Weighting the Waiting: Intertemporal Social Preferences[1]

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Abstract

This paper studies intertemporal social preferences. We introduce intertemporal dictator and ultimatum games where players decide on the timing of monetary payoffs. The setting is two-dimensional: inequalities can arise in the time as well as in the monetary dimension. The results of our experiment show that decisions on the distribution of the timing of payoffs depend on inequalities in the sizes of these payoffs in a systematic way in intertemporal ultimatum games, but much less so in intertemporal dictator games. Surprisingly, we found positive correlation between decisions only in some intertemporal games and regular games, and no correlation with time preferences. All in all our results cannot be explained by an intertemporal social preference model that assumes utility to be a simple weighted sum of discounted utilities of players. Our results rather suggest that the weight given to the discounted utility of a player depends on the inequality in discounted utilities. Hence, this paper calls for the development of new models of intertemporal social preferences.

Keywords: Intertemporal social preferences, social preferences, time preferences, dictator game, ultimatum game, multidimensional inequality

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1. Introduction

A large body of experiments in economics and other social sciences provides evidence that decision makers have social, or other-regarding, preferences. Individuals with such preferences behave as if they are maximizing a utility function that depends not only on their own payoff, but also on the payoffs of others. Studies on social preferences have enhanced our understanding of a wide range of behaviors that could not be explained by purely selfish motives, the assumption made in many traditional economic analyses (Bruhin et al. 2019, Fehr and Fischbacher, 2002, Garofalo and Rott, 2018, Grosskopf and Pearce, 2020, Grossman 2014).

A parallel stream of literature on intertemporal choice documents that decision makers discount the future, i.e. they find the present more important than the future. While many economic analyses assumed discounting to be exponential and thereby time-consistent, experiments provide evidence that people discount the future in a time-inconsistent manner (Frederick et al. 2002, Ebert and Prelec 2007, Baucells and Heukamp 2012, Abdellaoui et al. 2019, Rohde 2019). Consequently, studies on non-exponential discounting models have enhanced our understanding of a range of behaviors that cannot be explained well when assuming exponential discounting.

While the literature on social and intertemporal preferences have each contributed substantially to our understanding of decision making, these strands of literature have remained largely separate. The literature on social preferences has focused mainly on the social dimension of behavior, and the literature on intertemporal preferences has focused mainly on the time dimension of behavior. Yet, many decisions involve both a social and a time dimension (Andreoni and Serra-Garcia, 2021, Breman, 2011, Chopra et al., 2023, Craig et al., 2017, Ederer and Schneider, 2022). This paper studies such decisions in a lab-experiment. We study intertemporal social preferences in a context where people decide on the timing of payoffs that accrue to themselves and others. The payoffs are fixed, and the decision makers decide how to distribute a given total waiting time for these payoffs between themselves and others. Hence, they decide on how to prioritize the payoffs of themselves and others. Are they purely selfish by allocating all waiting time to others and thereby giving themselves full priority? Or do they maximize efficiency by allocating all waiting time to the person who gets the smallest payoff, thereby giving full priority to the person who gets the largest payoff? Or do they aim to minimize inequality and therefore allocate part of the waiting time to themselves and part of it to others? In practice, such decisions are made whenever one has to prioritize outcomes that may accrue to different persons. One example involves time management – giving priority to individual or teamwork. Another example, involving social planners, concerns managing waiting lists in the health care sector.

We are the first to study intertemporal social preferences in a setting where decision makers decide on the timing of payoffs for themselves and others, and inequalities arise both in the sizes and in the timings of these payoffs. We study two-player dictator and ultimatum games where the monetary payoffs of the players are given and proposers choose how to distribute a total waiting time of twelve weeks between the two players. By systematically varying inequalities in payoff sizes, we assess how decisions regarding payoff timing depend on inequalities in payoff sizes. We also analyze whether decisions in these games correlate with decisions in standard dictator and ultimatum games and with standard time preference measurements. All in all our results cannot be explained by an intertemporal social preference model that assumes utility to be a simple weighted sum of discounted utilities of players. Our results rather suggest that the weight given to the discounted utility of a player depends on the inequality in discounted utilities. Hence, this paper calls for the development of new models of intertemporal social preferences.

We first consider dictator and ultimatum games where monetary payoffs are equal, i.e., games where inequalities can only arise in the time dimension. In these games, we find that the general behavioral patterns found in standard dictator and ultimatum games are replicated when the task is to distribute waiting time instead of monetary payoffs. Proposers were, for instance, more generous in ultimatum than in dictator games and more generous than required by responders. Hence, when payoffs are equal, we find evidence that social preferences have a similar structure when applied to the time dimension, which extends the findings of Berger et al (2012) and Noussair and Stoop (2015) to waiting time in the usual intertemporal choice sense rather than waiting in the lab.

Next, we consider whether and how choices in these games change when monetary payoffs are distributed unequally. We distinguish between three types of behavior. First, we say that players are *insensitive* to increases in monetary payoffs if their allocation of waiting time is *independent* of the distribution of monetary payoffs. Secondly, we say that players *reinforce* increases in monetary payoffs when their allocation of waiting time becomes *more* generous toward the player whose monetary payoff has increased relative to the other player. They will thus *reduce* the waiting time for players whose share of the total monetary payoffs has increased. Finally, we say that players *compensate* increases in monetary payoffs when their allocation of waiting time becomes *less* generous towards the player whose monetary payoff has increased relative to the other player. They will thus *increase* the waiting time for players whose share of the total monetary payoffs has increased.

In the various distributions of monetary payoffs that we consider, between 25% and 43% of proposers in the dictator game were insensitive to changes in monetary payoffs. In the ultimatum games, between 19% and 37% of the proposers and between 35% and 77% of the responders were insensitive. On average, though, proposers and responders in ultimatum games were compensating for increases in monetary payoffs when both players received a non-zero payoff. Interestingly, for proposers in dictator games we found insensitivity to increases in monetary payoffs for non-zero payoffs, on average (but compensating behavior in one of the six cases). In both games, compensating behavior became more prevalent when inequalities in payoffs were reduced, and reinforcing behavior became more prevalent when inequalities in payoffs were increased (especially for proposers).

Finally, we found some positive correlation between decisions in intertemporal games and standard games, mostly for proposers in the intertemporal dictator games and responders in the intertemporal ultimatum games, when proposers received a larger payoff than responders. Surprisingly, we found no systematic correlation between decisions in intertemporal games and time preferences. All in all, we conclude that intertemporal and social preferences do not translate easily into intertemporal social preferences.

This paper is organized as follows. In Section 2 we discuss related literature. Section 3 describes our experiment and Section 4 shows the results. Section 5 discusses the results and Section 6 concludes.

2. Related Literature

We contribute to the literature in several ways. First, our design allows us to examine whether social preferences apply similarly when allocating waiting time as when allocating monetary payoffs. Most experiments involving dictator and ultimatum games ask subjects to distribute monetary payoffs. We ask our subjects to distribute waiting time for given payoffs. A few previous studies asked their subjects to distribute waiting time in the lab (Berger et al., 2012, and Noussair and Stoop, 2015). Time spent in the lab as the main decision outcome has also been implemented in risky decision making (Abdellaoui and Kemel, 2014). Our experiment expands on these studies by introducing waiting time outside the lab, namely multiple weeks during which the subjects can spend their time on other activities than the experiment, but have to wait for their monetary payoff from the experiment. Thus, while Berger et al. (2012), and Noussair and Stoop (2015), considered time spent waiting in the lab, we consider time in the usual intertemporal choice sense. Hence, just like recent studies on risky dictator games have added a risky dimension to the standard games (Brock et al. 2013), we add an intertemporal dimension to the standard games. We will compare the chosen distributions of waiting time in our experiment with the chosen distributions of waiting time in Berger et al. (2012) and Noussair and Stoop (2015) and with the chosen distributions of monetary payoffs in the standard versions of the games.

Our second and main contribution to the literature is that we move from a one-dimensional setting to a two-dimensional setting. In standard dictator and ultimatum games, inequalities can arise only in the monetary dimension. Similarly, in Berger et al. (2012) and Noussair and Stoop (2015) inequalities can arise only in the waiting time dimension. In our experiment, inequalities can arise both in the monetary and in the time dimension. This makes our approach somewhat comparable to the one by Exley and Kessler (2023) who study whether and how choices for distributions in one dimension depend on the given distribution of payoffs in another dimension. In their main setting, the two dimensions concern small and large tokens that together determine the total final monetary payoffs of subjects. Hence, they consider two dimensions that both concern the size of payoffs and therefore are perfect substitutes. In their setting, people can add the payoffs in the two dimensions to determine their total payoff. In our setting, the two dimensions (money and time) are no perfect substitutes, as waiting time and size of monetary payoff cannot simply be added to determine ‘total payoff’.

Exley and Kessler (2023) find that in a substantial fraction of decisions, subjects aimed for narrow equity instead of overall equity. Narrow equity refers to equity on the dimension for which decisions can be made, ignoring the degree of equity in the other dimension. Overall equity refers to equity on the total payoff or utility derived from both dimensions. In our experiment, narrow equity concerns would imply that allocations of waiting time are insensitive to changes in inequalities in payoffs. As the two dimensions in our setting are no perfect substitutes, we expect a larger fraction of narrow equity concerns in our setting than in Exley and Kessler (2023).

We are aware of a few recent studies that considered a setting where inequalities could arise in both the monetary and the time dimension. Rong et al. (2018) and Rong et al. (2019) asked their subjects to allocate money between a sooner and a later point in time, using the convex time budget method, and thereby also considering time in the usual intertemporal choice sense. They considered settings where both the sooner and the later payoff would go to the subjects themselves or both to their spouses, and settings where one of the two payoffs would go to the subjects themselves and the other to their spouses. In Rong et al. (2018) the subjects were cohabiting couples in the U.S., while in Rong et al. (2019) they were students who were randomly and anonymously paired. Both studies found that the discount rates that could be imputed from decisions differed between settings, illustrating that intertemporal and social motives interact. Kölle and Wenner (2023) asked their subjects to allocate effort tasks between themselves and another subject, and in a few of their settings the decision makers would have to do their effort sooner or later than the other subject, thereby also allowing for inequalities in two dimensions.

The treatments in Rong et al. (2018 and 2019) and in Kölle and Wenner (2023), in which either the sooner or the later payoff was for the decision maker and the other payoff was for the player they were paired with, can be interpreted as types of two-dimensional dictator games. The two dimensions are the payoffs (monetary or effort) and their timing. In these three studies the (inequality in terms of) timing was given and the payoffs had to be determined by the decision maker. In our study the (inequalities in terms of) payoffs are given and their timing has to be determined. Moreover, we consider a strategic as well as a non-strategic setting by considering both ultimatum and dictator games.

Some other recent studies considered intertemporal preferences with a social dimension. However, these studies take a one-dimensional approach in the sense that inequalities can arise either in the monetary payoffs or in their timings, but not in both. Rodriguez-Lara and Ponti (2017) let their subjects make choices between smaller sooner rewards and larger later rewards, where one of these choices would determine the subject's own payoff as well as the payoff of the subject they were matched with. Thus, both subjects would receive the same payoff at the same point in time. They found that subjects' choices were affected by the intertemporal preferences of the subject they were paired with and interpret this finding in terms of social motives and social influence. Carlsson et al. (2012) and Yang and Carlsson (2016) studied intertemporal preferences in Chinese couples. They compared individual decisions that would pay only the individuals themselves, and joint decisions where both spouses would receive the same payoff. They found that both spouses had an influence on joint decisions, but that the influence was larger for husbands than for wives. Schaner (2015) also studied intertemporal household decisions. They did so in a field experiment with couples in Kenya and found that, compared to couples with similar discount rates, couples with different discount rates are more likely to make inefficient savings decisions when choosing between individual and joint bank accounts.

These studies all show that intertemporal household decisions are influenced by social concerns. In turn, social concerns have also been shown to be influenced by the intertemporal structure of payoffs. Kovarik (2009) and Dreber et al. (2016) studied behavior in dictator games where all payoffs would be received at the same point in time for both players. Proposers in these games offered a lower amount to the recipients when the delay of the payoffs became larger. Kim (2023) showed that cooperation in an infinitely repeated prisoner's dilemma was lower for monthly than for weekly payments. Breman (2011), however, found that charitable giving is increased more when committing to increased donations in the future, than when increasing donations today. Andreoni and Serra-Garcia (2021) also found higher donations when they were delayed with one week than when they were implemented immediately.

Our study, therefore, adds to the mentioned studies by being the first to study intertemporal social preferences in a setting where decision makers decide on the timing of payoffs instead of their sizes, and inequalities arise both in the sizes and in the timings of these payoffs.

3. Experiment

The main purpose of our experiment is to study how choices over distributions of waiting time for payoffs depend on the (given) distribution of the sizes of these payoffs. Such decisions reveal intertemporal social preferences, which are expected to be strongly connected to intertemporal and social preferences. To verify this expected connection, Part 1 (time preferences) and Part 2 (social preferences) of the experiment elicited time preferences and social preferences in a usual way. The order of Parts 1 and 2 was randomized between subjects. Part 3 elicited intertemporal social preferences through games involving distributions of waiting time. Finally, Part 4 asked questions about demographics and perceptions of kindness.

The simplest and arguably cleanest setting to measure social preferences is a dictator game. Hence, we study social and intertemporal social preferences in two-person dictator games. To assess the robustness of the elicited preferences in a more strategic setting, we also study ultimatum games. Hence, our experiment consisted of two treatments: a dictator game treatment (DG) and an ultimatum game treatment (UG). Every subject was randomly allocated to one of the two treatments. The instructions can be found in the supplementary material.

3.1 Design

3.1.1 Part 1: Time Preferences

Part 1 elicited subjects' time preferences through two choice lists. One of these choice lists elicited subjects' own time preferences (*TPself*) and the other elicited subjects' time preferences for the subject they were paired with (*TPother*). The order of these choice lists was randomized between subjects. Every choice list consisted of 21 questions, where the subject had to choose between receiving a given amount of money now (Option A) or €40 in 12 weeks (Option B). The amount of money in Option A increased from €0 to €40 with steps of €2, thus increasing in attractiveness according to monotonic preferences. For each choice list, the present value (PV) was determined by taking the average value of Option A of the last row where the subject chose Option B and the first row where the subject chose Option A. For *TPself* the amount of money would be received by the subjects themselves and for *TPother* it would be received by the subject they were paired with.

3.1.2 Part 2: Social Preferences

Part 2 elicited social preferences by letting subjects play a standard Dictator Game (DG) or a standard Ultimatum Game (UG), depending on the treatment. For each game, every subject was randomly paired with another subject. One of them was randomly assigned the role of "Player A" (DGA & UGA) and the other one the role of "Player B" (DGB & UGB). Players' roles were determined at the start of the experiment and remained constant throughout the experiment.

In the standard dictator game, Players A were the proposers and had the task to divide €40 (in multiples of €2) between themselves and Player B, the responder. Player B essentially had no role other than being the recipient of whatever amount Player A was willing to give. In order to have Players A and B answer an equal number of questions in the experiment, Players B were asked how they would have divided €40 in case they would have been Player A[2].

In the standard ultimatum game, Player A had the same task as in the standard dictator game, but now knowing that his/her proposal could be rejected by Player B, which would result in both players receiving €0. For Player B, the strategy method was employed, meaning that Players B had to answer a choice list and indicate for each row in the list whether they would accept or reject the offer from Player A. The choice list started with a possible offer of €40 for Player A and €0 for Player B and ended at €0 for Player A and €40 for Player B with increments of €2. Players B can therefore be assumed to become more likely to accept proposals moving down the list[3]. The strategy method allowed us to measure the minimum acceptable offer for Player B and has the additional benefit that Player A and Player B did not have to wait for each other's responses to

[2] The exact framing of the hypothetical question was: "In this experiment, you are assigned the role of Player B. Player A decides how to divide €40 between him-/herself and you. Suppose you had been assigned the role of Player A. Please indicate below how you would have proposed to divide €40 between you and the other."

[3] Subjects who are extremely inequality averse may only accept offers in the middle of the list and will thereby not exhibit monotonicity throughout the list. In the analysis of the data we take this into account.

continue with the experiment. We determined the minimum acceptable offer (MAO) for Player B by taking the first amount offered by Player A for which Player B indicated to accept the offer.

3.1.3 Part 3: Intertemporal Social preferences

Part 3 elicited intertemporal social preferences (ISP) using intertemporal versions of the dictator and ultimatum game. In these games, both players get a certain amount of money, which always add up to €40. At the start of the game, both players have to wait 12 weeks to receive their monetary payoff. Player A can bring the payments of Player A and Player B forward by 12 weeks in total. Players A propose by how many weeks to bring forward their own payment (*t*) and by how many weeks to bring forward Player B's payment (12-*t*) (summarized in Table 1). In the ultimatum game, Players B can then decide by means of a strategy method which proposals by Player A to accept and which to reject. If the offer of Player A is rejected, both players will have to wait the full 12 weeks for their payment. This is similar to the approach of Noussair and Stoop (2015), where if player B rejected the offer, both players had to wait till the end of the experiment to be able to leave the lab. We chose to frame the decisions in terms of number of weeks by which the payments would be brought forward, to make sure that both dimensions (money and time) would be expressed in terms of gains. This facilitates a comparison between the intertemporal games and the standard games without confounding our findings with a gain-loss asymmetry.

The choice list for Players B in the ultimatum game started with an allocation where Players A bring forward their own payment completely, resulting in a final delay of zero weeks for Player A and 12 weeks for Player B, and ended with bringing forward the payment of Player B completely, resulting in a final delay of 12 weeks for Player A and 0 weeks for Player B. All other possible allocations (increments of 1 week) were presented in ascending order of reduction of waiting time for Player B. We can therefore reasonably assume that the offers became more attractive for Player B when going down the list[4]. For each Player B we determined the minimum acceptable offer (MAO) by taking the number of weeks Player B's payment was proposed to be brought forward (12-*t*) in the first offer that was accepted by Player B.

We considered nine different settings of the intertemporal dictator and ultimatum games, presented to subjects in random order. These settings differed in terms of the amounts of money that the players received. The amount of money Player A received *(y)* took the values of €0, €2, €5, €10, €20, €30, €35, €38 and €40, with Player B receiving €40 – *y*.

Table 1 – Illustration of Intertemporal Social Preference elicitation for Player A

	Amount		Initial delay		Brought forward by	Final delay
You will receive	€*y*	after	12 weeks	minus	*t* weeks	12-*t*
Player B will receive	€40-*y*	after	12 weeks	minus	12-*t* weeks	*T*

If subjects aim for narrow equity as in Exley and Kessler (2023), or, more generally, narrowly bracket their decisions on the decision-making-dimension (time), their decisions will be the same across the nine settings. For the extreme settings where one of the subjects gets €40 and the other gets €0, one can instead imagine that subjects would aim for maximizing efficiency and thereby reduce the waiting time for the €40 as much as possible. Alternatively, if in these settings subjects would want to minimize overall inequality (i.e., inequalities in discounted utilities), they would reduce the waiting time for the €40 as little as possible. Moreover, subjects who want to maximize efficiency for the highly unequal distribution in sizes of payoffs (i.e., €40/€0), may

[4] Subjects who are extremely inequality averse may only accept offers in the middle of the list and will thereby not exhibit monotonicity throughout the list. In the analysis of the data we will take this into account.

switch to minimizing overall inequality in settings where sizes of payoffs are more equal. Our setup allows us to detect such switches. We deliberately chose to have small changes in payoffs between settings at the extremes of the distributions of payoffs to detect where such switches would occur. For instance, a payoff of €5 may still be considered 'close to nothing', in which case choices in the settings with €5 or €0 would be similar. Alternatively, €5 may also be considered as offering a sufficiently high payoff to both players, potentially resulting in choices that are more similar to the setting with more equal payoffs.

3.1.4 Part 4: Demographic and kindness questions

The final part of the experiment for all participants, asked questions about demographics – age, gender and field of study – and perceptions of kindness. For all dictator and ultimatum games (depending on the treatment) we asked subjects to rate the kindness of a proposal by Player A of an equal allocation of money (in the standard games) or time (in the intertemporal games) on a scale from –10 (extremely unkind) to +10 (extremely kind). This kindness measure was inspired by Falk and Fischbacher (2006). We compare kindness ratings between intertemporal dictator and ultimatum games with different distributions of payoffs to provide further insight into whether subjects narrowly bracketed their decisions on one dimension (time) or took both dimensions (time and money) into account.

3.1.5 Inconsistencies

In the choice lists in our experiment, we did not prohibit multiple switches between options. In the ultimatum games, for instance, switching multiple times need not be a violation of monotonicity, but may reflect strong inequality aversion. Whenever a subject switched multiple times within a choice list, a message appeared asking them whether they were sure of their answers. If they indicated to be sure, they could continue; otherwise, they could adapt their answers.

Around 10 percent of the subjects (31 out of 292) switched multiple times in at least one of the choice lists. The majority of these were inconsistencies in the choice list to elicit time preference for others (21 subjects), while time preference for self was only answered inconsistently twice. Out of the 69 Players B in the UG treatment, eight players switched multiple times in at least one of the intertemporal games (four in at least three, and four in only one of the intertemporal games). Appendix C gives further details on how we treated these inconsistencies. Five subjects who were inconsistent for at least a third of the intertemporal games or both time preference questions, were dropped from the sample.

3.1.6 Notation

For ease of exposition, we adopt the following notation to refer to the different games. First, we denote whether it concerns the dictator (DG) or ultimatum game (UG), followed by the player making the decision (A or B). For the ultimatum game decisions of Player A, we thus refer to UGA. When referring to the separate settings of the intertemporal games, we first denote the payoff for player A, followed by the payoff for player B. For example, 1030 denotes the setting where player A receives €10 and player B receives €30.

3.2 Subjects

Using Orsee (Greiner, 2015), 292 subjects from Erasmus University Rotterdam were recruited, of which 154 subjects played the dictator games and 138 subjects played the ultimatum games. In total we ran 13 sessions[5], of which 7 DG and 6 UG. Each session lasted approximately 45 minutes. All subjects were students, with the majority studying either business or economics. The experiment was programmed in z-Tree (Fischbacher, 2007).

3.3 Payment

Subjects received a show-up fee of €5 in cash, with an additional payment varying between €0 and €40 by bank transfer. For the additional payment, we used a random incentive system between-subjects. More precisely, z-Tree randomly selected one question per session to be paid out for real. If the selected question concerned an (intertemporal) dictator or ultimatum game, half of the pairs of players were selected for payment. For the selected pairs, the proposal of Player A and, if applicable, the response of Player B, determined the amount (in standard games) or timing (in intertemporal games) of payment.

If the selected question concerned a time preference question, then a quarter of the subjects was selected for additional payment. Then, a random row of the choice list was selected, and the selected subject's choice in that line determined the additional payment. If the selected question was *TPself*, the selected subject was paid according to the choice (s)he made in the selected line. If the selected question was *TPother*, the partner of the selected subject was paid according to the selected subject's choice made in the selected line. The final payment to subjects thus varied between €5 and €45, with the payment date varying between the date of the session to 12 weeks after the session took place. On average, subjects were paid €15.37.

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[5] We ran 14 sessions, but one UG session with 14 subjects was lost, due to a crash in z-Tree.

4. Results

We report the results of our study in three steps. First, we present the results of the standard dictator and ultimatum games where €40 is divided between both players. Then, we elaborate on the results of the intertemporal games that give €20 to both players and ask to distribute a 12-week reduction in waiting time. These first games each can result in inequality in at most one dimension: the payoffs or the waiting times, respectively. Next, we analyze the results of the intertemporal dictator and ultimatum games that give unequal payoffs to both players and can, therefore, result in inequalities in both dimensions. We assess whether changes in inequality in payoffs have an impact on the chosen distribution of reduction in waiting times. Finally, we analyze correlations between decisions in standard and intertemporal games and between decision in intertemporal games and time preference elicitations.

Throughout, for completeness, we also report the results concerning the hypothetical choices of Players B in dictator games, though we discuss them only briefly as they are not the main focus of our study. These hypothetical choices of Players B can give interesting insights, though, as they can constitute an interesting bridge between choices of Players A in dictator and ultimatum games. In dictator games, Players A only need to consider their own social preferences. In ultimatum games, however, they also need to consider the social preferences of Player B who will determine whether they accept or reject an offer. Similarly, Players B in the dictator game are asked to take the perspective of the other player (Player A in their case). Hence, like Players A in ultimatum games, Players B in the dictator game take not only their own, but also the other's perspective into account. Yet, unlike Players A in ultimatum games, they do not have to act strategically, as their hypothetical offers cannot be rejected.

4.1 Social Preferences

Overall, the results of the standard dictator and ultimatum games replicated what has been found in previous literature (see Appendix A for details). The modal offer by Players A in both games was to split the endowment equally between Player A and Player B. Overall, the offers by Players A were marginally significantly higher in UG than in DG. Significantly fewer participants offered nothing to Player B in UG than in DG. Moreover, in UG the offers by Players A were significantly higher than the minimum acceptable offers of Players B.

4.2 One-dimensional Intertemporal Social Preferences

We first analyze intertemporal social preferences in the one-dimensional setting where both players receive an equal payoff of €20. Figure 1 and the *2020* column of Table 2 summarize the offers (DGA & UGA) by Players A and the hypothetical (DGB) and minimum acceptable offers (UGB) by Players B. For DGA and UGA, the amounts specify the proposed number of weeks of waiting time reduction for Player B. For DGB, the amounts specify the hypothetical proposed reduction in waiting time for the other player in case (s)he was assigned the role of Player A. For all these amounts, a higher value indicates less selfish (more pro-social) behavior. The amounts for UGB give the minimum number of weeks the waiting time of Player B had to be reduced for Player B to accept the offer. A higher value thus indicates that a larger reduction in waiting time was required in order for the proposal by Player A to be accepted (i.e., a higher chance of the proposal being rejected).

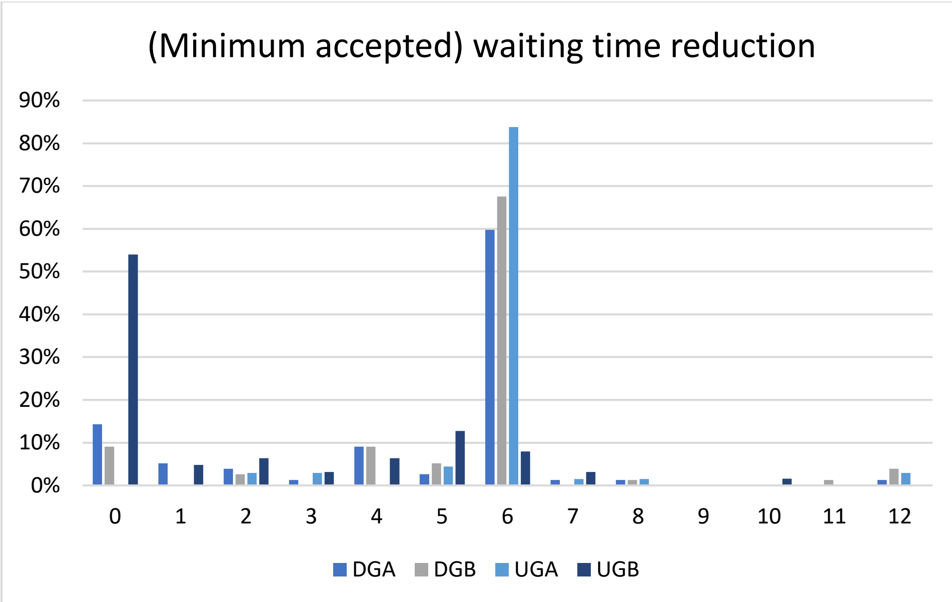


Figure 1 – Distributions of (minimum accepted) reduction in waiting times in the *2020* setting

Offers by Players A in the dictator and ultimatum games

In DG2020, most Players A (60%) divided the reduction in waiting time equally. This means that when both players received the same amount of money, Players A most frequently decided to reduce the twelve-week waiting time for both players by six weeks, resulting in six weeks waiting time for both. Nevertheless, 14% of Players A in DG2020 decided to offer zero waiting time reduction to Player B, thereby reducing their own waiting time to 0 weeks. In UG2020, the vast majority (84%) of Players A decided to split the waiting time equally, and all Players A reduced Player B's waiting time by at least two weeks. Overall, the reduction in waiting time offered by Players A to Players B was larger in UG2020 than in DG2020 (Mann-Whitney U, $p < 0.001$). Moreover, the proportion of Players A offering an equal split and the proportion making a non-zero offer were larger in UG2020 than in DG2020 (one-sided Fisher Exact, $p=0.001$ for both).

Result 1: Players A offered larger reductions of waiting time to Players B in UG2020 than in DG2020.

Actual offers by Players A and hypothetical offers by Players B in the dictator game

In DG2020, Players B were asked how much they would reduce the waiting time of Player B if they would have been assigned the role of Player A. Overall, we found no difference between the actual offers of Players A and the hypothetical offers of Players B (Mann-Whitney U, $p=0.089$). We also found no difference in the proportion of equal split and non-zero offers (one-sided Fisher's Exact, $p=0.201$ and $p=0.226$, respectively).

Minimum acceptable offers in ultimatum game

Table 2 shows that in UG2020, most Players B would have accepted any reduction of waiting time. The minimum acceptable offer equals zero weeks of waiting time reduction for 54% of Players B. Moreover, the minimum acceptable offers of Players B were significantly lower than the offers of Players A (Mann Whitney U, $p < 0.001$).

When taking the least conservative matching criterion where Players B with the lowest minimum acceptable offers are matched with Players A who made the lowest offers, then all proposals would have been accepted by Players B. On the other hand, when taking the most conservative criterion where Players B with the highest minimum acceptable offers are matched with Players A who made the lowest offers, then 7 out of 63 offers would have been rejected (11.1%). All possible matchings between Players A and Players B in UG2020 would thus have led to a rejection rate varying between 0% and 11.1%.

Result 2: In UG2020, the offers of Players A were significantly higher than the minimum acceptable offers required by Players B.

Comparing social preferences with one-dimensional intertemporal social preferences

The general patterns observed in DG2020 and UG2020 were similar to those observed in the standard dictator and ultimatum games. Offers by Players A were higher in the ultimatum games than in the dictator games. Moreover, the offers made in the ultimatum games by Players A were higher than the minimum acceptable offers required by Players B. However, the proportion of equal split offers by Players A was higher in the intertemporal DG2020 (60%) and UG2020 (84%) than in the standard DG (36%) and UG (44%).

4.3 Two-dimensional Intertemporal Social Preferences

The previous two sections showed that behavior in the one-dimensional dictator and ultimatum games involving waiting time was similar to behavior in the standard versions of these games involving monetary payoffs. Thus, players treated the money and time dimensions similarly when these were the only dimension that could generate inequality between players. This leaves open the question how these two dimensions would be treated in a two-dimensional setting where both dimensions can generate inequalities. In this section we will analyze behavior in the intertemporal dictator and ultimatum games that yielded unequal monetary payoffs. More specifically, we will study whether (minimum acceptable) offers of reductions in waiting time depended on the given distribution of monetary payoffs.

As discussed before, we distinguish between three types of behavior: players who are *insensitive* to changes in the distributions of monetary payoffs, players who *reinforce* increases in monetary payoffs (increase the reduction in waiting time for the player whose monetary payoff has increased) and players who *compensate* increases in monetary payoffs (decrease the reduction in waiting time for the player whose monetary payoff has increased).

Table 2 and Figures 2-5 summarize the offers in the various settings. First, for each setting we compare the choices of the two players in the different games. For the ultimatum games (Figures 4 and 5), the offers by Players A were larger than what was required by Players B in all settings, except for the *4000* setting. Moreover, the offers by Players A were larger in the ultimatum than in the dictator games when Players A received a larger payoff than Players B (Figures 2 and 4). Finally, within the dictator games, the actual offers of Players A did not differ much from the hypothetical offers of Players B (Figures 2 and 3). Mann-Whitney U tests confirm these findings (Table 3).

Table 2 – Descriptive statistics intertemporal DG and UG

		Setting								
		4000	*3802*	*3505*	*3010*	*2020*	*1030*	*0535*	*0238*	*0040*
DGA	*Average*	1.82	4.34	4.94	5.23	4.60	3.96	4.08	5.23	10.12
	Median	0	1	4	6	6	4	2	2	12
	Mode	0	0	0	2	6	6	0	0	12
	Obs	77	77	77	77	77	77	77	77	77
DGB	*Average*	3.16	5.71	6.31	6.10	5.44	4.14	3.18	4.64	7.96
	Median	0	6	8	7	6	3	1	1	12
	Mode	0	0	2	9	6	3	1	0	12
	Obs	77	77	77	77	77	77	77	77	77
UGA	*Average*	3.31	9.12	8.60	7.87	5.97	4.35	3.28	3.44	9.16
	Median	0	11	10	8	6	3.5	2	1	12
	Mode	0	12	12	9	6	3	1	0	12
	Obs	68	68	68	68	68	68	68	68	68
UGB	*Average*	7.92	7.62	6.08	4.45	2.02	1	0.72	0.54	0.58
	Median	12	10	7	4	0	0	0	0	0
	Mode	13	13	0	0	0	0	0	0	0
	Obs	65	65	64	64	63	65	65	65	65

Note: This table summarizes the average, median, and mode (minimum acceptable) offers, and the number of observations for each game in each setting.

Table 3 – Tests for differences between (minimum acceptable) offers, between players and games

	Setting								
	4000	*3802*	*3505*	*3010*	*2020*	*1030*	*0535*	*0238*	*0040*
DGA vs UGA	0.113	< 0.001	< 0.001	< 0.001	< 0.001	0.447	0.493	0.072	0.247
DGA vs DGB	0.304	0.045	0.047	0.145	0.089	0.957	0.272	0.354	0.012
UGA vs UGB	< 0.001	0.330	0.002	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Note: p-values of Mann-Whitney U tests; $p<0.05$ highlighted

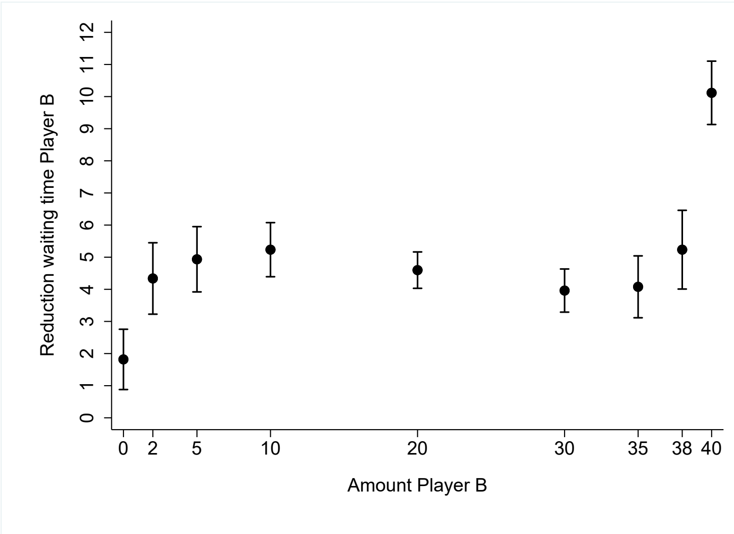


Figure 2 – Average offers by Players A in dictator games

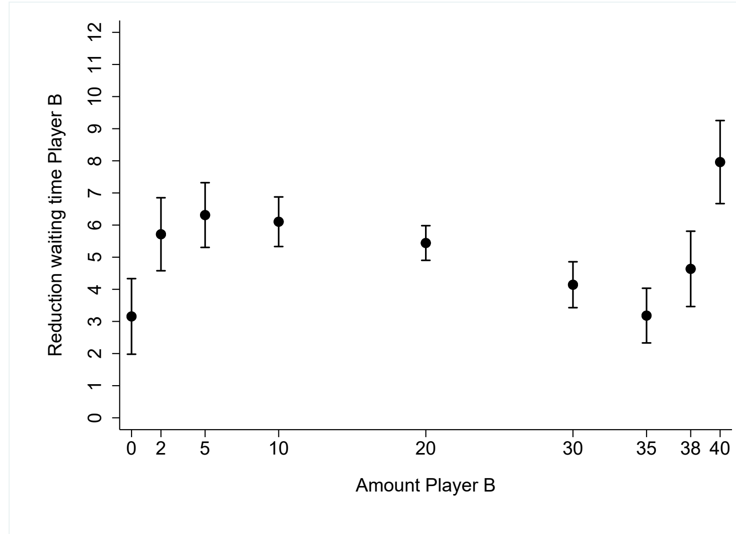


Figure 3 – Average hypothetical offers by Players B in dictator games

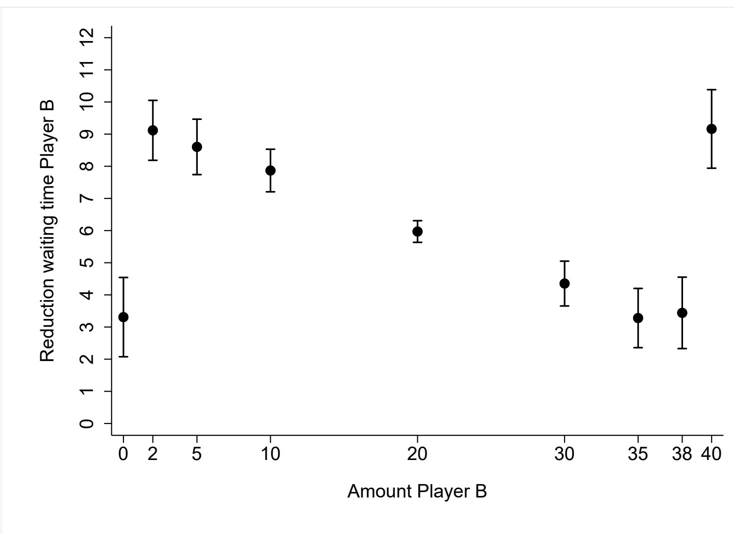


Figure 4 – Average offers by Players A in ultimatum games

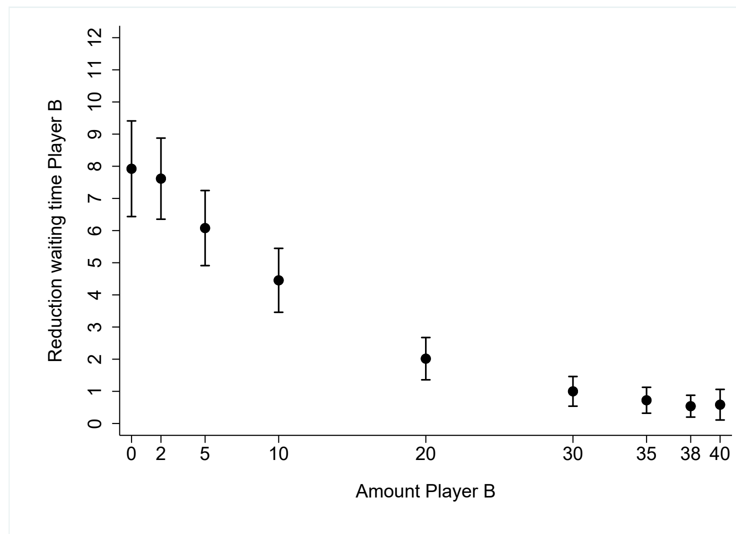


Figure 5 – Average minimum acceptable offers by Players B in ultimatum games

Highly unequal payoffs: the 4000 and 0040 settings

Figures 2-5 suggest that choices regarding waiting time depended on the distribution of payoffs. We will first analyze the settings with the most extreme inequalities in payoffs, where one of the players receives €0 for sure. These settings are interesting because they allow for a clear interpretation of behavior. We assume that all players are impatient, such that delaying a reward decreases the discounted utility it generates. Players who want to maximize overall efficiency (i.e., maximize the sum of discounted utilities) should allocate the entire reduction in waiting time to the player who receives €40. Alternatively, players who want to minimize overall inequality should allocate zero reduction in waiting time to the player who receives €40. The importance of allowing for inequality aversion as well as efficiency concerns was highlighted by Engelmann and Strobel (2004).

In DG4000 and UG4000, the majority of Players A (77% and 66%, respectively) allocated the entire reduction in waiting time to themselves. Their choices are consistent with pure selfishness and efficiency concerns: they maximize their own discounted utilities and overall efficiency. In these games respectively 12% and 21% of all players allocated zero reduction of waiting time to themselves, thereby minimizing overall inequality. Moreover, very few subjects (less than 1.5%) allocated 6 weeks reduction of waiting time to both players. In UG4000 the majority (57%) of Players B required full reduction in waiting time for themselves, thereby aiming to minimize overall inequality.

In DG0040 and UG0040, the majority of Players A (83% and 75%, respectively) allocated the entire reduction of waiting time to Player B, thereby maximizing overall efficiency. The proportions of Players A minimizing overall inequality in these settings were 14% and 21%, respectively. None of the players A allocated 6 weeks reduction of waiting time to both players.

In UG0040, the majority of players B (80%) accepted all offers, thereby minimizing overall inequality or simply being selfish.

Result 3a: When one of the players received a zero payoff, the majority of Players A in the intertemporal dictator and ultimatum games maximized overall efficiency by allocating the entire waiting time reduction to the player who received €40. In the dictator game that gave €0 to Player B, maximizing overall efficiency could also be the result of pure selfishness. A substantial minority (between 12% and 21%) minimized overall inequality by allocating the entire waiting time reduction to the player who received €0.

Result 3b: When one of the players received a zero payoff, the majority of Players B in the ultimatum game minimized overall inequality. In the ultimatum game that gave €0 to Player A, minimizing overall inequality could also result from pure selfishness.

Comparing all settings

Figures 2-4 show inverse-S shapes for the actual offers of Players A in the dictator and ultimatum games and for the hypothetical offers of Players B in the dictator games. These offers thus seem to depend on the distributions of payoffs. Figure 5 suggests that the minimum acceptable offers of Players B in the ultimatum game also differ across settings.

Table 4 summarizes the outcomes of Friedman tests for equality of (minimum acceptable) offers across settings. Including all different settings, these within-treatment tests confirm that the (minimum acceptable) offers differ across settings. Yet, when excluding the *4000* and *0040* settings, this difference is no longer statistically significant for offers of Players A in the dictator games. When comparing only the settings that give a non-zero payoff to Players B that is lower than the payoff to Players A (*3802*, *3505*, and *3010*), the difference across settings remains significant only for the ultimatum games. When comparing only the settings that give a non-zero payoff to Players A that is lower than the payoff to Players B (*0238*, *0535*, and *1030*), the difference across settings remains significant only for the ultimatum games and for the hypothetical offers of Players B in the dictator games. Further comparisons between settings are given in Appendix B (Table B1). Figures 4 and 5 and Appendix B also show that the (minimum acceptable) offers in the ultimatum game mostly follow a downward sloping trend, which implies compensating for increases in monetary payoffs.

The analysis of the kindness ratings of equal allocations of time (see Tables B3 and B4 of Appendix B) support the sensitivity to inequalities in payoffs in the ultimatum games, but also give some support for such sensitivity in dictator games.

Result 4a: Players A in the dictator games were insensitive to distributions of the monetary payoffs when both players received a non-zero payoff.

Result 4b: Players A in the ultimatum games were sensitive to distributions of the monetary payoffs when both players received a non-zero payoff, mainly driven by compensating for increases in monetary payoffs.

Result 4c: Players B in the ultimatum games were sensitive to distributions of the monetary payoffs when both players received a non-zero payoff, mainly driven by compensating for increases in monetary payoffs.

Table 4 – Friedman's tests on equality of means between settings

	DGA	DGB	UGA	UGB[#]
All settings	$Q(8) = 142.03$ *p < 0.001*	$Q(8) = 70.91$ *p < 0.001*	$Q(8) = 168.01$ *p < 0.001*	$Q(8) = 235.36$ *p < 0.001*
All excluding *0040 & 4000*	$Q(6) = 11.24$ *p = 0.081*	$Q(6) = 37.89$ *p < 0.001*	$Q(6) = 141.19$ *p < 0.001*	$Q(6) = 200.20$ *p < 0.001*
3802, 3505, 3010	$Q(2) = 4.10$ *p = 0.129*	$Q(2) = 0.97$ p = 0.616	$Q(2) = 28.93$ *p < 0.001*	$Q(2) = 42.62$ *p < 0.001*
0238, 0535, 1030	$Q(2) = 2.04$ *p= 0.360*	$Q(2) = 10.67$ *p = 0.005*	$Q(2) = 30.28$ *p < 0.001*	$Q(2) = 6.12$ *p = 0.047*

Note: $p < 0.05$ highlighted.
[#]For Players B in the ultimatum game, we excluded four players who had a missing value in at least one of the settings due to an inconsistent response.

Prevalence of different strategies in response to changes in monetary payoffs

Figures 2-5 showed that, on average, players were sensitive to changes in distributions of the monetary payoffs, this being more pronounced for behavior in the ultimatum games than in the dictator games. To gain further insight into the decision strategies adopted in the dictator and ultimatum games, and to assess the differences between these games, Figures 6-8 summarize the proportions of players adopting a reinforcing, insensitive, or compensating strategy. For both games and players, we ordered the settings from smallest to largest payoff for Player B, as in Figures 2-5. Next, for each setting, we counted the number of Players who increased ("reinforce"), did not change ("insensitive"), or decreased ("compensate") the reduction of waiting time offered to Players B when going to the setting 'next in order'. For each of these transitions to 'next in order', we tested whether the categorization of subjects differed between Players A in the dictator and ultimatum games using a Pearson chi-squared test. We did the same to test for differences between Players A and B in the ultimatum games. For both games and both players, we also tested whether the categorizations differed between settings. For sake of brevity, we do not consider Players B in dictator games for these analyses.

When considering Players A in the dictator and ultimatum games separately, Figures 6 and 7 show that a substantial proportion (19-43%) of subjects was insensitive to a change in monetary payoffs. Interestingly, for both types of games, reinforcing behavior among Players A was most prevalent when inequalities in payoffs were high. The proportion of Players A who reinforced was largest in the first and the last bars, and decreased towards the middle bars of Figures 6 and 7. The opposite holds for compensating behavior, which was most prevalent when inequalities in payoffs were lowest, and decreased in prevalence as inequalities in payoffs increased. Pearson chi-squared tests confirm that the distributions of strategies differ between settings ($p<0.001$ for DGA, UGA, and UGB). While these patterns are similar for the dictator and ultimatum games, the results of the Pearson chi-squared tests show that the pattern was more pronounced in ultimatum games ($p < 0.05$ except for *2020* → *1030*, *0535* → *0238*, and *0238* → *0040*). As will be elaborated in the discussion, in our experimental design smaller inequalities in payoffs coincided with larger differences in payoffs between settings and we cannot disentangle the two. To enhance readability, we will from now on refer to the bars in the middle of Figures 6-8 as having smaller inequalities in payoffs without adding the nuance that these bars also concern larger changes in payoffs between settings.

Result 5a: For Players A in the dictator and ultimatum games, reinforcing behavior became more prevalent when inequalities in payoffs were increased, and compensating behavior became more prevalent when inequalities in payoffs were reduced.

Result 5b: The patterns described in Result 5a were more pronounced in ultimatum games than in dictator games. In particular, the proportions of reinforcers, insensitives, and compensators differed between these games when Players A received a larger monetary payoff than Players B.

Figure 8 summarizes the proportions of reinforcers, insensitives, and compensators among Players B in the ultimatum games. We see a larger proportion of insensitives among Players B than among Players A in the ultimatum game, especially when the payoff was larger for Player B than for Player A, which is supported by the Pearson chi-squared tests ($p < 0.001$ except for *3802 → 3505*, *3505 → 3010*, and *3010 → 2020*). The high proportion of insensitives when the payoff for Player B was larger than for Player A, is likely to be partly driven by the minimum acceptable offers already being quite low in these settings, which gave Players B little opportunity to be compensators by reducing their minimum acceptable offers even further.

Looking at the proportions of Players B who were not insensitive, we see that the proportion of compensators was larger than the proportion of reinforcers in all settings. We also see that the proportions of compensators increased when the difference in payoffs between the two players decreased. Moreover, the proportion of compensators was larger when Players B received a lower payoff than Players A.

Result 6: For Players B in the ultimatum games, compensating behavior became more prevalent when inequalities in payoffs were reduced, and insensitive behavior became more prevalent when payoffs for Player B increased.

Figure 6 – Prevalence of strategies in response to changes in monetary payoffs, Players A, DG

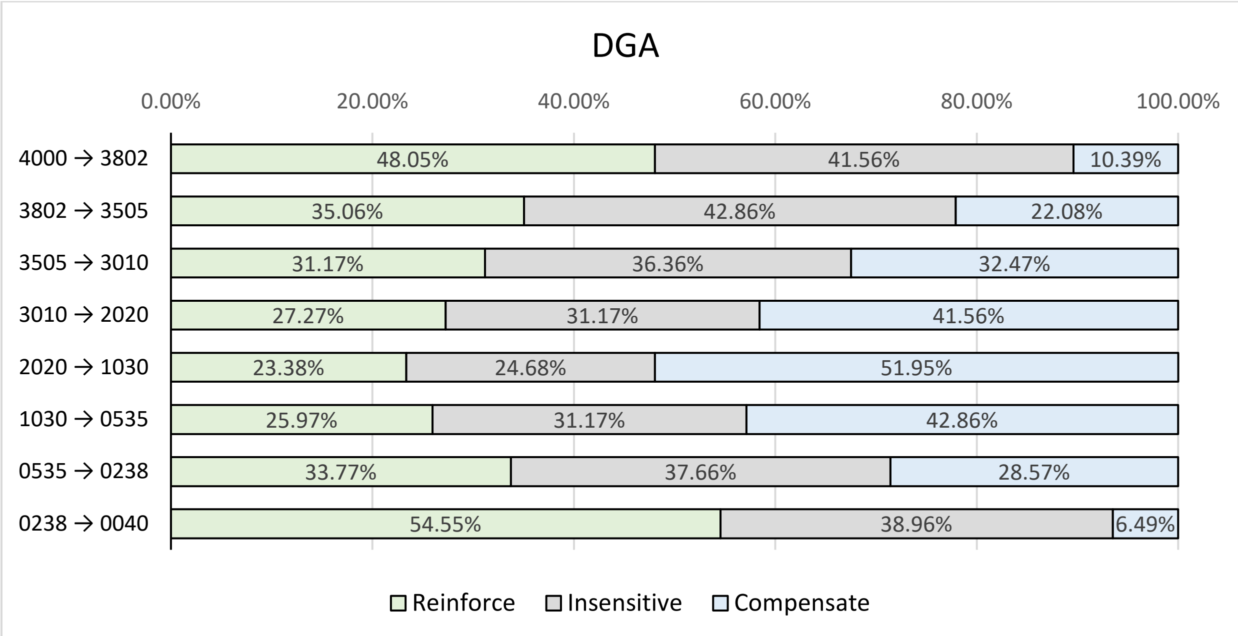


Figure 7 – Prevalence of strategies in response to changes in monetary payoffs, Players A, UG

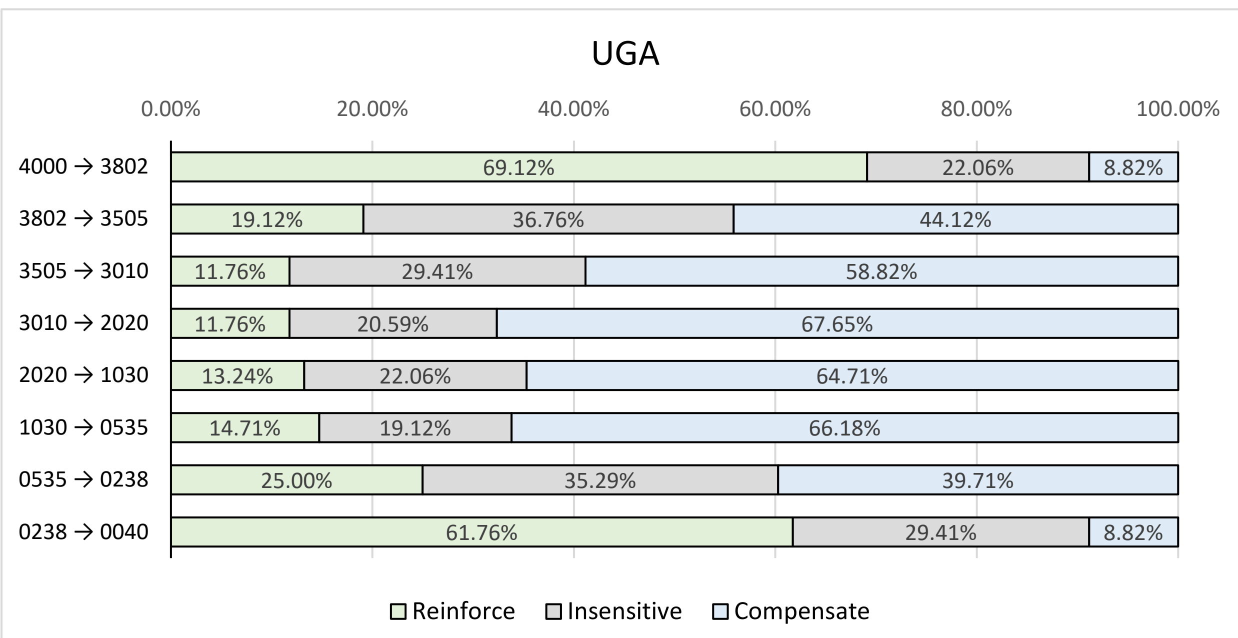
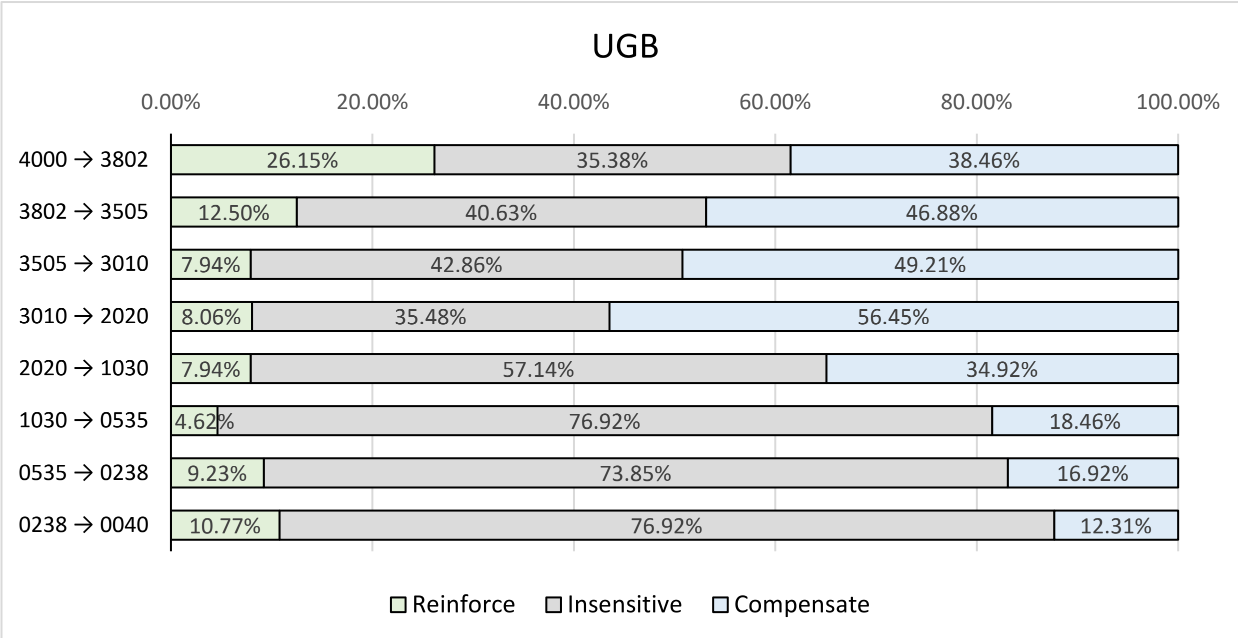


Figure 8 – Prevalence of strategies in response to changes in monetary payoffs, Players B, UG



While Figures 6-8 show that the proportion of reinforcers, insensitives, and compensators varies between settings, it remains an open question to what extent players are consistent across settings. To analyze consistency, we consider all increases in payoffs of Players B, except the extremes *“4000 → 3802”* and *“0238 → 0040”,* and we classify a subject as a reinforcer (insensitive, compensator) if they reinforced (were insensitive, compensated) in at least four of the six remaining cases. Figures 9-11 summarize the classifications. Among the Players A in the ultimatum games, fewer were unclassified than among Players A in the dictator games and Players B in the ultimatum games (19% compared to 36% and 38%, respectively). Moreover, the majority of Players A in the ultimatum games were classified as compensators. Overall, Figures 9-11 suggest that the patterns in Figures 6-8 are driven by substantial consistency within subjects rather than mere randomness.

Figure 9 – Classification of Players A in DG

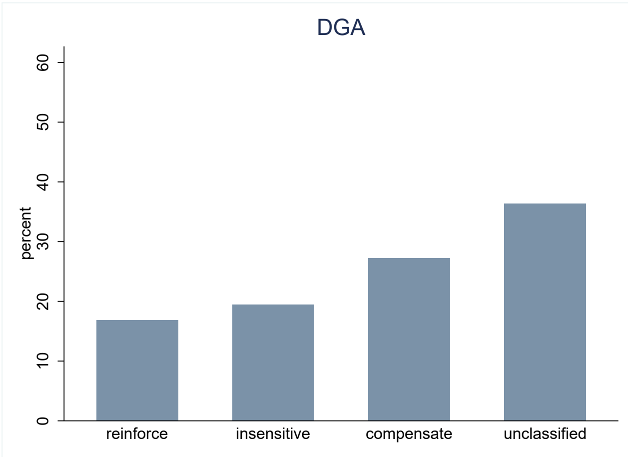


Figure 10 – Classification of Players A in UG

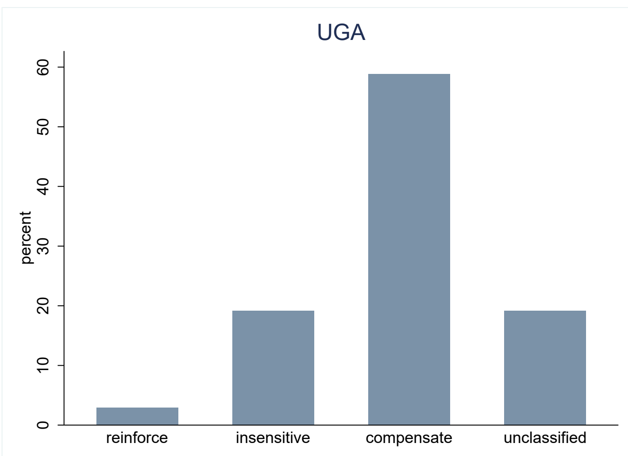
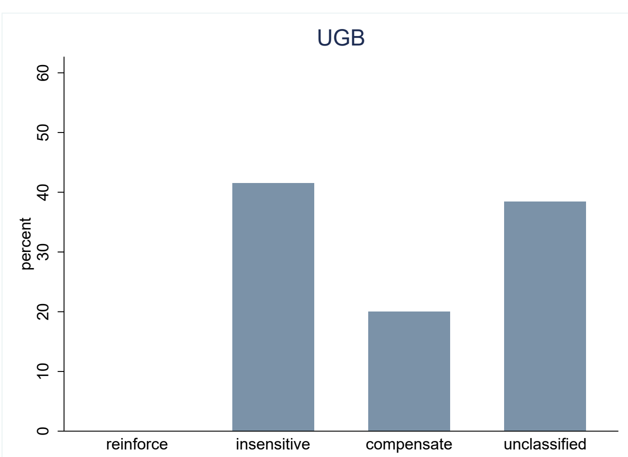


Figure 11 – Classification of Players B in UG



4.4 Intertemporal Social Preferences, social preferences, and time preferences

The previous section showed that subjects considered both the social and the time dimension when making decisions in the intertemporal games. The question remains to what extent the intertemporal social preferences that were revealed in the two-dimensional intertemporal games, are related with one-dimensional time preferences and social preferences. For all games and all settings, we computed Spearman correlations between the (minimum acceptable) offers in the intertemporal games and the (minimum acceptable) offers in the standard games. Table 5 summarizes these correlations and their statistical significance. We see that (minimum acceptable) offers in the one-dimensional standard games were positively correlated with (minimum acceptable) offers in the one-dimensional intertemporal 2020 games for Players A in both the dictator and ultimatum games. In the dictator game, these correlations were also positive for Players A when they received a larger payoff than Players B, but not in the other settings. In the ultimatum game, for Players A the correlation was significant only in the 3010 and 2020 settings, while for Players B the correlation was significant only when they received a lower payoff than Players A. To summarize, there was a positive correlation between social and intertemporal social preferences in some, but not in all settings. Thus, social preferences do not translate unambiguously into intertemporal social preferences.

We did a similar analysis to assess the relation between time preferences and intertemporal social preferences. The present values as measured in the time preference tasks were 29.9 and 29.2, on average, for selves and others with standard deviations of 8.4 and 9.0, respectively. For all games, we determined Spearman correlations between the minimum acceptable offers in the intertemporal games and the present values. Surprisingly, we found only few statistically significant correlations, even when not correcting for multiple hypothesis testing (see Appendix

B, Table B2). Therefore, we conclude that in our experiment there was no systematic correlation between time preferences and intertemporal social preferences.

Table 5 – Spearman correlations between standard and intertemporal dictator and ultimatum games

	Setting								
	4000	*3802*	*3505*	*3010*	*2020*	*1030*	*0535*	*0238*	*0040*
DGA	0.19	0.51	0.41	0.38	0.48	0.18	-0.09	-0.23	-0.15
	(0.094)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.117)	(0.447)	(0.045)	(0.194)
DGB	0.15	0.18	0.10	0.28	0.29	0.08	-0.09	-0.22	-0.06
	(0.195)	(0.110)	(0.395)	(0.013)	(0.010)	(0.506)	(0.455)	(0.060)	(0.635)
UGA	0.24	0.23	0.21	0.27	0.36	0.05	0.03	0.01	0.06
	(0.053)	(0.063)	(0.079)	(0.027)	(0.003)	(0.688)	(0.816)	(0.923)	(0.617)
UGB	0.35	0.49	0.48	0.44	0.22	0.07	0.18	0.07	0.125
	(0.004)	(<0.001)	(<0.001)	(<0.001)	(0.085)	(0.564)	(0.157)	(0.564)	(0.323)

Note: Spearman rank correlation (p-value); correlations with p<0.05 highlighted.

Finally, we also tested for gender differences in (minimum acceptable) offers for the standard as well as the intertemporal games using Mann-Whitney tests. We found no differences, except for women making higher offers than men when they were Players A in the standard ultimatum game and in the 0238 setting of the intertemporal ultimatum game. In addition, women made lower offers than men when they were Players A in the 3802 setting of the intertemporal ultimatum game.

5. Discussion

A first implication of the results of our experiment is that the behavioral patterns typically observed in standard dictator and ultimatum games extend to one-dimensional intertemporal games, where the task is to distribute waiting time for a predetermined equal distribution of money. In DG2020 and UG2020, the majority of Players A chose an equal distribution of waiting time. Moreover, Players A offered a larger reduction in waiting time to Players B in UG2020 than in DG2020. Yet, the reductions in waiting time offered in UG2020 were larger than what was required by Players B. While the behavioral patterns in these one-dimensional versions of the ultimatum and dictator games were largely similar to the standard versions of these games, we did observe a difference in equal split offers. In UG2020 and DG2020, we found more subjects offering an equal split than in the standard versions of these games as implemented in our experiment.

All in all, these results are largely in line with those of Berger et al. (2012) and Noussair and Stoop (2015) and show that behavior in standard ultimatum and dictator games extends not only to settings with waiting time in the lab but also to settings with waiting time outside the lab, in the usual intertemporal choice sense. An important difference between our study and Berger et al. (2012) and Noussair and Stoop (2015) in terms of design is that we chose to implement waiting time in the gain domain, while Berger et al. (2012) and Noussair and Stoop (2015) implemented waiting time as a loss. More specifically, while these former studies asked subjects to distribute waiting time, we asked subjects to distribute *reductions* in waiting time. Yet, it remains unclear to what extent subjects in the previous and current experiments actually perceived waiting time in terms of gains or losses. An interesting question for future research is to what extent framing of waiting time in terms of gains or losses matters.

The results of the two-dimensional intertemporal games, where inequalities could arise both in the time and the money dimensions, show that, on average, people treat these games as two-dimensional in the sense that their decisions concerning distributions of waiting time depend on the degree of inequality in monetary payoffs. Interestingly, this sensitivity towards inequalities in monetary payoffs is stronger in the ultimatum games than in the dictator games. While offers by Players A in the dictator games were mostly insensitive to changes in monetary payoffs, this was not the case for offers by Players A in the ultimatum games.

In the ultimatum games with non-zero payoffs, we found that the players who were sensitive to monetary inequalities tended to compensate for increases in monetary payoffs by decreasing the reduction in waiting time in response to an increase in monetary payoff. A motive possibly underlying this compensating behavior could be aversion towards inequalities in discounted utilities. Our experiment included two settings with extreme inequalities in monetary payoffs, where one player would receive all and the other player nothing. While these settings may at first sight appear to be irrelevant settings, they allow for a clear interpretation of behavior in terms of efficiency maximizing or inequality minimizing. Interestingly, we find that the majority of Players A in both games maximized overall efficiency, while the majority of Players B in the ultimatum game minimized overall inequality. Hence, we observed a clear difference between proposers and responders in these games. Moreover, the average insensitivity of Players A to monetary payoffs in the dictator games with non-zero payoffs, does not extend to games with zero payoffs.

The finding that the majority of Players A maximized overall efficiency in the ultimatum games with extreme inequality in payoffs seems to contradict the finding that for the games with non-zero payoffs they, on average, wanted to compensate for monetary increases in payoffs. When examining the various strategies in response to changes in monetary payoffs in more detail, we observed a difference between settings with relatively large and relatively small inequalities in payoffs. For Players A, we found compensating behavior to become more prevalent when inequalities in payoffs decreased and reinforcing behavior more prevalent when inequalities in payoffs increased. For Players B in the ultimatum games, compensating behavior was more prevalent than reinforcing behavior in all settings. Hence, the strategy used to respond to changes in inequalities in monetary payoffs depends on the initial levels of these inequalities and on the role of the player. Here, we should note that smaller inequalities coincided with large changes in payoffs between settings in our experiment. We can, therefore, not rule out that the strategies depended on changes in payoffs between settings rather than on inequalities in payoffs. Yet, in our experiment we did not explicitly encourage subjects to think in terms of changes in payoffs between settings, which is why we deem this interpretation less plausible.

In addition to the subjects who changed their decisions in response to changes in monetary inequalities, we also found that a substantial fraction of the subjects was insensitive to such changes (between 25% and 43% of Players A in the dictator game and between 19% and 37% of Players A in the ultimatum game). These subjects exhibited narrow bracketing of social preferences in the sense of ignoring the monetary dimension when making decisions on the time dimension. These results are, therefore, in line with Exley and Kessler (2023) who also found a substantial fraction of narrow bracketers[6]. Confirming other findings, we find that this narrow bracketing is less prevalent for proposers in the ultimatum game than in the dictator game. Thus, when strategic motives play a role, it seems that proposers are more likely to take both dimensions into account. One possible reason for this finding could be that in a strategic setting like an ultimatum game, proposers have higher incentives to take an overall perspective than in a dictator game. In a strategic setting, proposers already have to take into account two types of motives: their own preferences and their beliefs about reactions of responders. This may make it easier to take yet another motive into account, such as inequalities in other dimensions. Testing this conjecture is an interesting avenue for future research.

The results of our experiment and those of Rong et al. (2018 and 2019) also call for a further development of theories on intertemporal social preferences. Rong et al. (2018 and 2019) considered a utility function that is a weighted sum of the discounted utilities of both players, allowing for different intertemporal discount functions and utility functions for oneself and for the

[6] Unlike Exley and Kessler (2023), however, our design does not allow for a distinction between people aiming for a 50-50 split and narrow bracketers, as our initial endowment of waiting time was equal and the same across all settings.

payoff of another player. They found an interaction between intertemporal and social motives, thereby rejecting one of the assumptions of this model. Our results showed that response strategies to changes in monetary inequalities depend on initial levels of monetary inequalities. Moreover, we found hardly any correlation between behavior and time preferences, and a positive correlation between behavior of proposers in the intertemporal and standard games only when proposers would get a larger monetary payoff than responders. This all could imply that the weight given to the discounted utility of another player depends on the initial inequality in discounted utilities. Further studies are required to test this conjecture and to further develop models of intertemporal social preferences.

6. Conclusion

This paper contributed to bringing the literature on social and intertemporal preferences closer together by studying intertemporal social preferences in two-dimensional dictator and ultimatum games. For a given distribution of monetary payoffs, players had to decide on the distribution of waiting time for receiving the payoffs. In the setting with equal monetary payoffs between players, the chosen distributions of waiting time largely followed the same pattern as chosen distributions of monetary payoffs in standard dictator and ultimatum games. In the settings with inequality in monetary payoffs, the majority of proposers in the ultimatum games changed their chosen distributions of waiting time in response to the changes in monetary payoffs, but much less so in the dictator games. When monetary inequalities were small, proposers in ultimatum games tended to compensate, while when these were large, they tended to reinforce monetary inequalities. We conclude that, in the ultimatum games, most proposers take both the money and time dimensions into account when deciding, thereby revealing two-dimensional intertemporal social preferences. Interestingly, this sensitivity to both dimensions is much weaker in the dictator games.

Finally, we found that decisions in the intertemporal games were positively correlated with decisions in regular dictator and ultimatum games for some but not for all distributions of monetary payoffs, and we found no systematic correlation between decisions in the intertemporal games and time preferences. These observed patterns of behavior call for the development of new intertemporal social preference models that allow for, possibly complex, interactions between social and intertemporal preferences.

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Appendix A – Social Preferences

Table A1 and Figure A1 summarize the offers and minimum acceptable offers in the standard games. For DGA and UGA, the amounts specify the offers to Players B made by Players A. For DGB, the amounts specify the hypothetical offers made by Players B in case they were assigned the role of Player A. For all these amounts, a higher value indicates less selfish (more pro-social) behavior. The amounts for UGB give the minimum offers of Players A that would be accepted by Players B (minimum acceptable offer, MAO). A higher value thus indicates that a higher offer is necessary for the offer to be accepted. This can also be seen as a higher chance of the offer being rejected.

Table A1 – Descriptive statistics standard Dictator and Ultimatum Game

	DGA	**DGB**	**UGA**	**UGB**
Average	13.38	15.82	16.06	9.51
Median	16	20	16	10
Mode	20	20	20	2
# Obs.	77	77	68	65

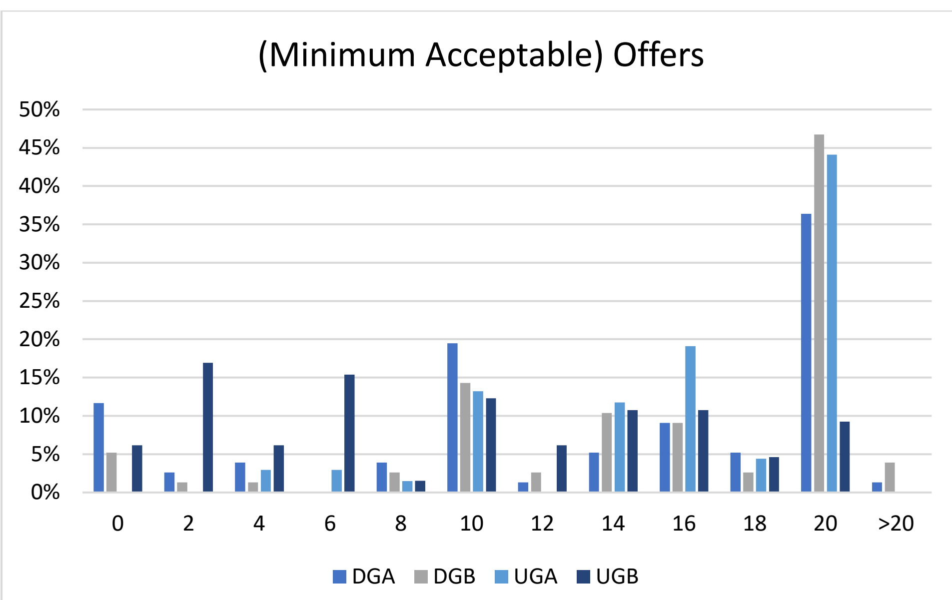

Figure A1 – Frequency distributions of (minimum acceptable) offers

Comparing the standard Dictator and Ultimatum Game: Players A

Most Players A in the standard DG divided the endowment equally (36% of the sample). Additionally, there are some players (12% of the sample) who kept the entire endowments to themselves. In the UG, Players A offered an equal split even more frequently (44% of the sample) and all Players A offered at least €4 euro to Player B. The offers of Players A differ marginally significantly between the DG and UG (p=0.0503, Mann-Whitney U test). Moreover, if we look at the subsample who offer less than half of the endowment, then the offer in UG was significantly higher than the offer in DG (p=0.004).

Additionally, we ran two Fisher's exact tests on binary transformations of the data: 1) binary variable indicating whether the offer was an equal split versus an unequal split; 2) binary variable indicating whether the offer was zero or positive. We found no significant difference between the DG and UG when it comes to the proportion that offers an equal split (one-sided Fisher's exact p = 0.217). Yet, in DG, a significantly higher proportion of players offered nothing to Player B than in UG (one-sided Fisher's exact = 0.003).

Comparing Player A's actual with Player B's hypothetical offer in the standard Dictator Game

As a filler question for Players B in DG, we asked what they (Player B) would offer to the other player if they had been assigned the role of Player A. In this hypothetical situation, most players would have offered an equal split of their endowment (47% of the sample). Additionally, there are some players (5% of the sample) who would have kept the entire endowment to themselves. On average, the hypothetical offers of Players B were higher than the actual offers of Players A (Mann-Whitney U, p = 0.036). The number of Players B who would have decided not to offer anything to the other player is also smaller than the number of Players A who actually decided not to offer anything. Nevertheless, if we only look at the subsample who offered less than €20 to the other player, we see no significant difference in offers between Players A and B different ($p=0.187$).

Similarly, as mentioned before, we also ran two Fisher's exact tests on the groups: 1) equal vs unequal split; 2) zero versus non-zero offer. Both Fisher's exact tests produced non-significant results (one-sided Fisher's exact $p = 0.126$ and $p = 0.123$ respectively).

Minimum acceptable offer

From the descriptive statistics, it seems that there is no clear consensus for Players B on what the MAO should be. Most of the Players B required that Players A offer them at least a small part of the total endowment (only 6% would accept an offer of 0 euros). The mode MAO is 2 (17% of the sample), but the values 6, 10, 14 and 16 were almost as frequent (answered by 15%, 12%, 11% and 11% of the sample respectively). Nevertheless, these MAO's are significantly lower than what was offered by Player A in UG (Mann-Whitney U test, $p<0.001$).

When taking the least conservative matching criteria (lowest MAO is matched with lowest offer), all offers by Players A would be accepted by a Player B. On the other hand, when taking the most conservative matching criteria (highest MAO is matched with lowest offer), then 16 out of 65 offers would be rejected (24.6%). All possible matchings between Player A and Player B in the Ultimatum Game would thus lead to a rejection rate varying between zero and 24.6%.

Appendix B – Further analyses

Table B1 – Comparison between next-in-order settings – Wilcoxon signed rank tests

	DGA	DGB	UGA	UGB
4000 → 3802	↑ ($p < 0.001$)	↑ ($p < 0.001$)	↑ ($p < 0.001$)	_ ($p = 0.371$)
3802 → 3505	_ ($p = 0.104$)	_ ($p = 0.365$)	↓ ($p = 0.019$)	↓ ($p < 0.001$)
3505 → 3010	_ ($p = 0.972$)	_ ($p = 0.500$)	↓ ($p < 0.001$)	↓ ($p < 0.001$)
3010 → 2020	_ ($p = 0.110$)	↓ ($p = 0.016$)	↓ ($p < 0.001$)	↓ ($p < 0.001$)
2020 → 1030	↓ ($p = 0.020$)	↓ ($p < 0.001$)	↓ ($p < 0.001$)	↓ ($p < 0.001$)
1030 → 0535	_ ($p = 0.365$)	↓ ($p = 0.002$)	↓ ($p < 0.001$)	↓ ($p = 0.016$)
0535 → 0238	_ ($p = 0.196$)	_ ($p = 0.515$)	_ ($p = 0.393$)	_ ($p = 0.255$)
0238 → 0040	↑ ($p < 0.001$)	↑ ($p < 0.001$)	↑ ($p < 0.001$)	_ ($p = 0.783$)

Note: ↑ denotes a significant increase, ↓ a significant decrease, and _ no difference.

Table B2 – Spearman correlations between time preferences and intertemporal dictator and ultimatum games

	Setting								
	4000	*3802*	*3505*	*3010*	*2020*	*1030*	*0535*	*0238*	*0040*
DGA & PVself	-0.13 (0.267)	0.10 (0.377)	0.14 (0.222)	0.10 (0.394)	-0.09 (0.444)	-0.15 (0.188)	-0.38 (<0.001)	-0.09 (0.417)	0.05 (0.651)
DGB & PVself	0.08 (0.473)	0.16 (0.175)	0.22 (0.049)	0.21 (0.063)	0.08 (0.481)	-0.04 (0.725)	-0.20 0.081	-0.13 (0.257)	0.13 (0.254)
UGA & PVself	0.04 (0.744)	0.21 (0.093)	0.12 (0.316)	0.29 (0.016)	0.287 (0.018)	0.22 (0.072)	0.16 (0.180)	0.13 (0.296)	0.13 (0.298)
UGB & PVself	-0.18 (0.144)	-0.29 (0.019)	-0.33 (0.008)	-0.19 (0.139)	-0.16 (0.202)	-0.08 (0.510)	0.06 (0.616)	-0.02 (0.896)	-0.06 (0.641)
DGA & PVother	-0.10 (0.405)	-0.003 (0.982)	0.07 (0.559)	0.07 (0.544)	-0.15 (0.211)	-0.13 (0.291)	-0.24 (0.041)	-0.003 (0.980)	0.06 (0.609)
DGB & PVother	0.09 (0.452)	0.06 (0.641)	0.11 (0.375)	0.19 (0.125)	-0.11 (0.376)	-0.11 (0.353)	-0.25 (0.039)	-0.04 (0.772)	0.22 (0.064)
UGA & PVother	0.13 (0.293)	0.08 (0.523)	-0.06 (0.618)	0.17 (0.169)	0.25 (0.042)	0.31 (0.010)	0.20 (0.113)	0.28 (0.022)	0.18 (0.151)
UGB & PVother	-0.11 (0.403)	-0.22 (0.092)	-0.30 (0.019)	-0.15 (0.247)	-0.16 (0.229)	-0.12 (0.346)	-0.027 (0.836)	-0.04 (0.787)	-0.15 (0.265)

Note: Spearman rank correlation (p-value); correlations with p<0.05 highlighted green.

Tables B3 and B4 give an analysis of the kindness questions.

Table B3 – Average kindness levels of equal distributions

		Setting									
		SP[#]	*4000*	*3802*	*3505*	*3010*	*2020*	*1030*	*0535*	*0238*	*0040*
DGA	*Average*	6.66	-1.53	-0.84	-0.12	1.97	6.19	4.35	4.79	4.14	1.56
	Obs	77	77	77	77	77	77	77	77	77	77
DGB	*Average*	7.09	-1.82	-1.13	-0.52	1.19	6.19	4.56	4.69	4.55	2.55
	Obs	77	77	77	77	77	77	77	77	77	77
UGA	*Average*	7.40	0.87	0.59	1.63	2.71	6.68	5.31	4.59	5.25	1.76
	Obs	68	68	68	68	68	68	68	68	68	68
UGB	*Average*	6.38	-5.09	-4.00	-2.23	0.29	5.26	6.85	7.34	7.94	6.86
	Obs	65	65	65	65	65	65	65	65	65	65

[#]*SP denotes the standard dictator and ultimatum games*

Table B4 – Friedman's tests on equality of means of kindness scores between settings

	DGA	**DGB**	**UGA**	**UGB**
All settings	$Q(8) = 89.858$ $p < 0.001$	$Q(8) = 121.317$ $p < 0.001$	$Q(8) = 83.937$ $p < 0.001$	$Q(8) = 285.842$ $p < 0.001$
All excluding *0040 & 4000*	$Q(6) = 77.061$ $p < 0.001$	$Q(6) = 117.586$ $p < 0.001$	$Q(6) = 72.061$ $p < 0.001$	$Q(6) = 233.257$ $p < 0.001$
3802, 3505, 3010	$Q(2) = 33.762$ $p < 0.001$	$Q(2) = 44.395$ $p < 0.001$	$Q(2) = 15.327$ $p < 0.001$	$Q(2) = 77.372$ $p < 0.001$
0238, 0535, 1030	$Q(2) = 2.712$ $p= 0.258$	$Q(2) = 4.809$ $p = 0.090$	$Q(2) = 5.098$ $p = 0.0782$	$Q(2) = 53.470$ $p <0.001$

Note: $p < 0.05$ highlighted.

Appendix C – Inconsistent responses

In the choice lists in our experiment, we did not prohibit multiple switches between options. In the ultimatum games, for instance, switching multiple times need not be a violation of monotonicity, but may reflect strong inequality aversion. Whenever a subject switched multiple times within a choice list, a message appeared asking them whether they were sure of their answers. If they indicated to be sure, they could continue.

Around 10 percent of the subjects (31 out of 292) switched multiple times in at least one of the choice lists. The majority of these were inconsistencies in the choice list to elicit the time preference for others (21 subjects), while time preference for self was only answered inconsistently twice. This might indicate some unclarity in the elicitation of time preference for others, consistent with our experience that the few questions asked by participants during the experiment almost all concerned the *TPother* question. In the time preference choice lists, switching multiple times is a violation of monotonicity. For subjects who chose a payoff of €0 now over €40 in 12 weeks and switched to choosing €40 in 12 weeks over a positive payoff now, we set their answer to that question to missing. The same was done for subjects who switched more than three times within a list. For subjects who switched twice within a list, we took the first switching point to determine the present value. For subjects who switched three times, we took the average between the first and the third switching point to determine the present value.

Out of the 69 Players B in the UG treatment, eight players switched multiple times in at least one of the intertemporal games (four in at least three, and four in only one of the intertemporal games). For subjects who accepted the first offer and rejected a better offer later in the list, we set the MAO to missing. This was the case for all multiple switches in the intertemporal games. In the standard ultimatum game, three subjects switched twice and one switched three times. For the subjects who switched twice, we set the MAO according to their first switching point. For the subject who switched three times, the MAO was set according to the average of the two switching points. The remainder of this Appendix C gives further details. Five subjects who were inconsistent for at least a third of the intertemporal games or both time preference questions, were dropped from the sample.

We now summarize the responses of 9 subjects with partially inconsistent responses. The subjects are referred to as subjects SA, SB, SC, SD, SE, SF, SG, SH, and SI.

Time preferences – PV other

Option A	SA	SB	SC	SD	Option B
Now 0	B	B	B	B	**40 in 12 weeks**
Now 2	B	B	B	B	**40 in 12 weeks**
Now 4	B	B	B	B	**40 in 12 weeks**
Now 6	B	B	B	B	**40 in 12 weeks**
Now 8	B	B	B	B	**40 in 12 weeks**
Now 10	B	B	B	B	**40 in 12 weeks**
Now 12	B	B	B	A	**40 in 12 weeks**
Now 14	B	B	A	A	**40 in 12 weeks**
Now 16	B	A	A	A	**40 in 12 weeks**
Now 18	B	A	A	A	**40 in 12 weeks**
Now 20	B	A	A	A	**40 in 12 weeks**
Now 22	B	A	B	A	**40 in 12 weeks**
Now 24	A	A	B	A	**40 in 12 weeks**
Now 26	B	A	B	A	**40 in 12 weeks**
Now 28	A	A	B	A	**40 in 12 weeks**
Now 30	A	A	B	A	**40 in 12 weeks**
Now 32	A	A	B	A	**40 in 12 weeks**
Now 34	A	A	B	A	**40 in 12 weeks**
Now 36	A	A	B	A	**40 in 12 weeks**
Now 38	A	B	B	A	**40 in 12 weeks**
Now 40	A	A	B	B	**40 in 12 weeks**
Present Value	*Deleted**	*27*	*13*	*11*	

Time preferences – PV self

Option A	SE	Option B
Now 0	B	**40 in 12 weeks**
Now 2	B	**40 in 12 weeks**
Now 4	B	**40 in 12 weeks**
Now 6	B	**40 in 12 weeks**
Now 8	B	**40 in 12 weeks**
Now 10	B	**40 in 12 weeks**
Now 12	B	**40 in 12 weeks**
Now 14	B	**40 in 12 weeks**
Now 16	A	**40 in 12 weeks**
Now 18	A	**40 in 12 weeks**
Now 20	A	**40 in 12 weeks**
Now 22	B	**40 in 12 weeks**
Now 24	B	**40 in 12 weeks**
Now 26	A	**40 in 12 weeks**
Now 28	A	**40 in 12 weeks**
Now 30	A	**40 in 12 weeks**
Now 32	A	**40 in 12 weeks**
Now 34	A	**40 in 12 weeks**
Now 36	A	**40 in 12 weeks**
Now 38	A	**40 in 12 weeks**
Now 40	A	**40 in 12 weeks**
Present Value	*19*	

Standard Ultimatum Game Player B

Keep	Offer	SF**	SG**	SH**	SI
40	**0**	Reject	Reject	Reject	Reject
38	**2**	Reject	Reject	Reject	Reject
36	**4**	Reject	Reject	Reject	Reject
34	**6**	Reject	Reject	Reject	Reject
32	**8**	Reject	Reject	Reject	Reject
30	**10**	Reject	Reject	Reject	Accept
28	**12**	Reject	Accept	Reject	Reject
26	**14**	Accept	Accept	Reject	Accept
24	**16**	Accept	Accept	Reject	Accept
22	**18**	Accept	Accept	Accept	Accept
20	**20**	Accept	Accept	Accept	Accept
18	**22**	Accept	Accept	Accept	Accept
16	**24**	Accept	Accept	Reject	Accept
14	**26**	Accept	Accept	Reject	Accept
12	**28**	Accept	Accept	Reject	Accept
10	**30**	Accept	Accept	Reject	Accept
8	**32**	Reject	Reject	Reject	Accept
6	**34**	Reject	Reject	Reject	Accept
4	**36**	Reject	Reject	Reject	Accept
2	**38**	Reject	Reject	Reject	Accept
0	**40**	Reject	Reject	Reject	Accept
MAO		*Deleted**	*12*	*18*	*12*

* Subjects SA and SF are deleted; SA because of inconsistencies in both time preference questions, SF due to being inconsistent for 3 or more ISP settings.

** For the observations of subjects SF-SH, the pattern seems to be strong preference for equality, rejecting both if Player SA receives more (to a certain extent) and if Player SB receives more.