Cooperating Across Generations: Reciprocal Cooperation or Intergenerational Exchange?

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Abstract

In both families and states, pay-it-forward schemes — where one cohort invests in the next (e.g., via education) with the expectation of future returns (e.g., via retirement support) — play a crucial role. However, the upfront costs of such schemes and the uncertainty of future returns raise questions about the extent to which they can be sustained through private contributions. We investigate, through a theoretically motivated experiment, whether altruism, reciprocity, and self-interest can motivate forward investments. Specifically, we conduct a large-scale online experiment in which an overlapping sequence of players (representative generations) allocate an endowment between themselves and future, prior, or contemporary players. By varying both the action set and information available, we disentangle the mechanisms driving forward investments. We find that the ability to give back significantly increases willingness to give forward, even without information that would allow players to condition their actions on past behavior. This suggests that a preference for implicit reciprocity, rather than self-interested tit-for-tat strategies or explicit reciprocity, underlies this behavior.

Keywords: Intergenerational exchange, altruism, reciprocity, experiment

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1 Introduction

Parental investments in offspring and government spending on future goods, such as education or long-term environmental protection, demonstrate a willingness to allocate resources for the benefit of future generations. Despite the often substantial returns on these investments (Hendren and Sprung-Keyser, 2020), the underlying motivations within families and broader society to contribute to their provision remain unclear, particularly since the current generation incurs upfront costs without immediate benefits. As a result, without additional incentives through institutional arrangements, future goods are likely to be underprovided. These institutional arrangements can take various forms: governments may directly determine the level of investment in tax-funded intergenerational public goods or offer subsidies for their private provision, while at the individual level, parents may invest more in their children under an explicit or implicit understanding of future benefits.

Past work suggests that familial or social structures can also incentivize investments in future goods, particularly when generations overlap. For example, Rangel (2003) shows that self-interested individuals may rationally invest in future cohorts when such investments are implicitly tied to backward transfers, like retirement support. Recent causal evidence indicating that greater commitments to pensions can reduce spending on offspring is consistent with this theory of intergenerational exchange (Bau, 2021; Danzer and Zyska, 2023). However, it could also be explained by a weakening of children's intrinsic motivation to give back (Fischbacher et al., 2001; Thöni and Volk, 2018). These two mechanisms have different implications for institutions that aim to promote intergenerational transfers. In the equilibrium described by Rangel (2003), it suffices for actors to be self-interested as long as each generation can condition its contributions on the actions of previous generations in a complex manner — i.e., a sophisticated and detailed information structure about past contribution needs to be available to the current generation. Conversely, simpler institutional arrangements might be equally effective in promoting forward investments if the willingness of a generation to transfer resources to the next is not driven solely by self-interest. Various types of other-regarding preferences are consistent with such transfers, with linear altruism being the simplest one (Andreoni and Miller, 2002).

While altruism is often cited as a significant driver of transfers within generations (Andreoni, 1990; Fehr and Fischbacher, 2003) and across generations (Wade-Benzoni and Tost, 2009; Hauser et al., 2014; Bosetti et al., 2022), the level of forward investment that altruism alone can sustain is typically low. Similarly, experimental evidence on intergenerational cooperation consistently shows that altruism — as the sole motive — is neither sufficiently common nor strong enough to maintain an efficient level of forward investments (Chermak and Krause, 2002; Jacquet et al., 2013; Hauser et al., 2014; Sherstyuk et al., 2016; Saijo, 2019; Lohse and Waichman, 2020; Böhm et al., 2020;

Balmford et al., 2023). Even within families, transfers to children are often significantly less than predicted by models of dynastic altruism (Altonji et al., 1997). Thus, although altruism certainly plays some role, it is unlikely to ensure an efficient level of forward investments by itself.

This paper investigates the relative importance of alternative motives that can lead to investments in the future, distinguishing between self-interested and other-regarding motives. We explore this question with a conceptual theoretical framework informing the design of a large-scale online experiment. In this design, participants act as representative agents in a sequence of generations. Forward investments are operationalized as transfers to subsequent players, with these transfers being multiplied to reflect efficiency gains. The baseline condition of our experiment assesses the extent to which altruism alone drives forward investments. In this condition, participants can transfer part of their endowment to a future player in their sequence and/or to a contemporary player outside their immediate generational sequence. To ensure that only altruistic motives are at play, we do not reveal the game history to players. Even under these highly restrictive conditions, we observe a substantial amount of forward investments.

We then systematically vary key elements of the information and action space to reintroduce and highlight additional motives for forward investments. In a second condition, which we call "Anonymous Exchange", we allow participants to transfer part of their endowment backward to the previous player within their own generational sequence, rather than to a player in a different sequence. This setup reintroduces a key concept of intergenerational exchange within overlapping-generations (OLG) models, where transfers can flow both backward and forward because members of different generations coexist. Despite the fact that the game history remains hidden in this condition, the option of backward transfers significantly increases the amount of forward investments. The differences observed between the baseline and this condition reveal an other-regarding preference that extends beyond pure altruism, which we term "reciprocal cooperation".

Reciprocal cooperators are players who increase their transfers to future players, motivated by the mere possibility of (implicit) reciprocity, even though the absence of information prevents them from explicitly conditioning their actions on others' previous transfers or directly influencing them. This observation informs our first key finding: Even without the information needed for participants to reward others' actions or for it to be self-interestedly rational to invest resources in future generations, approximately 90% of participants make a forward investment. This 8-percentage-point increase in forward investments relative to the baseline is a costly change in behavior: participants retain fewer resources for themselves when allocating more resources to both future and past players. However, participants are ultimately "rewarded" for their forward investments by receiving more backward transfers through this (implicit) reciprocity mechanism.

In subsequent conditions, we allow players to observe (parts of) the game history of their own generational sequence or of other sequences. This design enables us to examine the extent to which (explicit) reciprocity and/or self-interested strategies, as proposed by Rangel (2003) and Kotlikoff et al. (1988), influence forward investments. Although we find that providing this information affects participants' allocation behavior, the provision of additional information does not significantly increase the average forward investment. This suggests that self-interested motives are not the primary drivers of forward investments. Therefore, our second key finding is that the ability to observe a detailed game history plays a limited role in motivating forward investments in our experimental environment.

To further explore the motivations behind investments in future players, we investigate various alternative drivers. First, we examine whether social learning influences forward investments and backward transfers by presenting players with the history of a different sequence, following Schotter (2003). Comparing this condition to one without information, we find that behavior remains largely unchanged. This indicates that social learning and imitation do not affect average forward investments in our setting. Second, we investigate the role of beliefs in understanding these outcomes. We find that players in the *Anonymous Exchange* condition allowing for backward transfers — despite the absence of an observable game history — believe that past and future players transfer more of their endowment than in other conditions. This suggests that participants (correctly) anticipate the positive effects of a generational structure that facilitates implicit reciprocity, while not allowing for explicit reciprocity.

Our study contributes to the understanding of the motives behind the provision of future goods in three key ways. First, we examine and distinguish between various motives proposed in the literature through precise experimental tests. For this purpose, we build on a primarily theoretical literature on dynastic (Bernheim, 1989; Rangel, 2003; Bau, 2021; Danzer and Zyska, 2023) and non-dynastic intergenerational altruism and exchange (Loury, 1981; Kimball, 1987; Galperti and Strulovici, 2017; Nesje, 2022). Our experiments demonstrate that the mere possibility of backward transfers is sufficient to increase forward investments and, in a veil-of-ignorance sense, overall efficiency. Informational requirements are thus lower than those assumed necessary for self-interestedly rational intergenerational exchange in the theoretical literature. This finding suggests that simple mechanisms or even purely symbolic gestures that stress the possibility of implicit reciprocity can significantly boost investment in future generations.

Second, we are the first to identify and introduce the motive of "reciprocal cooperation" to the literature on social preferences. According to this motive, individuals give more to those who can implicitly reciprocate, even when the other person cannot observe their actions such that future rewards cannot be conditioned on past behavior. This differs from standard descriptions of explicit reciprocity, which assume direct conditioning on observed actions (Fehr and Schmidt, 2006).

Third, we create a novel experimental design to study investments in future goods. Our design introduces three novel elements into a literature that has studied similar questions via the intergenerational goods game (IGG). First, we change the way actions map into outcomes to create a decision environment that replicates the OLG framework used in the theoretical, representative agent literature.[1] Second, we introduce an alternative incentive structure where the efficiency of forward investments is modeled via a constant multiplier rather than being tied to a contribution threshold (Hauser et al., 2014; Lohse and Waichman, 2020; Böhm et al., 2020; Balmford et al., 2023).[2] As a third modification, to differentiate between different motives for forward investments, our design offers a way to control the information people receive about previous generations' actions. This aspect of our design extends on a mostly experimental literature on intergenerational games that has focused on the roles of naive advice and social learning in settings where a non-overlapping sequence of players faces the same task (e.g., Schotter, 2003; Çelen et al., 2010). Our design differs from this literature in modeling information flows within an OLG structure and looking at information rather than advice. In line with these studies, we observe that simply providing a fuller history of the game does not change average behavior significantly.

The paper is organized as follows: Section 2 presents a conceptual framework that outlines various motives for forward investments and the conditions under which these motives should theoretically be actionable. Section 3 describes our experimental design. Section 4 reports the experimental results, highlighting the differences between self-interested and other-regarding motives. Finally, Section 5 concludes with suggestions for future research.

2 Conceptual Framework

This section identifies the conditions under which altruistic, cooperative, or self-interested actors will invest in the future in a simple game. For each motive, the results tell us when we should expect

[1] In doing so, we contribute to a small literature on OLG structures in experimental games, which primarily examines public good provision, changing group compositions (Offerman et al., 2001; Duffy and Lafky, 2016; Fochmann et al., 2018), overlapping group membership (Xu and Potters, 2018), and learning in repeated play (Van der Heijden et al., 1998; March and von Weizsäcker, 2016). Although previous OLG studies have not focused on transfers to future generations, related aspects such as passing on debt are explored in March and von Weizsäcker (2016) and Fochmann et al. (2018). Our findings align with those reported in Van der Heijden et al. (1998) in showing no effect of monitoring on transfers to previous generations. We also investigate the effects of information on forward investments and experimentally support Van der Heijden et al. (1998)'s suggestion that being in an OLG encourages giving, as shown by our results on reciprocal cooperation.

[2] Our results indicate that the threshold structure typical for IGG experiments may affect players' behavior in ways not previously noted in the literature (except note variations in IGG thresholds, see Hauser et al. (2014)). Specifically, even in conditions without an OLG structure (i.e. conditions where transfers are unidirectional), our experiment reveal levels of intergenerational altruism that surpass those commonly observed in the IGG literature, possibly due to the linear multiplier associated with forward investments in our study. This finding also indicates that the typical threshold structure of the IGG may create additional barriers to public good provision that do not exist in all intergenerational cooperation problems.

to see investment in the future in our experiment and similar environments.

2.1 Game Setup

We study a game in which a sequence of players decide whether to make transfers to other players in their or another sequence. The game closely resembles our experimental setup, but the results apply to any similarly structured sequential game with forward investments and backward transfers. The central elements of the framework are based on the intergenerational exchange game described in Rangel (2003). Unlike Rangel (2003), we replace an infinitely repeated game with an indefinitely repeated game for the purposes of experimental implementation.

We now describe the players and the choices they make. Let $s \in S$ denote a sequence and $p \in P(S)$ a player. Player p in sequence s has an endowment e_p that they split across three accounts: the "forward" account f_{sp}, the "backward" account b_{sp}, and the "me" account m_{sp}, the first of which we will refer to in general as the b and f accounts. That is, they choose (f_{sp}, b_{sp}, m_{sp}) subject to $f_{sp} + b_{sp} + m_{sp} = e_p$. Whatever p places in f_{sp} goes to another player; in the main condition, f_{sp} goes to player $p+1$ in the same sequence s. The transfer in f_{sp} gets multiplied by some growth factor g_f, so the recipient gets $g_f f_{sp}$. Whatever they place in b_{sp} gets multiplied by g_b and given to another player; in the main condition, it goes to player $p-1$ in sequence s.

Before deciding what to do, a player may or may not observe information about previous players' actions (i.e., part of the game's history). The information each player receives, depending on the different experimental conditions we study, may include the following:

- The previous player's b amount, $b_{s,p-1}$
- The previous player's f amount, $f_{s,p-1}$
- The maximum of the second- and third-previous players' b amounts, $\max\{b_{s,p-2}, b_{s,p-3}\}$.
- The minimum of the second- and third-previous players' b amounts, $\min\{b_{s,p-2}, b_{s,p-3}\}$.
- The maximum of the second- and third-previous players' f amounts, $\max\{f_{s,p-2}, f_{s,p-3}\}$.
- The minimum of the second- and third-previous players' f amounts, $\min\{f_{s,p-2}, f_{s,p-3}\}$.

Providing the last four pieces of information facilitates cooperation under an equilibrium refinement without providing the full history of the game. As shown below, cooperation requires knowing what previous players did in a perfect Bayesian equilibrium, i.e., an equilibrium where the strategy is rational off the equilibrium path. However, providing information on all previous players' actions would complicate the theoretical analysis and experimental implementation game. For example, providing the full history would mean that later players receive more information.[3]

The play of the game is as follows. A player receives the above information, if applicable. Then they decide how much of their endowment to place in their respective b and f accounts. After that, they receive any transfers that a previous player made to them, and any transfer from them to another player is made. This means that, at the time of their choice, players only know about the choices of previous players from the information they explicitly receive as described above and not from the transfers themselves. Finally, with probability δ play moves on to the next player $p+1$, and with probability $1-\delta$ the game ends with anything already allocated for the next player going to waste.

2.2 Forward Investments and Social Preferences

Our first theoretical findings relate behavior in the game to altruism, conditional cooperation, and a novel motive we call "reciprocal cooperation". Understanding the importance of these motives for forward investments helps us predict which settings are more or less conducive to intergenerational cooperation.

To begin to study players' preferences, we first delineate the expected final payoff players receive. Consider a player p whose accounts f_{sp} and b_{sp} go, respectively, to players p_1 in s_1 and p_2 in s_2 and who receives transfers from player p_3 in s_3's f account and p_4 in s_4's b account. In the experiment, we mostly study conditions in which players can send transfers to the previous and the next player. Then, $s = s_1 = s_2 = s_3 = s_4$, $p_3 = p_1$, and $p_4 = p_2$, but in this section we will use more general notation. Let t_{pp_1} denote the size of player p's transfer to player p_1, if any. Player p's expected final payoff (x_p) is given by

$$x_{sp} = e_s - b_{sp} - f_{sp} + g_f \mathbb{E}[f_{s_3 p_3}] + \delta g_b \mathbb{E}[b_{s_4 p_4}]$$

Each player gets their endowment minus their transfers to others plus their expected transfers from others, multiplied.

Information is a key lever to distinguish different motives in our setting. We consider two alternative assumptions about what information players get. These assumptions correspond to the experimental conditions that we study.

[3] In an experimental implementation of the game, this change from a static to a dynamic framework would also greatly increase the required sample size for a given level of statistical power.

ASSUMPTION 1A: Players receive no information about others' actions.

ASSUMPTION 1B: Players observe the actions of the person before them.

The distinction between the two assumptions is that under the second assumption, players can condition on previous players' actions.

A simple utility function can represent three potential motivations for transfers to other players. Let p's preferences be characterized by the following additive separable utility function, where t_{pp_1} denotes p's transfer to p_1, if any:

$$x_p + \alpha(x_{p_1}) + \alpha(x_{p_2}) - \beta(|t_{pp_1} - t_{p_1p}|) - \beta(|t_{pp_2} - t_{p_2p}|)$$

Here $\alpha(x_{p_1})$ determines the direct value p places on p_1's consumption, and $\beta(|t_{pp_1} - t_{p_1p}|)$ determines the p's preference for reciprocity or equality in transfers with p_1. The α terms capture both pure and warm-glow altruism (Andreoni, 1990).[4] The β terms resemble inequality aversion as in Fehr and Schmidt (1999) and Charness and Rabin (2002) but are instead about transfers. In this sense, they resemble the intentions-based preferences of Rabin (1993).[5] We assume risk neutrality for simplicity, but the remarks in this section all hold in a more general setting.

We first observe that, when p_1 cannot make any transfers to p, and p's behavior is not observed by anyone else, the only reason for p to make a transfer to p_1 within our framework is altruism.

REMARK 1 (Altruism): *Suppose $t_{p_1p} = 0$. Under Assumption 1A, p will make a positive transfer $t_{pp_1} > 0$ to p_1 if and only if $\alpha'(0) > 1 + \beta'(0)$.*

That p's actions are unobserved implies that their actions can only affect their own payoff via the direct cost; their choice will affect nobody else's action. If the other player does not make any transfer to them, then their only motive for giving is concern for the other player's payoff. Concern for the other player's payoff could take the form of warm-glow altruism, inequality aversion, or pure altruism as long as it does not respond in any way to the other player's actions.

A second observation is that conditional cooperation can occur if p_1 can make transfers to p, but only if one of them observes the other's choice.

[4] To see this, note that $x_{p_1} = e_{p_1} - t_{p_1p} - t_{\hat{p}p} + t_{pp_1} + t_{p\hat{p}}$ for some $\hat{p}$, so an exogenous change in p_1's endowment has the same effect on the α term as a change in p's transfer to p_2. We do not take a position on the shape of altruism in our setting but only seek to distinguish preference over giving to others from reciprocity.

[5] A preference for inequality that includes potentially exogenous inequality would again be subsumed by the α term.

REMARK 2 (Conditional Cooperation): *Suppose $t_{p_2p} = 0$. Under Assumption 1B, p will make a positive transfer $t_{pp1} > 0$ to $p1$ if $\beta'(0) > 1 - \alpha'(0)$ and $t_{p'p} > 0$.*

Remark 2 states that a player will respond to another player's transfer if they are sufficiently conditionally cooperative in the sense of Fehr and Gächter (2000). Together with Remark 1, we know that altruism the way we have defined it cannot explain such behavior. Under Assumption 1B, it may also be possible for it to be in players' self interest to send a transfer, which Appendix Section 2.3 details. Relatedly, if a self-interested player anticipates that the next player is a conditional cooperator, they may cooperate for that reason under Assumption 1B.

As a third observation, we note that a behavior we term "reciprocal cooperation" can arise under Assumption 1A. This behaviour resembles conditional cooperation but arises without observability. Suppose that instead of the preferences given above, player p has preferences only over their belief about player p_1's transfer to them. If they expect that p_1 will make a transfer when given the opportunity, then p will give more to another person p_1 who has the opportunity to give to them even if neither can observe the other.

REMARK 3 (Reciprocal Cooperation): *Suppose p believes p_1 will contribute a nonzero amount to both their accounts. Under Assumption 1A, p will make a positive transfer $t_{pp_1} > 0$ for a sufficiently large β' if and only if p_1 is able to make transfers to p.*

Remark 3 notes that even if p does not observe p_1's actions, merely telling p that p_1 may make a transfer to them can cause them to cooperate. Importantly, this is unrelated to either p's endowment or p_1's generosity: what matters is whether p is the recipient of what p_1 sends.

In a setting without observability, reciprocal cooperation follows from the possibility of transfers between players regardless of whether those changes actually occur. If two equally well-off and generous players know that each one will interact with the other, they may give more than if the transfer possibility is unidirectional. This can occur even if each player believes the other is just as willing to give. In contrast with conditional cooperation, it can occur even if they are unable to reward actual behavior.

2.3 Forward Investments with Self-Interested Rationality

We now explore how and when forward investments can be sustained by self-interest alone. We again assume players are risk-neutral expected utility maximizers, and we consider a setting in which deposits to the f and b accounts go to the next and previous players, respectively.[6] Each seeks to maximize their average final allocation x_p. They are unconcerned with other players' wellbeing or social comparisons. Their final allocation is simply $x_p = e_s - b_{sp} - f_{sp} + g_f f_{s,p-1} + g_b b_{s,p+1}$. Allowing future players to possibly observe and respond to player p's actions, p's expected payoff (x_p) is now given by

$$x_{sp} = e_s - b_{sp} - f_{sp} + g_f \mathbb{E}[f_{s,p-1}] + \delta g_b \mathbb{E}[b_{s,p+1}(f_{sp}, b_{sp}))]$$

where the key change from before is that the distribution of $b_{s,p+1}$ may depend on (f_{sp}, b_{sp}).

This leads to the result that self-interested forward giving is impossible without observing previous players' backward transfers. The relationship between transfers to the b account and transfers to the f account might initially be surprising but captures the core intuition of Rangel (2003).

PROPOSITION 1 (Non-Cooperation): *If players in sequence s do not observe previous players' contributions to the b account, then in any Nash equilibrium, $\forall p$, $f_{sp} = 0$.*

Proof: *Clearly, if player $p+1$ does not observe b_{sp}, then $b_{s,p+1}$ cannot depend on b_{sp}, i.e. $\frac{\partial b_{s,p+1}}{\partial b_{sp}} = 0$. It follows that the maximizing choice is to set $b_{sp} = 0$. Since this applies for all p, it follows that the value of $\mathbb{E}[b_{s,p+1}]$ cannot change based on f_{sp}, i.e. $\frac{\mathbb{E}[\partial b_{s,p+1}]}{\partial f_{sp}} = 0$. Hence the maximizing choice is to set $f_{sp} = 0$.*

Information about previous players' backward good is crucial for self-interested forward giving because otherwise, there can be no equilibrium reward or punishment for forward giving. We next observe that self-interested forward giving can arise if players receive information about previous players' backward and forward giving. Specifically, information on several previous players' backward giving enables a perfect Bayesian equilibrium with positive transfers to future generations:

PROPOSITION 2 (Cooperative Equilibrium): *If each player p in sequence s observes $b_{s,p-1}$, $f_{s,p-1}$, $\min\{b_{s,p-2}, b_{s,p-3}\}$, and $\min\{f_{s,p-2}, f_{s,p-3}\}$ before making their choice, there is a perfect Bayesian equilibrium where $\forall p, f_{sp} > 0$.*

[6]Note that we can relax the assumption of risk neutrality and still obtain each of the results in this section adjusting for the degree of risk aversion. We assume risk neutrality here for simplicity of exposition. In the parameterization of the experiment, we account for risk aversion by setting high growth factors.

Proof: *Consider a strategy profile where every player adopts the following grim-trigger strategy. Set* $f_{sp} = \frac{g_b\delta-1}{g_b\delta}e_s$ *and* $b_{sp} = \frac{e_s}{g_b\delta}$ *if the following hold:*

- $f_{s,p-1} = \frac{g_b\delta-1}{g_b\delta}e_s$
- $b_{s,p-1} = \frac{e_s}{g_b\delta}$
- $\min\{b_{s,p-2}, b_{s,p-3}\} = \frac{e_s}{g_b\delta}$
- $\min\{f_{s,p-2}, f_{s,p-3}\} = \frac{g_b\delta-1}{g_b\delta}e_s$

Otherwise, set $b_{sp} = 0$. *Let each player believe that if* $\min\{b_{s,p-2}, b_{s,p-3}\} \neq \frac{e_s}{g_b\delta}$, *then* $b_{s,p-2} \neq \frac{e_s}{g_b\delta}$, *and if* $\min\{f_{s,p-2}, f_{s,p-3}\} \neq \frac{g_b\delta-1}{g_b\delta}e_s$, *then* $f_{s,p-2} \neq \frac{g_b\delta-1}{g_b\delta}e_s$.

These beliefs are fully rational. Under these beliefs, if a player before me has deviated, I will not get rewarded for anything I pay to others, so I will not pay others anything. If all players before me have cooperated, then I will receive a transfer from the next player if and only if I cooperate, and the amount I expect to receive for cooperating, e_s, *is equal to the amount I am giving away by cooperating.*

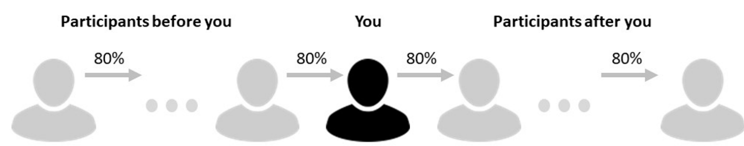
Proposition 2 shows that with the provision of information about players before the previous player, a sequence can sustain forward giving.[7] Note that it is possible to relax the strong informational requirements of Proposition 2, which we show in Appendix A.2. Relaxing these requirements, however, comes at the cost of a Nash equilibrium that is not perfectly Bayesian, meaning that the equilibrium strategies are not sequentially (self-interestedly) rational off the equilibrium path. As such, we focus on the equilibrium with the stronger informational requirements going forward.

3 Experiment Design

The design of our online experiment follows the conceptual framework outlined above. In the baseline condition, each player can make transfers to a later player but not an earlier player. Instead of the ability to transfer to an earlier player, they can transfer resources to a player outside of their generational sequence. In a second condition, we introduce the ability to make transfers to an earlier player. In the remaining conditions, we vary the information we provide to identify the motives that affect forward investments.

[7] In Appendix A.1, we show that it is also possible to sustain giving to the player after the next player, in line with a similar result from Rangel (2003).

Figure 1: Structure of the game



3.1 Basic Setup and Player Roles

When participants begin the experiment, they are randomly assigned to a treatment and, within that treatment, to a specific sequence. In each sequence, participants represent a generation, with their position denoted by p (e.g., $p = 1$ for the first player, $p = 2$ for the second, etc.). As outlined in Section 2, our experimental design mirrors typical overlapping generations (OLG) models, where at any given time there are three generations: the older generation, the current (middle-aged) generation, and the younger generation. Participants progress through these stages accordingly. During their young and old stages, participants passively receive transfers (passive income phases), while in their middle-aged stage, they actively make allocation decisions, as described below. This cycle continues indefinitely for each sequence until the game ends probabilistically. After each period, there is an 80% chance that the game continues, transitioning the current young to middle-aged, the middle-aged to old, and introducing a new young generation. Conversely, there is a 20% chance that the game ends, in which case all resources committed to the next young generation are lost.[8] Figure 1 summarizes the structure of a generational sequence in the way it was presented in the experimental instructions.

3.2 Allocation Decisions

In each condition, the current generation player is endowed with 20 points to allocate among three different accounts as they choose. Players keep all points allocated to **Account A** for themselves. Allocating points to **Account B** involves transferring points, multiplied by 3, to another player. Similarly, allocating points to **Account C** involves transferring points, multiplied by 5, to a different player.

Allocations to Accounts B and C are transferred to players in various positions and generational sequences, depending on the treatment condition. In the "Forward Only" condition (see Section

[8]Participants are informed that there will be a new generation with probability $p = 0.8$ and that the game will end with probability $p = 0.2$. These probabilities were used to generate the lengths of each sequence ex-ante, such that the expected number of generations corresponds to the theoretical expectation.

3.3), points allocated to Account B are transferred to a player occupying the same position in a different generational sequence, i.e. an outside transfer to a contemporary who cannot tranfer any points back. Points allocated to Account C are transferred to the next player in the same sequence if the game continues to the next generation.

In the "Anonymous Exchange" condition, points allocated to Account B are transferred to the previous player within the same sequence, while points allocated to Account C continue to be transferred to the next player in the same sequence. The remaining conditions follow the same structure as the "Anonymous Exchange" condition but provide different levels of information about the actions of past players.

We select the multipliers for each account to capture key stylized features of the the conceptual model of Section 2, ensuring that, with full information, a cooperative Nash equilibrium exists (see Proposition 2, Section 2.3). Since Account C represents transfers to a future generation player in most conditions, the multiplier on this account could be thought of reflecting the efficiency gains from forward investments that enhance the wealth of younger generations. One simplification compared to real-world applications is that we do not allow the younger generation to pass on any of the multiplied transfers they receive — that is, each generation starts with the same constant endowment of 20 points.[9]

When allocations to Account B represent transfers to earlier players, the multiplier depicts a situation where older generations might benefit more from the resource, perhaps due to lower income. The multipliers can also be interpreted as reflecting the returns to scale typical of a public good, benefiting either the older or younger generation. The larger multiplier on Account C, compared to Account B, accounts for the indefinite nature of the game, where the resources allocated to Account C are lost if the game ends with a probability of $p = 0.20$. The larger multiplier on Account C also ensures that there is an equilibrium where players contribute nonzero amounts to Accounts B and C, and a moderately risk-averse player has an incentive to cooperate.

3.3 Treatment Conditions and Predictions

To differentiate between the potential motives that support forward investments, as described in Section 2, we implement eight different treatment conditions that differ along two dimensions: (i) the recipients of points allocated to Accounts B and C, and (ii) the availability of information. For brevity, we describe the main five conditions here and summarize them in Table 1; the remaining three auxiliary conditions, which primarily serve as robustness checks of our results or are not the

[9]This design choice keeps the framework static, as each generation receives the same endowment to make an allocation choice from. Although dynamic frameworks in which wealth accumulates over time raise interesting questions (Gächter et al., 2017), we deliberately abstract from such considerations here to avoid issues related to statistical power and independence in experimental studies of dynamic games.

main focus of this paper, are discussed in Appendix B. Each of the main conditions is described in terms of the contribution and information space available.

Forward Only: In the "Forward Only" condition, which serves as our baseline, Account C contributions go to the subsequent player within the same sequence, while Account B contributions are transferred to a player in another sequence from the same generation. Players receive no information about the actions of other players before making their choices. Consequently, players will allocate points to Account C or Account B only if they are motivated by altruism, as defined in Remark 1 in Section 2.2.[10]

Backward Only: In addition to the "Forward Only" condition, we implement a "Backward Only" condition where contributions to Account B are directed to the previous player within the same sequence, while contributions to Account C go to a player in a different sequence. Since this condition, like the previous one, does not provide players with information about others' actions, comparing it to the "Forward Only" condition allows us to assess whether players have an intrinsic preference for giving forward via Account C in our setup. This is plausible if players are altruistic, considering that the accounts have different multipliers. Thus it offers control for whether allocations to Account C are due to the higher multiplier or due to the fact that points are transferred to a player within the same sequence in "Forward Only".

Anonymous Exchange: This condition allows players to transfer resources to both the preceding and subsequent players within the same sequence: points allocated to Account B go to the previous player, and points allocated to Account C go to the next player. Players cannot observe any information about what previous players did, so they cannot condition their choices on others' past actions or influence the decisions of subsequent players. Comparing transfers to Acoounts B and C between the "Anonymous Exchange" condition and the "Forward Only" condition enables us to test for reciprocal cooperation, as described in Remark 3 in Section 2.2.

Exchange with Forward History: In the "Exchange with Forward History" condition, the recipients of Accounts B and C are the previous and subsequent players within the same sequence, just as in the "Anonymous Exchange" condition. The key difference is that players now observe information about previous players' forward investments – that is, their Account C contributions.

[10]Each player's Account B recipient occupies the same position in their respective sequence as they do. To implement this, our experiment has an even number of sequences of the same length and we match them accordingly. This setup ensures that the recipient of a player's Account B transfer cannot influence or be influenced by the actions of the player, preventing any possibility of a linked chain of reciprocity across different sequences.

Table 1: Treatment Conditions

Condition Name	**Transfer Recipients**	**Information Space**
Forward Only	B: Random Player (different sequence) C: Next Player	None
Backward Only	B: Previous Player C: Random Player (different sequence)	None
Anonymous Exchange	B: Previous Player C: Next Player	None
Exchange with Forward History	B: Previous Player C: Next Player	Account C contributions from previous player (k-1). Account B from a random sequence. Maximum contributions of the two players before the previous one for Account C (max k-2, k-3). Account B from a random sequence (max k', k") Minimum contributions of the two players before the previous one for Account C (min k-2, k-3). Account B from a random sequence (min k', k")
Exchange with History	B: Previous Player C: Next Player	Contributions of previous generation (k-1) Maximum contributions of the two players before the previous one (max k-2, k-3) for both Accounts B and C Minimum contributions of the two players before the previous one (min k-2, k-3) for both Accounts B and C

Specifically, each player sees the amount that the immediate preceding player (denoted by $p-1$) allocated to Account C, as well as the maximum and minimum amounts allocated by the second and third preceding players (denoted by $p-2$ and $p-3$) to Account C.[11]

Additionally, players receive information about the backward transfers — that is, the Account B contributions — of players in a random other sequence. We include this to ensure that the total amount of information provided is the same as that in the “Exchange with History” condition.[12]

Comparing this condition with the “Anonymous Exchange” condition reveals whether conditional cooperation generates contributions to the future in our experimental setting (Remark 2, Section 2.2). That is, do contributions to the future increase if I expect the subsequent player to observe and reward these contributions via a backward transfer?

Exchange with History: Finally, the “Exchange with History” condition provides the most comprehensive information among all conditions. In this condition, the current generation player receives detailed information about the allocation decisions of the previous player ($p-1$), as well as the maximum and minimum contributions made by the two players before ($p-2$ and $p-3$). Consequently, it becomes common knowledge that the decisions of the current generation will be fully observed by the next generation (if it exists) and partially observed by the two subsequent generations. This condition is unique in that it allows for a self-interestedly rational, cooperative equilibrium, as characterized in Propositions 1 and 2 (Section 2.3).[13]

3.4 Experimental Procedure

We conduct the experiment using oTree (Chen et al., 2016) and recruit participants through Prolific. Eligible participants are those who have an approval rating greater than 98% for previous tasks, have completed at least 25 submissions, and are located in the United States. Based on a power analysis for detecting medium-sized treatment effects ($\alpha = 0.05; \beta = 0.8$) as outlined in our pre-registration (AEARCTR-0009928), we collect 50 sequences of varying lengths per condition. Using a random number generator, we pre-determine the length of each sequence and keep these lengths constant across treatments (i.e. for each sequence of a given length there is a matching sequence in all treatments). In total, this results in 235 players per condition and 1,880 players

[11] See Appendix H for the experimental interface.

[12] We test whether the amount of information provided about random players matters with an additional condition described in Appendix B (”Exchange with Random History”).

[13] We provide only the maximum and minimum amounts from the second and third previous players, rather than full information, because full information would not allow a perfect Bayesian equilibrium unless the entire previous sequence were known. Providing information on the entire sequence would introduce inconsistencies in the amount of information received by players as the sequence progresses, complicating comparisons between players in different positions within the sequence.

overall. Participants receive a flat payment of £1.50 for completing the study, along with bonus payments at a rate of £0.04 per point, where the initial endowment is 20 points in each condition. After completing the main task, there are several questionnaires, including four standard incentivized tasks to elicit social norm perceptions (Krupka and Weber, 2013), beliefs about the allocations made by previous and subsequent players, risk preferences, and general generosity. In the risk preference task, participants had to select their preferred lottery from a set of six lotteries varying in risk and reward (Eckel and Grossman, 2008). From participants' choices in this task, we construct a simple risk aversion scale ranging from 1 to 6, with higher values indicating greater risk tolerance. Generosity is measured using a multiple price list design, where participants choose between allocating a fixed amount to themselves or an increasing amount to a charity of their choice (Exley, 2020). As the allocation to the charity increases for each subsequent row, a later switching point — scored on a scale from 1 to 30 — reflects lower generosity. Subsequently, we administer additional validated survey questions on other-regarding preferences (Falk et al., 2018) and collect information on key demographics. Table C1 in the Appendix provides summary statistics of these variables across treatment conditions and corresponding joint and pairwise balance tests.

A central feature of our design is that players are unaware of their exact position in the sequence. This maintains the static nature of our game and allows us to treat each player's decision independently, rather than treating each sequence as an independent observation. To achieve this, we inform players that they will see the same full information table as all other players, even if they are the first player in their sequence. However, for players who are first in a sequence, we generate this information from a pre-experiment consisting of 50 seed sequences conducted under a variant of the Exchange with History condition.[14] The only difference between the pre-experiment and the main experiment is that the seed sequences have a predetermined length of 7, and the first-generation players' transfers and instructions differ. We use the decisions of generations 4, 5, and 6 from the seed sequences — who have access to a complete information table similar to the main sequences — to populate the information and, accordingly, the transfers for the first players in the main experiment.

For the first player in a sequence, all accounts function in the same way as for later players, except for the backward account. Specifically, we invite an additional participant — who does not make any decisions — to receive the points allocated by the first player to Account B (in the relevant conditions). In addition, the first player receives points from the forward account as per the randomly drawn pre-sequence. We explain this procedure to participants, clarifying that the forward account they observe will be allocated to them in the same manner, even if they are the first player (in relevant conditions). This approach maintains the basic structure of the game for

[14] We inform players of this procedure, and all information provided is presented as described to avoid deception.

each player, regardless of whether they take the first or a later position in the sequence.

4 Results

We begin by comparing conditions based on whether backward transfers within the same sequence are possible or not. We find a substantial willingness to transfer resources to the next generation even when such forward investments can only be motivated by altruism (the *Forward Only* condition). However, we observe a significant increase in the willingness to transfer resources to the next generation when there is also an opportunity to make backward transfers (the *Anonymous Exchange* condition).

This observation yields our first core result on *reciprocal cooperation*: the ability to give both backward and forward increases forward investments — and overall generosity — even without the ability to observe and therefore explicitly condition behavior on others' actions. We then compare the *Anonymous Exchange* condition to those conditions that provide additional information about the game's history. These different information conditions reveal whether explicit reciprocity, imitation, or the existence of a self-interestedly rational cooperative equilibrium further increase forward investments (Kotlikoff et al., 1988; Rangel, 2003). Here, our second core finding is that providing additional information does not significantly increase forward investments on average.

4.1 Baseline behavior

To contextualize our key findings later, we begin by providing descriptive statistics on participants' decisions in the *Forward Only* condition. This condition serves as our baseline, allowing us to gauge the extent of intergenerational altruism: participants are able to transfer resources via Account C to the subsequent player in the same sequence, whereas any transfers to Account B go to a player in another sequence. There is no information about prior decisions.[15]

At the extensive margin, we observe that 81.7% of participants contribute a positive amount to Account C (i.e., to the next generation) and 73.2% contribute a positive amount to Account B (i.e., a player in a different sequence). At the intensive margin, the average transfers to Account C is 5.37 units and to Account B is 3.74 units. Both the frequency ($p < 0.001$, one-sample proportion test) and the mean contributions ($p < 0.001$, one-sample t-test) to Accounts B and C are significantly different from 0. Given that there is no observability, no possibility for benefiting from positive reciprocity, and no information that could otherwise influence behaviour, these transfers can only be motivated by pure (intergenerational) altruism. We also observe that the contributions to Account

[15]Appendix Table C2 provides descriptive statistics for this baseline, as well as all other main and auxiliary conditions.

C are significantly larger than contributions made to Account B ($p < 0.001$, one-sample t-test) in line with the idea that intergenerational altruism (i.e. transferring money to a subsequent member of the same generational sequence) is a more important motive than intragenerational altruism, when there is no further information.

In the next section, we explore to what extent transfer decisions change when the possibility of a "backward transfer" (i.e. to the player in the same sequence before the current player) is made possible, but without the possibility of observing what that previous player's transfer was, and thus conditioning actions on the game history.

4.2 Anonymous exchange and reciprocal cooperation

Anonymous Exchange versus Forward Only. Even without information on past transfers, we find that players are significantly more likely to transfer resources to subsequent players via Account C when giving back to previous players is possible (*Anonymous Exchange*) than when giving back is not possible (*Forward Only*). Given the positive multipliers on both Accounts B and C, the increased transfers between generations means that the efficiency of the final outcome — as measured by the average player's expected payoff — is improved.

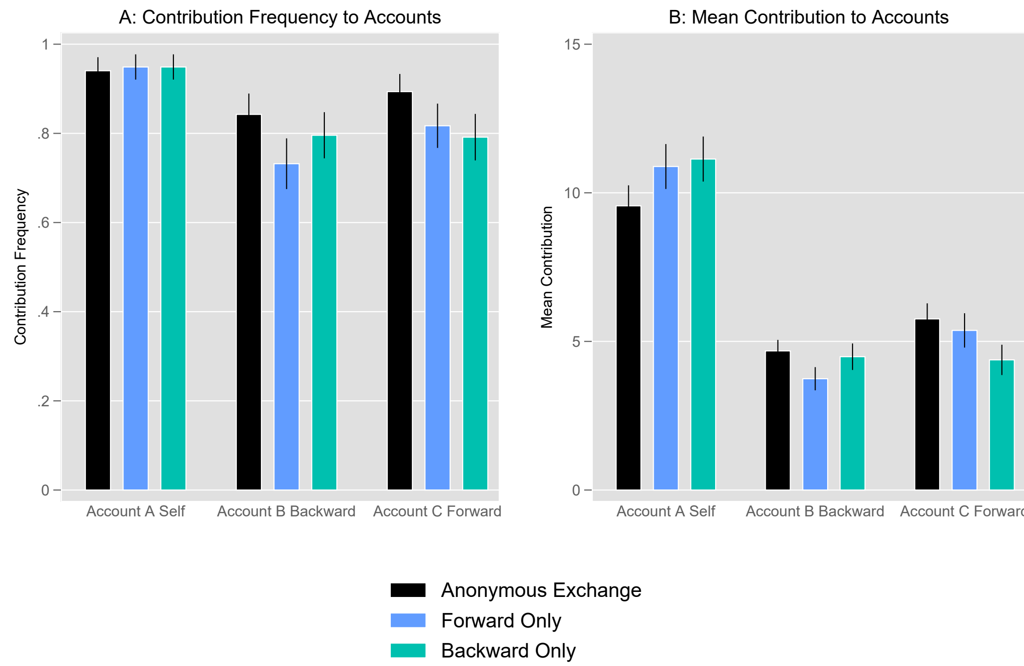
The left and right panels of Figure 2 illustrate the effect of allowing for anonymous backward transfers by showing the frequency of positive contributions (Panel A) and the total amount of contributions (Panel B) to the three available accounts (Accounts A, B, C) in the three conditions where no game history information is available. We find that players in the *Anonymous Exchange* condition (black bars) are significantly more likely to make an allocation to the forward account than players in the *Forward Only* condition, as indicated by the blue bars (89.41% vs 81.7%, chi-square test, $p = 0.017$). At the intensive margin, we similarly observe that players allocate higher amounts to Account C in *Anonymous Exchange*, though this difference to *Forward Only* is not statistically significant (5.77 vs 5.37, Mann-Whitney test, $p = 0.126$).

Appendix Tables D1 (extensive margin) and D2 (intensive margin) provide additional support for these results in a regression format by demonstrating that they are robust to controlling for further demographic variables and basic preference parameters (risk preferences and generosity) elicited in separate questionnaires and incentivized tasks at the end of the study.

Result 1: *Players are significantly more likely to transfer resources to future players when it is also possible to give back to past players.*

What might motivate these higher transfers to future players? One reason could be the emergence of "reciprocal cooperation" as defined in *Remark 3* of Section 2.2: When backward transfers

Figure 2: Players Give More when Giving Back Is Possible



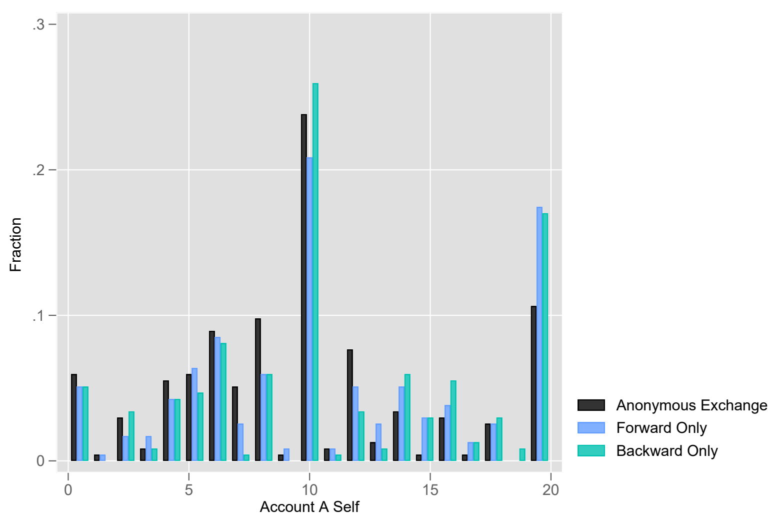
Notes: Contributions to the three accounts (A,B,C) in the three choice set treatments of the experiment.

within the same sequence are possible, participants may anticipate that they will receive some of those backward transfers from future players. Indeed, backward transfers (i.e. contributions to Account B) are significantly higher in the *Anonymous Exchange* condition than in the *Forward Only* condition, where those transfers go to a player in a different sequence. This finding holds for both the frequency of an allocation (84.3% vs. 73.2%, chi-square test, $p = 0.003$) and its average size (4.67 vs. 3.74, Mann-Whitney test, $p = 0.003$). These increased backward transfers suggest participants are "paying back" previous participants even without knowing whether those participants indeed have made a forward contribution to them in the first place; however, our results above on forward contributions suggests that, on average, this belief is correct.

Anonymous Exchange versus Backward Only. We next turn to exploring the *Backward Only* condition. We find that the differences in transfer behavior between the *Anonymous Exchange* and *Backward Only* conditions (green bars in Figure 2) are also consistent with the phenomenon of reciprocal cooperation. Similar to *Forward Only*, reciprocal cooperation is not possible in *Backward Only* since players cannot transfer points to the next player in their sequence. Despite the lack of information to condition their contributions on, players in the *Anonymous Exchange* condition allocate more to Account C (see Figure 2). The frequency of contributions to Account C is significantly higher in the *Anonymous Exchange* condition (89.4% vs. 79.1%, chi-square test, $p = 0.002$).

We also observe that more players in the *Anonymous Exchange* condition contribute to Account B (which benefits the previous player), although this difference is not statistically significant (84.2% vs. 79.6%, chi-squared test, $p = 0.187$). A similar pattern emerges in the average amount of points allocated: players in the *Anonymous Exchange* condition allocate significantly more points to Account C and slightly more to Account B, though the latter increase is not statistically significant (Account C: 5.76 vs. 4.38, Mann-Whitney test, $p < 0.001$; Account B: 4.68 vs. 4.48, Mann-Whitney test, $p = 0.507$). Tables D3 and D4 of the Appendix show that these results continue to hold in regression based tests, which again control for demographic attributes and basic preference parameters.

Figure 3: Distribution of self-allocations



Notes: Histogram of allocations to Account A across the three choice set treatments. The Anonymous Exchange has n=236 observations. The Forward and Backward conditions each have n=235 observations.

Units kept for own payoff. Players in the *Anonymous Exchange* condition keep significantly less for themselves than in the *Forward Only* and *Backward Only* conditions, which increases overall efficiency. Since contributions to Accounts B and C are multiplied by 3 and 5, respectively, the sum of payoffs across generations strictly decreases with Account A allocations. As in any social dilemma game, while it is in every player's self-interest to allocate more units to their Account A, everyone would be better off if fewer units were allocated on average to Account A within a generational sequence.

While the frequencies of allocations to Account A are high in all conditions and not significantly different between any of them (ps > 0.10, chi-squared test)[16], players in the *Anonymous Exchange* condition allocate significantly fewer points to Account A overall (*Forward Only*: 9.56 vs. 10.89, Mann-Whitney test, $p = 0.017$; *Backward Only*: 9.56 vs. 11.14, Mann-Whitney test, $p = 0.003$). Figure 3 shows that these differences emerge because the entire distribution of Account A allocations shifted to the left-hand side when exchange is possible. Moreover, significantly fewer participants in the *Anonymous Exchange* condition keep their full endowment of 20 tokens to themselves compared to both the *Forward Only* and *Backward Only* conditions (*Forward Only*: 10.6% vs. 17.5%, chi-squared test, $p = 0.034$; *Backward Only*: 10.6% vs. 17.0%, chi-squared test, $p = 0.045$).

4.3 Information and self-interested cooperation

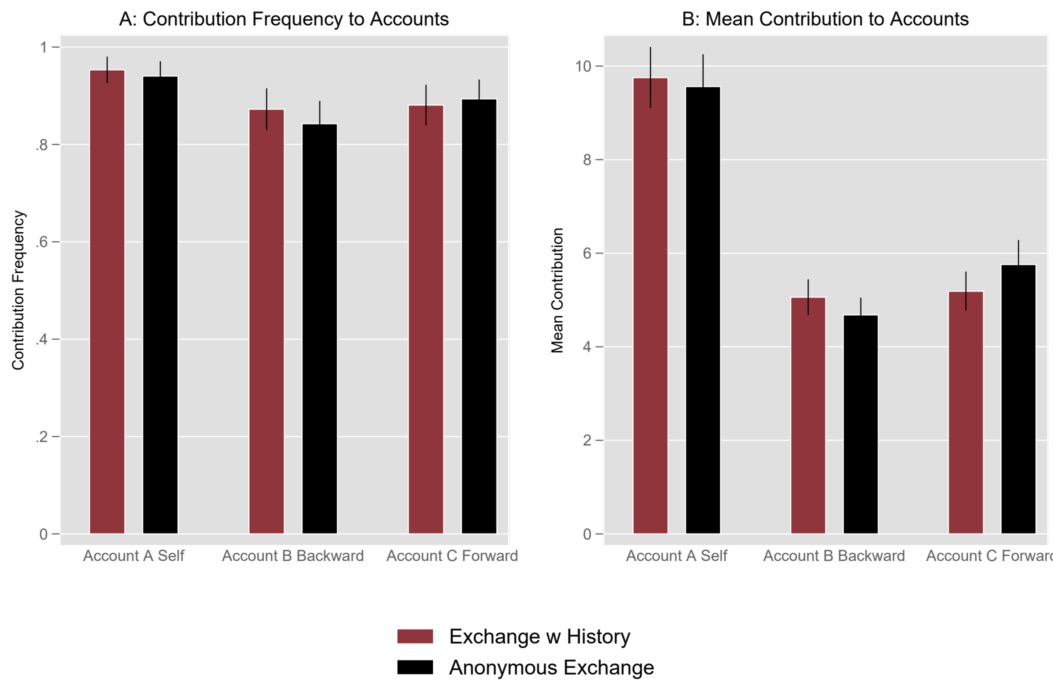
We next turn to the other main conditions, where players can observe (some) additional information about others' allocation decisions. Recall that our theoretical framework suggests that providing access to the full game history allows for the emergence of self-interested cooperative equilibria (see Section 2.3). In the experiment, we test these predictions through additional conditions where different elements of the history of the own (or a different) sequence is shown to players. However, we find that providing players with information about the full game history does not increase forward investments. In other words, despite the theoretical possibility that such equilibria now exist, forward investments do not increase in our experiment.

Exchange with History and Anonymous Exchange. Our main test for the effects of providing access to the full game history relies on comparing the allocations made in the *Anonymous Exchange* and the *Exchange with History* conditions. The two conditions are the same with respect to the action sets available to players through Accounts B and C — in other words, allocations to Account B are always transfers to the previous player in the same sequence and allocations to Account C are transfers to the next player in the same sequence. The sole difference is that the *Exchange with History* condition offers participants access to the complete game history, whereas the *Anonymous Exchange* condition offers no such information.

We find that information provision does not increase forward investments. The left side of Figure 4 (Panel A) shows the frequency of positive allocations made. The average size of allocation made is shown on the right side (Panel B). There are no significant differences between the two

[16] *Anonymous Exchange* vs. *Forward Only*: 94.1% vs. 94.9%, chi-square test, $p = 0.695$; vs. *Backward Only*: 94.1% vs. 94.9%, chi-squared test, $p = 0.687$)

Figure 4: Effect of information on average contribution behaviour



Notes: Contributions to the three accounts (A,B,C) comparing the exchange treatment without game history (Anonymous Exchange) to a game with fully history availalbe.

conditions in the frequency of positive allocations made to the forward account (Account C, 88.13% vs. 89.41%, chi-squared test, $p = 0.662$), to the backward account (Account B, 87.29% vs. 84.32%, chi-squared test, $p = 0.356$), or to the self account (Account A, 95.33% vs. 94.07%, chi-squared test, $p = 0.538$).

There are also no significant differences in the average size of allocations made to each of the three accounts (Account B: 5.19 vs 5.76, Mann-Whitney test, $p = 0.235$; Account C: 5.06 vs 4.67, Mann-Whitney test, $p = 0.265$; Account A: 9.75 vs 9.56, Mann-Whitney test, $p = 0.644$). These observations suggests that the possibility of a self-interested cooperative equilibrium, as Propositions 1 and 2 show exists, does not increase actual cooperation.

Result 2: *Full information about the previous player's contributions does not increase average contributions to accounts B or C compared to the Anonymous Exchange condition.*

Robustness. We first probe the robustness of *Result 2* in a series of regression based tests that

Table 2: Equivalence of Contribution Frequency Across Arms

	H0: The treatment changes contribution frequency by x pp.					
x	-5%	5%	-7.5%	7.5%	-10%	10%
Account C: Forward	1.28	2.15**	2.13**	3.01***	2.99***	3.86***
Account B: Backward	2.47***	0.63	3.25***	1.40	4.02***	2.18**
Account A: Self	3.03***	1.80*	4.24***	3.01***	5.45***	4.21***

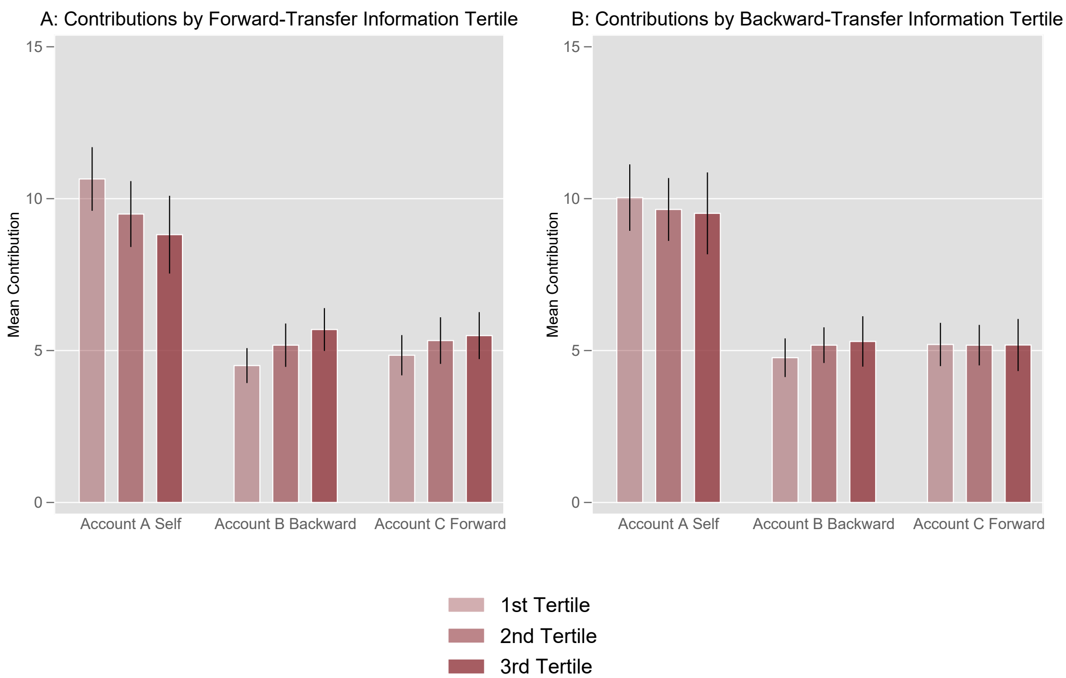
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

control for individual characteristics and preferences. We continue to find no significant extensive margin effects of providing access to the full game history. At the intensive margin, there is weak evidence ($p < 0.1$) that forward transfers are slightly larger in the *Anonymous Exchange* condition compared to the *Exchange with History* condition (Appendix Tables E1 and E2). Together, these findings lend further robustness to Result 2 that providing access to the full game history does not facilitate intergenerational exchange.

In a second robustness test of this result, we conduct a mean equivalence test (Schuirmann, 1987; Dinno, 2017) under the null hypothesis that including the history of the game changes allocations to accounts B and C by more than x percentage points compared to contributions in the anonymous exchange condition (where x is the equivalence boundary). In Table 2, we present the results of this test for effect sizes of 5, 7.5, and 10 percentage points in either direction. The numbers in the table are z-scores. For the frequency of contributions to the forward account, we can bound the null outcome to be within 5 percentage points in either direction and, for the backward account, 10 percentage points. This modest bound on the possible effect of information is particularly notable given that simply expanding the action set to permit backward transfers leads to an increase in the contribution frequency to Account C by 7.4 percentage points. Table G4 presents results for the contribution amounts, which reveal similar patterns.

Disentangling the effects of potentially conflicting information. Though we do not find evidence that providing access to information about the game history affects future investments, when averaging over all possible game histories in the different sequences, there could be effects that cancel each other out. For instance, some players could increase their allocations to Account B when they observe that they have received more points via Account C and, conversely, other players could decrease them when they receive less. It is thus plausible that providing information would not increase transfers on average even if each piece of information provided affects behavior. We test for the presence of this form of conditional behavior by comparing sequences with different game histories within the *Exchange with History* condition. Figure 5 shows how players' contributions to the three accounts vary with the previous generation's allocation decisions they could observe. Panel A (left) shows responses to observed forward investments made by the previous player, while Panel B (right) displays responses to observed backward transfers made by the previous player via Account B. These observed transfers made by the previous player are categorized into low (1st tertile), medium (2nd tertile), and high (3rd tertile) levels.

Figure 5: Contributions conditional on observed contributions of previous generation



Notes: Contributions to the three accounts (A,B,C) in the Exchange with History condition conditional on the observed choices made by the previous generation (broken down in tertiles).

Panel A of Figure 5 shows a clear pattern: When a player of the current generation can observe that the prior generation's player transferred high amounts to them (i.e. higher tertile), they allocate less to Account A (own payoff) and more to Account B (i.e. a backward transfer to the previous generation's player). Panel A depicts this trend based on tertiles in the left set of three descending bars indicating allocations to Account A (1st vs. 2nd tertile: Mann-Whitney test, $p = 0.171$; 1st vs. 3rd tertile: Mann-Whitney test, $p = 0.038$) and the middle set of three ascending bars indicating allocations to Account B (1st vs. 2nd tertile: Mann-Whitney test, $p = 0.171$; 1st vs. 3rd tertile:

Mann-Whitney test, $p = 0.003$). Jointly this pattern is consistent with standard theories of direct reciprocity or conditional strategies (e.g. tit-for-tat). We do not find evidence that receiving higher forward transfers increases forward transfers to the next generation (ps > 0.1), depicted in the final right three bars that show no ascending or descending trend. In Appendix Table F1, we show that the the patterns in Panel A of Figure 5 and the corresponding non-parametric test results are robust to controlling for individual characteristics and basic preference parameters.

Panel B of Figure 5 depicts the same analysis based on the prior generation's backward transfer, but shows markedly different results: Regardless of whether the previous player transferred little or much to the generation two steps back in the sequence, there is no significant effect on the current player's allocations across the three accounts (ps > 0.1). The absence of any information effects stemming from observing the prior generations' backward transfers is further confirmed in Appendix Table F2, where we control for demographic variables and basic preference parameters in a regression framework.

Our definition of a self-interested equilibrium in *Proposition 2* would predict that current players condition their allocations to Accounts B and C on the allocation decisions they observe from the prior generation. While we find evidence that the current generation conditions its backward transfers on observed forward transfers (consistent with direct reciprocity and/or other conditional strategies), players do not fully incorporate the information on backward transfers made by the prior generation to the generation two steps prior when deciding on their own B or C allocations (inconsistent with the self-interested equilibrium characterized in *Proposition 2*).

Result 3: *Players reciprocate forward investments they receive from previous players with higher backward transfers, but they do not condition their own backward transfers or forward investments on observed backward transfers of previous players.*

Joint effect of prior history. In the *Exchange with History* condition, players observe several additional pieces of information on the game history. Namely, the prior history included information about the forward and backward transfer of the prior generation, as well as the minimum and maximum forward and backward transfers from across the two generations before that. This leads to a total of six pieces of information presented to participants in the *Exchange with History* condition.

To understand the joint effect of these six pieces of information on the current player's allocation decisions, we analyse the results of several OLS regression models shown in Table 3. We study the joint effect of prior history using three models for each of the three accounts: Backward Transfer (Models 1 - 3), Forward Transfer (Models 4 - 6), and Self (Models 7 - 9). The models differ in which predictor variables they use: The first model for each account category includes only the previous player's (k-1) forward and backward transfers, complementing our earlier analyses by isolating the marginal effect of each piece of information. The second model for each account category uses the full six information variables that were shown in this condition. The final model within each account category uses the full information structure and additionally controls for individual characteristics and and preferences.

Our results from this joint analysis reveal the same patterns as noted before: Players only respond to the prior generation's forward transfer but not their backward transfer; in addition they do not respond to the additional information drawn from preceding generations. In particular, we find that information from generations earlier than the one immediately preceding them has no direct impact on their contribution behavior in any specification. In particular, in Models 1 - 3, players allocate more to backward transfers (Account B) the more they receive from the previous player's forward transfer (Account C) contribution (ps < 0.1). In contrast, Models 4 - 6 show that observed information does not significantly influence allocations to future generations via Account C (ps > 0.1). Consistent with the effect observed in Models 1 - 3, we observe in Models 7 - 9 that when the previous player contributes more to Forward Transfers (Account C), the current player is significantly less likely to act selfishly (ps < 0.05). Specifically, they keep 0.212 - 0.214 fewer points for themselves (Account A) for each additional point the previous player contributes to the next player (Account C). These findings suggest that while the possibility of bidirectional transfers can increase allocations to future generations, information about it only impacts transfers made to the previous but not the subsequent generation.

Table 3: Intensive Margin Effects of Information Shown in Exchange with History

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Back	Back	Back	Forward	Forward	Forward	Self	Self	Self
Prev. Player's Forw. Trans.	0.112*	0.117*	0.122**	0.100	0.0962	0.0896	-0.212*	-0.214*	-0.212**
	(0.0664)	(0.0655)	(0.0548)	(0.0634)	(0.0677)	(0.0673)	(0.106)	(0.109)	(0.0991)
Prev. Player's Back. Trans.	0.0333	0.0342	0.00373	-0.0336	-0.0278	-0.0472	0.000289	-0.00645	0.0435
	(0.0799)	(0.0767)	(0.0799)	(0.0684)	(0.0715)	(0.0730)	(0.132)	(0.136)	(0.138)
Min. Prev. Two's Forw. Trans.		-0.0694	-0.0731		0.0205	0.0141		0.0489	0.0590
		(0.119)	(0.113)		(0.119)	(0.115)		(0.200)	(0.189)
Min. Prev. Two's Back. Trans.		0.0461	0.0831		-0.0544	-0.0522		0.00830	-0.0309
		(0.109)	(0.117)		(0.123)	(0.124)		(0.205)	(0.214)
Max. Prev. Two's Forw. Trans.		0.0763	0.0464		-0.0444	-0.115		-0.0318	0.0685
		(0.0571)	(0.0544)		(0.0721)	(0.0753)		(0.101)	(0.105)
Max. Prev. Two's Back. Trans.		-0.0350	-0.0377		-0.00643	-0.00914		0.0414	0.0468
		(0.0728)	(0.0721)		(0.0881)	(0.0901)		(0.115)	(0.112)
Additional Controls	No	No	Yes	No	No	Yes	No	No	Yes
Constant	4.300***	4.091***	7.063***	4.834***	5.293***	6.096***	10.87***	10.62***	6.841***
	(0.673)	(0.989)	(1.449)	(0.497)	(1.008)	(1.192)	(1.050)	(1.481)	(2.344)
Observations	235	235	234	235	235	234	235	235	234
R-squared	0.019	0.024	0.112	0.010	0.013	0.088	0.019	0.021	0.117

Note: Linear regressions. DV: Amount Allocated. Standard errors clustered at the sequence level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Additional controls: Gender Ethnicity, Risk Preferences, Generosity

Variations in prior history information. We included three auxiliary conditions in our experiment to better understand the channels through which information influences allocation choices. Two of these additional conditions provide players with less comprehensive information about the game history. In line with our theoretical considerations, we find that in these coarser information environments, there is less conditioning on past behavior. Specifically, in the first of these conditions where players only observe precise information on forward investments only (*Forward History*), they do not condition their own decisions on this information (see Appendix Table G1 for details). Similarly, in a second condition where players can observe the behavior of the previous generation in full but lack access to a longer game history (*Recent History*), they do not condition their behaviour on observed forward transfers of the previous generation but partially on observed backward transfers (Appendix Table G2). This suggests that having full knowledge of the game history plays some role in conditioning behaviour, even if all theoretically predicted signatures of a self-interested cooperative equilibrium do not appear in our main condition (*Exchange with History*).

A final auxiliary information condition provides participants information from a random sequence rather than their own (*Random History*). This condition allows us to understand to what degree learning or imitation rather than reciprocity or self-interested motives drive reactions to the information presented. Imitation or social learning would for instance imply that players increase their forward (backward) transfers upon observing high forward (backward) transfers in another random sequence. Table G3 in the Appendix shows the results of a regression based test of the relationship between observed information and own behaviour. While there is some evidence that players react to some pieces of the random information provided, the results do not follow an obvious pattern of imitation and in some cases go in conflicting directions (e.g., the effects of the minimum and maximum information about Account B have opposite signs).

4.4 Beliefs and Heterogeneity

Our key findings, summarized in Result 1, is that forward investments are primarily driven by reciprocal cooperation. Unlike direct reciprocity which requires knowledge of the amount that a previous player allocated to the focal player, reciprocal cooperation has fewer requirements: Indeed, we see it emerge in the *Anonymous Exchange* condition, even when the information about how much was allocated to the focal player is not available, but merely when it is common knowledge that the previous player has the opportunity to contribute to the current player.

What could explain greater forward investment in the *Anonymous Exchange* condition? We argue that forward investments can be sustained at a higher rate in the *Anonymous Exchange* condition than in the *Forward Only* condition, as long as players hold positive beliefs about others' willingness to reciprocate. If this is the case, we would empirically expect (i) a positive relationship between beliefs and behaviour (ii) more optimistic beliefs when there is an opportunity to engage in reciprocal cooperation and (iii) accurate beliefs in the absence of additional information.

Players' contributions are closely linked to their beliefs about others' pro-social behavior. To examine this, we analyze how contributions vary based on participants' stated beliefs about past and future transfers, using a simple OLS regression. In the *Anonymous Exchange* condition, those who believe the previous player allocated more to them via Account C also tend to transfer more back to that player via Account B (OLS: $\beta = 0.11, p = 0.017$). Likewise, participants who invest more in the future via Account C expect to receive higher backward transfers from the next player via Account B (OLS: $\beta = 0.31, p < 0.001$). These findings indicate a strong correlation between beliefs and allocation choices.

Next, we assess whether beliefs about others' allocation decisions differ across the conditions without observable game history, where reciprocal cooperation could either emerge (*Anonymous Exchange*) or not (*Forward Only* and *Backward Only*). Tables 4 and 5 present regression estimates analyzing how beliefs about allocations to the three accounts vary across these conditions. Using dummy variables for the different treatments, we compare the *Forward Only* and *Backward Only* conditions to the *Anonymous Exchange* condition, which serves as the left-out category. For each account, we estimate models with and without additional control variables.

Beliefs about previous player. First, we examine beliefs about the previous player: Relative to players in the *Anonymous Exchange* condition, we observe that players in the *Forward Only* condition expect fewer backward allocations (Account B) ($\beta = -0.804$, $p < 0.01$, Model 1) from the previous player, and players in the *Backward Only* condition expect fewer forward allocations (Account C) ($\beta = -1.350$, $p < 0.01$, Model 3) from the previous player. These significant differences relative to the *Anonymous Exchange* conditions are instructive because, in both cases, contributions to these accounts go to a player outside the sequence (rather than, as is the case in the *Anonymous Exchange* condition, to the previous and next players within the same sequence, respectively). Additionally, in both conditions, players believe that the previous player keeps more resources for themselves (Account A) (Model 5). These differences persist when including further control variables (Models 2, 4, and 6).

In other words, these results suggest that in the *Anoymous Exchange* condition reciprocal cooperation occurs in part because players in the *Anoymous Exchange* condition believe that the previous player's forward allocations are higher (relative to the *Forward Only* condition) and the previous player's backward allocations are higher (relative to the *Backward Only* condition).

Beliefs about next player. Beliefs about the next player's contributions follow a similar pattern. Beliefs about the next player's backward allocations (Account B) reflect how many points players in the *Anonymous Exchange* and *Backward Only* conditions expect to receive, but not in

Table 4: Beliefs About Previous Player

	Beliefs about Previous Player's					
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Backward	Backward	Forward	Forward	Self	Self
			Allocations			
Forward Only (1=Yes)	-0.804***	-0.825***	-0.340	-0.333	1.145**	1.157**
	(0.297)	(0.296)	(0.328)	(0.329)	(0.516)	(0.518)
Backward Only (1=Yes)	-0.0638	-0.0534	-1.349***	-1.286***	1.413***	1.339**
	(0.320)	(0.310)	(0.333)	(0.336)	(0.530)	(0.526)
Male (1=Yes)		-0.253		0.484*		-0.231
		(0.310)		(0.286)		(0.467)
White (1=Yes)		0.517		0.853		-1.370
		(0.661)		(0.650)		(1.126)
Asian (1=Yes)		0.214		0.431		-0.645
		(0.910)		(0.779)		(1.463)
Black (1=Yes)		1.338		0.606		-1.944
		(0.888)		(1.028)		(1.376)
Lottery Task (1-6)		0.0377		0.126		-0.164
		(0.0835)		(0.0908)		(0.139)
Charity Task (1-30)		-0.0166		0.0114		0.00519
		(0.0135)		(0.0114)		(0.0197)
Constant	4.443***	4.229***	4.757***	3.260***	10.80***	12.51***
	(0.210)	(0.754)	(0.237)	(0.805)	(0.359)	(1.360)
Observations	705	700	705	700	705	700
R-squared	0.011	0.019	0.024	0.034	0.012	0.017

In all regressions, the omitted reference category is the *Anonymous Exchange* condition. Standard errors are clustered at the sequence level and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

the *Forward Only* condition. Consequently, we find that players in the *Forward Only* condition expect fewer backward contributions compared to those in the *Anonymous Exchange* condition ($\beta = -1.013$, $p < 0.01$, Model 1). This is not the case for the *Backward Only* condition, in which beliefs about the next player's backward allocations are not significantly different from the *Anonymous Exchange* condition ($p > 0.1$).

Table 5: Beliefs About Next Player

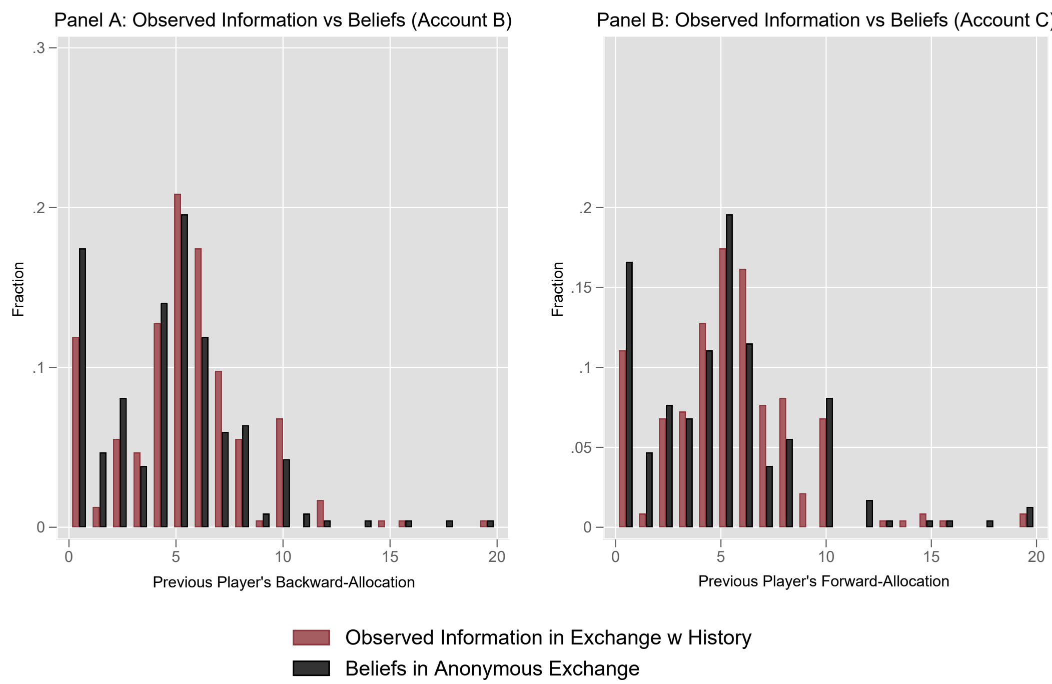
VARIABLES	(1) Backward	(2) Backward	(3) Forward	(4) Forward	(5) Self	(6) Self
	Beliefs about Previous Player's					
			Allocations			
Forward Only (1 = Yes)	-1.013***	-0.993***	-0.855**	-0.872**	1.868***	1.865***
	(0.228)	(0.227)	(0.371)	(0.386)	(0.512)	(0.521)
Backward Only (1 = Yes)	-0.332	-0.276	-1.579***	-1.531***	1.911***	1.806***
	(0.250)	(0.248)	(0.348)	(0.353)	(0.494)	(0.492)
Male (1=Yes)		-0.0452		0.785**		-0.740*
		(0.231)		(0.304)		(0.433)
White (1=Yes)		-0.0872		1.238*		-1.151
		(0.693)		(0.708)		(1.226)
Asian (1=Yes)		-0.242		0.628		-0.385
		(0.835)		(0.851)		(1.511)
Black (1=Yes)		0.367		1.734*		-2.102
		(0.798)		(1.010)		(1.556)
Lottery Task (1-6)		0.132*		-0.0310		-0.101
		(0.0734)		(0.0915)		(0.141)
Charity Task (1-30)		-0.00942		0.0178		-0.00835
		(0.0105)		(0.0133)		(0.0198)
Constant	4.255***	4.185***	5.234***	3.481***	10.51***	12.33***
	(0.155)	(0.781)	(0.254)	(0.774)	(0.326)	(1.382)
Observations	705	700	705	700	705	700
R-squared	0.021	0.028	0.027	0.042	0.025	0.033

In all regressions, the omitted reference category is the *Anonymous Exchange* condition. Standard errors are clustered at the sequence level and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Furthermore, relative to the *Anonymous Exchange* condition, players in both the *Forward Only* and *Backward Only* conditions expect the next player to contribute less to the subsequent player (Account C) (*Forward Only*: $\beta = -0.855$, $p = 0.023$, *Backward Only*: $\beta = -1.579$, $p < 0.01$, Model 3) and keep significantly more for themselves (Account A) (*Forward Only*: $\beta = 1.870$, $p < 0.01$, *Backward Only*: $\beta = 1.913$, $p < 0.01$, Model 5). These results persist when including further control variables (Models 2, 4, and 6).

Taken together, these results suggest that the possibility of reciprocal cooperation in the *Anonymous Exchange* condition significantly increases expectations of overall cooperation from both previous and future players.

Figure 6: Comparison of Information and Beliefs in Backward Allocations (Account B) and Forward Allocations (Account C)



Notes: This figure compares the distribution of players' beliefs about the previous player's allocation decisions in the Anonymous Exchange condition (black bars) with the actual information observed in the Exchange with History condition (red bars). The two panels distinguish between allocation accounts: Panel A shows distributions for Account B (backward allocations), while Panel B presents results for Account C (forward allocations).

Ruling out the need for information. As discussed earlier, there are no significant average differences in Account B and C allocations between the *Anonymous Exchange* and *Exchange with History* conditions. This suggests that reciprocal cooperation is a key motive as long as players already hold accurate beliefs, leading them to learn little new information in the *Exchange with History* condition. The histograms in Figure 6 are consistent with this explanation. For the *Anonymous Exchange* condition (black bars), this figure depicts the distribution of beliefs about the previous player's backward allocation (Panel A) or forward allocation (Panel B) that players held at the time they made their own allocation decision. This distribution is contrasted with the actual distribution of observed allocations in the *Exchange with History* condition (red bars), where players had access to information about their predecessor's choices. The figure thus provides a comparison between beliefs in the absence of information and the actual information shown to players in a condition where the game history was fully observable. It shows that over their full distribution, beliefs in the *Anonymous Exchange* condition are only slightly more pessimistic than the actual behavior observed in the *Exchange with History* condition. Notably, the median values for both beliefs and observed information are identical across both conditions for both Account B (5) and Account C (5). However, the mean belief is slightly lower than the actual observed allocations for both Account B (4.44 vs. 5.13) and Account C (4.75 vs. 5.25). These differences between beliefs and observed behavior are primarily driven by a higher proportion of participants expecting that the previous player contributed nothing (0), whereas actual contributions were more generous.

5 Discussion

Theory offers several explanations for why transfers to future generations occur, with motives ranging from selfish rationality to altruism. Understanding the relative importance of these motives is critical for designing policies that encourage such transfers, especially in cases where they lead to increased efficiency.

We develop a new experimental approach to investigate the relative significance of selfish rationality and altruism within a representative OLG framework. Our findings show that simply having the ability to repay transfers from past generations significantly increases contributions to future generations, regardless of whether information on past transfers is available.

Neither self-interest nor reciprocity fully explain the high rate of investment in the future. Notably, providing full information about the actions of previous players does not significantly influence the willingness to give forward for the average generation. Consequently, transfers to future generations do not appear to depend on the potential for rewards that are explicitly conditioned on past play. What appears to matter is the *mere existence* of a generational link that enables (implicit) reciprocity through giving back when the possibility exists that the previous generation has given forward.

Our findings thus reveal a novel type of social preference that we term "reciprocal cooperation" in which simply the possibility of an exchange drives a willingness to give, even without the ability to actually observe each other's actions. This differs from direct reciprocity where people explicitly condition their actions on the observed choices of others. In our setting, we find that the possibility of receiving a transfer from someone increases the willingness to give even when neither party observes the other's contribution. Importantly, many experimental illustrations of reciprocity or conditional cooperation may not separate these concepts from this "reciprocal cooperation". It is therefore possible that reciprocal cooperation, which does not depend on actually conditioning one's actions, might be part of many phenomena thus far attributed to conditional cooperation in the literature. If this is the case, the conditions when we might expect cooperation to emerge (both in intergenerational and intra-generational contexts) are less strict than previously thought. We encourage future research to explore this possibility.

These results leave open the possibility that self-interested equilibria, as proposed by Rangel (2003), may emerge under different circumstances. Our findings, however, indicate that such equilibria do not arise naturally in a simple game. Specifically, the absence of coordination mechanisms, such as communication, makes it more difficult for complex strategies to materialize. It is therefore plausible that with more communication, a self-interested equilibrium, like the one suggested by Rangel (2003), could emerge. Alternatively, different contextual cues might trigger such equilibria in other environments. Nevertheless, our results show that without additional coordination devices or institutions, this type of equilibrium does not arise spontaneously.

The finding that reciprocal cooperation is sufficient to motivate substantial transfers to future generations suggests that investments in the future may be more likely to emerge than previously thought and do not seem to require explicit conditioning on past behaviors. Rangel (2003) suggests that linking pensions with environmental protection or family remittances with investment in children's education could encourage greater forward investment. In his setup, this requires that transfers to the older generation be conditioned on their past investments in the future. However, our results suggest that such explicit observation may not be necessary. Instead, simply linking the two policies together — and, more broadly, reinforcing the perception that generations are connected through reciprocal cooperation — could be enough to increase contributions to future generations.

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A Additional Conceptual Framework

A.1 Beyond the Next Generation

An observation that also arises in Rangel (2003) is that Proposition 2 applies just as easily if f goes to a player further into the future. This is what the next result describes.

COROLLARY A1 *Suppose the game is as described as in Proposition 2, but for any* p*,* f_{sp} *gets transferred to* $p+2$*. Then there is a perfect Bayesian equilibrium where* $f_{sp} > 0$*.*

Proof: *By inspection of the proof of Proposition 2.*

Note that Corollary A1 would also follow more generally if f_{sp} went to an irrelevant other person, a charity, or even got destroyed. The transfer to $p+2$ is of particular interest, however, since it captures the setting we study, where investments in the future yield growth that enables backward transfers.

A.2 Cooperative Imperfect Equilibrium

In this section, we show that information on only the previous generation's choices can sustain a Nash equilibrium that is not perfect Bayesian. While Section 2.3 showed the existence of a cooperative perfect Bayesian equilibrium, that equilibrium required information on the actions of generations before the previous one. With less information, there can still be a cooperative Nash equilibrium, albeit one where the equilibrium strategies are not sequentially (self-interestedly) rational off the equilibrium path:

PROPOSITION A1: *If each player* p *in sequence* s *learns* $b_{s,p-1}$ *and* $f_{s,p-1}$ *before making their choice, there is a Nash equilibrium where* $\forall p, f_{sp} > 0$ *whenever* $\delta g_b > 1$*, but there is no perfect Bayesian equilibrium where* $\exists p, f_{sp} > 0$*.*

Proof: *We first prove the first part of the proposition. Suppose each player* p *in sequence* s *learns* $b_{s,p-1}$ *and* $f_{s,p-1}$*. Consider the following strategy. Set* $f_{sp} = \frac{g_b\delta-1}{g_b\delta}e_s$*. If* $f_{s,p-1} = \frac{g_b\delta-1}{g_b\delta}e_s$ *and* $b_{s,p-1} = \frac{e_s}{g_b\delta}$*, set* $b_{sp} = \frac{e_s}{g_b\delta}$*; otherwise, set* $b_{sp} = 0$*. It is a Nash equilibrium for every player to adopt this strategy. If every player follows this strategy, then the payoff to following the strategy is* $e_s(1 + g_f\frac{g_b\delta-1}{g_b\delta})$*, and the payoff to deviating cannot be any greater.*

For the second part of the proposition, suppose there is a perfect Bayesian equilibrium where

$f_{sp} > 0$ for some p. It must be the case that $p+1$ will set $b_{s,p+1}$ higher depending on the value of f_{sp}. But for any value of f_{sp}, the payoff to player $p+1$ is the same function of $b_{s,p+1}$ and $f_{s,p+1}$. Setting $b_{s,p+1} > 0$ is costly to $p+1$, so it must be that $b_{s,p+1} = 0$, a contradiction.

Proposition 2 tells us that providing information about backward giving can allow forward giving to be sustained by self-interest alone, but the giving is fragile without complex information. If it is in each player's interest to give forward, it cannot be in each player's interest to retaliate against those who deviate.

As with Proposition 2, Proposition A1 yields a corollary in the case where f goes to a generation further into the future:

COROLLARY A2: *Suppose the game is as described in Proposition 2, but for any p, f_{sp} gets transferred to $p+2$. Then there is a Nash equilibrium but not a perfect Bayesian equilibrium where $f_{sp} > 0$.*

Proof: *By inspection of the proof of Proposition A1.*

The same note applies here as for Corollary A1. Corollary A2 tells us that with information on the previous player's choices that includes their backward transfer, one can sustain a wide range of equilibria, including cooperation with the far future.

B Experimental Design: Auxiliary Conditions

Here, we describe three auxiliary experimental conditions that, while not the primary focus of this paper, form the basis of some robustness tests and supplementary analyses discussed in the main text and appendix. Table B1 provides an overview over all main and auxiliary conditions of the experiment.

Long-Term Future:
Account C contributions go to the player directly after the next player in the sequence (which occurs with a 64% chance – i.e. based on an 80% chance that someone comes after and an 80% chance that someone comes after them). Otherwise, this arm is the same as the "Exchange with History" arm in that players have access to the maximal information set.

This condition allows for a test of Corollary A1, which says that there is an equilibrium where people give to more distant future generations if there are backward transfers and sufficient information.

Exchange with Random History: Instead of receiving information from the generations before them, they receive information from players in a random sequence. This means that reciprocity is not theoretically possible, instead, players can only take social cues from this information, that could inform their beliefs.

Exchange with Recent History: Current generation players receive information about what the previous generation in their sequence did (k-1) and information about two consecutive generations in a random sequence. This restriction information set can allow contributions to FIG, but without complex information, they are fragile and can unravel, as shown in Appendix Section A.2.

Appendix Table B1: All Treatment Conditions

Condition Name	Transfer Recipients	Information Space
Forward Only	B: Other Sequence C: Next Player	None
Backward Only	B: Previous Player C: Other Sequence	None
Anonymous Exchange	B: Previous Player C: Next Player	None
Exchange w. Forward Hist.	B: Previous Player C: Next Player	C contributions from previous player (k-1). B from a random sequence. Maximum contributions of the two players before the previous one for C (max k-2, k-3). B from a random sequence (max k', k"). Minimum contributions of the two players before the previous one for C (min k-2, k-3). B from a random sequence (min k', k")
Exchange w. Hist.	B: Previous Player C: Next Player	Contributions of previous generation (k-1). Maximum contributions of the two players before the previous one (max k-2, k-3). Minimum contributions of the two players before the previous one (min k-2, k-3).
Long-Term Future	B: Previous Player C: Player After Next	Contributions of previous generation (k-1). Max contribution of the two players before the previous one (max k-2, k-3). Min contribution of the two players before the previous one (min k-2, k-3).
Exchange w. Random Hist.	B: Previous Player C: Next Player	Contributions of a previous generation from a random sequence. Max contributions from a random sequence (max k', k"). Min contributions from a random sequence (min k', k").
Exchange w. Recent Hist.	B: Previous Player C: Next Player	Contributions of previous generation (k-1)

C Sample Descriptive and Outcomes

Here, we provide summary statistics for key demographics used as control variables in our regressions. Table C1 shows averages (s.d.) for each of these variables by condition. We use a multinomial logit model to perform a test of joint orthogonality confirming balance across our main treatment conditions (Chi2, p=0.144). The corresponding pairwise tests can be found in the final column.

Appendix Table C1: Panel Demographics

	Anonymous Exchange	**Forward Only**	**Backward Only**	**Exchange w. Hist.**	**Exchange w. Recent Hist.**	**Exchange w. Forward Hist.**	**Random Hist.**	**Long-Term Future**	**Balance (p-value)**
Mean age	41.91 (12.72)	40.68 (13.28)	39.98 (13.37)	39.71 (12.16)	40.16 (13.32)	39.62 (13.59)	40.23 (12.66)	40.24 (13.22)	0.54
Gender									0.33
Male	46.78%	43.40%	48.71%	39.32%	47.44%	43.40%	46.12%	50.21%	
Ethnicity									
White	85.96%	88.94%	79.57%	89.36%	88.51%	85.11%	87.66%	87.66%	0.05
Black	3.40%	4.26%	4.26%	2.55%	2.98%	2.55%	2.55%	1.28%	0.59
Asian	4.68%	5.53%	11.06%	5.11%	4.26%	7.66%	5.53%	6.38%	0.06
Other	3.83%	0.85%	3.40%	2.13%	3.40%	4.26%	2.55%	2.98%	0.46
Other tasks									
Charity task (1-30)	16.25	16.29	16.03	14.69	16.82	17.22	16.47	17.17	0.28
Lottery task (1-6)	2.33	2.26	2.17	2.24	2.41	2.46	2.46	2.65	0.04
N	235	235	235	235	235	235	235	235	

Note: The values for the Charitable Giving task use a multiple price list, the switch point from self to charity (30 rows). The values for the Lottery task are the mean choice (1–6) based on the Eckel and Grossman (2008) task. The final column provides the p-value of a statistical balance test between experimental conditions for the respective variable. We use Chi2-tests for binary variables and Kruskal-Wallis tests for ordinal scaled variables.

Table C2 provides summary statistics for our two main outcome variables (Account A and B allocations) for all main and auxiliary treatment conditions. Panel I contains information on allocation means (s.d.) i.e. intensive margin behaviour. Similarly, Panel II contains information on average rates of cotntribution per condition i.e. extensive margin behaviour.

Appendix Table C2: Descriptive Results by Condition

	Anonymous Exchange	Forward Only	Backward Only	Exchange w. Hist.	Exchange w. Recent Hist.	Exchange w. Forward Hist.	Random Hist.	Long-Term Future
Panel I: Intensive Margin								
Account C	5.76 (4.07)	5.37 (4.50)	4.38 (3.98)	5.19 (3.28)	5.69 (3.91)	5.75(3.80)	5.48 (3.75)	5.71 (4.11)
Account B	4.68 (2.89)	3.74 (3.04)	4.48 (3.47)	5.05(2.98)	4.87 (2.84)	4.96 (3.23)	5.17 (3.07)	4.95 (3.14)
Panel II: Extensive Margin								
Account C	0.89	0.81	0.79	0.88	0.89	0.86	0.89	0.88
Account B	0.84	0.73	0.79	0.87	0.86	0.82	0.86	0.84

Note: Intensive margin: Mean allocations (s.d.); Extensive margin: Rate of positive allocations.

D Treatment Effect Regressions: Result 1

In this section, we provide regression-based tests for *Result 1*, incorporating controls for demographic variables and individual preferences for risk and generosity, as summarized in Table C1. Each regression compares the *Anonymous Exchange* and *Forward Only* conditions, both with and without additional controls included.

Models (1) and (2) examine allocations to the backward account, Models (3) and (4) focus on the forward account, and Models (5) and (6) analyze allocations to the self account. Extensive margin results (i.e. any positive allocation) are shown in table D1 and intensive margin results (i.e. amounts allocated) are shown in table D2.

Regression tables D3 and D4 contain the corresponding results for the comparison of the *Anonymous Exchange* and *Backward Only* conditions.

Appendix Table D1: Extensive Margin: Forward only vs Anonymous Exchange

VARIABLES	(1) Back	(2) Back	(3) Forward	(4) Forward	(5) Self	(6) Self
Forward Only (1=Yes)	-0.111***	-0.110***	-0.0766**	-0.0771**	0.00851	0.0101
	(0.0346)	(0.0319)	(0.0308)	(0.0300)	(0.0195)	(0.0201)
Male (1=Yes)		-0.126***		-0.0905***		-0.0428*
		(0.0384)		(0.0334)		(0.0232)
White (1=Yes)		-0.147**		-0.0701		-0.0570***
		(0.0693)		(0.0667)		(0.0157)
Asian (1=Yes)		-0.0422		-0.0835		-0.0847
		(0.0882)		(0.0968)		(0.0606)
Black (1=Yes)		-0.0318		0.0798		-0.00455
		(0.108)		(0.0661)		(0.0135)
Lottery Task (1-6)		-0.00871		-0.000974		0.00678
		(0.0128)		(0.0117)		(0.00696)
Charity Task (1-30)		-0.00595***		-0.00392**		-0.00152
		(0.00213)		(0.00171)		(0.00102)
Constant	0.843***	1.148***	0.894***	1.063***	0.940***	1.022***
	(0.0184)	(0.0784)	(0.0161)	(0.0698)	(0.0156)	(0.0269)
Observations	470	468	470	468	470	468
R-squared	0.018	0.081	0.012	0.053	0.000	0.021

Note: Linear probability model. DV: Positive allocation (1=Yes). Standard errors clustered at the sequence level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Appendix Table D2: Intensive Margin: Forward only vs Anonymous Exchange

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Back	Back	Forward	Forward	Self	Self
Forward Only (1=Yes)	-0.936***	-0.965***	-0.387	-0.398	1.323***	1.363***
	(0.256)	(0.248)	(0.382)	(0.393)	(0.491)	(0.500)
Male (1=Yes)		-0.550**		0.749*		-0.198
		(0.269)		(0.419)		(0.545)
White (1=Yes)		0.0743		0.797		-0.872
		(0.836)		(0.881)		(1.580)
Asian (1=Yes)		0.416		0.338		-0.754
		(0.955)		(1.094)		(1.836)
Black (1=Yes)		0.456		0.401		-0.857
		(0.888)		(1.294)		(1.831)
Lottery Task (1-6)		-0.0226		-0.0235		0.0461
		(0.0866)		(0.125)		(0.176)
Charity Task (1-30)		-0.0405**		-0.0109		0.0514*
		(0.0156)		(0.0204)		(0.0286)
Constant	4.681***	5.551***	5.757***	4.929***	9.562***	9.521***
	(0.176)	(0.866)	(0.270)	(0.970)	(0.329)	(1.636)
Observations	470	468	470	468	470	468
R-squared	0.024	0.058	0.002	0.012	0.014	0.025

Note: Linear regressions. DV: Amount Allocated. Standard errors clustered at the sequence level. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table D3: Extensive Margin: Backward only vs Anonymous Exchange

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Back	Back	Forward	Forward	Self	Self
Backward Only (1=Yes)	-0.0468	-0.0463	-0.102***	-0.0966***	0.00851	0.00913
	(0.0324)	(0.0307)	(0.0294)	(0.0284)	(0.0204)	(0.0211)
Male (1=Yes)		-0.0771*		-0.0647*		-0.0542**
		(0.0402)		(0.0334)		(0.0220)
White (1=Yes)		0.00358		0.0414		-0.0151
		(0.0859)		(0.0815)		(0.0497)
Asian (1=Yes)		-0.0345		-0.0468		-0.0326
		(0.0965)		(0.0962)		(0.0682)
Black (1=Yes)		0.137		0.206**		0.0429
		(0.112)		(0.0845)		(0.0498)
Lottery Task (1-6)		-0.00196		0.0156		-0.00356
		(0.0132)		(0.0114)		(0.00876)
Charity Task (1-30)		-0.00280		-0.00194		-0.00208**
		(0.00212)		(0.00208)		(0.00103)
Constant	0.843***	0.921***	0.894***	0.877***	0.940***	1.021***
	(0.0184)	(0.105)	(0.0161)	(0.0973)	(0.0156)	(0.0538)
Observations	470	465	470	465	470	465
R-squared	0.004	0.026	0.020	0.047	0.000	0.028

Note: Linear probability model. DV: Positive allocation (1=Yes). Standard errors clustered at the sequence level. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table D4: Intensive Margin: Forward only vs Anonymous Exchange

VARIABLES	(1) Back	(2) Back	(3) Forward	(4) Forward	(5) Self	(6) Self
Backward Only (1=Yes)	-0.196	-0.206	-1.379***	-1.323***	1.574***	1.530***
	(0.273)	(0.263)	(0.349)	(0.358)	(0.472)	(0.481)
Male (1=Yes)		-0.131		0.749**		-0.619
		(0.320)		(0.371)		(0.524)
White (1=Yes)		0.704		1.183		-1.887
		(0.755)		(0.780)		(1.446)
Asian (1=Yes)		0.697		0.302		-0.998
		(0.879)		(0.958)		(1.616)
Black (1=Yes)		0.485		0.697		-1.182
		(0.811)		(1.280)		(1.748)
Lottery Task (1-6)		-0.00125		0.141		-0.140
		(0.100)		(0.134)		(0.174)
Charity Task (1-30)		-0.0115		0.0207		-0.00927
		(0.0165)		(0.0217)		(0.0298)
Constant	4.681***	4.273***	5.757***	3.689***	9.562***	12.04***
	(0.176)	(0.866)	(0.270)	(0.951)	(0.329)	(1.665)
Observations	470	465	470	465	470	465
R-squared	0.001	0.005	0.029	0.049	0.019	0.030

Note: Linear regressions. DV: Amount Allocated. Standard errors clustered at the sequence level. *** p<0.01, ** p<0.05, * p<0.1

E Treatment Effect Regressions: Result 2

This section contains regression-based tests for *Result 2*. Each regression model incorporates controls for demographic variables and individual preferences for risk and generosity, as summarized in Table C1. The main treatment dummy compares the *Anonymous Exchange* and *History with Exchange* conditions, both with and without additional controls included.

Models (1) and (2) examine allocations to the backward account, Models (3) and (4) focus on the forward account, and Models (5) and (6) analyze allocations to the self account. Extensive margin results (i.e. any positive allocation) are shown in table E1 and intensive margin results (i.e. amounts allocated) are shown in table E2.

Appendix Table E1: Extensive Margin: History w. Exchange vs Anonymous Exchange

VARIABLES	(1) Back	(2) Back	(3) Forward	(4) Forward	(5) Self	(6) Self
Anonymous Exchange (1=Yes)	-0.0298	-0.0159	0.0128	0.0212	-0.0128	-0.0116
	(0.0299)	(0.0282)	(0.0248)	(0.0248)	(0.0205)	(0.0201)
Male (1=Yes)		-0.115***		-0.0878***		-0.0308
		(0.0373)		(0.0331)		(0.0232)
White (1=Yes)		-0.113*		-0.0692		-0.00278
		(0.0571)		(0.0550)		(0.0562)
Asian (1=Yes)		0.00621		0.0140		0.00648
		(0.0657)		(0.0678)		(0.0723)
Black (1=Yes)		-0.0649		0.0309		0.0529
		(0.0960)		(0.0535)		(0.0535)
Lottery Task (1-6)		-0.00921		0.00231		0.0120*
		(0.0130)		(0.0116)		(0.00634)
Charity Task (1-30)		-0.00523***		-0.00309*		-0.000507
		(0.00181)		(0.00165)		(0.00113)
Constant	0.872***	1.117***	0.881***	1.016***	0.953***	0.946***
	(0.0236)	(0.0641)	(0.0189)	(0.0588)	(0.0133)	(0.0624)
Observations	470	467	470	467	470	467
R-squared	0.002	0.065	0.000	0.038	0.001	0.013

Note: Linear probability model. DV: Positive allocation (1=Yes). Standard errors clustered at the sequence level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Appendix Table E2: Intensive Margin: History w. Exchange vs Anonymous Exchange

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Back	Back	Forward	Forward	Self	Self
Anonymous Exchange (1=Yes)	-0.379	-0.236	0.570*	0.627*	-0.191	-0.392
	(0.293)	(0.267)	(0.337)	(0.336)	(0.487)	(0.486)
Male (1=Yes)		-0.603**		-0.00781		0.611
		(0.278)		(0.403)		(0.538)
White (1=Yes)		0.0787		1.108		-1.186
		(0.801)		(0.715)		(1.388)
Asian (1=Yes)		0.407		1.018		-1.426
		(0.930)		(0.828)		(1.497)
Black (1=Yes)		-0.0127		1.594		-1.581
		(0.905)		(1.225)		(1.588)
Lottery Task (1-6)		-0.177*		0.0301		0.147
		(0.0908)		(0.129)		(0.172)
Charity Task (1-30)		-0.0490***		-0.0135		0.0625**
		(0.0133)		(0.0192)		(0.0241)
Constant	5.060***	6.322***	5.187***	4.231***	9.753***	9.447***
	(0.234)	(0.843)	(0.200)	(0.756)	(0.358)	(1.337)
Observations	470	467	470	467	470	467
R-squared	0.004	0.056	0.006	0.012	0.000	0.025

Note: Linear regressions. DV: Amount Allocated. Standard errors clustered at the sequence level. *** p<0.01, ** p<0.05, * p<0.1

F Information Effect Regressions: Result 3

Tables F1 and F2 provide further insights into the intensive margin effect of observing information on forward and backward transfers of the prior generation within the *Exchange with History* condition. The left out category is low forward (backward) transfers (1st Tertile) of the previous player, respectively. In line with *Result 3*, higher observed forward transfers (2nd and 3rd tertile vs 1st tertile) lead to higher backward transfers and lower self allocations.

Appendix Table F1: Intensive Margin: Effect of FIG information

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Back	Back	Forward	Forward	Self	Self
2nd Tertile Forward k-1 (1=Yes)	0.672	0.854*	0.483	0.534	-1.155	-1.388*
	(0.477)	(0.466)	(0.524)	(0.549)	(0.815)	(0.813)
3rd Tertile Forward k-1 (1=Yes)	1.187**	1.191**	0.646	0.658	-1.833*	-1.848**
	(0.528)	(0.476)	(0.517)	(0.517)	(0.918)	(0.876)
Male (1=Yes)		-1.157***		-1.204**		2.361***
		(0.340)		(0.482)		(0.616)
White (1=Yes)		-1.011		0.197		0.814
		(1.543)		(1.148)		(2.602)
Asian (1=Yes)		-0.148		-1.248		1.396
		(1.847)		(1.134)		(2.720)
Black (1=Yes)		-1.428		1.116		0.312
		(1.610)		(0.973)		(2.517)
Lottery Task (1-6)		-0.174		0.170		0.00336
		(0.147)		(0.186)		(0.247)
Charity Task (1-30)		-0.0584***		-0.0484**		0.107***
		(0.0172)		(0.0239)		(0.0327)
Constant	4.505***	7.094***	4.846***	5.483***	10.65***	7.424***
	(0.376)	(1.403)	(0.326)	(1.036)	(0.613)	(2.278)
Observations	235	234	235	234	235	234
R-squared	0.026	0.119	0.007	0.076	0.022	0.120

Note: Linear regressions. Standard errors clustered at the sequence level.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table F2: Intensive Margin: Effect of BIG information

VARIABLES	(1) Back	(2) Back	(3) Forward	(4) Forward	(5) Self	(6) Self
2nd Tertile Backward k-1 (1=Yes)	0.413	0.359	-0.0222	-0.146	-0.391	-0.213
	(0.441)	(0.450)	(0.560)	(0.531)	(0.854)	(0.811)
3rd Tertile Backward k-1 (1=Yes)	0.535	0.293	-0.0167	-0.148	-0.519	-0.145
	(0.571)	(0.585)	(0.628)	(0.666)	(0.991)	(1.035)
Male (1=Yes)		-1.187***		-1.233**		2.420***
		(0.356)		(0.482)		(0.640)
White (1=Yes)		-1.443		0.115		1.328
		(1.750)		(1.235)		(2.892)
Asian (1=Yes)		-0.654		-1.335		1.989
		(2.124)		(1.260)		(3.105)
Black (1=Yes)		-1.596		1.185		0.412
		(1.875)		(1.089)		(2.887)
Lottery Task (1-6)		-0.163		0.175		-0.0126
		(0.150)		(0.187)		(0.254)
Charity Task (1-30)		-0.0512***		-0.0460*		0.0972***
		(0.0174)		(0.0242)		(0.0332)
Constant	4.765***	7.801***	5.200***	5.980***	10.04***	6.219**
	(0.396)	(1.521)	(0.429)	(1.031)	(0.705)	(2.430)
Observations	235	234	235	234	235	234
R-squared	0.006	0.094	0.000	0.068	0.002	0.096

Note: Linear regressions. Standard errors clustered at the sequence level.

*** p<0.01, ** p<0.05, * p<0.1

G Other information conditions

In this section we provide evidence on the effects of providing information in the coarser information environments in three auxiliary coditions: *Forward History*, *Recent History* and *Random History*.

Appendix Table G1: Intensive Margin: Effects of Information in Forward History

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Back	Back	Forward	Forward	Self	Self
Prev. Player's Forw. Trans.	-0.0231	-0.0142	0.0503	0.0443	-0.0272	-0.0301
	(0.0536)	(0.0544)	(0.0587)	(0.0563)	(0.0973)	(0.0949)
Male (1=Yes)		-0.148		0.178		-0.0298
		(0.431)		(0.511)		(0.802)
White (1=Yes)		0.953		1.078		-2.032
		(0.923)		(0.836)		(1.636)
Asian (1=Yes)		-0.202		-0.298		0.500
		(1.055)		(1.224)		(2.039)
Black (1=Yes)		3.299**		-0.777		-2.522
		(1.289)		(1.039)		(2.096)
Lottery Task (1-6)		0.00487		0.204		-0.208
		(0.185)		(0.166)		(0.290)
Charity Task (1-30)		-0.0270		-0.0254		0.0525*
		(0.0224)		(0.0175)		(0.0280)
Constant	5.096***	4.683***	5.467***	4.486***	9.438***	10.83***
	(0.367)	(0.945)	(0.383)	(0.932)	(0.655)	(1.697)
Observations	235	235	235	235	235	235
R-squared	0.001	0.036	0.003	0.033	0.000	0.034

Note: Linear regressions. Standard errors clustered at the sequence level.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table G2: Intensive Margin: Effects of Information in Recent History

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Back	Back	Forward	Forward	Self	Self
Prev. Player's Forw. Trans.	-0.00501	0.0152	0.0822	0.0851	-0.0772	-0.100
	(0.0463)	(0.0427)	(0.0735)	(0.0705)	(0.0688)	(0.0753)
Prev. Player's Back. Trans.	0.00970	-0.0106	-0.220**	-0.256***	0.210*	0.266**
	(0.0570)	(0.0635)	(0.0931)	(0.0898)	(0.113)	(0.116)
Male (1=Yes)		-0.174		1.147***		-0.974*
		(0.357)		(0.425)		(0.548)
White (1=Yes)		-0.232		-0.189		0.421
		(0.720)		(1.166)		(1.756)
Asian (1=Yes)		1.539		-1.072		-0.468
		(1.241)		(1.502)		(2.495)
Black (1=Yes)		-2.143**		0.320		1.823
		(0.975)		(2.028)		(2.249)
Lottery Task (1-6)		-0.0699		0.212		-0.142
		(0.124)		(0.218)		(0.280)
Charity Task (1-30)		-0.0373**		-0.0462**		0.0835**
		(0.0171)		(0.0227)		(0.0353)
Constant	4.853***	5.923***	6.320***	6.408***	8.827***	7.669***
	(0.388)	(0.800)	(0.650)	(1.573)	(0.795)	(2.151)
Observations	235	234	235	234	235	234
R-squared	0.000	0.054	0.029	0.073	0.015	0.053

Note: Linear regressions. Standard errors clustered at the sequence level.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table G3: Intensive Margin: Effects of Information in Random History

VARIABLES	(1) Back	(2) Back	(3) Forward	(4) Forward	(5) Self	(6) Self
Prev. Player's Forw. Trans	0.0494	0.0461	0.0583	0.0652	-0.108	-0.111
	(0.0510)	(0.0531)	(0.0775)	(0.0850)	(0.110)	(0.120)
Prev. Player's Back. Trans	-0.0575	-0.0622	-0.0946	-0.0881	0.152**	0.150**
	(0.0417)	(0.0438)	(0.0622)	(0.0677)	(0.0618)	(0.0690)
Min. Prev. Two's Forw. Trans.	0.110	0.0745	0.152	0.193	-0.263*	-0.267*
	(0.0804)	(0.0881)	(0.117)	(0.125)	(0.141)	(0.149)
Min. Prev. Two's Back. Trans.	-0.0166	-0.0150	0.199*	0.187	-0.183	-0.172
	(0.0832)	(0.101)	(0.107)	(0.112)	(0.118)	(0.142)
Max. Prev. Two's Forw. Trans.	0.0424	0.0502	0.0398	0.0206	-0.0822	-0.0708
	(0.0407)	(0.0500)	(0.0628)	(0.0637)	(0.0652)	(0.0749)
Max. Prev. Two's Back. Trans.	-0.105	-0.0896	-0.192*	-0.210*	0.297***	0.299***
	(0.0824)	(0.0876)	(0.106)	(0.105)	(0.0960)	(0.106)
Male (1=Yes)		0.127		0.143		-0.270
		(0.507)		(0.572)		(0.916)
White (1=Yes)		0.233		0.619		-0.852
		(0.643)		(0.883)		(1.372)
Asian (1=Yes)		0.304		-0.493		0.189
		(1.084)		(1.263)		(2.130)
Black (1=Yes)		0.772		-1.032		0.260
		(1.465)		(1.242)		(2.265)
Lottery Task (1-6)		-0.0189		0.179		-0.160
		(0.118)		(0.124)		(0.182)
Charity Task (1-30)		-0.000878		0.00527		-0.00439
		(0.0222)		(0.0294)		(0.0415)
Constant	5.140***	4.853***	5.165***	4.199***	9.696***	10.95***
	(0.657)	(1.026)	(0.806)	(1.417)	(1.157)	(2.060)
Observations	235	232	235	232	235	232
R-squared	0.018	0.021	0.032	0.049	0.034	0.040

Note: Linear regressions. Standard errors clustered at the sequence level.

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table G4: Equivalence of Contribution Amounts Across Arms

	H0: The treatment changes contribution amounts by x points					
x	-0.75	0.75	-1	1	-1.25	1.25
Account C: Forward	0.53	3.87***	1.26	4.60***	3.1.99**	5.33***
Account B: Backward	4.16***	1.37*	5.08***	2.29**	6.00***	3.21***
Account A: Self	1.95**	1.16	2.47***	1.67**	2.98***	2.19**

*** p<0.01, ** p<0.05, * p<0.1

H Experiment Instructions

EXPERIMENTAL INSTRUCTIONS:

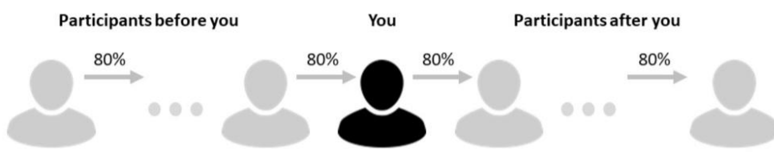
ANONYMOUS EXCHANGE TREATMENT:

[Introduction]

In this study, a sequence of participants completes a decision task one after the other. Some people may have participated before you in your sequence. Others may participate after you in your sequence. Your position in your sequence of participants is random.

With an 80% chance, another participant will participate in your sequence after you. With a 20% chance, your sequence will end after you. The decision task is the same for every participant in this sequence (regardless of whether they come before or after you).

The following image summarizes these instructions:



You can earn a bonus payment in this study. For each point that is allocated to you by the end of the study, you will receive ${e://Field/ConversionRatePt2GBP}, which will be paid to you via Prolific within 28 days of completing the study.

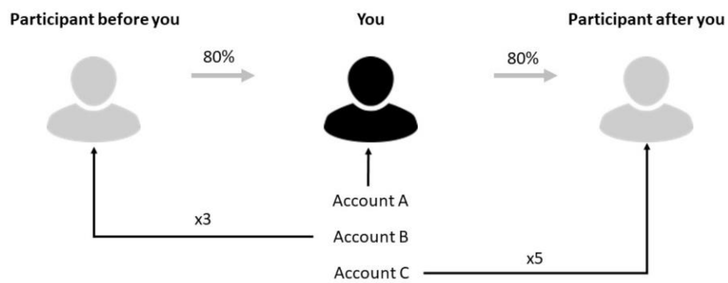
You will make decisions that affect your bonus and the bonuses of other participants in your sequence.

[Decision Making]

To earn a bonus, you will accumulate points based on your decisions and the decisions of other participants. At first, you will receive an endowment of 20 points. Then you will choose how to allocate these 20 points across three accounts:

- **Account A**: Points allocated to this account will be given to **you**. Points in this account will not be multiplied.
- **Account B**: Points allocated to this account will be multiplied by 3 and given to the participant directly **before you** in your sequence.
- **Account C**: Points allocated to this account will be multiplied by 5 and given to the participant directly **after you** in your sequence (if another participant comes after you, which occurs with an 80% chance).

The following image summarizes these instructions:

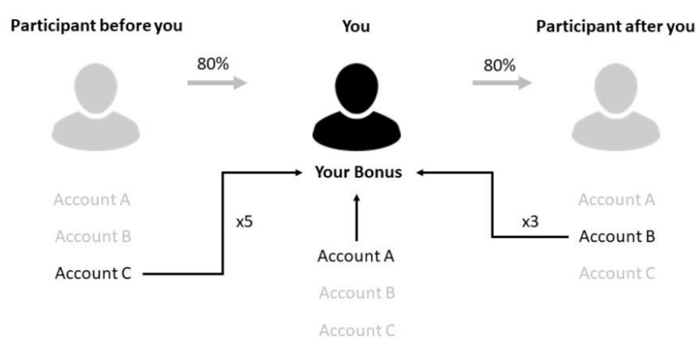


[Your Own Payment]
As you saw before, your decisions affect your own bonus and the bonuses of other participants. Similarly, the decisions of other participants affect your bonus and their own bonus.

Specifically, **your bonus** will be the sum of the following:

- All points that you allocate to **Account A**.
- All points that the participant before you allocated to **Account C, multiplied by 5**.
- All points that the participant after you allocates to **Account B** (assuming there is another participant in your sequence, which occurs with an 80% chance), **multiplied by 3**.

The following image summarizes these instructions:



[First Player in Sequence]

What happens if you are randomly chosen to be the first participant in your sequence?

Some of the instructions on the previous pages will differ slightly if you are the first participant in your sequence.

If you are the first participant in your sequence, where do your points allocated to Account B go, and where do your points received from Account C come from?

The decision screen will look the same as for all other participants in your sequence. This means that you will not know your position in your sequence from looking at the decision screen.

You will decide how to allocate your endowment to Accounts A, B, and C. We will invite an additional participant who does not make any decisions. This participant will receive the points you allocate to Account B and may have points sent to you via Account C. In other words, this participant will receive: (1) an endowment of 20 points plus (2) any points you allocate to Account B minus (3) a predetermined Account C amount.

Since your position in your sequence will be decided randomly, you should make your decision as if you could be in any position in your sequence. Note, however, that for most people in your sequence, points allocated to Account B will go to the participant before them and points allocated to Account C will go to the participant after them, as explained on the previous pages.

[Post Decision Page]

Congratulations! You have completed the decision part of this study.

Now, all that remains is completing the follow-up survey.

Some answers to the questions in the follow-survey may influence your bonus payment: when this is the case, you will be told so and it will be explained how you can earn a bonus payment.

When there is no mention of a bonus payment, your answers will **not** influence your payment from this study in any way. Please answer these questions truthfully.

Please proceed to the follow-up survey.

EXCHANGE WITH HISTORY TREATMENT (Differences)

[Decision History]

Before you make your allocation decisions, you will see a summary of how previous participants in your sequence allocated their points to Accounts B and C. The summary will look like the table below. (You will be shown the exact same table again on the decision screen later.)

In the first column, you can see the allocations to Accounts B and C made by the participant who came immediately before you in your sequence. The two participants described in the next two columns have taken part earlier in your sequence, i.e. these participants have participated directly before the participant who came before you in your sequence. They participated one after the other.

Note: Participants who come after you in your sequence will learn about your and others' allocation decisions, as is illustrated in this table.

	Participant in your sequence *immediately* before you	**The two participants in your sequence *before* the previous participant**	
	Exact amount allocated	Minimum allocated	Maximum allocated
Account B			
Account C			

Note: The "minimum allocated" indicates the lowest amount contributed to this account by either of the two participants before the participant before you in your sequence, while the "maximum allocated" indicates the highest amount contributed by either of those two participants.

Recall that your position in your sequence of participants is randomly decided. If there are at least three participants before you in your sequence, all information in this summary table will be based on the behavior of previous participants in your sequence. (We will tell you at the end of the instructions what happens if there are fewer than three participants before you in your sequence.)

[First Player in Sequence]

What happens if you are randomly chosen to be the first participant in your sequence?

Some of the instructions on the previous pages will differ slightly if you are the first participant in your sequence.

What information will the participants who are first, second or third in your sequence see in the summary table?

All other participants in the sequence will also have a summary table with the same rows and columns. This means that you will not know your position in your sequence from looking at the summary table.

If you are the first, second or third participant in your sequence, some or all of the information you will see in the summary table will come from a previous version of this study we conducted before you were invited to this study:

- If it is randomly decided that you are the first participant in your sequence, all information in the summary table will reflect decisions in a previous version of the study.
- If there is one participant before you in your sequence (i.e., if it is randomly decided that you are the second participant in your sequence), you will see information on their actual decisions, but the information on the participants before them will reflect decisions made in a previous version of this study.
- If there are two participants before you in your sequence (i.e., if it is randomly decided that you are the third participant in your sequence), you will see information on their actual decisions, but the information on the participant before them will reflect decisions made in a previous version of this study.

While most elements of the previous study were the same as in this study, some participants may have seen different instructions about how the three accounts interacted with other participants. In all cases, however, allocations to Account A always went to the participant themselves and allocations to Accounts B and C always went to, or came from, other participants.

Since your position in your sequence will be decided randomly, you should make your decision as if you could be in any position in your sequence.

If you are the first participant in your sequence, where do your points allocated to Account B go, and where do your points received from Account C come from?

The decision screen will look the same as for all other participants in your sequence. This means that you will not know your position in your sequence from looking at the decision screen.

You will decide how to allocate your endowment to Accounts A, B, and C. We will invite an additional participant who does not make any decisions. This participant will receive the points you allocate to Account B and may have points sent to you via Account C. In other words, this participant will receive: (1) an endowment of 20 points plus (2) any points you allocate to Account B minus (3) a predetermined Account C amount.

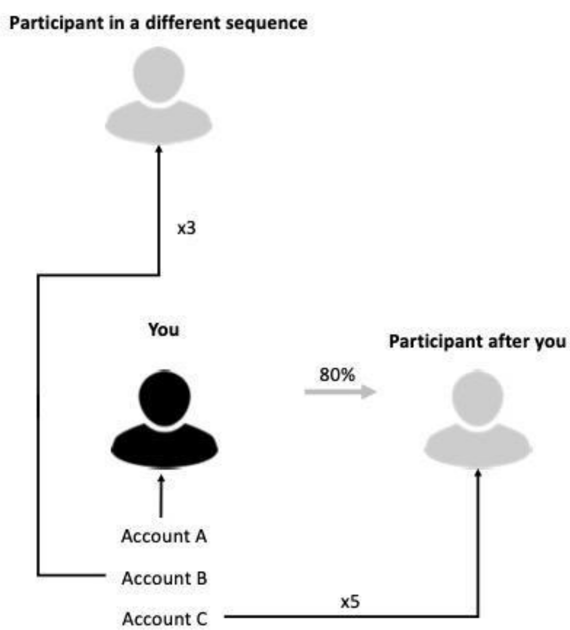
Since your position in your sequence will be decided randomly, you should make your decision as if you could be in any position in your sequence. Note, however, that for most people in your sequence, points allocated to Account B will go to the participant before them and points allocated to Account C will go to the participant after them, as explained on the previous pages.

FORWARD ONLY TREATMENT (Differences):

[Decision Making]

- **Account A**: Points allocated to this account will be given to **you**. Points in this account will not be multiplied.
- **Account B**: Points allocated to this account will be multiplied by 3 and given to a participant in **a different sequence**.
- **Account C**: Points allocated to this account will be multiplied by 5 and given to the participant directly **after you** in your sequence (if another participant comes after you, which occurs with an 80% chance).

The following image summarizes these instructions:



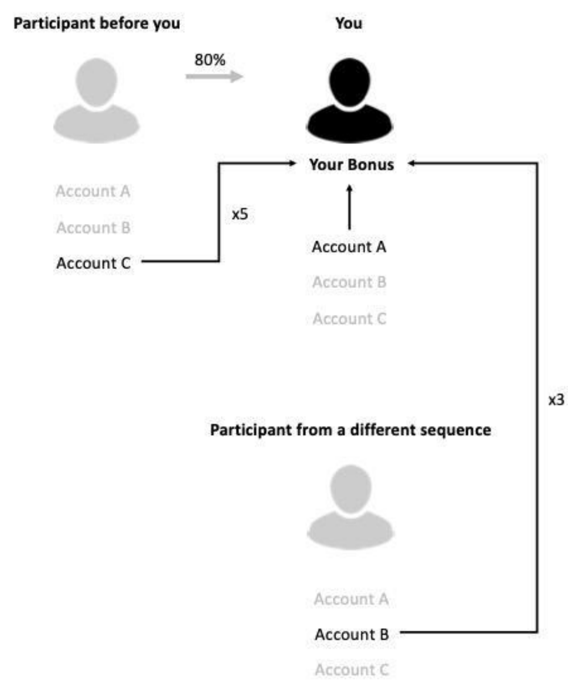
[Your Own Payment]

Specifically, **your bonus** will be the sum of the following:

- All points that you allocate to **Account A**.

- All points that the participant before you allocated to **Account C, multiplied by 5**.
- All points that a participant in a different sequence allocates to **Account B**, **multiplied by 3**.

The following image summarizes these instructions:



Note that the participant in a different sequence who can receive points from your contribution to Account B is **not the same participant** who can affect your points by contributing to their Account B.

[First Player in Sequence]

What happens if you are randomly chosen to be the first participant in your sequence?

Some of the instructions on the previous pages will differ slightly if you are the first participant in your sequence.

If you are the first participant in your sequence, where do your points received from Account C come from?

The decision screen will look the same as for all other participants in your sequence. This means that you will not know your position in your sequence from looking at the decision screen.

You will decide how to allocate your endowment to Accounts A, B, and C. We will invite an additional participant who does not make any decisions. This participant may have points sent to you via Account C. In other words, this participant will receive: (1) an endowment of 20 points minus (2) a predetermined Account C amount.

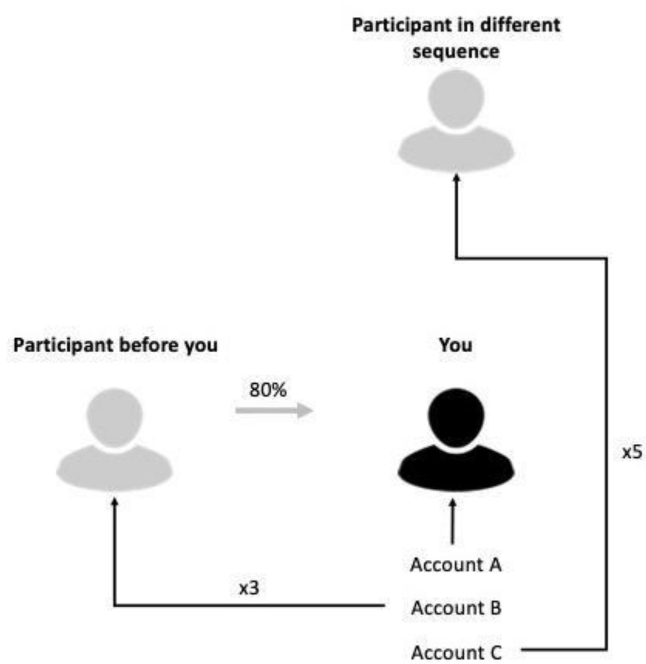
Since your position in your sequence will be decided randomly, you should make your decision as if you could be in any position in your sequence. Note, however, that for most people in your sequence, points allocated to Account C will go to the person after them and, for everyone, points allocated to Account B will go to a participant in a different sequence, as explained on the previous pages.

<u>BACKWARD ONLY TREATMENT (Differences):</u>

[Decision Making]

- **Account A**: Points allocated to this account will be given to **you**. Points in this account will not be multiplied.
- **Account B**: Points allocated to this account will be multiplied by 3 and given to the participant directly **before you** in your sequence.
- **Account C**: Points allocated to this account will be multiplied by 5 and given to a participant in **a different sequence**.

The following image summarizes these instructions:



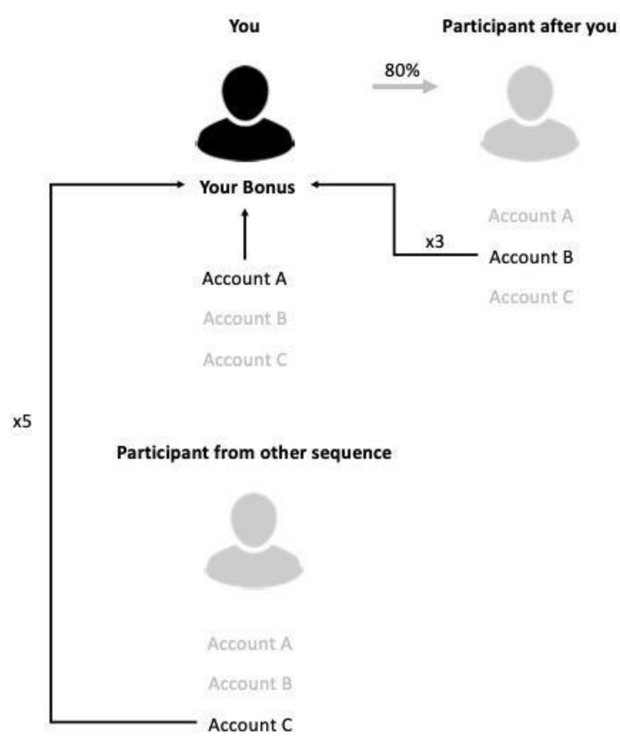
[Your Own Payment]

Specifically, **your bonus** will be the sum of the following:

- All points that you allocate to **Account A**.

- All points that a participant in a <u>different</u> sequence allocated to **Account C, multiplied by 5**.
- All points that the participant after you allocates to **Account B** (assuming there is another participant in your sequence, which occurs with an 80% chance), **multiplied by 3**.

The following image summarizes these instructions:



Note that the participant in a different sequence who can receive points from your contribution to Account C is **not the same participant** who can affect your points by contributing to their Account C.

[First Player in Sequence]

What happens if you are randomly chosen to be the first participant in your sequence?

Some of the instructions on the previous pages will differ slightly if you are the first participant in your sequence.

If you are the first participant in your sequence, where do your points allocated to Account B go?

The decision screen will look the same as for all other participants in your sequence. This means that you will not know your position in your sequence from looking at the decision screen.

You will decide how to allocate your endowment to Accounts A, B, and C. We will invite an additional participant who does not make any decisions. This participant will receive the points you allocate to Account B. In other words, this participant will receive: (1) an endowment of 20 points plus (2) any points you allocate to Account B.

Since your position in your sequence will be decided randomly, you should make your decision as if you could be in any position in your sequence. Note, however, that for most people in your sequence, points allocated to Account B will go to the participant before them and, for everyone, points allocated to Account C will go to a participant in a different sequence, as explained on the previous pages.

EXCHANGE WITH FORWARD HISTORY TREATMENT (Differences):

[Decision History]

Before you make your allocation decisions, you will see a summary of how participants in a different sequence allocated their points to Account B and previous participants in your sequence allocated their points to Account C. The summary will look like the table below. (You will be shown the exact same table again on the decision screen later.)

The top half of the table shows information from participants who are taking part in a different sequence than yours, i.e. these participants have not participated before you in your sequence and none of your actions will affect their bonuses or vice versa. In the first column, you can see the allocations to Account B made by a participant in this different sequence. The two participants described in the next two columns have participated immediately before this participant in the first column. The three participants participated one after the other in this different sequence.

The bottom half of the table shows information from participants in your sequence. In the first column, you can see the allocations to Account C made by the participant who came immediately before you in your sequence. The two participants described in the next two columns have taken part earlier in your sequence, i.e. these participants have participated before the participant who came before you in your sequence. They participated one after the other.

Note: All participants who come after you in your sequence will learn something about both your and others' allocation decisions, as is illustrated in the bottom half of this table. In addition, they will see the same exact information you see in the top half of this table. In addition, some participants in a different sequence in this study (whose actions do not directly affect your bonus or vice versa) may learn about your and others' allocation decisions, as is illustrated in this table.

	Participant in a different sequence	**The two participants *before* the previous participant in a different sequence**	
	Exact amount allocated	Minimum allocated	Maximum allocated
Account B			
	Participant in your sequence *immediately* before you	**The two participants in your sequence *before* the previous participant**	
	Exact amount allocated	Minimum allocated	Maximum allocated

Account C			

Note: The "minimum allocated" indicates the lowest amount contributed to this account by the two participants before the first-column participant in the different sequence (top half of the table) or by the two participants before the participant before you in your sequence (bottom half of the table), while the "maximum allocated" indicates the highest amount contributed by those two participants, respectively.

Recall that your position in your sequence of participants is randomly decided. If there are at least three participants before you in your sequence, all information in the bottom half of this summary table will be based on the behavior of previous participants in your sequence. (We will tell you at the end of the instructions what happens if there are fewer than three participants before you in your sequence.)

[First Player in Sequence]

What happens if you are randomly chosen to be the first, second or third participant in your sequence?

Some of the instructions on the previous pages will differ slightly if you are the first, second or third participant in your sequence.

What information will the participants who are first, second or third in your sequence see in the summary table?

All other participants in the sequence will also have a summary table with the same rows and columns. This means that you will not know your position in your sequence from looking at the summary table.

If you are the first, second or third participant in your sequence, some or all of the information you will see in the summary table will come from a previous version of this study we conducted before you were invited to this study:

- If it is randomly decided that you are the first participant in your sequence, all information in **the bottom half of** the summary table will reflect decisions in a previous version of the study.
- If there is one participant before you in your sequence (i.e., if it is randomly decided that you are the second participant in your sequence), you will see information on their actual decisions, but the information on the participants before them will reflect decisions made in a previous version of this study.
- If there are two participants before you in your sequence (i.e., if it is randomly decided that you are the third participant in your sequence), you will see information on their actual decisions, but the information on the participant before them will reflect decisions made in a previous version of this study.

While most elements of the previous study were the same as in this study, some participants may have seen different instructions about how the three accounts interacted with other participants. In all cases, however, allocations to Account A always went to the participant themselves and allocations to Accounts B and C always went to, or came from, other participants.

Since your position in your sequence will be decided randomly, you should make your decision as if you could be in any position in your sequence.

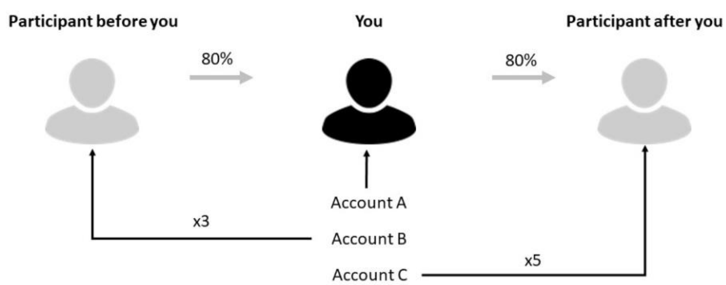
[Follow Up Survey]

The first few questions relate to the instructions you have read and the decision you just made.

Recall that each participant could allocate their endowment of 20 points across Accounts A, B, and C.

- **Account A**: Points allocated to this account will be given to **you**. Points in this account will not be multiplied.
- **Account B**: Points allocated to this account will be multiplied by 3 and given to the participant directly **before you** in your sequence.
- **Account C**: Points allocated to this account will be multiplied by 5 and given to the participant directly **after you** in your sequence (if another participant comes after you, which occurs with an 80% chance).

The following image summarizes these instructions:



Please answer the following question:

How do you think the participant immediately ***after*** you in your sequence will allocate their points to Accounts A, B and C?

For each answer you provide below, you will receive a bonus of 1 point if it is correct.

Account A: ____
Account B: ____
Account C: ____

Please answer the following question:

How do you think the participant immediately ***before*** you in your sequence allocated their points to Accounts A, B and C?

For each answer you provide below, you will receive a bonus of 1 point if it is correct and there exists a participant immediately before you.

Account A: ____
Account B: ____
Account C: ____

For the next question, we will show you a table indicating several possible amounts another participant **could have** allocated to Accounts A, B and C:

Please answer the following question:

For each row of the table, we will ask you to indicate if you think this allocation would be **"socially appropriate"** and "consistent with moral or proper social behavior" or **"socially inappropriate"** and "inconsistent with moral or proper social behavior." By socially appropriate, we mean behavior that **most people agree is the "correct" or "ethical" thing to do.**

At the end of the study, we will randomly select one row of the table corresponding to one possible allocation choice**.** For the choice selected, we will determine which response was selected by the most people in this study. If you give the **same response as that most frequently given by other people**, then you will receive a bonus of 1 point.

Please indicate for each row in the table whether you would find this allocation socially appropriate or socially inappropriate.

A participant's possible allocation across Accounts A, B, and C	Very Socially Inappropriate	Somewhat socially inappropriate	Somewhat socially appropriate	Very socially appropriate
A: 20 points B: 0 points C: 0 points				
A: 0 points B: 0 points C: 20 points				
A: 0 points B: 20 points				

C: 0 points				
A: 10 points B: 10 points C: 0 points				
A: 10 points B: 0 points C: 10 points				
A: 0 points B: 10 points C: 10 points				
A: 10 points B: 5 points C: 5 points				
A: 5 points B: 10 points C: 5 points				
A: 5 points B: 5 points C: 10 points				
A: 12 points B: 5 points C: 3 points				
A: 12 points B: 4 points C: 4 points				
A: 14 points B: 3 points C: 3 points				
Allocate the **same points** to B and C as the **previous** participant				
Allocate **fewer points** to B and C than the previous participant				
Allocate **more points** to B and C than the previous participant				

In this question, you can win an additional amount of points. The amount you can win depends on your own decisions and on chance. In the table below, you can choose one of six options. Each option describes two bonus payments. A virtual coin flip will determine the bonus payment you will receive. In 50% of all cases, you will receive the amount for **Head** and in 50% of all cases you will receive the amount for **Tail**. We will randomly select 20% of participants, for whom we will implement their decisions and pay bonus points accordingly.

Please choose your favorite option among the six options displayed in the table below.

In each option, a (virtual) fair coin is tossed. Each option pays two possible payoffs depending on the outcome. The only exception is option 1 in which the payoff is always 7 points.

Option	If the coin indicates	You earn in Points
1	Heads Tails	7 7
2	Heads Tails	9 6
3	Heads Tails	11 5
4	Heads Tails	13 4
5	Heads Tails	15 3
6	Heads Tails	17 1

Please select your preferred charity from the following menu. On the next screen, we will give you the opportunity to share some money with your chosen charity.

DROPDOWN MENU:

- Macmillan Cancer Support
- Cancer Research UK
- St. John Ambulance
- Guide Dogs
- British Heart Foundation
- Marie Curie
- Samaritans
- Great Ormond Street Hospital
- Alzheimer's Society
- WWF

In this list:

- **<u>Option A</u>** will always be: **you** receive **10 points** and **CHARITY_NAME** receives **nothing**.
- **<u>Option B</u>** will always be: **CHARITY_NAME** receives **some** number of points and **you** receive **nothing**.

As you proceed down the rows of a list, the amount CHARITY_NAME receives will increase from 0 to 30 points. For each row, all you have to do is decide whether you prefer Option A or Option B. Indicate your preference by selecting the corresponding button. Most people begin by preferring Option A and then switch to Option B, so one way to complete this list is to determine the best row to switch from Option A to Option B. We will randomly select 20% of participants, for whom we will carry out the decisions in a randomly selected row in this table.

<u>Option A</u> (CHARITY_NAME receives nothing, you receive …)	**<u>Option B</u>** (you receive nothing, CHARITY_NAME receives …)
10 points	0 points
10 points	2 points
10 points	4 points
10 points	6 points
10 points	8 points
10 points	10 points
10 points	12 points
10 points	14 points
10 points	16 points
10 points	18 points
10 points	20 points
10 points	22 points
10 points	24 points
10 points	26 points
10 points	28 points
10 points	30 points

We now ask you for your willingness to act in a certain way. Please indicate your answer on a scale from 0 to 10. A 0 means “completely unwilling to do so,” and a 10 means “very willing to do so.” You can also use any number between 0 and 10 to indicate where you fall on the scale, using 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10.

How willing are you to give up something that is beneficial for you today in order to benefit more from that in the future?
[Likert scale: 0 … 10]

How willing are you to punish someone who treats **you** unfairly, even if there may be costs for you?
[Likert scale: 0 … 10]

How willing are you to punish someone who treats **others** unfairly, even if there may be costs for you?
[Likert scale: 0 … 10]

How willing are you to give to good causes without expecting anything in return?
[Likert scale: 0 … 10]

How well does each of the following statements describe you as a person? Please indicate your answer on a scale from 0 to 10. A 0 means “does not describe me at all,” and a 10 means “describes me perfectly.” You can use any number between 0 and 10 to indicate where you fall on the scale, using 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10.

When someone does me a favor, I am willing to return it.
[Likert scale: 0 … 10]

If I am treated very unjustly, I will take revenge at the first occasion, even if there is a cost to do so.
[Likert scale: 0 … 10]

I assume that people have only the best intentions.
[Likert scale: 0 … 10]

I am good at math.
[Likert scale: 0 … 10]

I tend to postpone tasks even if I know it would be better to do them right away.
[Likert scale: 0 … 10]

Please indicate the extent to which you agree with the following statements:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I made my decisions in this study carefully.	○	○	○	○	○
I made the decisions in this study randomly.	○	○	○	○	○
I understood what my decisions meant for my payment.	○	○	○	○	○
Please check the option that is on the far left.	○	○	○	○	○
Please check the option that is on the far right.	○	○	○	○	○

We will now ask you a few questions about yourself:

Which gender do you identify with: (man; woman; Other/non-binary; Prefer not to say)

Which race do you identify with (select all that apply): (White American; Black or African American; American Indian or Alaska Native; Asian American; Native Hawaiian or Other Pacific Islander; Other; Prefer not to say)

Please enter your year of birth: (numeric text box)