in contributions when delaying the costs or benefits of cooperation. This provides managers and policy makers with an estimate of how much funds are needed, e.g., in form of subsidies, rebates, or performance-contingent team bonuses, to restore cooperation to the levels without any delay.

To address this question, we conducted a second laboratory experiment. The basic design of this second study is similar to the one in Study 1. A new set of $n = 188$ subjects that had not participated in our first study, were randomly assigned to one out of two treatments, *NowLater* ($n = 92$) or *LaterNow* ($n = 96$), using a between-subjects design. Both treatments consist of three parts. In the first two parts, subjects played two versions of a one-shot linear public goods game. As before, the game was played in groups of four, groups were randomly re-shuffled between parts using a perfect stranger-matching protocol, and no information about behavior of others was revealed until the very end of the experiment. In Part 1, subjects either played the game with delayed benefits (*NowLater*) or with delayed costs (*LaterNow*). In both cases, subjects had to state their contributions for varying levels of the marginal per capita returns, θ, using the strategy method. We had a total of 13 different MPCR levels, ranging from 0.3 to 0.9 (increasing in increments of 0.05), presented to subjects in a simple table on one decision screen (see Appendix C.3 for a screenshot and a copy of the experimental instructions). To incentivize all choices, at the end of the experiment, for each group one MPCR was randomly selected to determine subjects' contributions and payoffs. After all subjects made their contribution decisions, we also elicited their beliefs about the other group members' contributions. As in Study 1, we elicited beliefs using the interval method. In Part 2, subjects in both treatments then played a one-shot public goods game without any delay and a fixed MPCR of 0.5 (as in our *NowNow* treatment in Study 1).

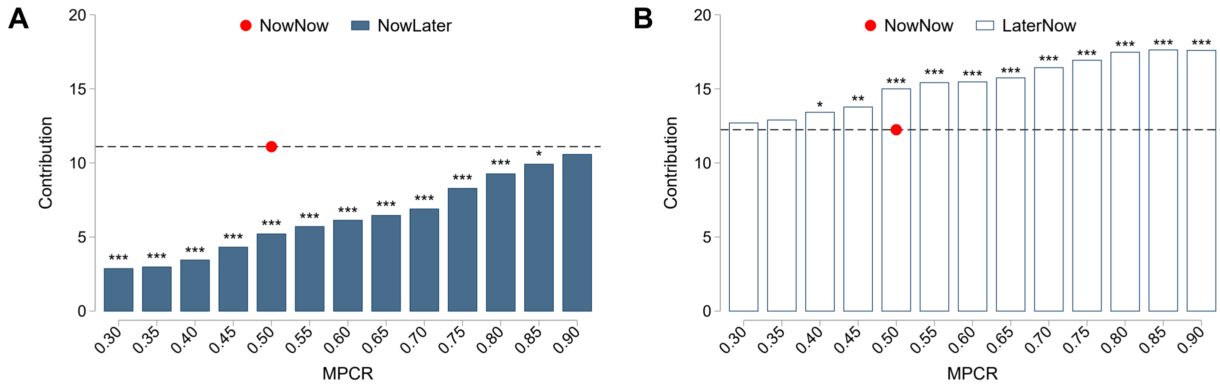

Figure 6: Contributions as a function of the MPCR in *NowLater* (Panel A) and *LaterNow* (Panel B). ***, **, and * indicate significance at the 1%, 5%, and 10% level using non-parametric Wilcoxon Signrank tests.

Finally, in Part 3 we elicited a proxy for subjects' time preferences in an individual decision context using the same choice list design as in Study 1. All other procedures including the recruitment and payment of subjects were identical to the ones in our first study. As before, subjects had to correctly answer a set of control questions before the start of the experiment.

Our main results are summarized in Figure 6. For both treatments, it shows the average contributions in Part 1 of the experiment for each level of the MPCR. Panel A shows the results from treatment *NowLater*, and Panel B shows the same data for treatment *LaterNow*. As a comparison, in both cases we also display the level of cooperation from the second part of the experiment in which there was no delay and a fixed MPCR of 0.5 (*NowNow*), as indicated by the dot and the dashed line.

The figure reveals that in both treatments contributions are monotonically increasing in the MPCR, indicating that subjects positively react to economic incentives in the expected way: the higher the MPCR (i.e., the lower the costs of cooperation) the higher the contributions.[20] More importantly, the results indicate for both treatments by how much economic incentives need to change in order to close the cooperation gap compared to the case without any delay. For *NowLater*, our results reveal that the MPCR has to be increased up to a level of 0.9 in order for the cooperation difference relative to the case without delay to become insignificant (Signrank test, $p = 0.247$). For all smaller levels of the MPCR, contributions are significantly lower than the ones in *NowNow* (Signrank tests, all $p < 0.065$). For *Lat-*

[20]Note that the MPCR values considered here are all in a range where, from a standard economic point of view, full free riding is a dominant strategy. The fact that contributions are increasing in the MPCR, thus, hints at the fact that other-regarding motivations are at play here as well, and that these motivations are weighted and evaluated against the monetary incentives for cooperation.

erNow, in contrast, we find that the MPCR can be decreased to a level of 0.35 in order for the cooperation differences to become insignificant (Signrank test, $p = 0.218$). For all larger levels of the MPCR, contributions are significantly higher than in *NowNow* (Signrank tests, all $p < 0.060$).

To calculate an exact value for the shift in incentives that is necessary to offset the cooperation gap, we use linear regressions with contributions as the dependent variable, and the MPCR as the independent variable. Using the estimated coefficients, we can then calculate a threshold value for the MPCR such that contributions between the case with and without delay are completely equalized. For *NowLater*, this break-even point is equal to $\hat{\theta} = 0.962$, which, relative to the case without any delay, corresponds to a necessary increase in economic incentives of 92.4%. For *LaterNow*, in contrast, we find that the MPCR can be lowered to a level of $\hat{\theta} = 0.247$, corresponding to a decrease in economic incentives of 50.7%.

Given that we also elicited subjects' expectations about how much others' contribute in each scenario (see Figure A5 in Appendix A for an overview of the results), we can separate these effects into two parts: (i) the necessary shift in incentives that is due to changes in beliefs, and (ii) the necessary shift in incentives that is due to changes in preferences for conditional cooperation. To do this, we first calculate the contribution-belief ratio for the case *without* any delay (*NowNow*), which we use as subjects' average willingness to conditionally cooperate in this context. Combining this measure with the elicited beliefs about others' contributions in the case *with* delay, we can then calculate hypothetical contributions for each level of the MPCR in *NowLater* and *LaterNow*. These hypothetical contributions thus incorporate the shift in beliefs that occurs when delaying the costs or the benefits of cooperation, but they ignore the fact that, on top of that, also the willingness to match those beliefs is altered. We can then use these hypothetical contributions and re-run our regression analysis from above. From this we obtain threshold values for the MPCR that are solely driven by the shift in beliefs.

For *NowLater*, we estimate a break-even point equal to $\hat{\theta} = 0.897$, which corresponds to a necessary increase in economic incentives relative to *NowNow* of 79.5%. When comparing this number to the overall effect of 92.4% from above, this reveals that the largest part of the necessary shift in incentives can be attributed to a shift in beliefs. For *LaterNow*, in contrast, we now estimate a threshold of $\hat{\theta} = 0.460$, corresponding to a decrease in economic incentives of 8.0%. This suggests that in this case, the overall effect of 50.7% is mainly driven by a shift in preferences rather than in beliefs. Note that this asymmetry between treatments is in line with the results from Figure 4 above, which also revealed a greater shift in conditional contributions in *LaterNow* than in *NowLater*. We summarize these findings in our fifth result:

> **Result 5:** *The amount of incentives needed in order to close the cooperation gap between the case with and without delay are substantial. While in NowLater monetary incentives have to almost be doubled, in LaterNow they can be halved. The large magnitude of these effects can be explained by the fact that delay affects both beliefs and cooperation preferences, which both triggers a response in behavior.*

Apart from providing us with an estimate of much monetary incentives are needed to close the cooperation gap, the data from our second study further allows us to conduct a more in-depth individual-level analysis of how the timing of costs and benefits affects cooperation. The reason is that in contrast to our first study in which we used a between-subjects design, we now have, at an MPCR level of 0.5, data on how much subjects contribute and how much they believe others' contribute both for the case with and without delay. This allows us to calculate an individual-level measure for the shift in contributions, beliefs, and preferences.

Consistent with our findings from the first study, we find a significant shift in contributions between *NowNow* and *NowLater* (11.10 vs. 5.20, Signrank test, $p < 0.001$). At the individual-level, we find that the large majority of subjects (70%) lower their contributions, while 24% leave their contributions unaltered (most of them because they contribute zero in both cases); only 6% of subjects contribute more when the benefits are delayed. We also find beliefs (11.39 vs. 6.36, respectively; Signrank test, $p < 0.001$) and preferences (as measured by the contribution-belief ratio) to significantly differ across the two setups (0.95 vs. 0.72, respectively; Signrank test, $p = 0.004$). As before, we find these shifts to be significantly correlated with subjects' individual time preferences as elicited in Part 3 of the experiment.[21] The comparison between *NowNow* and *LaterNow* yield similar consistent findings compared to our first study, as indicated by a positive shift in contributions (12.24 vs. 15.00, respectively; Signrank test, $p = 0.011$), beliefs (12.16 vs. 13.11, respectively; Signrank test, $p = 0.176$), and the contribution-belief ratio (0.95 vs. 1.17, respectively; Signrank test, $p = 0.004$). Overall, these results demonstrate that our general findings of the effects of delay on cooperation are robust both within and between subjects.

[21] The Spearman rank correlation between the number of late choices and the gap in contributions is $\rho = -0.22, p = 0.034$. For the shift in beliefs we obtain $\rho = -0.22, p = 0.037$, and for the shift in the contribution-belief ratio we get $\rho = -0.41, p < 0.001$.

6 Conclusion

In today's highly complex economic environment, cooperation among individuals is crucial for organizational and societal success. Most of the situations in which cooperation is required involve a time dimension, forcing people to make intertemporal trade-offs between costs and benefits that occur at different points in time. Examples range from team production and collaborations within and among firms, to the maintenance of natural resources and the provision of public goods. Our comprehensive analysis of cooperation in anintertemporal context demonstrate that the time factor is an important but so far largely ignored determinant of cooperation in such contexts. We show that voluntary contributions systematically vary when delaying the costs or benefits of cooperation, and that the magnitude of these effects can be explained by the interaction of cooperation preferences, beliefs about others' actions, and individuals' degree of patience.

With regard to applications outside the laboratory such as the problem of climate change in which the benefits of today's costly efforts can only be reaped in the far future, our results reveal that the expected level of voluntary contributions is rather low, although some significant positive amount of cooperation remains even in this setting. On a mroe positive note, our results also provide insights into how to best enhance cooperation in such situations. Our finding that the general principle of reciprocity, i.e., the willingness to contribute more the more others' contribute, as well as the norm of conditional cooperation is maintained even when the benefits of cooperation are delayed is good news for policy makers as it hints at potential solution mechanisms they can build on. Specifically, finding ways of engineering trust and optimism, or decreasing uncertainty about others' cooperativeness, e.g., via communication or other coordination devices, can already offset a large part of the observed negative effect on cooperation. Furthermore, with regard to situations in which the timing of costs and benefits can be determined by a principal or social planner, our results indicate that costs should be delayed while benefits should be immediate. While in many situations this is hard to achieve (e.g., as in the case of climate change where the timing of payments cannot be chosen endogenously), this might be relevant, for example, in firms or organizations that rely on performance-contingent team incentives, as they often have some discretion about when to pay these bonuses. Our results suggest that paying bonuses only at the end of year might yield to lower collaborative team efforts than paying them, e.g., quarterly or immediately after the end of the project. The results from our second study further provide policy makers with an estimate of how much funds they need to invest in order to offset the effect of delayed payments in case the timing of these cannot be altered. Such estimates are useful when performing cost-benefit analyses and thus can help firms improving their management practices.

Of course, our study only constitutes a first step towards an understanding of cooperative behavior – and strategic decision making more generally – in intertemporal contexts. More research is needed to test the robustness of these results across different environments. For example, one interesting next step is to investigate the extent to which (potentially inaccurate) beliefs about the impatience of others affects behavior in such contexts. Furthermore, by systematically varying by how much the costs and benefits of cooperation are delayed, one could investigate whether, similar to the evidence from choices in individual decision situations, people exhibit present-biased preferences also in the context of cooperation. In addition, while in our experiment we focused on a series of one-shot interactions to cleanly identify the different channels through which the timing of costs and benefits affects cooperation, many human interactions outside the lab take place in repeated contexts. Future research should therefore investigate the extent to which our results translate into such repeated interactions, in which the effects of learning, reputation, and other strategic incentives matter, too. Another interesting avenue for future research is to investigate whether institutions that have been shown to foster cooperation in contexts without any delay, such as communication (Isaac and Walker, 1988; Balliet, 2010), punishment (Fehr and Gächter, 2000; 2002; Herrmann et al., 2008), or leading by example (Güth et al., 2007; Potters et al., 2007), are equally effective in promoting social efficiency in intertemporal cooperation problems.

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Online Appendix

A Additional Analysis

A.1 Additional Tables

Decision #	Option A	Option B	Annual interest rate (%)
1	€50	€51.25	2.5
2	€50	€52.50	5.0
3	€50	€53.75	7.5
4	€50	€55.00	10.0
5	€50	€56.25	12.5
6	€50	€57.50	15.0
7	€50	€58.75	17.5
8	€50	€60.00	20.0
9	€50	€61.25	22.5
10	€50	€62.50	25.0
11	€50	€63.75	27.5
12	€50	€65.00	30.0
13	€50	€66.25	32.5
14	€50	€67.50	35.0
15	€50	€68.75	37.5
16	€50	€70.00	40.0
17	€50	€71.25	42.5
18	€50	€72.50	45.0
19	€50	€73.75	47.5
20	€50	€75.00	50.0

Table A1: Choice list for eliciting individual time preferences in Part 3 of the experiment.

	Mean (sd) contributions	Full free-riding ($c_i = 0$)	Full cooperation ($c_i = 20$)
NowNow	9.59 (7.62)	21.88%	25.00%
NowLater	4.61 (5.44)	45.31%	4.69%
LaterNow	16.45 (6.56)	8.93%	71.43%
LaterLater	10.16 (8.45)	31.25%	32.26%
Pairwise comparisons			
NowNow vs. NowLater	$p < 0.001$	$p = 0.005$	$p = 0.001$
NowNow vs. LaterNow	$p < 0.001$	$p = 0.053$	$p < 0.001$
NowNow vs. LaterLater	$p = 0.693$	$p = 0.230$	$p = 0.330$

Notes: The first column displays mean contributions in each of the four treatments (standard deviations are in parentheses). The second and third column display the share of participants contributing nothing and their full endowment, respectively. p-values according to t-tests (column 1) or χ^2-tests (columns 2 and 3).

Table A2: Contributions in the one-shot direct-response game in Part 2.

	NowNow	NowLater	LaterNow	LaterLater
Number of late choices	0.077	0.281**	-0.463***	-0.100
(patience)	(0.135)	(0.116)	(0.113)	(0.144)
Constant	9.004***	2.605***	19.724***	11.080***
	(1.418)	(0.967)	(0.573)	(1.646)
N	64	64	56	64
R^2	0.005	0.114	0.224	0.007

Notes: OLS regressions. The dependent variable is the number of tokens contributed to the public good. Robust standard errors are in parentheses. Significance levels * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: Effects of time preferences on contributions by treatment.

	(1)
Avg. contrib. of others	0.605***
	(0.055)
Avg. contrib. of others × *NowLater*	-0.015
	(0.076)
Avg. contrib. of others × *LaterNow*	0.137
	(0.086)
Avg. contrib. of others × *LaterLater*	0.015
	(0.083)
NowLater	-1.569**
	(0.642)
LaterNow	2.996**
	(1.275)
LaterLater	-0.371
	(0.859)
Constant	1.212**
	(0.563)
N	5208
R^2	0.355

Notes: OLS regression. The dependent variable is the number of tokens contributed to the public good in the strategy-method experiment (part 1). Robust standard errors (clustered at the individual level) are in parentheses. Significance levels * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: Conditional contributions in the strategy-method experiment.

	NowNow (1)	NowLater (2)	LaterNow (3)	LaterLater (4)
Negative deviations	-0.059***	-0.059***	-0.058***	-0.058***
	(0.004)	(0.003)	(0.003)	(0.004)
Positive deviations	-0.031***	-0.021***	-0.017***	-0.033***
	(0.005)	(0.006)	(0.006)	(0.005)
No deviation	0.868***	0.831***	0.774***	0.838***
	(0.027)	(0.030)	(0.034)	(0.031)
N	9765	9765	9975	9765
R^2	0.369	0.323	0.305	0.351
H_0(Neg. dev. = pos. dev.)	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p = 0.001$

Notes: OLS regressions. The dependent variable is the social appropriateness rating. Robust standard errors (clustered at the individual level) are in parentheses. Significance levels * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Wald tests confirm that the estimated coefficients do not differ across the four models: negative deviations ($p = 0.997$), positive deviations ($p = 0.120$), no deviation ($p = 0.187$).

Table A5: Social appropriateness of actions depending on deviation from others' contributions

A.2 Additional Figures

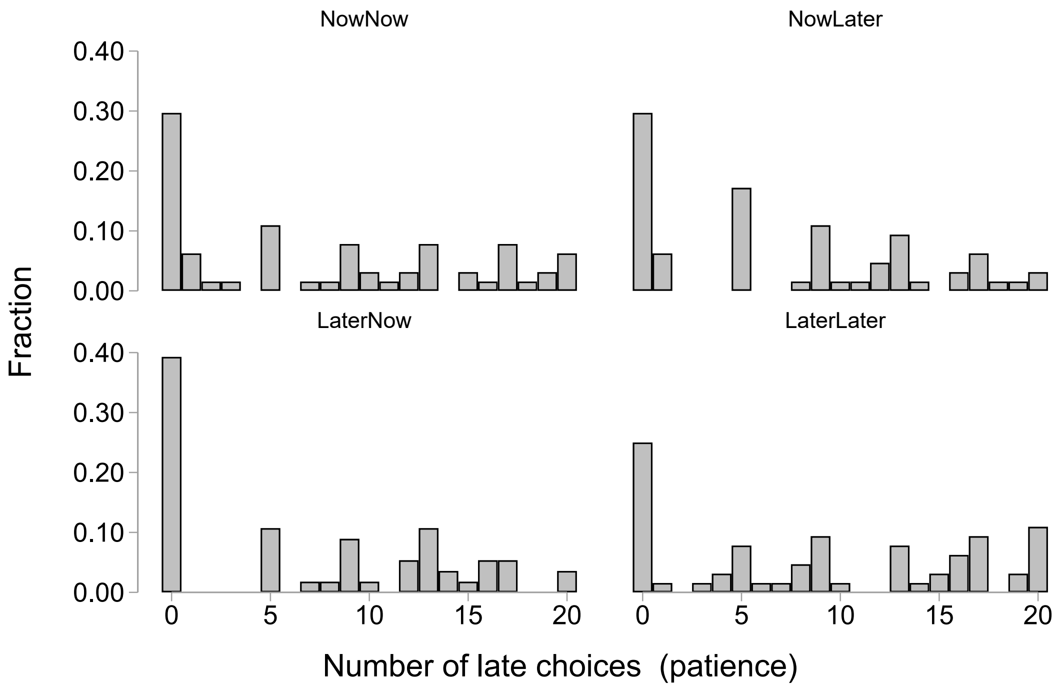

Figure A1: Distribution of the number of late choices in the time preference elicitation task in Part 3 of Study 1, separately by treatment.

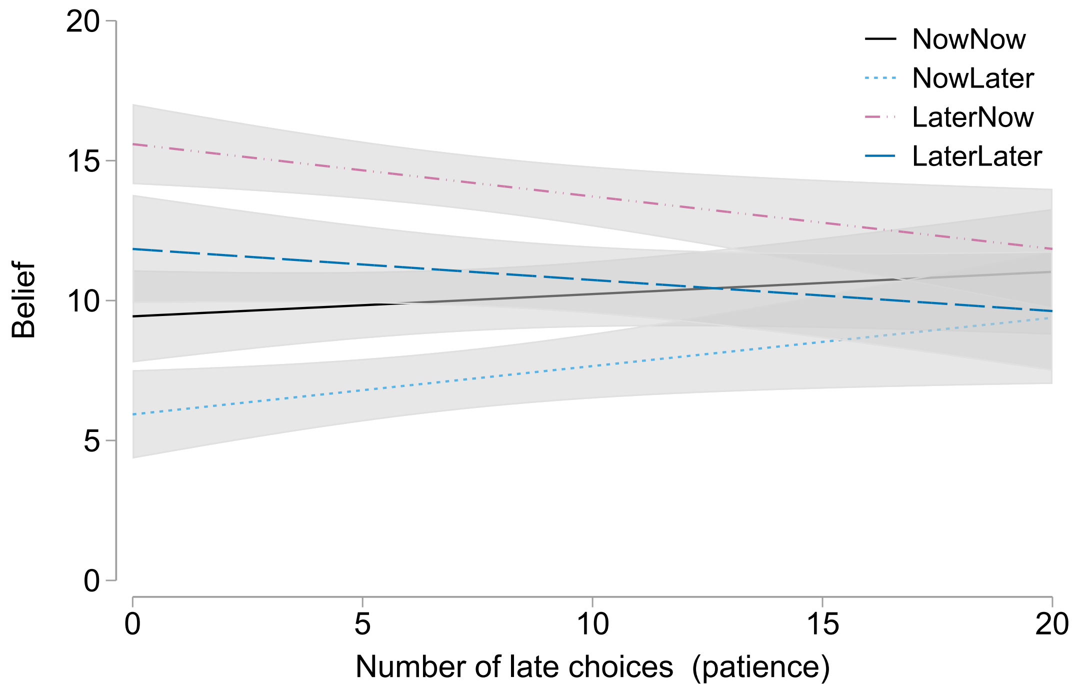

Figure A2: Fitted lines from linear regressions including a 95% confidence interval.

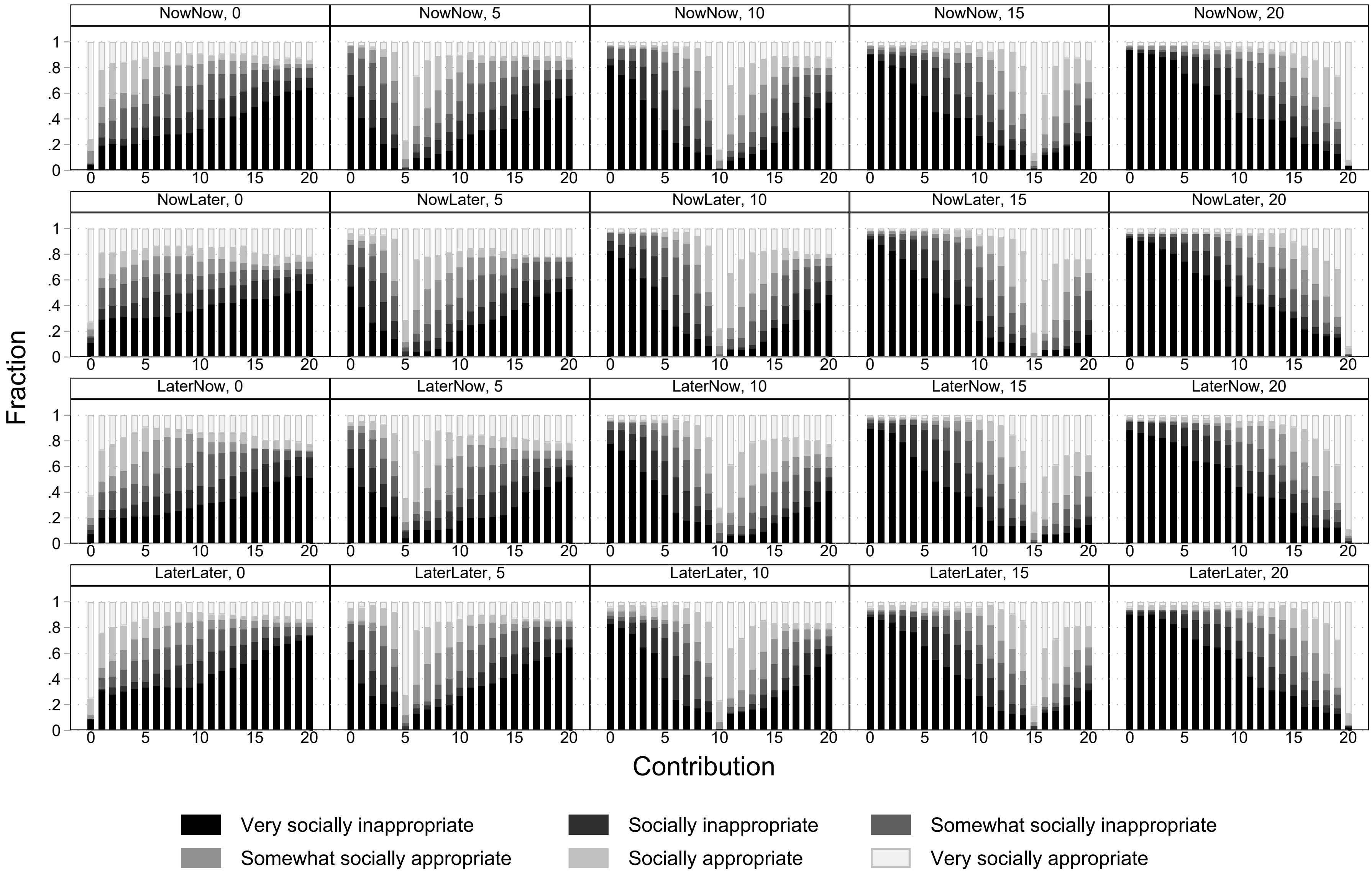

Figure A3: Distribution of social appropriateness ratings, separately for each scenario and treatment.

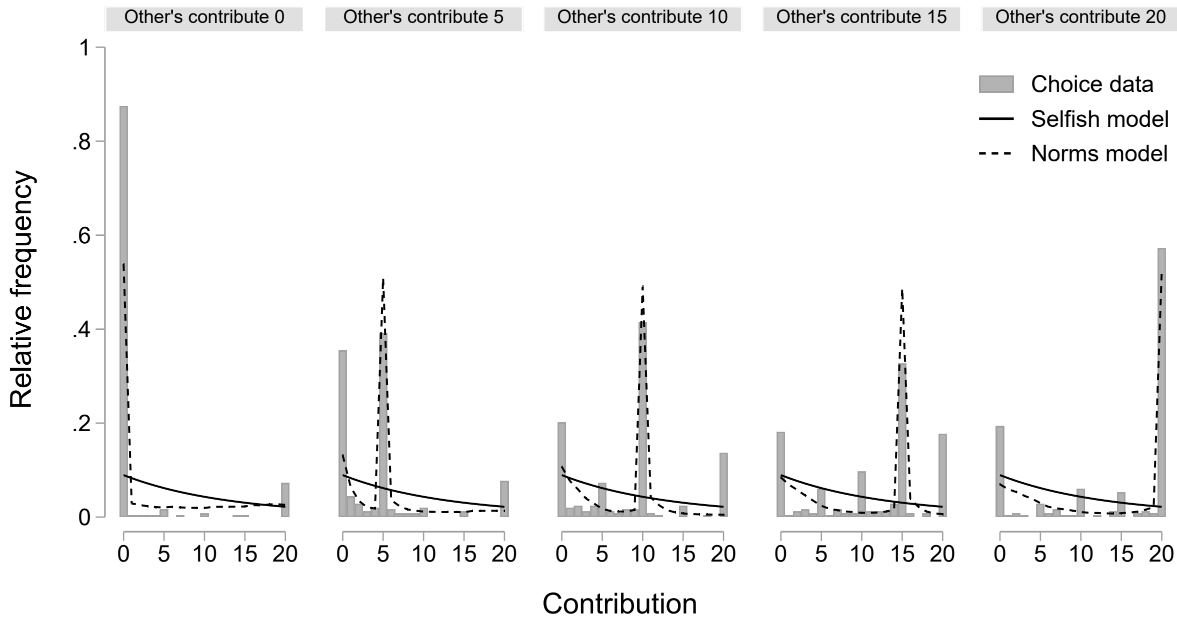

Figure A4: Distributions (grey bars) and predicted distributions of actions taken in the strategy-method experiment, separately for each scenario. The predictions are based on the selfish model (solid lines) and social norms model (dashed lines) as shown in Model (1) and (3) in Table 2.

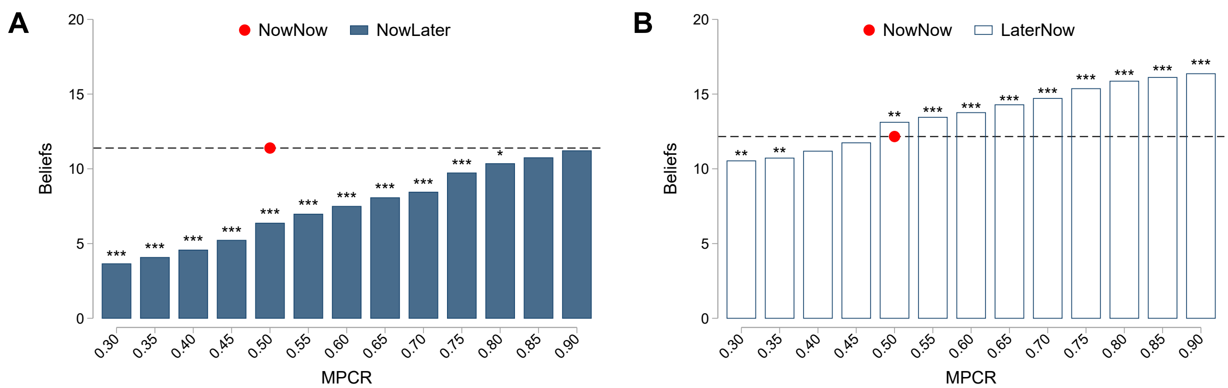

Figure A5: Beliefs (midpoint of the belief interval) as a function of the MPCR in *NowLater* (Panel A) and *LaterNow* (Panel B). ***, **, and * indicate significance at the 1%, 5%, and 10% level using non-parametric Wilcoxon Signrank tests.

B Theoretical Considerations

According to the standard economic discounting model (Frederick et al., 2002), a person's intertemporal utility function at time t can be written as:

$$U^t(y_t, \ldots, y_T) = u(y_t) + \sum_{k=1}^{T} \delta_i^k u(y_{t+k})$$

where y_t is the consumption in period t. Given that in our experiment we only have two time periods ("immediate‘" and "after 12 months"), we can write

$$U^t(y_0, y_{12}) = u(y_0) + \delta_i u(y_{12})$$

The payoffs from our public goods game are given by

$$\pi_i = m - c_i + \theta \cdot \sum_{j=1}^{n} c_j \tag{6}$$

where m denotes individual i's endowment, c_i denotes their contribution to the public good, and θ denotes the marginal per capita return (MPCR).

Selfish prediction:

Under the standard assumption that individuals are fully rational and only interested in maximizing their own discounted monetary payoffs, i.e., $u = \pi_i$, taking the first derivative with respect to c_i yields the following first-order conditions:

$$\frac{\partial U^t}{\partial c_i} = \begin{cases} -1 + \theta & \text{if } x_i \text{ and } c_i \text{ are realized immediately} \\ -1 + \delta_i \theta & \text{if } x_i \text{ is realized immediately and } c_i \text{ delayed} \\ -\delta_i + \theta & \text{if } x_i \text{ is realized delayed and } c_i \text{ immediately} \\ -\delta_i + \delta_i \theta & \text{if } x_i \text{ and } c_i \text{ are realized delayed} \end{cases} \tag{7}$$

In each row, the first term denotes the (discounted) marginal costs of contributing to the public good, while the second term denotes the (discounted) marginal benefits of contributing to the public good. Given the range of values for θ and δ_i, it is straightforward to see that the dominant strategy for individual i is to free-ride and contribute nothing to the public good ($c_i = 0$) in all cases, except when x_i is realized delayed, c_i is realized immediately, and δ_i is sufficiently low. In this case, if $\delta_i < \theta$, the benefits of cooperation outweigh the discounted costs, and full cooperation ($c_i = m$) becomes the dominant strategy. Hence, under the assumption of pure self-interest we do not expect any differences across treatments *NowNow*, *NowLater*, and *LaterLater*, but contributions are expected to be higher for those individuals in *LaterNow* who are sufficiently impatient. Formally, we have:

$$c^*_{NowNow} = c^*_{NowLater} = c^*_{LaterLater} = 0. \tag{8}$$

and

$$c^*_{LaterNow} = \begin{cases} 20 & \text{if } \delta_i < \theta \\ 0 & \text{if } \delta_i \geq \theta \end{cases} \tag{9}$$

There is now, however, plenty of evidence indicating that many people are not solely motivated by their own monetary payoffs, but that they also care about fairness and the well-being of others. For example, even when nobody is predicted to contribute anything, evidence from previous public good experiments suggest that there is some positive amount of voluntary cooperation, even in anonymous one-shot interactions (see e.g., Gächter and Herrmann, 2009; Chaudhuri, 2011, for overviews of the literature). A variety of models of other-regarding preferences have been established that can explain social behavior observed in the laboratory and in the field (see e.g., Sobel, 2005; Fehr and Schmidt, 2006, for an overview). In the following, we analyze to what extent the predictions above change if we incorporate some form of social preferences. We start with a model of altruism.

Altruism:

In our modeling approach, we broadly follow Andreoni (1989) and Anderson et al. (1998) and incorporate pure altruism by introducing a parameter $\alpha_i > 0$ that represents individual i's utility weight on the payoff of the other players. To model warm glow (or impure altruism), we add a utility payoff term g_i times the amount contributed. The objective function of individual i can then be written as:

$$u = \pi_i + g_i c_i + \alpha_i \sum_{i \neq j} \pi_j \tag{10}$$

It is reasonable to assume that (i) the utility from warm glow is realized when the decision to contribute is made, and that (ii) the utility from altruism only flows when the cause to which one contributes is realized. Under these assumptions, the first-order conditions are given by:

$$\frac{\partial U^t}{\partial c_i} = \begin{cases} -1 + \theta + g_i + \alpha_i \theta (n-1) & \text{if } x_i \text{ and } c_i \text{ are realized immediately} \\ -1 + \delta_i \theta + g_i + \delta_i \alpha_i \theta (n-1) & \text{if } x_i \text{ is realized immediately and } c_i \text{ delayed} \\ -\delta_i + \theta + g_i + \alpha_i \theta (n-1) & \text{if } x_i \text{ is realized delayed and } c_i \text{ immediately} \\ -\delta_i + \delta_i \theta + g_i + \delta_i \alpha_i \theta (n-1) & \text{if } x_i \text{ and } c_i \text{ are realized delayed} \end{cases} \tag{11}$$

We thus have:

$$c^*_{NowNow} = \begin{cases} 20 & \text{if } \alpha_i \geq \frac{1-\theta-g_i}{\theta(n-1)} \\ 0 & \text{otherwise} \end{cases} \tag{12}$$

$$c^*_{NowLater} = \begin{cases} 20 & \text{if } \alpha_i \geq \frac{1-\delta_i\theta-g_i}{\delta_i\theta(n-1)} \\ 0 & \text{otherwise} \end{cases} \tag{13}$$

$$c^*_{LaterNow} = \begin{cases} 20 & \text{if } \alpha_i \geq \frac{\delta_i - \theta - g_i}{\theta(n-1)} \\ 0 & \text{otherwise} \end{cases} \tag{14}$$

$$c^*_{LaterLater} = \begin{cases} 20 & \text{if } \alpha_i \geq \frac{1 - \theta - g_i}{\theta(n-1)} \\ 0 & \text{otherwise} \end{cases} \tag{15}$$

As can be seen, depending on an individual's degree of altruism, α_i the model above predicts either full free riding or full cooperation. However, the range of altruism parameters for which full cooperation can be sustained systematically varies across treatments. Let's denote $\tilde{\alpha}_i$ the threshold value the altruism parameter has to exceed such that full cooperation becomes optimal. From this it follows that

$$\tilde{\alpha}_i^{NowLater} \geq \tilde{\alpha}_i^{NowNow} = \tilde{\alpha}_i^{LaterLater} \geq \tilde{\alpha}_i^{LaterNow} \tag{16}$$

as

$$\frac{1 - \delta_i \theta - g_i}{\delta_i \theta(n-1)} \geq \frac{1 - \theta - g_i}{\theta(n-1)} \geq \frac{\delta_i - \theta - g_i}{\theta(n-1)} \tag{17}$$

Based on these considerations, and under the assumption that α_i, g_i, and δ_i are equally distributed across treatments, we expect $c_{LaterNow} > c_{NowNow} = c_{LaterLater} > c_{NowLater}$. The intuition for these predictions is straightforward. If people discount future payoffs, i.e., $\delta_i < 1$, delaying the benefits of cooperation makes cooperation (relative to private consumption) more expensive, thereby decreasing the marginal incentives for cooperation. As a consequence, stronger non-pecuniary incentives, here in form of altruism, are needed in order to make contributing optimal. Reversely, when the costs rather than the benefits are delayed, this increases the marginal incentives for cooperation. As a result, cooperation can be sustained even for lower concerns for altruism. Qualitatively very similar predictions can be derived for the required level of warm-glow utility, g_i.

Inequity aversion:

To capture inequity aversion, we use a modified version of the Fehr and Schmidt (1999) model that, in addition to full free-riding, can capture two behavioral regularities observed in previous literature: (i) positive rates of cooperation, i.e., $c_i > 0$, and (ii) conditional cooperation, i.e., contributions that are increasing in (the beliefs about) others' contributions. In particular, we allow for the possibility that players dislike inequality, i.e., they experience a loss in utility if they receive a (discounted) material payoff that is either higher or lower than the (discounted) average payoff of the other group members, $\bar{\pi}_{-i} = \frac{1}{n-1} \sum_{j \neq i}^{n} \pi_j$. Note that different to the original specification by Fehr and Schmidt (1999), we use the average rather than individual payoffs of others as the reference point (as e.g., in Bolton and Ockenfels (2000)). We chose this modification for two reasons. First, in our experiment subjects were only provided with information about average but not individual behavior of others, which renders individual payoff comparisons difficult. Second, as shown by Hartig et al. (2015), even if individuals are provided with information about individual contribution behavior, the majority of people who do react positively to others' contributions are indeed mainly guided by the average contribution of others (rather than, e.g., by the highest or the lowest contribution).

A player i's objective function can then be written as

$$u = \pi_i - \alpha_i \cdot max\{\bar{\pi}_{-i} - \pi_i, 0\} - \beta_i \cdot max\{\pi_i - \bar{\pi}_{-i}, 0\} \tag{18}$$

where α_i measures individual i's marginal psychological costs of disadvantageous inequality and β_i that of advantageous inequality. Following Fehr and Schmidt (1999), we assume $\alpha_i \geq \beta_i \geq 0$ and $\beta_i < 1$.

Given the linearity of the utility function, depending on an individual's marginal disutility from inequality as well as their degree of impatience, they will either free-ride completely, exactly match others' average contribution $\bar{c}_{-i} = \frac{1}{n-1} \sum_{j \neq i}^{n} c_j$, or contribute their whole endowment m. In particular, maximizing (18) with respect to c_i, the best-response function yields:

$$c_i^* = \begin{cases} m & \text{if } I_c\theta > I_x(1+\alpha_i) \\ \bar{c}_{-i} & \text{if } I_x(1-\beta_i) < I_c\theta \leq I_x(1+\alpha_i) \\ 0 & \text{otherwise} \end{cases} \tag{19}$$

The basic intuition for this result is as follows: For each token contributed to the public good, a player earns a (discounted) monetary payoff of $I_c\theta$. Every dollar used for private consumption, instead, yields a (discounted) monetary benefit of I_x minus a (discounted) non-pecuniary loss of at most $I_x\beta_i$ from increasing inequality (in case others contribute a positive amount to the public good). Therefore, if $I_x(1-\beta_i) > I_c\theta$, it is a dominant strategy for player i to contribute nothing. If, however, their marginal dis-utility from advantageous inequality becomes sufficiently strong such that $I_x(1-\beta_i) \leq I_c\theta$, they find it optimal to exactly match others' contributions in order to reduce inequality. In that case, as shown by Fehr and Schmidt (1999), multiple equilibria with positive contributions $c_i = \bar{c}_{-i} \in [0, m]$ exist. In some cases, if $I_c\theta \geq I_x(1+\alpha_i)$, a player even finds it optimal to contribute their full endowment irrespective of others' contributions. Note, however, that this condition can only be fulfilled if the benefits from the private consumption are delayed, the benefits from the public good are immediate, discounting is sufficiently high, and the disutility from disadvantageous inequality, α_i, is sufficiently small. In all other cases, player i at most contributes the amount (they believe) others contribute.

To better compare how the timing of the costs and benefits of cooperation affects the incentives to contribute to the public good, from (19) we can derive threshold values, $\tilde{\beta}_i$, the degree of advantageous inequality concerns has to exceed in order to make (conditional) cooperation feasible. The threshold values are given by

$$
\begin{aligned}
\tilde{\beta}_i^{NowNow} &= 1-\theta \\
\tilde{\beta}_i^{NowLater} &= 1-\delta\theta \\
\tilde{\beta}_i^{LaterNow} &= \tfrac{\delta-\theta}{\delta} \\
\tilde{\beta}_i^{LaterLater} &= 1-\theta
\end{aligned}
$$

From this it follows that:

$$\tilde{\beta}_i^{NowLater} \geq \tilde{\beta}_i^{NowNow} = \tilde{\beta}_i^{LaterLater} \geq \tilde{\beta}_i^{LaterNow} \tag{20}$$

as

$$1-\delta\theta \geq 1-\theta \geq \frac{\delta-\theta}{\delta} \tag{21}$$

The intuition for this result is straightforward. First, compared to the benchmark case without any delay (*NowNow*), if players discount future payoffs, delaying the benefits from the public good (*NowLater*) makes cooperation more costly and, hence, a higher degree of inequality aversion is needed in order to make an individual willing to match others' contributions. Second, because delaying the benefits from the private good (*LaterNow*) makes cooperation relatively cheaper, in that case a lower degree of inequality aversion is sufficient to induce cooperation. Last, if both the benefits from the private and the public good are delayed, the degree of inequality aversion needed to sustain cooperation is the same as in the no delay case. The reason is that delaying all payments does not affect the marginal trade-off between contributing or not because δ enters both sides of the equation and, hence, cancels out.

Based on these considerations, and under the assumption that α_i, β_i, and δ_i are equally distributed across treatments, we can make a straightforward prediction about contribution behavior in our strategy-method experiment, in which subjects can condition their contributions on that of others, i.e., first-order beliefs about others' behavior are fixed. We predict $c_i^{LaterNow} > c_i^{NowNow} = c_i^{LaterLater} > c_i^{NowLater}$. Furthermore, since in *NowLater* (*LaterNow*) the threshold value $\tilde{\beta}_i$ has to exceed in order to make player i willing to conditionally cooperate is decreasing (increasing) in δ_i, we expect the differences in cooperation between *NowNow*, *NowLater*, and *LaterNow* to be larger the higher subjects' degree of impatience, i.e., the lower δ_i. For our direct-response experiment, in which players move simultaneously, predictions are less straightforward as there are always multiple equilibria; given the right beliefs about others' contributions, any contribution level can be sustained as an equilibrium outcome. Hence, according to this model, depending on the participants' beliefs, contributions may or may not differ across treatments.

Social Norms:

Next, we investigate how predictions of contribution behavior change if we assume that individuals have a concern for adhering to social norms. To this end, we follow the social norms framework as proposed by previous literature (Krupka and Weber, 2013; Kimbrough and Vostroknutov, 2016). According to this framework, decision-makers are motivated by both material self-interest and a preference for conforming to norms, i.e., collectively recognized rules of behavior that define which actions are viewed as socially appropriate. In the most general form, decision-maker i's utility function can be written as:

$$u(\pi, a_k) = V_i(\pi_i(a_i, a_{-i})) + \gamma_i N(a_i|a_{-i}) \tag{22}$$

where the function $V_i(.)$ represents the value the individual places on the monetary payoffs $\pi_i(a_i, a_{-i})$ that result from selecting action a_i given the actions of the other individuals as denoted by a_{-i}. The second term of the utility function captures the preference for norm compliance. The social norm function $N(.)$ assigns to each of the possible actions available to the decision maker a degree of appropriateness or inappropriateness that reflects the norm in the relevant group. Note that the social appropriateness of an action a_i may depend on social and contextual influences, such as the behavior of others a_{-i}. Thus, if, for an action a_i there is collective recognition that the action constitutes "norm-consistent" behavior, then $N(.) > 0$. If there is joint recognition that an action constitutes "norm-inconsistent" behavior, then $N(.) < 0$. The parameter γ_i measures the extent to which the decision-maker cares about conforming to norms. Decision-makers who care about norm compliance ($\gamma_i > 0$) enjoy a positive utility by selecting actions that are viewed as socially appropriate, whereas they suffer a dis-utility from actions that are inappropriate.

For the context of cooperation, Fehr and Schurtenberger (2018) propose the following specific functional form:

$$u = \pi_i - \gamma_i(c_i - c^*)^2 \tag{23}$$

where c_i corresponds to the individual's contribution and c^* describes the contribution norm. As before, the parameter γ_i captures an individual's strength of desire to conform to the social norm, and the term $\gamma_i(c_i - c^*)^2$ denotes the psychic cost of deviating from the norm.

From this it becomes clear that individuals face a trade-off between maximizing their own monetary payoff and adhering to the social norm. That is, while higher contributions c_i are costly and thus reduce an individual's material payoff π_i, if c_i is below the norm c^*, an increase in c_i reduces the costs of non-conformity $\gamma_i(c_i - c^*)^2$. The model implies that individuals with a very low γ_i ($\gamma_i \approx 0$) will always choose the payoff-maximizing action of defection, while those with a sufficiently large γ_i will cooperate and obey to the norm c^*. Furthermore, if γ_i is positive but sufficiently small, individuals will not obey the norm perfectly, but reduce their contributions somewhat below c^*, which implies imperfect conditional cooperation.

To see how the timing of the costs and benefits affect the incentives to contribute in this framework, we derive optimal contributions by taking the first derivative of equation (24) with respect to c_i. To do that, we have to make an assumption about when the (dis-)utility from (not) complying with the social norm accrues. We believe that it is most natural to assume that the (dis-)utility from norm compliance occurs at the time when the decision is made, i.e., when oneself or others observe $i's$ action. Hence, the utility from $\gamma_i N(a_i|a_{-i})$ always flows immediately, irrespective of whether monetary payments are delayed or not. Under this assumption, the first-order conditions are given by:

$$\frac{\partial U^t}{\partial c_i} = \begin{cases} -1 + \theta - 2\gamma_i(c_i - c^*) & \text{if } x_i \text{ and } c_i \text{ are realized immediately} \\ -1 + \delta_i\theta - 2\gamma_i(c_i - c^*) & \text{if } x_i \text{ is realized immediately and } c_i \text{ delayed} \\ -\delta_i + \theta - 2\gamma_i(c_i - c^*) & \text{if } x_i \text{ is realized delayed and } c_i \text{ immediately} \\ -\delta_i + \delta_i\theta - 2\gamma_i(c_i - c^*) & \text{if } x_i \text{ and } c_i \text{ are realized delayed} \end{cases} \tag{24}$$

From this, we obtain the following optimal contributions $\hat{c}$:

$$\hat{c}_{NowNow} = c^* - \frac{1-\theta}{2\gamma_i} \tag{25}$$

$$\hat{c}_{NowLater} = c^* - \frac{1-\delta_i\theta}{2\gamma_i} \tag{26}$$

$$\hat{c}_{LaterNow} = c^* - \frac{\delta_i-\theta}{2\gamma_i} \tag{27}$$

$$\hat{c}_{LaterLater} = c^* - \frac{\delta_i(1-\theta)}{2\gamma_i} \tag{28}$$

As can be seen, in all cases the social norm, c^*, enters positively into the equation, i.e., the larger the contribution prescribed by the norm, the more an individual contributes. The second term in equations (26) to (29) describe by how much an individual deviates from the norm. The deviation is the larger, the lower the pecuniary incentives for cooperation (i.e., the lower θ) and the lower an individual's desire to conform with the social norm (i.e., the lower γ_i). When payments are delayed, the deviation from the norm is additionally altered by the individual's degree of impatience δ_i. In the case of delayed benefits (NowLater), deviations from the norm are the larger the less patient an individual is (i.e., the lower δ_i). When the costs of cooperation are delayed (LaterNow), in contrast, a decrease in δ_i leads to smaller deviations from the norm. The same effect occurs when both the costs and the benefits are delayed to the same extent (LaterLater). The reason is that in this case, if individuals discount future consumption, the utility derived from social norms becomes relatively more important than the utility derived from monetary payments, as the latter occurs delayed while the former occurs immediately.

Based on these considerations, and under the assumption that c^* is the same across conditions and that γ_i and δ_i are equally distributed in all our experimental treatments, we can make a straightforward prediction about the expected levels of contributions. We predict $c_i^{LaterNow} > c_i^{LaterLater} > c_i^{NowNow} > c_i^{NowLater}$. Of course, these predictions change if, for instance, delaying the costs and/or the benefits of cooperation have a direct effect on what is considered to be socially appropriate behavior, i.e., if c^* is context-specific. Our social norms experiment, described in Section 4.3, aims at shedding light on this question by eliciting c^* separately for each treatment.

C Experimental Instructions

C.1 Experimental Instructions Study 1

Note: The instructions below are for the treatment LaterNow. The instructions for the other treatments are very similar and available upon request.

<u>General Information</u>

Welcome and thank you for your participation in this experiment. For your participation and punctual arrival you receive €4. You can earn an additional substantial amount of money in this experiment. The exact amount you will receive depends on your decisions and the decisions of the other participants. It is therefore very important that you read the following instructions carefully.

General Rules

The results of this experiment will be used for a research project. It is therefore important that all participants follow certain rules of conduct. During the experiment, you are not allowed to communicate with other participants of the experiment or any person outside the laboratory. For this reason, all mobile phones have to be switched off. If you have questions with regard to the instructions or the study, please raise your hand – we will privately answer your question at your place. Disregarding this rule leads to exclusion from this experiment and from all payments.

Anonymity

All decisions are made anonymously, i.e., no other participant learns about the identity of a participant that made a certain decision. Also, the payment is made anonymously, i.e., no participant learns about the payment of the other participants.

Payment

During the experiment, your income will be calculated in points. At the end of the experiment, the total number of points you earned will be converted to Euro at the following rate:

$$5 \text{ points} = 1 \text{ Euro.}$$

IMPORTANT NOTE: Your payment from this experiment will be credited via bank transfer (except for the show-up fee of €4 which you will receive in cash at the end of the experiment). It is therefore necessary that you are willing to provide us with information about your bank account. All payments will be executed immediately after the experiment. Yet, the payment date, i.e., the date when the money will be credited to your account (the value date), can vary. In particular, you will receive one part of your payment at an earlier date, and the other part of your payment at a later date. The dates you will receive the two parts of your payment depends on your decisions and the decisions of others. We will email you a confirmation of the bank transfers of all payments within the next two days.

Your bank information will be exclusively used for your payment and does in no respect enter the statistical analysis of this experiment. In particular, at no time will your bank account information be linked to your decisions in the experiment. After all payments are completed, all bank account information will be deleted.

Course of the experiment

The experiment consists of three parts. You will first receive the instructions for the first part. You receive the instructions for the next part as soon as the previous part is completed. Your total income equals the sum of incomes from all three parts of the experiment. You should therefore take all your decisions seriously.

General Setup

First, we explain the general setup to you. After that, you will be informed about the exact task. At the beginning of part I, all participants are randomly matched into groups of four (4) participants. Each group member receives an initial endowment of 20 points. Then, you are asked to decide how you want to distribute the 20 points. All participants in your group face the same decision situation than you. You can either keep the points for yourself, or you can contribute all or some of them to a group project. Each point that is not contributed to the group project automatically remains in your private account. No other group member benefits from the points in your private account. Each point that you contribute to the group project is multiplied by two and put into the group account. After all group members have made their decisions, the group account is distributed equally among all four group members. This means that all group members will profit equally from the points that you or any another group member contributed to the group account. Your income from the group project is determined by:

$$\text{Income from the group project} = \frac{2 \times \text{sum of contributions}}{4}$$

Your total income is the sum of your income from your private account and of your income from the group project.

$$\begin{aligned}
&\text{Total Income} \\
&\qquad = \text{Income from your private account} + \text{income from the group project} \\
&\qquad = 20 - \text{your contribution to the group project} + \frac{2 \times \text{sum of contributions}}{4}
\end{aligned}$$

Payments

As outlined at the beginning, your total income will be converted into Euro according to the above mentioned rate. The payment is made as follows:

- The payment of your **income from the private account** is credited **IN 12 MONTHS**.
- The payment of your **income from the group project** is credited **IMMEDIATELY**.

IMMEDIATELY means that we will transfer your income to your bank account immediately after the experiment and that the money will be credited immediately (*please note that in Germany bank transfers can take up to one workday*).

IN 12 MONTHS means that we will transfer your income to your bank account immediately after the experiment and that the money will be credited in 12 months (*please note that in Germany bank transfers can take up to one workday*).

Control Questions

Please answer the following questions. The purpose of these questions is to make sure that all participants have understood these instructions correctly.

Assume that neither you nor any other group member contributes anything to the group project.

Question 1: What is your total income (in points)?

Question 2: What is the total income of each of your three group members (in points)?

Now assume that you and the other three group members each contribute 20 tokens to the group project.

Question 3: What is your total income (in points)?

Question 4: What is the total income of each of your three group members (in points)?

Assume that the other three group members contribute a total of 30 tokens to the group project.

Question 5: What is your total income (in points) if in addition to that, you contribute 0 tokens?

Question 6: What is your total income (in points) if in addition to that, you contribute 10 tokens?

Question 7: What is your total income (in points) if in addition to that, you contribute 20 tokens?

Assume that you contribute 10 tokens to the group project.

Question 8: What is your total income (in points) if in addition to that, the other three group members contribute a total of 10 tokens to the group project?

Question 9: What is your total income (in points) if in addition to that, the other three group members contribute a total of 30 tokens to the group project?

Question 10: What is your total income (in points) if in addition to that, the other three group members contribute a total of 50 tokens to the group project?

Question 11: Points that you and the other group members contribute to the group project

- generate income from the group project that is credited immediately.
- generate income from the group project that is credited in 12 months.
- generate income from the private account that is credited immediately.
- generate income from the private account that is credited in 12 months.

Question 12: Points that you do not contribute to the group project

- generate income from the group project that is credited immediately.
- generate income from the group project that is credited in 12 months.
- generate income from the private account that is credited immediately.
- generate income from the private account that is credited in 12 months.

Instructions Part I

Decision The decisions you make in this part of the experiment are based on the general setup described above. In this part, each group member has to make **two types of decisions** which, in the following, we will refer to as **contribution of type I** and **contribution of type II**.

Contribution of type I

For the contribution of type I, you need to indicate how many of your 20 points you want to contribute to the group project.

Contribution of type II (contribution table)

For the contribution of type II, you need to fill in a table in which you indicate for all possible average contributions of your group members, how many of your 20 points you want to contribute to the group project. You make your contribution decisions on the following screen:

Type II contribution (contribution table)

Your group members' contribution	Your contribution	Your group members' contribution	Your contribution	Your group members' contribution	Your contribution
0		7		14	
1		8		15	
2		9		16	
3		10		17	
4		11		18	
5		12		19	
6		13		20	

The numbers to the left of the blue cells are the average contribution to the group project of the other three group members. Your task is to decide for each of these situations, how many points you want to contribute, if the the other group members contributed 0, 1, 2, 3, ... points, on average. Once you have made an entry in each input box, please click on the "next" button.

After all participants have made both types of decisions, three of the four group members are randomly selected. For these group members, the payment is determined by their contribution of type I. For the group member that has not been randomly selected, the payment is determined by his contribution of type II. The relevant decision is determined by the three type I contributions of the randomly selected group members.

At the time of the decision, you will not know which decision will be relevant for you. You should therefore take all your decisions seriously as any decision can determine your payment.

Reminder:

$$
\begin{aligned}
\text{Total Income} & \\
&= \text{Income from your private account} + \text{income from the group project} \\
&= 20 - \text{your contribution to the group project} + \frac{2 \times \text{sum of contributions}}{4}
\end{aligned}
$$

Payment

- The payment of your **income from the private account** is credited **IN 12 MONTHS**.
- The payment of your **income from the group project** is credited **IMMEDIATELY**.

Instructions Part II

At the beginning of Part II, all participants are randomly matched in new groups of four. It is ensured that you have not interacted with any of your new group members in Part I.

The general setup in Part II is identical to Part I. As before, each group member receives an initial endowment of 20 points that you can keep for yourself, or that you can contribute completely or partly to to the group project. All group members make their decisions simultaneously. **You make only one decision**. There is not contribution table. Your income is calculated as in the first part of the experiment. Reminder:

Reminder:

$$\begin{aligned}\text{Total Income}&\\ &= \text{Income from your private account} + \text{income from the group project}\\ &= 20 - \text{your contribution to the group project} + \frac{2 \times \text{sum of contributions}}{4}\end{aligned}$$

Payment

The total points you earn in Part II will be converted into Euro at the rate described above: 5 points = 1 Euro, and will be added to your income from Part I.

As in Part I it holds that:

- The payment of your **income from the private account** is credited **IN 12 MONTHS**.
- The payment of your **income from the group project** is credited **IMMEDIATELY**.

Instructions Part III

This is the end of Part II. Part III starts now. At the beginning of Part III, the groups are dissolved, i.e., the decisions you will make in this part do not influence the income of the other participants. Also, the decisions of the other participants will not influence your income in this part of the experiment. Your income of this part will be added to your income of Part I and II.

In Part III, you have to make **20 decisions**. In each of these decisions, you can choose between **two options**.

- **Option A** gives you an **immediate payoff of €50**.
- **Option B** gives you a **higher payoff in 12 months**.

The money amount in Option A is identical for all 20 decisions, while the money amount in Option B changes from decision to decision.

At the end of the experiment, one participant is randomly selected and is paid according to his decisions in Part III. For this participant, the computer randomly selects one of the 20 decisions. The choice in this decision determines the payment date and the payoff from Part III. As before, we will transfer the income from this part of the experiment into your bank account directly after the experiment. The amount will be credited either immediately (in Option A), or in 12 months (Option B).

At the time of your decision, you do not know if you will be randomly selected and which decision is relevant for your payment. It is therefore important that take all your decisions seriously as any decision can determine your payment.

Payment agreement - participant's copy

For your participation in today's experiment you received the following amount:

Date of payment	Amount in Euro
04.07.2016	4.00

In addition to this the following amounts will be transferred to your bank account on the date stated below:

Date of payment	Amount in Euro
04.07.2016	*<Sooner Payoff>*

Date of payment	Amount in Euro
04.07.2017	*<Later Payoff>*

The amounts stated above will be transferred to the following bank account:

Depositor:	*<First and last Name>*
IBAN:	*<IBAN number>*
BIC:	*<BIC number>*
E-mail:	*<E-mail address>*

The experimenter assures that the amounts stated above will be transferred on time to the above bank account.

Experimenter's signature

Contact:
<Contact details of one of the authors>

C.2 Experimental Instructions Social Norm Elicitation

Note: The instructions below are for the treatment NowLater. The instructions for the other treatments are very similar and available upon request.

Information about your Participation

Experiment description: You participate in a scientific decision-making experiment. During the experiment you will read instructions, answer questions, and make various decisions that may affect your payout and the payout of other participants.

Participant rights: Your participation in this experiment is voluntary. In order for us to use your data for research purposes, it is necessary that you process all parts of the experiment. You can withdraw from participating in the experiment at any time without having to state any reasons.

Data protection: All data in this experiment is anonymous and does not allow any conclusions about individual participants. There is no connection between your anonymous data in the experiment and the personal data that is stored about you in the participant database of the Cologne Laboratory for Economic Research (CLER) for the purpose of experiment invitation. The data collected in the context of this experiment will be used exclusively for research purposes, and will be stored only for scientific evaluation.

I am aware that I can contact the principal investigator if I want to receive further information about the experiment and that I can contact the principal investigator or the responsible ethics committee if I want to file a complaint regarding my participation.

I agree with these terms and conditions. YES / NO

——— *page break* ———

General Information

Welcome and thank you for your participation in this online experiment. For your participation in this experiment and the complete processing of all questions you will receive a payment of €5. You have further the possibility to earn an **additional amount of money** in this experiment. In the following we will explain your tasks in today's experiment.

General Description of the Task

In a few minutes, you will read the descriptions of several situations. The descriptions correspond to situations in which a person (person A) has to make a decision. For each situation, you will get a detailed description of the possible options person A could choose from when making the decision.

After reading the description of the decision situation, your task is to evaluate every possible action available to person A. **In particular, for each possible action of Person A, we will ask you whether choosing that action is "*socially appropriate*" and**

"in line with most people's expectations about what Person A should do"* or whether choosing that action is *"socially inappropriate"* and *"not in line with most people's expectations about what Person A should do". By socially appropriate we mean behavior that you think most people would agree is the "correct" or "moral" behavior. Another way to think about it is that if person A chose a socially inappropriate action, other people would be upset about it.

Based on your answers you can earn money. In particular, for each situation and each possible action, we will ask you to choose the answer that you believe matches the **majority of answers by all participants** in this online experiment. In order to determine your payment, at the end of the experiment, we will randomly select one situation and one possible action by person A. For this situation we will then check which answer was chosen by most participants. If your answer **matches the answer of most other participants, you will receive a payment of €10**.

We ask you to answer as honestly as possible, based on your opinion of what most participants in this experiment believe is socially appropriate or socially inappropriate behavior.

To show you how to evaluate the different actions, in the following we show you short example.

——— *page break* ———

Example

Person A is sitting in a cafe near the university. While there, individual A notices that someone has left a wallet at one of the tables. Individual A must decide what to do. Individual A can choose one of these four options:

- take the wallet.
- ask others nearby if the wallet belongs to them.
- leave the wallet where it is.
- give the wallet to the shop manager.

The table below lists all possible actions of person A. For each of these actions, we ask you to indicate whether choosing this action is "*socially appropriate*" and "*in line with most people's expectations about what Person A should do*" or whether choosing this action is "*socially inappropriate*" and "*not in line with most people's expectations about what Person A should do*". You can choose between the following options: very inappropriate, inappropriate, somewhat inappropriate, somewhat appropriate, appropriate or very appropriate. To rate the actions, mark the corresponding option on the scale.

	very inappro-priate	inappro-priate	somewhat inappro-priate	somewhat appro-priate	appro-priate	very appro-priate
Take the wallet	○	○	○	○	○	○
Ask others nearby if the wallet belongs to them	○	○	○	○	○	○
Leave the wallet where it is	○	○	○	○	○	○
Give the wallet to the shop manager	○	○	○	○	○	○

For example, suppose that you believe that most people think

- taking the wallet is very inappropriate
- asking others nearby if the wallet belongs to them is somewhat appropriate
- leaving the wallet where it is is somewhat inappropriate
- giving the wallet to the shop manager is very inappropriate.

In this case your evaluation should look like the following:

	very inappro-priate	inappro-priate	somewhat inappro-priate	somewhat appro-priate	appro-priate	very appro-priate
Take the wallet	●	○	○	○	○	○
Ask others nearby if the wallet belongs to them	○	○	○	●	○	○
Leave the wallet where it is	○	○	●	○	○	○
Give the wallet to the shop manager	○	○	○	○	○	●

——— *page break* ———

Your Task in today's Experiment

In a few minutes you will read the descriptions of **five situations** in which **a participant in a previous experiment, which was conducted at the Cologne Laboratory for Economic Research (CLER) at the University of Cologne**, had to make a decision. For simplicity, in the following we call this participant **person A**. For each situation you will receive a detailed description of the possible options available to person A when he/she had to make the decision. You are then asked to indicate for each possible action of person A, whether choosing this action is "socially appropriate" or "socially inappropriate". Your answers are entered in a table like in the example above.

Your Payment from today's Experiment

At the end of today's experiment we randomly select one situation and one possible action of person A. Your payment **depends on how similar your answer is to the answer of the other participant in this situation**:

- If your answer in the selected situation **matches** the answer of most other participants, you will receive a **payment of € 10**. For example, if your answer is "very appropriate" and the most frequent answer by the participants is also "very appropriate", then you will receive a payment of € 10.
- If your answer in the selected situation does **not match** the most frequent answer by the other participants, you will **not receive any payment**. For example, if your answer is "very appropriate" and the most frequent answer of the other participants is "somewhat appropriate", you will receive a payment of € 0.

——— *page break* ———

Control Questions

Before we start the experiment, we want to make sure that all participants have fully understood the rules of the experiment and the payments. To do this, we ask you to answer the following questions:

1. If your rating in the selected situation is "socially appropriate" and the rating of most other participants is "socially appropriate", then your payment will be:
2. If your rating in the selected situation is "very socially appropriate" and the rating of most other participants is "rather inappropriate", then your payment will be:

——— *page break* ———

General description of the decision situation in the previous experiment

All five situations in which person A (a participant from a previous experiment) could make a decision are based on the following decision situation:

At the beginning of the experiment, person A was randomly **placed in a group with three other participants**. Each group member received an **initial endowment of 20 points**. Each group member could then decide how to distribute the 20 points. The group members could **either keep the points for themselves**, or they could contribute all or some of them to a **group project**. Each point not contributed to the group project automatically remained in the private account of the group member. **No other group member benefited from the points in the private account**. Each point that was contributed to the group project was first **doubled**, and then **shared equally among all four group members**. This means that all members of the group benefited equally from the tokens contributed to the group project. The income of a participant therefore was determined as follows:

$$\text{Income from the group project} = \frac{2 \times \text{sum of contributions}}{4}$$

$$\begin{aligned}\text{Total Income}&\\ &= \text{Income from the private account} + \text{income from the group project}\\ &= 20 - \text{contribution to the group project} + \frac{2 \times \text{sum of contributions}}{4}\end{aligned}$$

——— *page break* ———

Control Questions

Before we continue with the experiment, we want to make sure that all participants have fully understood the general decision situation of person A and the other participants in the previous experiment. To do this, we ask you to answer the following questions:

Question 1: Assume that **neither person A nor any other group member** contributes any points to the group project. What is the total income (in points) of each group member?

Question 2: Now assume that **all group members (including person A) each contributes 20 points** to the group project. What is the total income (in points) of each group member?

Question 3: Now assume that the three group members together contribute **a total of 30 points** to the group project. What is the total income (in points) of person A, if **person A contributes 0 points**?

Question 4: Now assume that the three group members together contribute **a total of 30 points** to the group project. What is the total income (in points) of person A, if **person A contributes 10 points**?

Question 5: Now assume that the three group members together contribute **a total of 30 points** to the group project. What is the total income (in points) of person A, if **person A contributes 20 points**?

——— *page break* ———

Decision Situation of Person A

The exact decision situation in the previous experiment was as follows:

- First, the three group members had to simultaneously decide how many points (between 0 and 20) they want to contribute to the group project.
- After that, **person A was informed about the average contribution of the other three group members**.
- Then, **person A could decide himself/herself**, how many points he or she wants to contribute to the group project.

After person A took his/her decision, the experiment was finished.

Payments of the Participants

At the end of the previous experiment, the point income of the participants was first converted into Euro. Afterwards, the participants received their payments via bank transfer. The following rules applied:

- The payment of the **income from the private account** was credited **IMMEDIATELY**.
- The payment of the **income from the group project** was credited **WITH A DELAY OF 12 MONTHS**.

——— *page break* ———

Control Questions

Before we continue with the experiment, we want to make sure that all participants have fully understood the decision situation of person A in the previous experiment. To do this, we ask you to answer the following questions:

Question 1: When deciding on how many points to contribute to the group project,

- ☐ person A was informed about the average contributions of the other group members.
- ☐ person A did not know how many points the other group members had contributed.

Question 2: Each point contributed to the group project

- ☐ generated income from the group project that participants received immediately.
- ☐ generated income from the group project that participants received after 12 months.
- ☐ generated income from the private account that participants received immediately.

- ☐ generated income from the private account that participants received after 12 months.

Question 3: Each point not contributed to the group project

- ☐ generated income from the group project that participants received immediately.
- ☐ generated income from the group project that participants received after 12 months.
- ☐ generated income from the private account that participants received immediately.
- ☐ generated income from the private account that participants received after 12 months.

C.3 Experimental Instructions Study 2

Note: The instructions below are for the treatment LaterNow. The instructions for the other treatments are very similar and available upon request.

General Information

Welcome and thank you for your participation in this experiment. For your participation and punctual arrival you receive €4. You can earn an additional substantial amount of money in this experiment. The exact amount you will receive depends on your decisions and the decisions of the other participants. It is therefore very important that you read the following instructions carefully.

General Rules

The results of this experiment will be used for a research project. It is therefore important that all participants follow certain rules of conduct. During the experiment, you are not allowed to communicate with other participants of the experiment or any person outside the laboratory. For this reason, all mobile phones have to be switched off. If you have questions with regard to the instructions or the study, please raise your hand – we will privately answer your question at your place. Disregarding this rule leads to exclusion from this experiment and from all payments.

Anonymity

All decisions are made anonymously, i.e., no other participant learns about the identity of a participant that made a certain decision. Also, the payment is made anonymously, i.e., no participant learns about the payment of the other participants.

Payment

During the experiment, your income will be calculated in points. At the end of the experiment, the total number of points you earned will be converted to Euro at the following rate:

$$5 \text{ points} = 1 \text{ Euro.}$$

IMPORTANT NOTE: Your payment from this experiment will be credited via bank transfer (except for the show-up fee of €4 which you will receive in cash at the end of the experiment). It is therefore necessary that you are willing to provide us with information about your bank account. All payments will be executed immediately after the experiment. Yet, the payment date, i.e., the date when the money will be credited to your account (the value date), can vary. In particular, you will receive one part of your payment at an earlier date, and the other part of your payment at a later date. The dates you will receive the two parts of your payment depends on your decisions and the decisions of others. We will email you a confirmation of the bank transfers of all payments within the next two days.

Your bank information will be exclusively used for your payment and does in no respect enter the statistical analysis of this experiment. In particular, at no time will your bank account information be linked to your decisions in the experiment. After all payments are completed, all bank account information will be deleted.

Course of the experiment

The experiment consists of three parts. You will first receive the instructions for the first part. You receive the instructions for the next part as soon as the previous part is completed. Your total income equals the sum of incomes from all three parts of the experiment. You should therefore take all your decisions seriously.

General Setup

First, we explain the general setup to you. After that, you will be informed about the exact task. At the beginning of part I, all participants are randomly matched into groups of four (4) participants. Each group member receives an initial endowment of 20 points. Then, you are asked to decide how you want to distribute the 20 points. All participants in your group face the same decision situation than you. You can either keep the points for yourself, or you can contribute all or some of them to a group project. Each point that is not contributed to the group project automatically remains in your private account. No other group member benefits from the points in your private account. Each point that you contribute to the group project is multiplied by two and put into the group account. After all group members have made their decisions, the group account is distributed equally among all four group members. This means that all group members will profit equally from the points that you or any another group member contributed to the group account. Your income from the group project is determined by:

$$\text{Income from the group project} = \frac{2 \times \text{sum of contributions}}{4}$$

Your total income is the sum of your income from your private account and of your income from the group project.

$$\begin{aligned}
&\text{Total Income} \\
&\qquad = \text{Income from your private account} + \text{income from the group project} \\
&\qquad = 20 - \text{your contribution to the group project} + \frac{2 \times \text{sum of contributions}}{4}
\end{aligned}$$

Payments

As outlined at the beginning, your total income will be converted into Euro according to the above mentioned rate. The payment is made as follows:

- The payment of your **income from the private account** is credited **IN 12 MONTHS**.

- The payment of your **income from the group project** is credited **IMMEDIATELY**.

IMMEDIATELY means that we will transfer your income to your bank account immediately after the experiment and that the money will be credited immediately (*please note that in Germany bank transfers can take up to one workday*).

IN 12 MONTHS means that we will transfer your income to your bank account immediately after the experiment and that the money will be credited in 12 months (*please note that in Germany bank transfers can take up to one workday*).

Control Questions

Please answer the following questions. The purpose of these questions is to make sure that all participants have understood these instructions correctly.

Assume that neither you nor any other group member contributes anything to the group project.

Question 1: What is your total income (in points)?

Question 2: What is the total income of each of your three group members (in points)?

Now assume that you and the other three group members each contribute 20 tokens to the group project.

Question 3: What is your total income (in points)?

Question 4: What is the total income of each of your three group members (in points)?

Assume that the other three group members contribute a total of 30 tokens to the group project.

Question 5: What is your total income (in points) if in addition to that, you contribute 0 tokens?

Question 6: What is your total income (in points) if in addition to that, you contribute 10 tokens?

Question 7: What is your total income (in points) if in addition to that, you contribute 20 tokens?

Assume that you contribute 10 tokens to the group project.

Question 8: What is your total income (in points) if in addition to that, the other three group members contribute a total of 10 tokens to the group project?

Question 9: What is your total income (in points) if in addition to that, the other three group members contribute a total of 30 tokens to the group project?

Question 10: What is your total income (in points) if in addition to that, the other three group members contribute a total of 50 tokens to the group project?

Assume that the factor M is 1.6 and that you and the other three group members each contribute 5 tokens to the group project.

Question 11: What is the income from your private account (in points)?

Question 12: What is your income from the group project (in points)?

Now assume that the factor M is 3.6 and that you and the other three group members each contribute 5 tokens to the group project.

Question 11: What is the income from your private account (in points)?

Question 12: What is your income from the group project (in points)?

Question 15: Points that you and the other group members contribute to the group project

- generate income from the group project that is credited immediately.
- generate income from the group project that is credited in 12 months.
- generate income from the private account that is credited immediately.
- generate income from the private account that is credited in 12 months.

Question 16: Points that you do not contribute to the group project

- generate income from the group project that is credited immediately.
- generate income from the group project that is credited in 12 months.
- generate income from the private account that is credited immediately.
- generate income from the private account that is credited in 12 months.

Instructions Part I

Decision. The decisions you make in this part of the experiment are based on the general setup described above. In this part you are asked to fill in a contribution table in which you indicate for different values of the **factor M**, how many points you want to contribute to the group project. In each row, there are 20 points at your disposal. You make your contribution decision on the screen in the following table:

Contribution table

Factor M	Your contribution
1.2	
1.4	
1.6	
1.8	
2.0	
2.2	
2.4	
2.6	
2.8	
3.0	
3.2	
3.4	
3.6	

The numbers in the first column are the values of the factor M, by which all contributed points are multiplied by. Your task to decide how many points you want to contribute in each of these cases. That is, you indicate how many points you want to contribute if the multiplication factor M equals 1.2, 1.4, 1.6, etc. Once you have made an entry in each input box, please click on the "next" button.

After all participants have made their decisions, one situation (row) is randomly selected. For this situation, the income of all group members will be determined according to the procedure described above.

At the time of the decision, you will not know which decision will be relevant for you. You should therefore take all your decisions seriously as any decision can determine your payment.

Reminder:

$$
\begin{aligned}
\text{Total Income} & \\
&= \text{Income from your private account} + \text{income from the group project} \\
&= 20 - \text{your contribution to the group project} + \frac{2 \times \text{sum of contributions}}{4}
\end{aligned}
$$

Payment

- The payment of your **income from the private account** is credited **IN 12 MONTHS**.

- The payment of your **income from the group project** is credited **IMMEDIATELY**.

Instructions Part II

At the beginning of Part II, all participants are randomly matched into **new groups of four**. It is ensured that you have not interacted with any of your new group members in part I.

The general setup in Part II is the same as in Part I. As before, each group member receives an initial endowment of 20 points that you can either keep for yourself, or that you can contribute fully or partly to to the group project. All group members make their decisions simultaneously. In Part II, all contributed points are **multiplied by 2 (factor M=2)** and, subsequently, distributed equally among all four group members. **You make only one decision.** There is no contribution table.

Your income is calculated in the same way as in the first part of the experiment. Reminder:

$$
\begin{aligned}
&\text{Total Income} \\
&\qquad = \text{Income from your private account} + \text{income from the group project} \\
&\qquad = 20 - \text{your contribution to the group project} + \frac{2 \times \text{sum of contributions}}{4}
\end{aligned}
$$

Payment

The total points you earn in Part II will be converted into Euro at the rate described above: **5 points** = 1 Euro, and will be added to your income from Part I.

IMPORTANT

In contrast to Part I, the payment of your whole income from the private account and from the group project are paid IMMEDIATELY.

Reminder: IMMEDIATELY means that we will transfer your income to your bank account immediately after the experiment and that the money will be credited immediately. (please note that in Germany bank transfers can take up to one workday).

Instructions Part III

This is the end of Part II. Part III starts now. At the beginning of Part III, the groups are dissolved, i.e., the decisions you will make in this part do not influence the income of the other participants. Also, the decisions of the other participants will not influence your income in this part of the experiment. Your income of this part will be added to your income of Part I and II.

In Part III, you have to make **20 decisions**. In each of these decisions, you can choose between **two options**.

- **Option A** gives you an **immediate payoff of €50**.
- **Option B** gives you a **higher payoff in 12 months**.

The money amount in Option A is identical for all 20 decisions, while the money amount in Option B changes from decision to decision.

At the end of the experiment, one participant is randomly selected and is paid according to his decisions in Part III. For this participant, the computer randomly selects one of the 20 decisions. The choice in this decision determines the payment date and the payoff from Part III. As before, we will transfer the income from this part of the experiment into your bank account directly after the experiment. The amount will be credited either immediately (in Option A), or in 12 months (Option B).

At the time of your decision, you do not know if you will be randomly selected and which decision is relevant for your payment. It is therefore important that take all your decisions seriously as any decision can determine your payment.