Everyone Likes to Be Liked: Experimental Evidence from Matching Markets

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Everyone likes to be liked: Experimental Evidence from Matching Markets

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Abstract

Matching markets can be unstable when individuals prefer to be matched to a partner who also wants to be matched with them. Through a pre-registered and theory-guided laboratory experiment, we provide evidence that such *reciprocal preferences* exist, significantly decrease stability in matching markets, and are driven both by belief-based and preference-based motives. Participants expect partners who want to be matched with them to be more cooperative, and are more altruistic themselves. This leads to higher cooperation and larger profits when participants can consider each other's preferences.

Keywords: *Experiment, Market Design, Matching, Reciprocal Preferences, Incomplete Information, Gale-Shapley Deferred Acceptance Mechanism*

JEL Codes: *C78, C91, C92, D82, D83, D91*

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1 Introduction

We often prefer to interact with individuals who also want to interact with us. For example, applicants may reconsider a job offer after learning they were not the first-choice candidate (Antler, 2019).[1] They may realize that an employer who does not favor them will be less invested in their relationship, or they may be less willing to invest in such a relationship themselves. We say that individuals who prefer to be matched with a partner who wants to be matched to them have *reciprocal preferences*.

Reciprocal preferences appear to be particularly relevant in two-sided matching markets, since neither participant can simply choose their partner, but also needs to be chosen. For example, schools seek to know students' preferences to take into account "who wants them most".[2] Preferences of other market participants are typically not disclosed in matching markets. However, agents even modify mechanisms to still attract those who want to be matched with them. To do so, it became common for German universities to only accept medical students who had ranked the respective university favorably.[3] Similarly, Avery and Levin (2010) show that universities use early admission programs to admit highly interested students who, in turn, have lower grade point averages. Such policies, while individually rational, undermine the efficient functioning of matching markets. Opitz and Schwaiger (2022) show theoretically that reciprocal preferences even cause agents to break up their assigned match when centralized matching mechanisms are in place –contradicting the main objective of matching mechanisms to establish stable relations. For this, it is enough that agents observe the final matching and update their beliefs about others' preferences. At the same time, observational data does not allow direct inference of reciprocal preferences, since neither the true preferences of market participants nor their information sets are precisely known.

In this study, we identify reciprocal preferences and their impact on matching markets through a laboratory experiment. The experimental setting allows us to observe participants' preferences under different information sets. We directly test whether agents' preferences are sensitive to information about others' preferences. We hypothesize that participants prefer a partner who ranks them favorably (Aronson & Worchel, 1966; Montoya & Horton, 2012). Therefore, participants change

[1] See also https://www.forbes.com/sites/lizryan/2018/01/20/im-the-second-choice-candidate-should-i-still-take-the-job, accessed 07/18/2022.

[2] Concerns were raised when it came to changes in the school admission system that had left principals uninformed about students' rankings of the schools (see https://www.nytimes.com/2004/11/19/education/council-members-see-flaws-in-schooladmissions-plan.html, accessed 07/18/2022).

[3] While this practice was prohibited by the Federal Constitutional Board in 2017 (*BVerfG, 1 BvL 3/14*, 2017), many institutions still have similar procedures, such as Trinity College in Toronto, which only accepts students who rank the college first.

their preference order after learning how others ranked them, which leads to instability in the matching market.

In the experiment, participants form two-person teams for a Public Goods Game (PGG) through a centralized matching mechanism. During the team-formation stage, participants interact in groups of eight, evenly divided between two sides of the market. Based on personality questionnaire responses, participants indicate with whom from the other market side they would like to play the PGG. They submit a rank-ordered list of potential partners from the other market side to a centralized Deferred Acceptance (DA) mechanism. The DA mechanism theoretically achieves stable allocations in two-sided matching markets, such that no participant benefits from breaking up the formed match (Gale & Shapley, 1962). In our treatment (*Info*), one side of the market receives information about with whom they are tentatively matched and how their potential partners rank them. In our baseline (*No-Info*), this market side never learns how their potential partners rank them and only sees with whom they are tentatively matched. In both treatments, they can subsequently change their preference list, resubmit it to the mechanism, and may get a new partner as a result. Afterwards, the matched partners play a standard PGG, which captures the essential trade-off between collectively beneficial but individually costly contributions to a public good. This design allows us to understand the effects of reciprocal preferences on the stability of matching markets.

We develop a stylized behavioral model to study two possible channels for the emergence of reciprocal preferences in cooperative settings. The first channel is belief-based. It assumes that agents expect partners who like to be matched with them to be more cooperative (i.e., they expect their partner to contribute more in the PGG). The belief that favorable preferences signal a higher match-specific payoff provides a material rationale for reciprocal preferences. The second channel is preference-based. This channel posits that agents derive higher utility from the material well-being of a matched partner who likes them. As a consequence, they prefer to be more cooperative themselves (i.e., they contribute more in the PGG). Both channels imply that being matched with a partner who ranks the agent favorably spurs a higher utility, thereby providing a foundation for reciprocal preferences. This experiment allows us to test both channels.

Our outcome variables stem from the team-formation stage and the PGG. The first set of outcome variables investigates the effect of reciprocal preferences on stability. Achieving stable outcomes is central to matching mechanisms and implies Pareto efficiency (Gale & Shapley, 1962); Opitz and Schwaiger (2022) show that reciprocal preferences can lead to instability when agents update their beliefs about others' preferences after the allocation of the mechanism.[4] We analyze whether

[4]Updating can either happen through directly learning others' preferences (as in the experimental design), or more subtly through observing the final matching and being able to make inferences about the underlying preferences that led to the matching. For a detailed analysis, see Opitz and Schwaiger (2022).

participants change their preference order once they learn how they are ranked by their potential partners, whether these preference changes are indicative of reciprocal preferences, and how this affects stability. The second set of outcome variables is based on subsequent behavior in the PGG and sheds light on belief-based and preference-based channels underlying reciprocal preferences. We test whether reciprocal preferences are belief-based by eliciting incentivized beliefs about the partner's contributions to the PGG. To test the preference-based channel, we focus on conditional contribution decisions. In these decisions, we isolate altruism from the beliefs about a partner's contribution.

The main results can be summarized as follows: First, agents adjust their preferences significantly more often when they observe their potential partners' preferences (*Info*) than when they do not (27.67 vs. 9.67 percent). We find that preference adjustments in *Info* are consistent with reciprocal preferences. Participants rank those who rank them favorably higher than those who do not - they *like to be liked*. Second, these preference adjustments translate into significantly more unstable matchings in *Info* than in *No-Info* (40.00 vs. 10.67 percent). This outcome provides strong evidence that reciprocal preferences can inhibit the desired functioning of matching mechanisms. Third, our results indicate that both belief-based and preference-based motivations underlie reciprocal preferences. We show that participants hold (accurate) beliefs that someone who likes to be matched with them will be more cooperative. In this sense, revealed preferences signal the future value of the match, providing a profit-maximizing rationale for working with someone who likes you. In addition, we find evidence that participants act more altruistically towards those who indicated a preference towards them, providing support for a preference-based foundation. Lastly, in *Info*, we document higher average cooperation and profits.

Our findings contribute to a better understanding of matching markets, team formation, and team behavior. First, we contribute to the growing experimental literature on matching markets (see Hakimov & Kübler, 2021, for a review). This literature attempts to uncover factors that limit the efficient functioning of matching markets because they affect agents' strategies. We are the first to study reciprocal preferences experimentally, and investigate whether outcomes of the DA mechanism remain stable. In this way, we test the empirical stability of the DA mechanism when others' preferences are revealed. Closest to this is previous work on the impacts of information about other participants' preference profiles and reporting strategies in one-sided (Pais & Pintér, 2008) and two-sided centralized markets (Pais, Pintér, & Veszteg, 2011; Shimada, 2022) on truth-telling.[5] While

[5]In Shimada (2022), experimental participants are matched with computerized players. When computerized players apply a strategy in which a participant moves up in their preference list if the participant evaluates them favorably (i.e., in our terminology they are programmed to have reciprocal preferences), participants misrepresent their preferences as a response. This is similar to theoretical results in Opitz and Schwaiger (2022).

these papers center on the extent to which agents use additional information to misrepresent their preferences strategically across mechanisms, we are interested in the causal effect of knowing one's rank in the preference order of potential partners on stability.

Second, we contribute to social preferences, team formation, and cooperation literature. Individuals often prefer to interact and team up with agents who are similar to them, which is known as *homophily* (McPherson, Smith-Lovin, & Cook, 2001). Homophily can be observed in experimental settings (Currarini & Mengel, 2016; R. Chen & Gong, 2018), as well as economic settings (e.g., the choice of co-workers and entrepreneurial teams (Hedegaard & Tyran, 2018; Boss et al., 2021)). Self-selected teams display higher satisfaction, collaborative spirit, and effort (R. Chen & Gong, 2018; Boss et al., 2021), while results on performance are mixed.[6] We contribute to the organizational literature on efficient team formation by highlighting the role of reciprocal preferences. We show that for an individual not only the similarity with their potential team partners matters, but also their partners' preferences.

Moreover, individuals are more likely to cooperate with those they perceive as similar. People are more cooperative if they perceive others to belong to the same group (Akerlof & Kranton, 2000), where social identity may either be fostered through previous interaction (Eckel & Grossman, 2005), or by a shared preference (e.g., Y. Chen & Li, 2009, with a minimal group paradigm). Consequently, social proximity can overcome market imperfections (Chandrasekhar, Kinnan, & Larreguy, 2018; Jain, 2020), leading to higher levels of altruism (Leider et al., 2009; Goeree et al., 2010). Given that similar people also like each other, our paper provides an explanation for why similarity leads to higher cooperation. This is in line with recent literature showing that mutual dislike often hinders team performance (Gerhards & Kosfeld, 2020).

Lastly, people also treat those who have been generous towards them more favorably (Akerlof, 1982). We extend the recent literature on reciprocity towards non-monetary gifts (Kube, Maréchal, & Puppe, 2012; Bradler et al., 2016). In our experiment, receiving a favorable rank can be interpreted as a non-monetary gift, which leads to higher cooperation. With this, we show that interpersonal preferences are another currency of reciprocity, most closely related to the idea in R. Dur (2009) that "employees care more for their manager when [...] their manager cares for them".

The paper is structured as follows: Section 2 presents our experimental design, Section 3 outlines our hypotheses and results on reciprocal preferences at the matching stage. Section 4 illustrates the underlying channels through a stylized model, and investigates these channels empirically. Finally, we discuss and conclude in Section 5.

[6] See Horwitz and Horwitz (2007) for a broader discussion on homophily and (workplace) performance.

2 Experimental Design

Research Questions Through our experimental design, we examine three main research questions. First, do participants have reciprocal preferences? Second, do reciprocal preferences lead to instability in matching markets? Third, what are the mechanisms underlying the change in stated preferences? To address these questions causally, we exogenously manipulate information structures between treatments. This provides us with the necessary variation that observational data cannot give us to identify reciprocal preferences, their underlying mechanisms, and their implications for matching markets.

Overview The pre-registered experiment consists of three main parts.[7] In Part I, we collect self-reported personality data. In Part II, participants form two-player teams through a centralized matching mechanism and play a PGG within the formed dyads. Participants indicate with whom they would like to team up based on their potential partner's personality profiles from Part I. In Part II, we compare behavior under two information structures in a between-subject design. In the treatment condition (*Info*), participants on one side of the market learn how their potential partners ranked them before submitting their final preference ranking. In *No-Info*, participants never know how their potential partners ranked them. In Part III, we elicit beliefs about the PGG contribution of their team partner and collects control variables (loss aversion/ cognitive ability/ gender). The design is visualized in Figure 1.

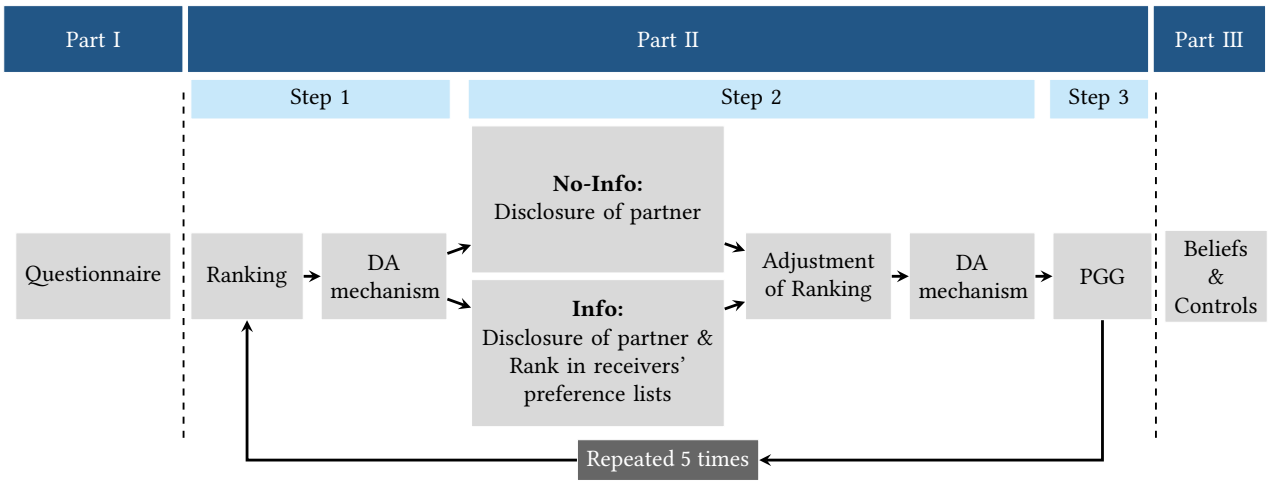


Figure 1: Design Overview

Part I All participants fill out a personality questionnaire with 15 items on a four-point Likert scale. It contains five statements each on personality traits, preferred leisure activities, and societal

[7]The preregistration of our design, as well as a detailed pre-analysis plan can be found at AEARCTR-0007551.

opinions (see Appendix B.2 for the complete questionnaire). Since the later ranking is based on answers to these questions, they are intended to give an impression about the respondent.[8]

Part II Participants are randomly assigned to one of two market sides. As it is standard in two-sided markets, these roles are referred to as proposers and receivers.[9] In each *matching market*, there are four proposers and four receivers. The centralized DA mechanism (Gale & Shapley, 1962) forms four teams, consisting of one proposer and one receiver. We rely on the DA mechanism because of its theoretically desirable properties, in particular because the final allocation is stable under standard assumptions. This procedure is the same in every *matching market*. Part II consists of three steps.

Step 1 Proposers and receivers submit a rank-ordered list of their potential partners. Proposers rank the four receivers in their *matching market* according to the desirability to be matched with them and vice versa. Teams are tentatively formed through the centralized DA mechanism, which matches one proposer with one receiver for the upcoming PGG.[10] Participants submit their preferences based on questionnaire responses from Part I. Each proposer in the *matching market* sees the same five randomly chosen answers from each receiver. The receivers see the answers to five different questions randomly selected among the remaining ones.[11] After the participants submit their rank-ordered lists, the DA mechanism forms the tentative allocation.

Step 2 Proposers can submit a revised preference list to the DA mechanism. We vary the information between our two treatments *Info* and *No-Info*. In *No-Info*, proposers see with whom they have been matched in the first step. In *Info*, a proposer receives additional information on how all receivers ranked him. After examining this information, proposers decide on whether to revise their preference list and re-submit it to the DA mechanism. Receivers do not play an active role in this step as their preferences remain fixed. Furthermore, they never learn that proposers can adjust their preferences. Proposers know that receivers never learn about proposers' preferences (and changes thereof). The DA again forms a tentative allocation. Then, one of the two tentative allocations (Step 1 or Step 2) is implemented with equal probability.

[8] At the same time, the answers should not provide clear information about their cooperation behavior to minimize the initial correlation of preferences on each market side. In the extreme case, every participant on one side of the market submits the same preferences to the mechanism. Then, *reciprocal preferences* do not affect the outcome, because all potential partners are equally inclined to cooperate with one.

[9] In the beginning of Part II, participants are informed about their role, and receive detailed instructions on the procedures of the team-formation process and the PGG (see Appendix B).

[10] This means that we study a setting of two-sided matching in a one-to-one matching market, often referred to as a *marriage market* following Gale and Shapley (1962).

[11] The intuition for sharing distinct questions is to minimize the initial correlations between preferences across market sides. If similarity is a relevant determinant for the choice of a partner (*homophily*), different questions provide different information about similarity, which reduces the correlation of preferences. In the extreme of perfect correlation, everyone is already matched with the partner they prefer most and that prefers them most, such that *reciprocal preferences* do not affect the outcome.

Step 3 The formed dyads play a two-player PGG in the final step of Part II. Both partners receive an initial endowment of 10 Taler (experimental currency) to be either allocated to a private account or to be contributed to a public account. The contributed amount of each partner $c_i \in \{0, 1, ..., 10\}$ is referred to as the unconditional contribution. The sum of both players' contributions to the public good is multiplied by 1.5, and divided equally between the two. This leads to the following payoff function for a participant i: $\pi_i = 10 - c_i + 0.75 * (c_i + c_j)$. The marginal per capita return of 0.75 implies that free-riding ($c_i = 0$) is the dominant strategy from an individual perspective. However, since the sum of marginal returns is greater than 1, contributing the entire endowment of 10 Taler maximizes the team surplus. In addition to the unconditional contribution, proposers also fill in a table indicating their contribution for every possible contribution of their matched partner, referred to as their conditional contributions (Fischbacher, Gächter, & Fehr, 2001). Receivers only state their unconditional contribution.[12] The final payoff for the receiver depends on the stated unconditional contributions of both players. The final payoff for the proposer depends on the receiver's unconditional payoff and on the proposers conditional or unconditional contribution.

Part III We complement the contributions to the PGG with incentivized point beliefs about partner's unconditional contribution, for both proposers and receivers (Gächter, Kölle, & Quercia, 2017). We do not announce the belief elicitation before, to rule out that expectations about the ability to judge the behavior of another player influence preference submission.

We also elicit proxies for cognitive ability, loss attitudes, and socio-demographic controls. Proposers with higher cognitive abilities may be more likely to perceive receivers' preferences as signals for their contribution and adjust their preferences strategically. We use Raven's Matrices as a proxy for cognitive ability.[13] Participants are given 5 minutes to complete increasingly difficult Raven's Matrices, scored on the number of correct answers minus the number of incorrect answers. High degrees of loss aversion may make participants less likely to adjust their preferences if they feel attached to their current partner. Although unlikely given the information sets of participants in our experiment, (expectation-based) loss aversion may influence initial reporting strategies (Meisner & von Wangenheim, 2022). Hence, we elicit an incentivized measure of loss aversion in risky choices (Gächter, Johnson, & Herrmann, 2022). Before concluding the experiment, participants complete a short socio-demographic questionnaire.

[12] This circumvents the problem with conditional contributions that the standard (unique) Nash-Equilibrium of not contributing anything requires common knowledge of rationality (Fischbacher, Gächter, & Fehr, 2001, Footnote 6). In light of a substantial fraction of conditional cooperators in previous PGG experiments, we do not want to assume this and let receivers only make an unconditional contribution decision (which is known to the proposers).

[13] The Raven's Matrices test is a leading non-verbal measure of analytic intelligence, test scores are associated with the degree of sophistication in the beauty contest (Gill & Prowse, 2016), in manipulable matching mechanisms (Basteck & Mantovani, 2018), as well as with more accurate beliefs (Burks et al., 2009).

Repetitions We repeat Part II five times. During each repetition, participants play within a new *matching market* of randomly selected participants. Roles as proposer or receiver remain constant across rounds. To minimize the influence of earlier rounds on later rounds, participants do not receive feedback between rounds. Furthermore, by displaying only a subset of questionnaire responses in each round and randomly assigning participants to *matching markets*, we minimize the possibility that participants may identify others across rounds.

Payoffs and Incentive Compatibility One round of the PGG is randomly chosen to be payoff relevant. Participants earn money through their final payoff from the PGG (determined by their own and their partner's contribution choice) in one of the five rounds. For proposers, we randomize whether their conditional or their unconditional contribution is implemented. Through the compensation in the PGG, we incentivize the submission of truthful rank-ordered lists. To guarantee that both the initial submission, as well as the potentially revised preference order are incentive compatible, one of the two is implemented with equal probability to determine the final matching. We incentivize the point beliefs about their partner's contributions. Participants receive a fixed amount if their stated belief corresponds to the actual unconditional contribution, and they receive no payment otherwise. Additionally, participants are paid based on their performance in the Raven's matrices task and the loss attitudes elicitation.

Experimental Procedures The experiment was conducted at the Munich Experimental Laboratory for Economic and Social Sciences (MELESSA). In total, 235 student participants participated in the experiment. The participants were recruited using the online system ORSEE (Greiner, 2015). The experiment was programmed with the software oTree (D. Chen, Schonger, & Wickens, 2016). We conducted 10 sessions (5 sessions per treatment, each with a desired number of 24 participants). On average, participants earned 21.5 EUR (including a show-up fee of 6 EUR). The experiment lasted about 80 minutes.

3 Reciprocal Preferences in Matching Markets

Our experimental design test the hypothesis that proposers adjust their preferences in *Info* to be matched with a receiver who wants to be matched with them, which in turn leads to a different matching outcome (instability). In pre-registered analyses, we test whether proposers adjust their preferences more often in *Info*, whether these adjustments lead to higher instability, and whether they display reciprocal preferences. Exploratory analyses that were not pre-registered are marked as such.

3.1 Instability of the Deferred Acceptance Mechanism

Proposers change their individual preferences more often when they see their potential partners' preferences (*Info*) compared to when theydo not see the receivers' preferences (*No-Info*).

Result 1. *The fraction of preference adjustments in Info is 27.67 percent, while it is only 9.67 percent in No-Info. This difference is significant ($p < 0.01$; Mann-Whitney-U test (MWU)).*

Regression analysis in Table A.1 in Appendix A.2 confirms that the fraction of preference adjustments is significantly higher in *Info*.

As a consequence of more frequent preference adjustments, the fraction of *matching markets* where the rematching outcome changes after the rematching stage is larger under *Info*. Instability of a matching is defined at the *matching market* level. We compute the resulting matching with both the initial and the (potentially) revised preference list. A matching is stable when both resulting matchings are the same (i.e., if all participants are matched to the same partner). Otherwise, a matching is unstable. This implies that a matching market is unstable if at least one of the proposers changed their preferences list, and this change led to a different market outcome. A change in reported preferences leads to a different outcome only if it results in a proposer-receiver pair that prefers to be matched to each other compared to their current match. The fraction of unstable matchings is substantially larger under *Info* than under *No-Info*. Hence, a *matching market* is nearly four times more often unstable under *Info* than under *No-Info*.

Result 2. *There is significantly higher instability in Info than in No-Info. The fraction of unstable matching markets in Info is 40.00 percent; it is only 10.67 percent in No-Info ($p < 0.01$;χ^2 test).*

Thus, we conclude that proposers are more likely to adjust their preference ranking when they see the preferences of receivers, leading to instability in the DA mechanism.

3.2 Reciprocal Preferences and Preference Adjustments

Proposer's preference changes indicate the presence of reciprocal preferences. For each preference adjustment, we can classify whether it is consistent with the participants having reciprocal preferences or not. A proposer's preference adjustment is *consistent* with reciprocal preferences if the now more favorably ranked receiver(s) gives a strictly better rank to the proposer compared to the now less favorably ranked receiver(s). Formally, this requires that if $Proposer\ P$ switches the position of $Receiver\ R$ and $Receiver\ S$, and $Receiver\ R$ was the initially more preferred candidate, then $Proposer\ P$ must have been ranked strictly better by $Receiver\ S$ than by $Receiver\ R$.[14]

[14]For a formal introduction of reciprocal preferences into matching markets, we refer the interested reader to Opitz and Schwaiger (2022).

Our results strongly support that preference adjustments largely reflect *reciprocal preferences*. In *Info*, 73.68 percent of the adjustments are consistent with *reciprocal preferences*. This compares to a fraction of 20.69 in *No-Info* where participants could not systematically react to others' preferences.[15] The difference between both conditions is significant ($p<0.001$; MWU). Table A.2 in Appendix A.2 confirms these findings through a logit regression, documenting a significantly higher likelihood of a consistent preference adjustment (compared to an inconsistent adjustment or none) in *Info*, both in a uni-variate regression (Column 1) and when adding individual-level controls (Column 2).[16]

A more detailed exploratory analysis of the determinants of preference adjustments supports the conjecture that proposers' preference adjustments reflect *reciprocal preferences* (see Table A.5 in Appendix A.3). First, the more favorably a proposer ranks their initial partner, the lower the likelihood that the proposer will adjust preferences. This holds true both in *No-Info* (Column 1) and *Info* (Columns 2 & 3). Second, receivers' preferences matter when deciding whether to adjust the preference ranking in *Info*. Being liked by the (tentatively) matched receiver lowers the likelihood that a proposer adjusts their preferences. At the same time, being a preferred candidate by other (non-matched) receivers increases the likelihood of adjusting preferences. Column 2 shows that a more favorable average rank by the non-matched receivers increases the likelihood of adjusting the preference ranking; Column 3 confirms this pattern by estimating the effect of the best rank received by one of the other three receivers. That proposers in *Info* are less likely to adjust preferences when their matched partner ranked them favorably, and more likely when the other potential partners ranked them favorably is entirely consistent with reciprocal preferences.

Result 3. *Preference adjustments are largely reflecting reciprocal preferences in Info, as 73.68 percent of the adjustments are consistent with reciprocal preferences (while this fraction is only 20.69 percent in No-Info).*

[15] If participants switched the position of two receivers in the preference lists randomly, we would expect 20.9% of the adjustments to be consistent with reciprocal preferences by chance. 24 out of 29 preference adjustments in *No-Info* are such that (only) two receivers switch their position. In more complex cases, the probability of a random adjustment being consistent with reciprocal preferences is even lower.

[16] In the loss attitude task (Gächter, Johnson, & Herrmann, 2022) individuals are asked to choose between no payment and a risky lottery with one negative and one positive outcome. Every individual makes several decisions. We keep the positive outcome fixed at 6 Euro, the negative outcomes varies between a loss of 2 and 7 Euro. 2.55 percent of the participants maximize expected payoffs. While the fraction of participants accepting negative expected earnings is negligible (1.28 percent), the vast majority of the participants reject gambles with a positive expected value. The modal response is to accept gambles when the expected value is larger than 2 EUR and reject them otherwise. Loss aversion is defined as the lottery where a participant switches from accepting to rejecting it. For example, if a participant accepts all lotteries, this is coded as 1. If a participant accepts no lottery, this is coded as 7. Cognitive ability is calculated by the number of correctly solved matrices, minus the number of incorrectly solved ones. Out of 10 matrices, participants achieve an average net score of 6.23. 2.55 percent of participants did not solve any matrix correctly, while 5.53 percent solved all 10 matrices correctly.

Beyond establishing that information about others' preferences leads to higher instability, and that the preference changes are consistent with reciprocal preferences, our design allows us to pin down the underlying channels for these preference changes.

4 Mechanisms Underlying Reciprocal Preferences

In this section, we analyze the channels underlying reciprocal preferences using a theoretical model, which we then test empirically. In Section 4.1, we derive the optimal strategy of a proposer in a stylized version of the experimental *Info* condition and differentiate between belief-based and preference-based mechanisms. In Sections 4.2-4.4, we put the model's assumptions and implications to the empirical test.

4.1 Theoretical Framework

Two proposers (*he*) $p \in \{P, Q\}$ and two receivers (*she*) $r \in \{R, S\}$ participate in a simplified version of the matching market. The DA mechanism forms two teams, each with one proposer and one receiver, to play a PGG.[17] In this model, we allow proposers to be altruistic. Each proposer cares about their own direct (monetary) utility $u_p(\pi(c_p, c_r))$ which depends on the monetary payoff $\pi(c_p, c_r)$. The monetary payoff $\pi(c_p, c_r)$ is determined by both partners' contributions $c_{p,r} \in [0, 10]$. Selfish proposers ($a_p = 0$) follow a profit-maximizing strategy and free-ride ($c_p = 0$). Altruistic proposers ($a_p \geq 0$) care not only about their own direct (monetary) utility, but also about their matched partner's direct utility (u_r). The level of altruism $a_p \in [0, 1)$ towards the receiver depends on how likable the proposer perceives the receiver to be.

The core of our experimental treatment *Info* is that applicants learn how receivers rank them. We make two main assumptions about why this matters. Fist, we assume that the level of altruism is determined by the proposer's initial assessment of the receiver (l_p), and on how likable the receiver perceives him (l_r) to be. The level of altruism increases in l_p and l_r.[18] In other words, we assume that agents are more altruistic towards partners they like (Leider et al., 2009) and that "receiving information that another is attracted to you is a powerful determinant of liking" (Montoya & Horton, 2012). In our context, we assume that the receiver's rank is informative about l_r.[19]

Assumption 1. *Preference-based mechanism: The level of altruism (a_p) increases in l_r.*

[17] Section 2 offers a detailed description of the PGG and the DA mechanism. While participants in the experiment make discrete contribution choices, in Section 4.1 we assume that these are continuous.

[18] We assume that $l_{r,p}$ is a natural number.

[19] This is related to the idea of R. Dur (2009) that agent i's altruism towards another agent j depends the altruism of agent j towards agent i (which agent i infers from some action of agent j).

Second, we assume that receivers contribute more to the PGG when being matched to a proposer they rank favorably. Proposers perfectly know the relation between the receivers' ranking (l_r) and their contributions' (c_r).

Assumption 2. *Belief-based mechanism: Receiver's contributions (c_r) increase in l_r.*

The direct (monetary) utility function $u_{p,r}$ is positive, monotonically increasing, continuous, and concave in the monetary payoff $\pi_{p,r}$ and has the same functional form for all agents. The adjusted utility of a proposer is given by:[20]

$$v_p = u_p(\pi_p(c_p, c_r)) + a_p(l_p, l_r) \cdot u_r(\pi_r(c_p, c_r))$$

These utility functions predict 1) how a proposer optimally selects his partner and 2) how he decides about his contributions to the PGG. The timing of the model mirrors our experimental design in *Info*. First, proposers and receivers submit their preferences to the DA mechanism. At this point, the proposer has no information about l_r, his belief is the same for both receivers ($\hat{l_R} = \hat{l_S}$). This implies that proposers base their decision solely on l_p. Then, proposers learn the true preferences of both receivers (l_R, l_S). As proposers have (a priori) no information about l_r, being ranked first provides a weakly positive update about l_r while being ranked second presents a weakly negative update about l_r. Afterwards, proposers can adjust their ranking and play the PGG with their matched receiver. We solve the model by backward induction, first describing the contribution decisions before examining the implications for preference changes.

When matched with a receiver, a proposer optimizes by choosing his contribution to the PGG. Increasing the contribution level lowers his monetary outcome while raising the matched receiver's payout. The proposer's adjusted utility is maximized if the decrease in his marginal direct utility equals the increase in the matched receiver's marginal utility times the altruism factor towards her (altruism utility).

$$\max_{c_p} v_p : u_p(\pi_p(c_p, c_r) + a_p(l_p, l_r) \cdot u_r(\pi_r(c_p, c_r) \tag{1}$$

$$\frac{\partial v_p}{\partial c_p} = \underbrace{\frac{\partial u_p}{\partial c_p}}_{<0} + \underbrace{a_p(l_p, l_r) \cdot \frac{\partial u_r}{\partial c_p}}_{>0} = 0 \tag{2}$$

Following the optimization problem of the proposer, we give a short overview of the model's main predictions.[21] These proofs can be found in Appendix A.1.

[20] The idea of direct (monetary) utility and adjusted utility is first described by Levine (1998).

[21] The second order condition holds ($\frac{\partial^2 v_p}{\partial c_p^2} = \frac{\partial^2 u_p}{\partial {c_p}^2} + a_p \frac{\partial^2 u_r}{\partial {c_p}^2} < 0$).

Proposition 1. *An increase in l_r has a non-negative effect on the contribution of a proposer c_p.*

We assume that the level of altruism a_p (Assumption 1) and receiver's contribution $\hat{c_r}$ (Assumption 2) increase in l_r. If l_r increases, both channels then increase the proposer's contribution c_p in the case of an interior solution. First, as the level of altruism a_p increases, a proposer benefits more from the receiver's monetary payoff. Hence, the proposer's contribution c_p increases. Second, the higher contribution of the receiver decrease the proposer's marginal direct (monetary) utility and increase the receiver's marginal direct monetary utility. To equalize these marginal benefits (weighted by the altruism factor), the proposer increases his contribution.

Proposition 2. *A change of preferences for proposer P can only happen if a receiver R, whom proposer P initially ranked worse than receiver S, ranks him better than receiver S.*

If the proposer observes that he is ranked first by a receiver, he positively updates l_r. This change increases the proposer's adjusted utility of being matched with the receiver. Through a higher l_r (and hence a higher a_p and $\hat{c_r}$), the proposer both expects a higher monetary outcome for himself and cares more about the receiver. Both effects result in a higher contribution and lead to a higher utility for the proposer.

We can now derive the proposer's preferences over receivers and show why these preferences may change. A proposer ranks receivers based on his expected adjusted utility v_p of being matched with them if a strategy-proof mechanism is applied. His preference order can change upon learning how the receivers rank him. A positive update about l_r (weakly) increases the adjusted utility of being matched with a receiver. The reverse is true for a negative update. Therefore, a change of preferences can, for example, happen if the proposer initially ranked receiver R over receiver S, but then learns that he was ranked first by receiver S, and second by receiver R. This can, but need not, change the proposer's preference order. For an altruistic proposer ($a > 0$), these changes can be driven by preference-based and belief-based motives. For selfish proposers ($a = 0$), changes are entirely driven by beliefs about others' contributions. Selfish proposers will never contribute, but want to be matched to the highest contributing receiver.

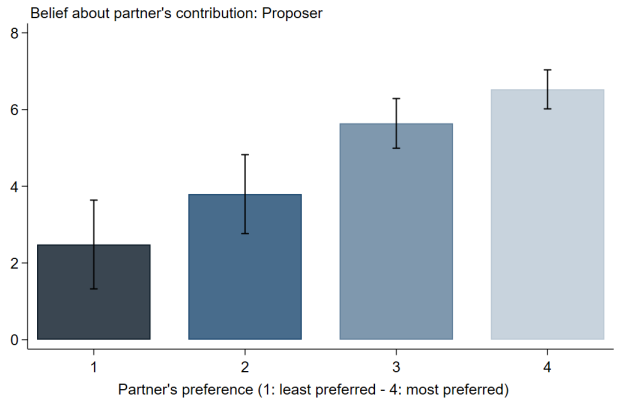
Our model predicts preference changes consistent with reciprocal preferences (see Results 1 and 3). It highlights two channels for this behavior. First, participants change their preferences because they expect partners who like them to contribute more to the PGG. Preferences are interpreted as a signal about the match-specific value, and proposers change their preferences accordingly (belief-based). Second, a proposer may prefer to be matched with a receiver who liked them because he is more altruistic towards such a receiver (preference-based). Our results on the PGG behavior allow

us to test whether preference-based or belief-based reasons explain the adjustments in *Info*, and how these adjustments translate into cooperative behavior.

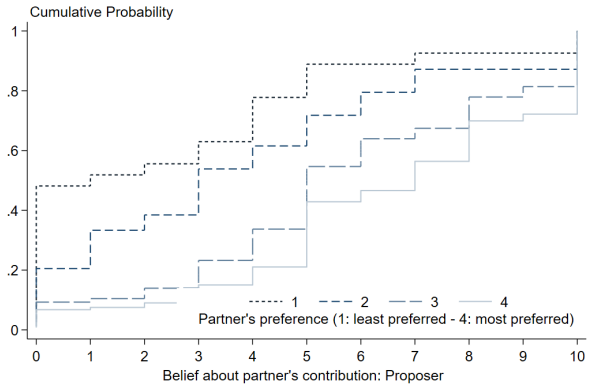
4.2 Evidence for a Belief-Based Mechanism

We test the belief-based channel by analyzing (incentivized) beliefs of proposers about their matched receivers' contributions depending on how their partner ranked them. This means that we directly test our model's key Assumption 2 – that the receivers' preferences (l_r) are perceived as a signal about their contributions ($\hat{c_r}$). We first show that the receiver's preferences are indeed perceived as a signal about their contribution. We then demonstrate that these beliefs are accurate.

We find that proposers expect receivers who rank them better to contribute more to the PGG. Figure 2 shows this plotting beliefs over *Partner's preferences (1-4)*. This variable takes the value of four if the proposer was the matched receiver's most preferred choice, three if the participant was the second most preferred choice, and so on. Panel A shows that mean beliefs about the matched receiver's contribution increase with the receiver's preferences. Panel B illustrates this trend by presenting cumulative distribution functions. It shows, for example, that only 6.77 percent of proposers believe that their partner will contribute nothing when they were their partner's first choice. By comparison, 48.15 percent believed their partner will not contribute anything to the public good when they were their partner's least preferred choice.



A) Averages by *Partner's Preference*



B) Distributions by *Partner's Preference*

Notes. This figure displays the beliefs of proposers in *Info* about the unconditional PGG contributions of their matched receiver by the preferences of the matched partner. *Partner's preferences (1-4)* takes the value of four if the participant was the most preferred choice of their matched partner, three if the participant was the second most preferred choice, and so on. Panel a) shows averages, Panel B) the cumulative distribution functions.

Figure 2: Beliefs about Receiver's PGG Contributions: Proposers in *Info*

Table 1 corroborates that proposers expect receivers who like to be matched with them to contribute more. The effects are sizable (Column 1), and remain so when controlling for the round and individual-level characteristics of the proposer (Column 2). Proposers expect matched receivers

to contribute around 1.4 Taler (out of 10) more if they are ranked one place better on the receiver's preference list. This expectation is consistent with the notion that the expression of interest is "one cue to identify someone who is likely to act [...] cooperatively" (Montoya & Insko, 2008, p.478). Given such beliefs, a proposer may expect a change in their preference order to be payoff-maximizing if it results in being matched with a receiver who prefers them as a partner.

Table 1: PGG Behavior of Proposers in *Info*

	Belief Partner Contribution		Unconditional PGG Contribution		Avg. Conditional PGG Contribution	
	(1)	(2)	(3)	(4)	(5)	(6)
Partner's preference (1-4)	1.348***	1.382***	.771***	.794***	.415***	.416***
	[.977,1.720]	[.915,1.849]	[.350,1.193]	[.340,1.248]	[.128,.702]	[.147,.685]
Preference for partner (1-4)	-.073	-.059	.105	.146	.013	.026
	[-.437,.291]	[-.445,.328]	[-.219,.429]	[-.172,.463]	[-.182,.209]	[-.159,.212]
Round		.064		-.197***		-.119**
		[-.118,.245]		[-.338,-.055]		[-.214,-.023]
Loss Aversion		-.795***		-.710**		.040
		[-1.389,-.201]		[-1.408,-.012]		[-.429,.509]
Cognitive Ability (Raven's)		.500*		.337		-.159
		[-.037,1.037]		[-.347,1.021]		[-.557,.239]
Male		-.025		-.589		-.605
		[-1.434,1.383]		[-2.273,1.096]		[-1.581,.371]
Observations	285	285	285	285	285	285

Notes. OLS Regressions. *** p <0.01, ** p <0.05, * p <0.1. Standard errors clustered at the individual level. The values in square brackets represent the 95% confidence intervals.
Partner's preferences (1-4) takes the value of four if the participant was the most preferred choice of their matched partner, three if the participant was the second most preferred choice, and so on. *Preference for partner (1-4)* takes the value of four if the matched partner was the first choice of the participant, three if the matched partner was the second choice, and so on. *Round* is a count variable, indicating the number of the current round (Round 1-5). *Loss aversion* and *Cognitive ability* are calculated as detailed in Footnote 16, *Male* is an indicator taking the value of 1 if a participant indicated to identify as male.

Result 4. *Proposers expect a significantly higher unconditional contribution from receivers who rank them better ($p < 0.01$).*

The beliefs of proposers are in line with receivers' actual cooperation behavior. Figure A.2 displays that receivers contribute more to the PGG when matched with proposers they prefer. Table A.3 shows that each rank the matched proposer is up in the preference list leads to a 0.96 Taler higher contribution to the PGG in the preregistered specification of Column 2, Table A.3.[22] Thus, proposers correctly expect receivers' preferences to influence their contribution decisions.

In sum, we provide evidence for a belief-based mechanism underlying reciprocal preferences. We show that proposers rationally expect higher contributions from receivers who rank them favorably, which provides a rationale for the observed preferences adjustments.

[22]Our design does not allow us to disentangle the underlying reasons for higher contributions by receivers. Still, our data is consistent with receivers (partly) contributing more when they like their partner, because they expect proposers they rank favorably list to contribute more to the PGG than proposers they rank less favorably (see Figure A.3 and Table A.7 in the Appendix). As receivers do not know that proposers learn their given rank, receivers believe that they can identify high-contributing proposers. In light of our findings that none of the personality questions predicts contributions in the PGG (see Table A.6), these beliefs turn out to be wrong.

4.3 Evidence for a Preference-Based Mechanism

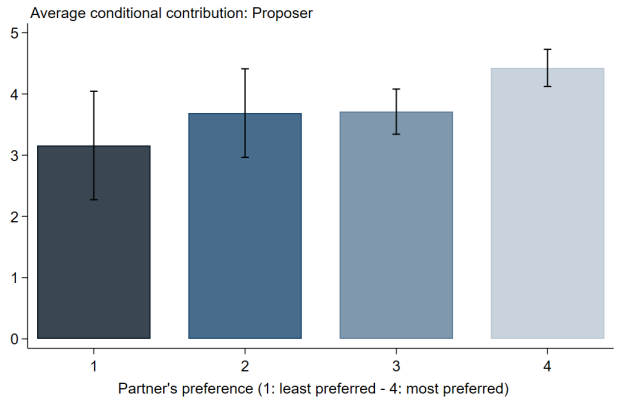
We test whether preference-based explanations play an additional role for reciprocal preferences by analyzing proposers' conditional contributions. Conditional contributions are independent from beliefs about the partners' contribution and, therefore, directly informative about the level of altruism (a_p). If proposers conditionally contribute more when interacting with a receiver who ranked them favorably, this implies higher altruism. Hence, we can directly test whether altruism is sensitive to the partner's preferences (l_r), which we presume by Assumption 1.

Proposers provide higher conditional contributions when matched to a receiver who ranks them favorably. Their average conditional contributions increase monotonically in the position on the receiver's preference list (see Figure 3, Panel A). Across the eleven conditional contribution decisions, they contribute around 0.4 Taler more for each spot they are ranked better (see Table 1). These averages mask an interesting heterogeneity, which we investigate in an exploratory analysis. Figure 3, Panel B shows that this difference in behavior is especially pronounced when facing higher contributions of the partner. The sub-figure plots the regression coefficient of the partner's preferences for each of the eleven contribution decisions, given the specification in Table 1, Column (6). For low contribution values of the receiver, the receiver's preferences do not strongly impact proposers' behavior. For example, proposers do not condition their contributions on whether a free-rider wants to be matched with them or not. However, receivers' preferences become an important determinant of proposers' conditional contributions when receivers make higher contributions. Proposers are then more altruistic towards receivers that indicate a preference to be matched with them.

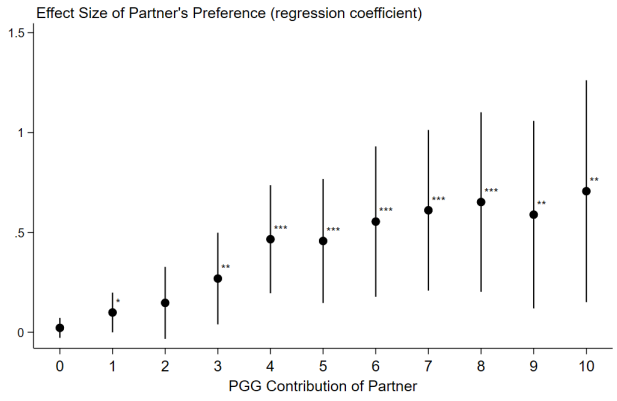
Result 5. *The conditional contributions of proposers are significantly higher when they interact with a receiver who ranked them favorably, especially for high levels of contributions by the receiver ($p < 0.01$).*

This provides evidence that preference-based explanations are important for the observed behavior. We document higher social preferences towards receivers who rank the proposer favorably. Reciprocal preferences are therefore likely to stem both from preference-based and belief-based factors.[23]

[23] Table A.4 in the Appendix corroborates the robustness of these results in pre-registered analyses, showing that these are specific to the information environment in *Info*.



Notes. This figure displays the average conditional contributions of proposers in *Info* by the preferences of matched receiver.



Notes. The figure plots the regression coefficients β_1 of the regressions $y_i = \beta_1 * Partner's\ preference + \beta_2 * Preference\ for\ partner + \beta_3 * t + \beta_4 * X_p$, corresponding to Table 1 with t indicating the round, and X_p as a vector consisting of gender, cognitive ability, and loss aversion. The outcome variables y_i is the conditional contributions of a proposer for any (unconditional) contribution $i \in 0, 10$ of the matched receiver. *** p <0.01, ** p <0.05, * p <0.1

A) Averages by *Preference for Partner* B) Coefficient Plot

Figure 3: Average Conditional PGG Contributions: Proposer in *Info*

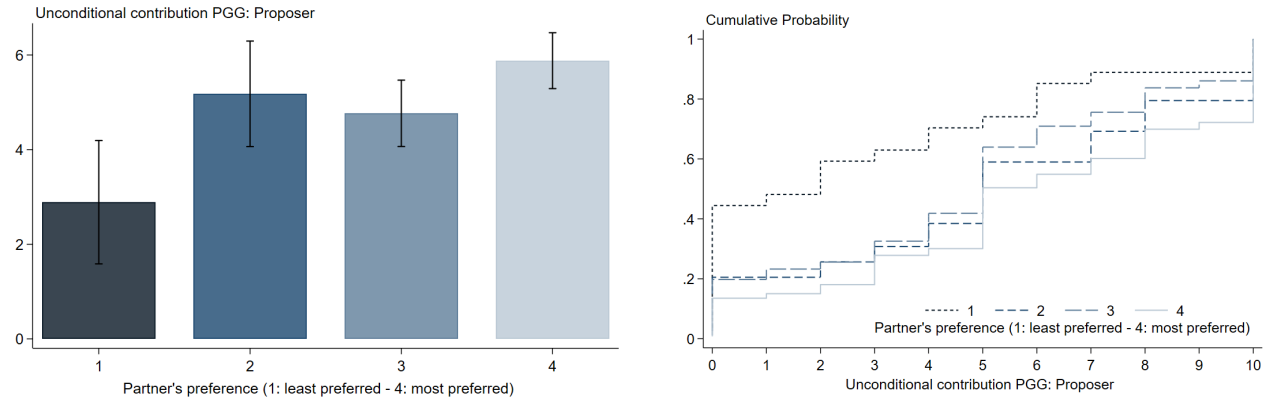
4.4 Unconditional Cooperation

Unconditional contribution decisions inform about the overall effect of reciprocal preferences in one-time simultaneous cooperation. Higher altruism (preference-based) leads to higher unconditional contributions. Higher beliefs about the contributions of the partner (belief-based) result in higher unconditional contributions by those willing to contribute more the more the other contributes (*i.e., conditional cooperation* as in Fischbacher, Gächter, & Fehr, 2001). The analysis of unconditional contributions directly tests Proposition 1.

On average, proposers contribute more to the PGG when interacting with a receiver who ranks them favorably. Table 1, Column 4 documents that proposers contribute around 0.8 Taler more when they are ranked one spot more favorably by their matched receiver. The partner's preferences (see l_r in the model) are more predictive of the actual contribution behavior of proposers than their own (initial) preference for the partner (l_{p_r}). Figure 4 shows that unconditional contributions are especially low when interacting with a receiver who ranked them on the worst spot of their preference list.[24]

Result 6. *The unconditional contribution of proposers is significantly higher when they interact with a receiver who ranked them favorably on their preference list* ($p < 0.01$).

[24]This is consistent with evidence from other domains which highlights the aversion of being ranked last, such as Kuziemko et al. (2014).



A) Averages by *Partner's preference*

B) Distributions by *Partner's preference*

Notes. This figure displays the unconditional contributions of proposers in *Info* by the preferences of the matched receiver. *Partner's preferences (1-4)* takes the value of four if the participant was the most preferred choice of their matched partner, three if the participant was the second most preferred choice, and so on. Panel a) shows averages, Panel b) the cumulative distribution functions.

Figure 4: Unconditional PGG Contributions: Proposers in *Info*

Comparing social efficiency between treatments, we find that average (unconditional) cooperation and payoffs are higher in *Info* than in *No-Info*. While proposers in *No-Info* contribute on average 4.12 (out of 10) Taler to the PGG, contributions are around 25.7 percent higher in *Info* (5.18). On average, participants in *Info* contribute 0.96 Taler more to the PGG ($p = 0.039$; MWU), which translates into 0.48 Taler higher payoffs in *Info*. Accordingly, information about others' preferences increases average cooperation and payoffs.[25]

4.5 Gender Heterogeneity

Overall, male participants drive the differences in proposer's behavior depending on their partner's preference. In an exploratory regression analysis (Table 2), we show that men's contribution decisions are significantly more influenced by their partner's preferences. This is true for both their unconditional (Column 2), and their conditional contributions (Column 3). In addition, men's beliefs (Column 1) about others' contributions are more responsive to their position on their partner's preference list.[26]

This gender heterogeneity raises interesting questions regarding how men and women react to rankings and evaluations. Previous research has found that women update more pessimistically than men when receiving negative feedback (Berlin & Dargnies, 2016). In addition, women attribute negative feedback to skill rather than to luck more often than men (Shastry, Shurchkov, & Xia,

[25]Figure A.4 shows that the higher average payoff does not mask a substantial mean-variance trade-off. The treatment *Info* increases payoffs across the distribution.

[26]This leads to a lower average belief accuracy for men than for women (average deviation of 3.54 vs. 4.47, $p = 0.02$; MWU).

2020), and react more strongly to likeability ratings based on their appearance (Gerhards & Kosfeld, 2020). In contrast, our results tend to suggest that men take the ranking more "personally" and react more strongly to it. This is consistent with previous findings recognizing women as being more ego-defensive (Möbius et al., 2022), and as having stronger internalized norms about giving, which leads to a lower elasticity of their altruism (Andreoni & Vesterlund, 2001). It is also in line with the finding of Barankay (2012) that feedback about performance rankings changes the behavior of men, but not of women.

Table 2: Gender Heterogeneity of Proposers in *Info*

	Belief Partner Contribution	Unconditional Contribution	Avg. Conditional Contribution
	(1)	(2)	(3)
Preference for partner (1-4)	-.086	.107	.006
	[-.462,.289]	[-.225,.438]	[-.174,.186]
Partner's preference (1-4)	1.004***	.253	.134
	[.457,1.551]	[-.225,.731]	[-.106,.373]
Partner's preference X Male	.798*	1.142***	.595**
	[-.037,1.634]	[.360,1.925]	[.123,1.068]
Male	-2.568*	-4.225***	-2.500**
	[-5.553,.418]	[-7.246,-1.205]	[-4.478,-.522]
Controls [Round + Individual]	Yes	Yes	Yes
Observations	285	285	285

Notes. OLS Regressions. *** p <0.01, ** p <0.05, * p <0.1. Standard errors clustered at the individual level. The values in square brackets represent the 95% confidence intervals.
Preference for partner (1-4) takes the value of four if the matched partner was the first choice of the participant, three if the matched partner was the second choice, and so on. *Partner's preferences (1-4)* takes the value of four if the participant was the most preferred choice of their matched partner, three if the participant was the second most preferred choice, and so on. *Male* is an indicator taking the value of 1 if a participant indicated to identify as male. *Partner's preferences x Male* takes the value of zero for observation with *Male=0,* and the value of *Partner's Preference X (1-4)* when *Male=1.* All columns control for *Round,* which is a count variable, indicating the number of the current round (Round 1-5), as well as *Loss aversion* and *Cognitive ability* that are calculated as detailed in Footnote 16.

4.6 Similarity, Homophily, and Reciprocal Preferences

Perceived similarity influences behavior in various decisions (e.g., Eckel & Grossman, 2005; Y. Chen & Li, 2009; Hedegaard & Tyran, 2018), and has been shown to relate to interpersonal attraction (McWhirter & Jecker, 1967). Hence, the effect of partner's preferences' on their behavior may operate through a channel of homophily (McPherson, Smith-Lovin, & Cook, 2001; Currarini, Jackson, & Pin, 2009). If a proposer only has an imprecise signal about their similarity with the matched receiver based on five questions, the receiver's preferences (that are based on five different questions) may provide a signal about their similarity. Assuming common preferences to interact with a similar individual, the preference of the partner can be interpreted as information about their similarity.[27] So far, we have shown that information about others' preferences leads

[27] Similar to Currarini and Mengel (2016), we find that similarity is an important predictor for partner choice in the PGG. The raw correlation between the rank given to a receiver and our basline measure for dissimilarity (Manhatten Distance) is 0.23, $p < 0.001$.

to more instability in matching markets through preferences adjustments (Section 3.1), that these adjustments are consistent with reciprocal preferences (Section 3.2), and that these adjustments likely stem from a combination of belief-based and preference-based factors (Sections 4.2 & 4.3). However, we have not yet established that the partner's preferences are not only similarity signals, but a fundamental determinant of behavior.

In Table 3, we provide evidence that partner preferences matter beyond being a signal for similarity. To do so, we add different measures of (objective) similarity to our main regression (Table 1). We see that our main effect persists when including these and conclude that similarity is unlikely to be the driver for our effects. We calculate similarity as the inverse of the average distance between the questionnaire responses of the matched partners (*Manhattan distance*). For example, the value is equal to 0 if one of the partners clearly affirmed each statement and the other clearly rejected all (i.e., the difference of their answers on the four-point Likert scale is maximal), and it is equal to 3 if they answered each question identically. First, the main coefficient of the partner's preferences remains constant when controlling for similarity based on all 15 questionnaire answers (Column 2). This implies that the partner's preferences do not fully operate by providing an accurate signal regarding similarity. Second, the main coefficient remains constant when including the similarity measure based on the five randomly selected questions for which the proposer has seen their partner's responses (Column 3). The positive and significant similarity coefficient implies that proposers condition their contributions on whether their partner's responses match their own. At the same time, the similar main coefficients in Columns 2 and 3 imply that there is little additional signaling value in the preferences of the other agent. If there were, we would expect the main coefficient in Column 3 to be substantially higher than in Column 2. Third, the coefficient remains stable when we control for the similarity in answers across the five randomly selected questions to which the receiver has seen the proposer's answers. If preference were a signal about this similarity, this would again imply a lower main coefficient in Column 4 than in Column 1 or 2.

Table 3: Homophily and Unconditional Contributions of Proposers in *Info*

	Unconditional PGG Contribution (0-10)			
	(1)	(2)	(3)	(4)
Partner's preference (1-4)	.794***	.704***	.812***	.794***
	[.340,1.248]	[.252,1.155]	[.371,1.254]	[.344,1.245]
Preference for partner (1-4)	.146	.044	.123	.139
	[-.172,.463]	[-.313,.402]	[-.195,.441]	[-.181,.458]
Similarity Answers (0-3) [Manhatten]		1.357		
		[-.563,3.278]		
Similarity of Shown Answers (0-3) [Manhatten]			1.041**	
			[.115,1.968]	
Similarity of Receiver's Answers (0-3) [Manhatten]				.862
				[-.293,2.017]
Controls [Round + Individual]	Yes	Yes	Yes	Yes
Observations	285	285	285	285

Notes. OLS Regressions. *** p <0.01, ** p <0.05, * p <0.1. Standard errors clustered at the individual level. The values in square brackets represent the 95% confidence intervals.
Partner's preferences (1-4) takes the value of four if the participant was the most preferred choice of their matched partner, three if the participant was the second most preferred choice, and so on. *Preference for partner (1-4)* takes the value of four if the matched partner was the first choice of the participant, three if the matched partner was the second choice, and so on. similarity is the inverse of the average distance between the questionnaire responses of the matched partners (Manhattan distance). *Similarity Answers (0-3)* is calculated based on all 15 questionnaire items, *Similarity of Shown Answers (0-3)* is based on the five questions the proposer saw the partner's answers for, *Similarity of Receiver's Answers (0-3)* is based on the five questions the receiver saw the partner's answers for. All columns control for *Round*, which is a count variable, indicating the number of the current round (Round 1-5), the indicator *Male* taking the value of 1 if a participant indicated to identify as male, as well as *Loss aversion* and *Cognitive ability* that are calculated as detailed in Footnote 16.

5 Conclusion

This paper shows that reciprocal preferences represent a powerful source of instability in matching markets. First, we demonstrate that reciprocal preferences exist – that is, that participants *like to be liked*. When participants learn the preferences of their potential partners, they adjust their preferences and rank more favorably those who would like to be matched with them. Second, we show that these changes substantially increase the number of unstable matchings. Third, we investigate the underlying motives of reciprocal preferences and find evidence for both belief-based and preference-based mechanisms. On the one hand, proposers expect receivers who like them to contribute more to the PGG. This provides a profit-maximizing rationale for preference adjustment due to changes in beliefs. On the other hand, proposers are more altruistic towards receivers who like to be matched with them. This supports a preference-based rationale for reciprocal preferences.

The PGG reflects the cooperative nature of many matching markets. In matching markets, not only are relationships formed without the coordinating function of prices, but also within the relationships there are non-contractible elements. Insofar as these elements relate to effort provision and commitment, cooperation plays a crucial role in these relationships. Consider a

university that wants to hire an enthusiastic job market candidate, and (in turn) a candidate who also wishes to receive support from the department. Both choosing a cooperative partner *and* being in a relationship where one wants to be cooperative oneself is key in such a setting, where decisive aspects cannot be contracted upon. The PGG allows us to investigate both of these channels.

Notwithstanding, our stylized experimental setting does not capture all aspects of the preference-based foundation of reciprocal preferences. Real interactions put more weight on psychological mechanisms, such as the non-pecuniary disutility of working with someone who does not like you. Therefore, investigating reciprocal preferences in inter-personal coordination tasks constitutes an avenue for future research. Compared to our experimental design, which likely provides a lower bound for the effect of reciprocal preferences, the effects could be even more pronounced when individuals expect a personal interaction.

Our results are policy-relevant, as they contribute to a better understanding of matching markets, cooperative behavior, and effective team formation in organizations. First, our results can help to design matching markets more efficiently. It is necessary to understand why matching markets sometimes fail to reach their full potential. Opitz and Schwaiger (2022) theoretically show that reciprocal preferences can be a source of instability. Evidence from real-world matching markets suggests that reciprocal preferences play an important role. Nevertheless, observational data does not allow for teasing apart reciprocal preferences, uncertainty, and other potential reasons for market failures. This paper establishes the empirical relevance of reciprocal preferences and thus highlights the importance of information design in matching markets. While learning about others' real-world preferences might sometimes be more subtle than in the experiment, already observing the final matching can lead to updates about other participants' preferences and result in instability. Our sizeable effects suggest that reciprocal preferences also play an essential role in slightly different information environments. Understanding the importance of reciprocal preferences helps to reconcile strategic modifications of the theoretically efficient mechanism by participants (e.g., by offering early admission (Avery & Levin, 2010), by making admission decisions contingent on others' preferences (U. Dur et al., 2022), or by introducing preference signaling devices (Lee & Niederle, 2015)). In addition, it helps to design mechanisms that accommodate agents' reciprocal preferences.

Second, we enhance understandings of social preferences and social proximity. Previous research shows that we treat those close to us more favorably, without being able to differentiate between our liking, being liked, and similarity (Leider et al., 2009). By isolating the role of being liked, we provide evidence that giving in a relationship depends on not only our own preferences, but also others' preferences. These findings are consistent with literature outside economics that emphasizes the wish to be liked as a universal desire (Baumeister & Leary, 1995) with neural underpinnings (Davey

et al., 2010), and the susceptibility of our own interpersonal preferences to the preferences of others (Montoya & Horton, 2012; 2014). We demonstrate that this susceptibility implies that interpersonal preferences are another currency of reciprocity, expanding previous findings on which type of gifts can lead to productivity gains (e.g., Kube, Maréchal, & Puppe, 2012). Hence, we link interpersonal preferences to organizational implications for motivating workers.

Third, our findings on the relevance of reciprocal preferences have broader organizational implications for team formation and teamwork. Organizational processes and production steps require voluntary cooperation to achieve optimal results (Deversi, Kocher, & Schwieren, 2020). We show that being liked can be necessary for cooperation. Previous literature has established that self-selected teams display homophily in their traits and networks, leading to higher satisfaction and effort (R. Chen & Gong, 2018; Boss et al., 2021). We provide a foundation for these results by highlighting greater cooperation when collaborating with a partner who likes you. We show that even in a stylized setting without personal interactions, we observe homophily in sorting, and higher cooperation among those matched with partners who like them.

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A Appendix

A.1 Behavioral Theory Model

A.1.1 Proof of Proposition 1

Proof. By Assumptions 1 and 2, an increase in l_r increases a_p and c_r. We use the Implicit Function Theorem to prove that an increase in a_p or c_r both weakly increases c_p. Hence, the increase in l_r must weakly increase c_p. We start with Equation (2) derived in Section 4.1, which shows the condition that maximizes the adjusted utility of a proposer, assuming an interior solution.

$$F(c_p; a_p, c_r) = \frac{\partial v_p}{\partial c_p} = \underbrace{\frac{\partial u_p}{\partial c_p}}_{<0} + \underbrace{a_p \cdot \frac{\partial u_r}{\partial c_p}}_{>0} = 0$$

We can make statements about the first and second partial derivatives of the twice differentiable concave direct utility functions ($u_{p,r}$). Higher contributions by the proposer c_p increase the monetary outcome of a receiver and decrease the monetary outcome of a proposer. This means that a higher contribution by the proposer (c_p) has a negative effect on the proposer's direct utility, while it positively affects the receiver's direct utility ($\frac{\partial u_p}{\partial c_p} < 0, \frac{\partial u_r}{\partial c_p} > 0$). The second partial derivatives, $\frac{\partial^2 u_p}{\partial {c_p}^2} < 0$ and $\frac{\partial^2 u_r}{\partial {c_p}^2} < 0$, are both negative. The positive marginal utility of more money decreases for the receiver. The negative marginal utility of losing money increases with less money for the proposer. The mixed partial derivatives are both positive ($\frac{\partial^2 u_p}{\partial c_p \partial c_r} > 0$ and $\frac{\partial^2 u_r}{\partial c_p \partial c_r} > 0$). For higher contributions of the other player, the negative marginal utility of contributing to the PGG is smaller, because the income is higher. This is true for the proposer and the receiver.

We use the Implicit Function Theorem to show how a change of a_p and c_r affects c_r. Proof that the optimal contribution c_p increases with a higher level of altruism ($\frac{\partial c_p}{\partial a_p} > 0$):

$$\frac{\partial c_p}{\partial a_p} = -\frac{\frac{\partial F}{\partial a_p}}{\frac{\partial F}{\partial c_p}} = -\frac{\overbrace{\frac{\partial u_r}{\partial c_p}}^{>0}}{\underbrace{\frac{\partial^2 u_p}{\partial {c_p}^2}}_{<0} + \underbrace{a_p \frac{\partial^2 u_r}{\partial {c_p}^2}}_{<0}} > 0$$

Proof that the optimal contribution c_p increases with a higher contribution of the receiver ($\frac{\partial c_p}{\partial c_r} > 0$):

$$\frac{\partial c_p}{\partial c_r} = -\frac{\frac{\partial F}{\partial c_r}}{\frac{\partial F}{\partial c_p}} = -\frac{\overbrace{\frac{\partial^2 u_p}{\partial c_p \partial c_r}}^{>0} + a_p \overbrace{\frac{\partial^2 u_r}{\partial c_p \partial c_r}}^{>0}}{\underbrace{\frac{\partial^2 u_p}{\partial {c_p}^2}}_{<0} + \underbrace{a_p \frac{\partial^2 u_r}{\partial {c_p}^2}}_{<0}} > 0$$

The equations above show that the denominator $\partial F / \partial c_p$ is always smaller than 0. Therefore, the necessary condition for the Implicit Function Theorem holds that the denominator is never 0.

This proves that c_p increases in l_r in the case of interior solutions. If the level of altruism a_p is so low that the contribution before and after the update is equal to zero ($\bar{c_p} = \ddot{c_p} = 0$), or if the contribution before is already at a maximum $\bar{c_p} = c^{max}$, the effect can be zero. Hence, the overall effect of an increase in l_r is non-negative on c_p. □

A.1.2 Proof of Proposition 2

Proof. To prove that the proposer's adjusted utility (v_p) increases in l_r, we show that a proposer can always choose a contribution $\ddot{c_p}$ that guarantees him a higher adjusted utility (v_p) than with a lower l_r. Following the experimental framework, we model an increase in l_r through learning the preferences of the matched receiver. This means that we demonstrate that a proposer's adjusted utility increases when he learns that l_r is higher than he previously thought. Note that we do not derive a proposer's optimal strategy, but show that there is always a strategy that makes the proposer better off.

The initially optimal contributions (given $\bar{l_r}$ and $\bar{a_p}$) by a proposer (receiver) are denoted by $\bar{c_p}$ ($\bar{c_r}$). The resulting monetary outcome of a proposer (receiver) is $\bar{m_p}$ ($\bar{m_r}$) and their direct (monetary) utility is $\bar{u_p}$ ($\bar{u_r}$). The preferences that the proposer then learns are denoted as $\ddot{l_r}$ ($> \bar{l_r}$), and the receiver's contribution is $\ddot{c_r}$ ($> \bar{c_r}$). The latter directly follows from Assumption 2. Note that if a player contributes c to the PGG, the sum of marginal returns for both players is greater than c. Therefore, contributing is always socially optimal.

In order to guarantee a higher adjusted utility, the proposer follows the following strategy: Contribute $\ddot{c_p}$, so that the receiver's new monetary outcome $\ddot{m_r}$ equals her old monetary outcome $\bar{m_r}$ (see Case 1). If this is not possible because it would require a higher contribution than is possible in the PGG ($\ddot{c_p} > c^{max}$), contribute the maximum possible contribution c^{max} to the PGG (see Case 2).

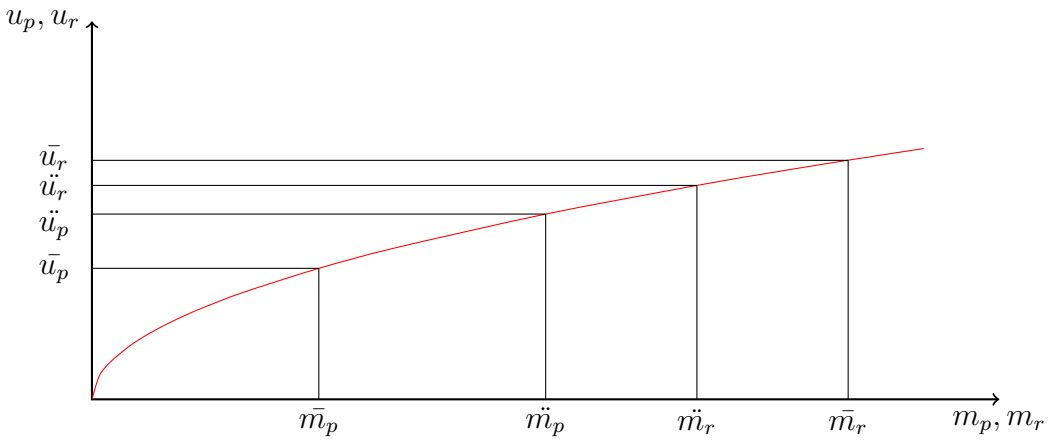


Figure A.1: Contributing c^{max} by the Proposer

Case 1: Contribute $\ddot{c_p}$ such that $\ddot{m}_r = \bar{m}_r$.

The receiver's direct utility $\ddot{u}_r$ remains the same as her previous direct utility $\bar{u}_r$. Because both players contribute more, the overall monetary outcome is larger than before. Given that $\ddot{c_p}$ is set such that $\ddot{u}_r = \bar{u}_r$, the monetary payoff for proposer ($\ddot{m}_p$) must have increased. This implies that the proposer's adjusted utility must also increase, because his direct utility u_p and the level of altruism a_p increases, while the receiver's direct utility remains constant u_r.

This strategy might not always be possible. It can be the case that, even if the proposer contributes c^{max}, the new receiver's monetary outcome remains smaller than before ($\ddot{m}_r < \bar{m}_r$). lNevertheless, contributing c^{max} will always yield a a higher adjusted utility for the proposer v_p than before.

Case 2: Contribute $\ddot{c_p} = c^{max}$.

If the proposer contributes c^{max} and $\ddot{m}_r < \bar{m}_r$, the overall monetary outcome increases due to the increased overall contributions ($\ddot{m}_p + \ddot{m}_r > \bar{m}_p + \bar{m}_r$). Since $\ddot{m}_r < \bar{m}_r$, the monetary gain for the proposer must be greater than the monetary loss for the receiver ($\ddot{m}_p - \bar{m}_p > \bar{m}_r - \ddot{m}_r$). It must also follow that $\ddot{m}_r \geq \ddot{m}_p$ because the proposer contributes c^{max}. However, if the receiver also contributes $\ddot{c_r} = c^{max}$, both monetary outcomes are the same ($\ddot{m}_p = \ddot{m}_r$). Due to the concavity of the direct utility function, the increase in proposer's direct utility must be greater than the direct utility loss for the receiver (see Figure A.1). The increase of altruism even dampens the decrease of the receiver's direct utility u_r on the proposer's adjusted utility v_p. □

A.2 Preregistered Analyses

A.2.1 Result 2: Regression Analysis

Table A.1: Preference Adjustments across Treatments

	1[Preference Adjustment]	
	(1)	(2)
Info	.165***	.158***
	[.095,.234]	[.089,.227]
Loss Aversion		-.020
		[-.051,.012]
Cognitive Ability (Raven's')		-.007
		[-.037,.022]
Male		-.002
		[-.073,.070]
Observations	575	575

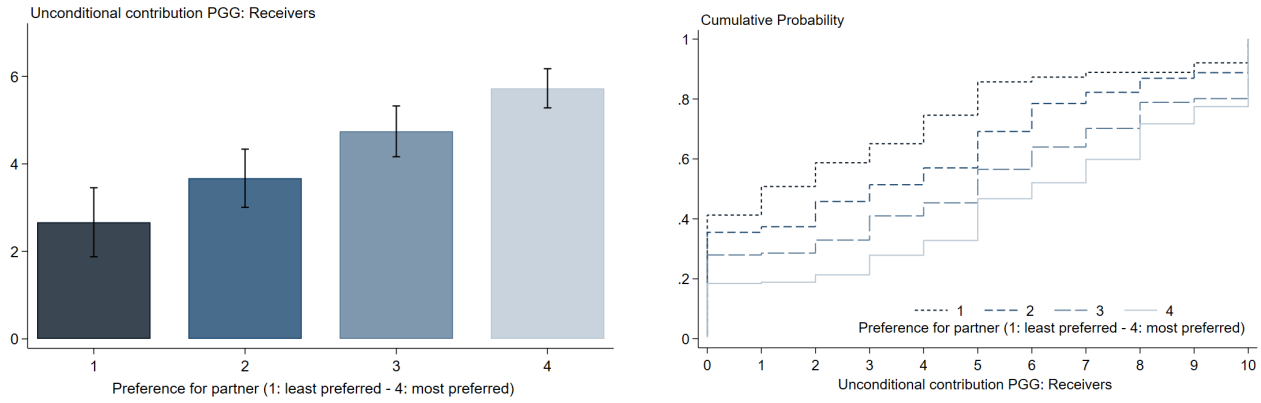
Notes. Logit Regressions. *** p <0.01, ** p <0.05, * p <0.1. The table shows marginal effects at the mean from a logit regression. Standard errors clustered at the individual level. The values in square brackets represent the 95% confidence intervals.

A.2.2 Result 3: Regression Analysis

Table A.2: Consistency of Preference Adjustments with Reciprocal Preferences

	1[Consistent Preference Adjustment]	
	(1)	(2)
Info	.152***	.150***
	[.108,.195]	[.107,.193]
Loss Aversion		-.010
		[-.024,.005]
Cognitive Ability (Raven's')		-.000
		[-.016,.016]
Male		-.021
		[-.060,.018]
Observations	575	575

Notes. Logit Regressions. *** p <0.01, ** p <0.05, * p <0.1. This table shows marginal effects at the mean from logit regressions where the dependent variable is an indicator for whether someone changed their preferences consistent with having reciprocal preferences. Standard errors are clustered at the individual level. The values in square brackets represent the 95% confidence intervals.
Info is an indicator, taking the value of one if the participant was randomly assigned to the treatment *Info*. *Loss aversion* and *Cognitive ability* are calculated as detailed in Footnote 16, *Male* is an indicator taking the value of 1 if a participant indicated to identify as male.



A) Averages by *Preference for partner*

B) Distributions by *Preference for partner*

Notes. This figure displays the unconditional contributions of receivers by their preferences for the matched proposer. *Preference for partner (1-4)* takes the value of four if the matched proposer was the first choice of the receiver, three if the matched receiver was the second choice, and so on. Panel A) shows averages, Panel B) the cumulative distribution functions.

Figure A.2: Unconditional PGG Contributions: Receiver

A.2.3 Unconditional Contributions of Receivers

Table A.3: Unconditional PGG Contributions of Receivers

	Unconditional PGG Contribution (0-10)	
	(1)	(2)
Preference for partner (1-4)	1.023***	.960***
	[.719,1.328]	[.666,1.253]
Round		-.216***
		[-.345,-.087]
Loss Aversion		-.480*
		[-.987,.027]
Cognitive Ability (Raven's')		.315
		[-.090,.720]
Male		-.805
		[-2.207,.597]
Observations	575	575

Notes. OLS Regressions. *** p <0.01, ** p <0.05, * p <0.1. Standard errors clustered at the individual level. The values in square brackets represent the 95% confidence intervals. *Preference for partner (1-4)* takes the value of four if the matched partner was the first choice of the participant, three if the matched partner was the second choice, and so on. *Round* is a count variable, indicating the number of the current round (Round 1-5). *Loss aversion* and *Cognitive ability* are calculated as detailed in Footnote 16, *Male* is an indicator taking the value of 1 if a participant indicated to identify as male.

A.2.4 Mechanisms across Treatments

In Sections 4.2-4.4, we compared proposers ranked favorably to proposers ranked less favorably by their partner within *Info*. To corroborate these results and to substantiate that they are specific to the information environment in *Info*, we now analyze the effect of being ranked favorable across both information conditions. We compare beliefs and contributions in the situation in which proposers knew their partner's preference (*Info*) to that in which the proposers did not know it (*No-Info*). Hence, in a type of Placebo test, we estimate the effect of *knowing* the rank on contributions and beliefs while holding the actual rank received by the partner constant across treatments. Table A.4 shows that none of our variables of interest is significant in *No-Info*.

Table A.4: PGG Behavior of Proposers in *Info* and *No-Info*

	Belief Partner Contribution	Unconditional Contribution	Avg. Conditional Contribution
	(1)	(2)	(3)
Preference for partner (1-4)	.246	.129	.035
	[-.059,.551]	[-.172,.430]	[-.128,.198]
Partner's preference (1-4)	.106	-.068	-.053
	[-.265,.477]	[-.499,.363]	[-.339,.233]
Partner's Preference X Info	1.208***	.862***	.444**
	[.600,1.815]	[.248,1.475]	[.062,.826]
Info	-2.566**	-1.609	-.763
	[-4.704,-.429]	[-3.826,.609]	[-2.123,.596]
Round	-.021	-.254***	-.169***
	[-.141,.099]	[-.359,-.149]	[-.238,-.100]
Loss Aversion	-.609**	-.570**	.300*
	[-1.112,-.106]	[-1.130,-.009]	[-.041,.641]
Cognitive Ability (Raven's)	.272	.180	-.196
	[-.133,.678]	[-.315,.675]	[-.465,.073]
Male	-.928*	-.884	-.325
	[-1.974,.117]	[-2.155,.387]	[-1.118,.468]
Observations	575	575	575

Notes. OLS Regressions. *** p <0.01, ** p <0.05, * p <0.1. Standard errors clustered at the individual level. The values in square brackets represent the 95% confidence intervals.
Partner's preferences (1-4) takes the value of four if the participant was the most preferred choice of their matched partner, three if the participant was the second most preferred choice, and so on. *Preference for partner (1-4)* takes the value of four if the matched partner was the first choice of the participant, three if the matched partner was the second choice, and so on. The interaction term *Partner's Preference X Info* takes the value of zero for observation in *No-Info*, and the value of *Partner's Preference X (1-4)* in *Info*. *Info* is an indicator, taking the value of one if the participant was randomly assigned to the treatment *Info*. *Round* is a count variable, indicating the number of the current round (Round 1-5). *Loss aversion* and *Cognitive ability* are calculated as detailed in Footnote 16, *Male* is an indicator taking the value of 1 if a participant indicated to identify as male.

A.3 Exploratory Analyses

A.3.1 Determinants of Proposers' Preference Adjustments

Table A.5: Determinants of Proposers' Preference Adjustments

	1[Preference Adjustment]		
	No-Info	Info	
	(1)	(2)	(3)
Preference for initial partner (1-4)	-.122***	-.117***	-.124***
	[-.172,-.073]	[-.180,-.055]	[-.188,-.060]
Initial partner's preference (1-4)		-.081***	-.085***
		[-.140,-.021]	[-.145,-.025]
Average preference of other receivers (1-4)		.088**	
		[.010,.166]	
Highest preference of other receivers (1-4)			.092***
			[.041,.143]
Round	-.023**	-.027*	-.028*
	[-.045,-.001]	[-.056,.003]	[-.058,.002]
Loss Aversion	-.004	-.024	-.025
	[-.047,.040]	[-.081,.033]	[-.082,.033]
Cognitive Ability (Raven's)	.001	-.020	-.022
	[-.025,.028]	[-.080,.041]	[-.084,.039]
Male	.036	-.047	-.046
	[-.055,.127]	[-.165,.071]	[-.164,.073]
Observations	290	285	285

Notes. OLS Regressions. *** p <0.01, ** p <0.05, * p <0.1. Standard errors clustered at the individual level. The values in square brackets represent the 95% confidence intervals.
Preference for initial partner (1-4) takes the value of four if the initial matched partner was the first choice of the participant, three if the matched partner was the second choice, and so on. *Round* is a count variable, indicating the number of the current round (Round 1-5). *Loss aversion* and *Cognitive ability* are calculated as detailed in Footnote 16, *Male* is an indicator taking the value of 1 if a participant indicated to identify as male. *Initial partner's preferences (1-4)* takes the value of four if the participant was the most preferred choice of their initial partner (i.e. before being able to adjust their preferences), three if the participant was the second most preferred choice, and so on. *Average preference of other receivers (1-4)* calculates the average preference of the other receiver and takes the value of four if the participant was the most preferred choice of all three receivers, the participant was not matched to initially. *Highest preference of other receivers (1-4)* takes the value of four if the partner was the most preferred choice of at least one of the non-matched receivers, three if the participant was not the most preferred choice of any receiver, but the second most preferred choice of at least one, and so on.

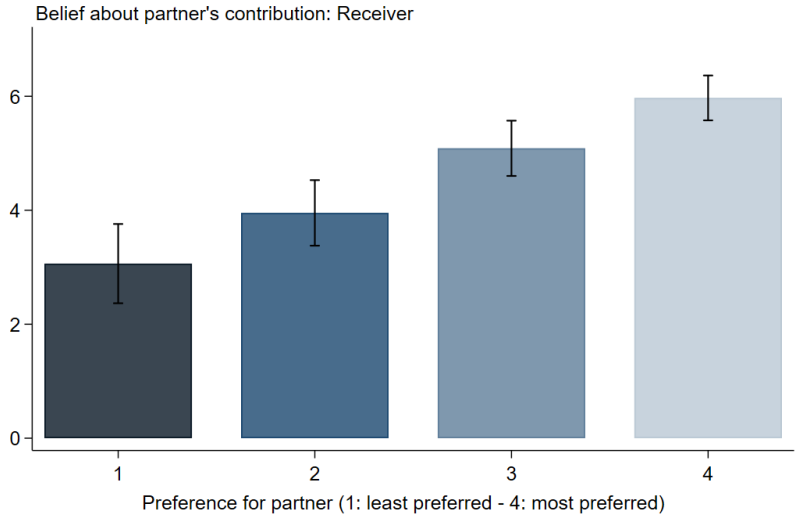
A.3.2 Predicting PGG Contribution with Questionnaire Responses

Table A.6: PGG Contributions and Questionnaire Responses

	Unconditional Contribution	Avg. Conditional Contribution
	(1)	(2)
Cat over Dog	-.207	.106
	[-.535,.121]	[-.204,.415]
Book over Film	.372	.005
	[-.119,.863]	[-.396,.406]
Beach over City	.150	-.028
	[-.343,.644]	[-.410,.353]
Bar over Club	-.176	-.225
	[-.678,.326]	[-.643,.192]
Living Alone over Shared	-.133	-.117
	[-.531,.264]	[-.487,.253]
Reserved	.455*	.179
	[-.025,.935]	[-.249,.607]
Lazy	.014	.021
	[-.509,.537]	[-.428,.470]
Handy with Hands	.261	.257
	[-.176,.698]	[-.105,.619]
Spontaneous	.092	.229
	[-.421,.605]	[-.290,.748]
Conflict Avoidant	.046	.227
	[-.456,.547]	[-.175,.629]
Strictness Covid19 Policy	-.108	.333
	[-.691,.475]	[-.097,.763]
Quota Disadvantaged	.417	-.031
	[-.081,.914]	[-.449,.387]
Bicycle Helmet Mandatory	.032	.055
	[-.420,.485]	[-.318,.428]
Legalize Marijuana	.342	.194
	[-.092,.775]	[-.219,.606]
Taxes Unhealthy Food	-.124	.106
	[-.543,.296]	[-.229,.441]
Observations	1150	575

Notes. OLS Regressions. *** p <0.01, ** p <0.05, * p <0.1. Standard errors clustered at the individual level. The values in square brackets represent the 95% confidence intervals. Column (1) includes both receivers and proposers. Column (2) only includes proposers, because receivers did not make conditional contribution decisions. For the wording of the questions, answered on a Likert scale from 1-4, see Appendix B.2.

A.3.3 Beliefs of Receivers about PGG Contribution of Partner



Notes. This figure displays the beliefs of receivers about the unconditional PGG contributions of their matched proposer by their preferences for the matched proposer. *Preference for partner (1-4)* takes the value of four if the matched proposer was the first choice of the receiver, three if the matched receiver was the second choice, and so on.

Figure A.3: Beliefs of Receivers: PGG Contributions of Partner

Table A.7: Beliefs of Receivers: PGG Contributions of Partner

	Beliefs about partner's PGG contribution (0-10)	
	(1)	(2)
Preference for partner (1-4)	.983***	.944***
	[.742,1.225]	[.708,1.181]
Round		-.057
		[-.198,.084]
Loss Aversion		-.234
		[-.710,.241]
Cognitive Ability (Raven's')		.213
		[-.111,.537]
Male		-.056
		[-1.142,1.029]
Observations	575	575

Notes. OLS Regressions. *** p <0.01, ** p <0.05, * p <0.1. Standard errors clustered at the individual level. The values in square brackets represent the 95% confidence intervals.
Preference for partner (1-4) takes the value of four if the matched partner was the first choice of the participant, three if the matched partner was the second choice, and so on. *Round* is a count variable, indicating the number of the current round (Round 1-5). *Loss aversion* and *Cognitive ability* are calculated as detailed in Footnote 16, *Male* is an indicator taking the value of 1 if a participant indicated to identify as male.

A.3.4 Payoffs from PGG across Treatments

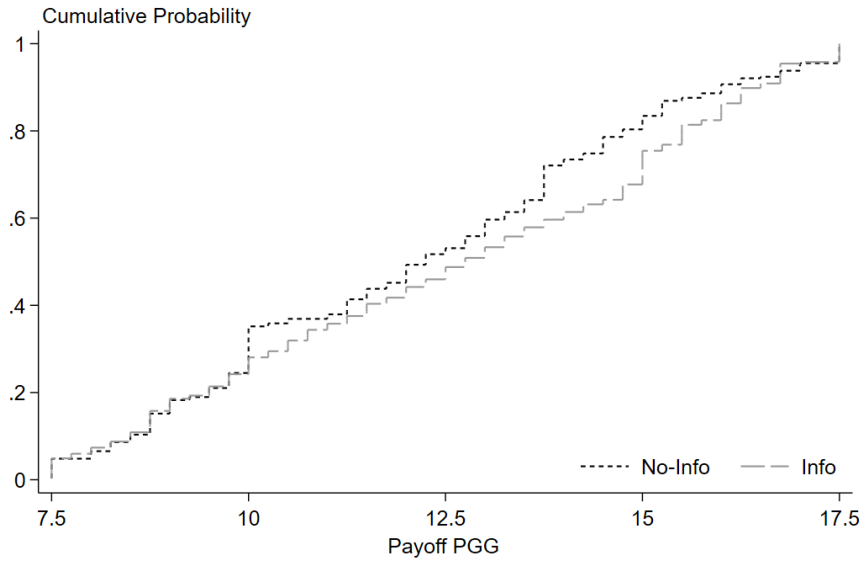


Figure A.4: Payoffs PGG: Implementation of Unconditional Decisions

B Instructions

Appendix B includes the translated instructions of the experiment (from German). Treatment specific parts are shown in *italics* and the corresponding treatment is clearly indicated.

B.1 General Instructions (before Part I)

Welcome to the experiment and thank you for your participation!

Please do not speak from now on with any other participant.

Procedures

In this experiment, we study economic decision-making. You can earn money by participating. The money you earn will be paid to you privately after the experiment.

The experiment lasts around 90 minutes and consists of four parts (I-IV). At the beginning of every part, you receive detailed instructions. In addition, you will receive comprehension questions for some parts to help you understand how the experiment works and the payoff conditions. If you have questions after reading the instructions or during the experiment, please raise your hand or press the red button on your keyboard. One of the experimenters will then come to you and answer your questions privately.

Tools

You find a pen at your desk. Please leave the pen and the instructions on the table after the experiment.

Anonymity

The analysis of the experiment is anonymous; that is, we will never link your name with the data generated in the experiment. To receive your payoff, you will need to provide your bank details or PayPal mail address at the end of the experiment. No further personal data will be passed on. Information collected during the experiment may be visible to other participants as the experiment progresses. You make all decisions anonymously, so no other participant can associate your decisions with you during the experiment.

Payment

In addition to the income that you earn during the experiment, you will receive 6 € for showing up on

time and answering a short questionnaire. In addition, you can achieve additional payoffs during the experiment. During the experiment, you and the other participants will be asked to make a series of decisions. These can affect the payoffs for you, and potentially for other participants. Additionally, you can earn money by making correct assessments. How your decisions relate to the payoffs will be explained in more detail in the respective instructions.

Exchange rate

In some parts of the experiment, we do not talk about Euro, but about Taler. We convert Taler into Euros at the end of the experiment. Please note the following exchange rate:

1 Taler = 0,70 €

B.2 Questionnaire (Part I)

[Instructions: *In the first part of the experiment, we ask you to truthfully fill out a questionnaire. This is a personality questionnaire, so there are no right or wrong answers.*
Please answer the questions with the answer options:
• *Does not apply* • *Tends not to apply* • *Tends to apply* • *Applies*]

1. I would rather have a cat than a dog as a pet.
2. I prefer reading a book in the evening to watching a movie.
3. I prefer to go to the beach on vacation than to visit a city.
4. I would rather spend an evening in a bar than partying in a club.
5. I prefer to live in a shared apartment than alone.
6. I am rather reserved and quiet.
7. I am easygoing, prone to laziness.
8. I am talented with my hands.
9. I often make decisions spontaneously and intuitively.
10. I tend to avoid conflict.
11. I am in favor of strong policy measures to contain the Covid-19 pandemic in Germany.
12. I support quota regulations in the labor market for socially disadvantaged groups (e.g., for women or migrants).
13. There should be a requirement to wear a bicycle helmet.
14. The possession of marijuana should be legalized.
15. Unhealthy foods should be taxed more.

B.3 Instructions (Part II)

The participants received the instructions for Part II of the experiment in print. An interactive screen to familiarize with the matching procedure and control questions to ensure understanding were later displayed on the computer screens.

Proposer

Part II of the experiment consists of 5 rounds. Each round is structured in the same way. In each round, you will make decisions that affect your payout amount, as well as the payout amount of another participant. One round will be randomly selected for which the achieved amount will be paid out. You will find out which round was selected only at the end of the experiment. Therefore, you should carefully consider your decisions in all rounds, as each may become relevant to you.

You were randomly assigned one of two roles for Part II of the experiment. This role remains the same across all rounds. There are participants of "Type P" and participants of "Type R". You are "Type P". All participants of "Type P" receive identical instructions. Participants of "Type R" are in a similar decision situation, we explicitly point out any differences. In each round, four "Type P" participants are matched with four "Type R" participants. This means that 8 randomly selected participants interact with each other per round. In each round, you will be randomly selected to interact with other participants.

We will illustrate the process of Part II using one round as an example. We will refer to your group of four "Type P" participants as Group A, and to the group of four "Type R" participants with whom you interact as Group B.

Each round consists of three consecutive sections (Section 1, Section 2 and Section 3).

In the final Section 3, you will simultaneously make decisions with one participant from Group B (your team partner) that are payoff-relevant for both of you. In Section 3, one participant from Group A and one participant from Group B thus form a team of 2.

In Section 1, you specify which participant of Group B you want as your team partner in this decision situation. Your choice of team partner is important to you because your team partner's decisions affect your payoffs.

In Section 2, you will be assigned a team partner for Section 3 based on your choice and the choices of the other participants through an assignment mechanism.

Below you find detailed information on all three sections.

Section 1

In the first section, you will see a randomly selected part of the answers of the 4 participants of Group B from the questionnaire. These participants are your possible team partners.

Example image: Answers from the questionnaire

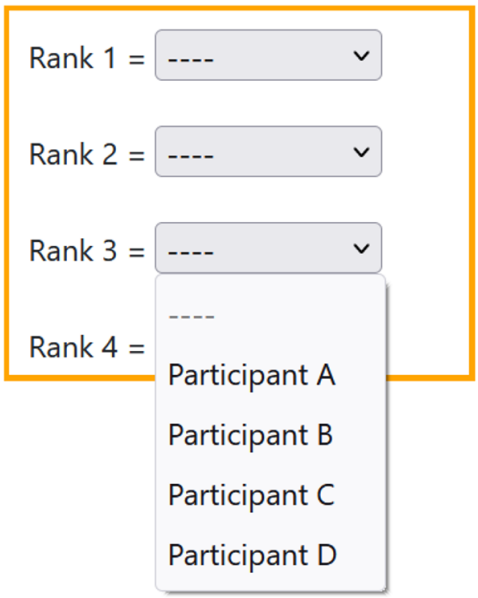
	Participant A	**Participant B**	**Participant C**	**Participant D**
Statement 1: I support quota regulations in the labor market for socially disadvantaged groups (e.g., for women or migrants).	Applies	Tends to apply	Tends not to apply	Tends not to apply
Statement 2: There should be a requirement to wear a bicycle helmet.	Does not apply	Applies	Does not apply	Does not apply
Statement 3: I would rather spend an evening in a bar than partying in a club.	Applies	Tends to apply	Does not apply	Applies
Statement 4: I am easygoing, prone to laziness.	Tends to apply	Tends to apply	Tends to apply	Does not apply
Aussage 5: I prefer to live in a shared apartment than alone.	Does not apply	Does not apply	Tends to apply	Tends to apply

At the same time, the participants of Group B (Participants A-D) see other randomly selected answers from your questionnaire and the questionnaires of the other 3 participants of Group A.

After viewing the profiles, we ask you to submit a preference order.

With this preference order, you indicate with whom of the participants from Group B you would prefer to be in the decision situation in Section 3. Rank 1 means that you would most like to have this participant as your team partner. Rank 2 means that you would second most like to have this participant as your team partner, and so on.

Example image: Preference order



All other participants of Groups A and B will also be asked to submit such a preference order.

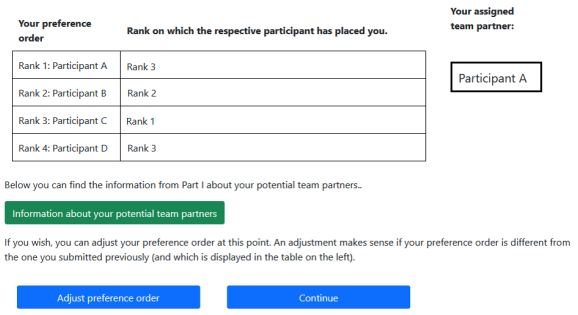
Section 2

In this section, a two-step mechanism will determine the allocation for Section 3. The mechanism is chosen so that it is always best for you to submit your actual preference order.

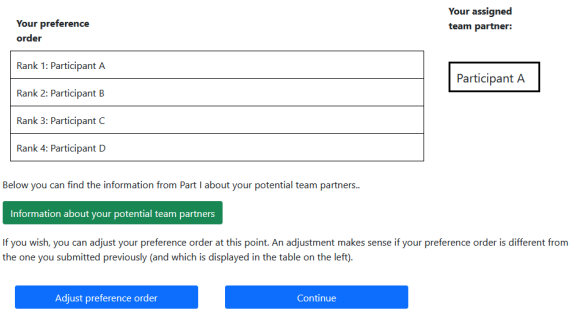
Example: Suppose you could choose between participants A, B, C or D from Group B. If you would prefer to have Participant A, second favorite Participant B, third favorite Participant C, and fourth favorite Participant D as your team partner, then you should submit the preference order A>B>C>D. If the assignment mechanism assigned you Participant B, for example, under the submission of your true preference order, there is no other preference order by which the mechanism assigns Participant A to you.

In the first step, the allocation mechanism determines the 2-person teams based on the preferences submitted. Then you will see which participant of Group B has been assigned to you. *In addition, for each participant of Group B, you will see the rank they have placed you on. [Only in Info]*

Example screen: Adjustment of preferences



Info



No-Info

In this example, in the first step, you have set Participant A to Rank 1, and have been assigned him or her as a team partner by the mechanism. *Participant A has placed you on Rank 3 of their preference order. [Only in Info]*

If you wish, you can adjust your preference order at this point. An adjustment makes sense if your preference order is different from the one you submitted previously.

In the second step, the allocation mechanism again determines 2-person teams based on these preference orders. If at least one participant has adjusted their preference order, other teams may result compared to the teams after the first step. The key is that it is always best for you to submit your true preference order.

At the end of Section 2, it will be randomly selected whether your final team partner for Section 3 will be the one assigned to you after the first step, or whether your team partner will be the one assigned to you after the second step of Section 2. Therefore, you should submit your true preference order in both steps.

Information and procedure for participants of Group B

The process of Section 2 is different for participants from Group B. Unlike you, your potential team partners from Group B cannot adjust their preference order in the second part of the assignment mechanism. *Participants from Group B do not know the preference orders of Group A and do not know that Group A will receive the preference order of Group B. [Only in Info]*

Section 3

Decision situation

You and your team partner can each put 10 Taler into a private account, or you can put all or part of 10 Taler into a joint account. Any money that you do not deposit into the joint account will automatically be deposited into the private account. You and your team partner will make your decisions independently and secretly in this part.

Income from the private account

Every Taler you put on the private account, you will get paid at the end. If you keep 10 Taler for yourself, you will receive these 10 Taler from the private account. If you keep 6 Taler for yourself, you will receive these 6 Taler from the private account. Nobody but you receives income from your private account.

Income from the joint account

You can also put your Taler into the joint account. For each Taler contributed to the joint account, both you and your team partner will receive 0.75 Taler each. Both of you benefit from the joint

account to the same extent, regardless of your respective deposits. The payoff from the joint account depends only on the sum of the deposits.

The payout of each team member is determined by the following formula.

Individual payout for each team member = (deposit from you + deposit from your team partner) * 0.75

If you and your team partner deposit 5 Taler each, the sum of the two deposits is 5+5=10. Of these 10 Taler, you and your team partner will each receive 10*0.75 = 7.5 Taler. If you and your team partner deposit a total of 16 Taler, you will both receive 16*0.75 = 12 Taler.

Total income

Your total income is the sum of your income from the personal account and your income from the joint account.

Your input

You and your team partner from Group B simultaneously and independently make the decision how many of your 10 Taler you want to contribute to the joint account. We call this decision contribution in the following.

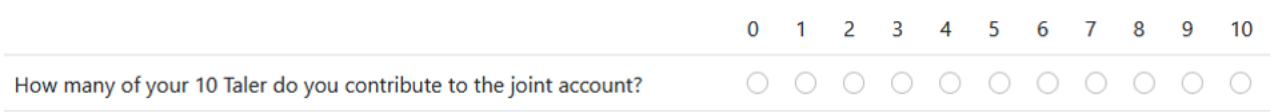
In addition to this, participants in Group A make a second contribution decision, the contribution table. For participants of Group A, it is chosen at random whether the contribution or the contribution table is relevant for payout. You must therefore carefully consider both types of contribution decisions, as both may become relevant to you. Since participants of Group B only make the contribution decision, the contribution is always and exclusively payoff relevant for these participants.

Contribution and contribution table

With your contribution to the joint account, you determine how many of the 10 Taler you want to deposit into the joint account. The deposit to your private account is automatically the difference between 10 Taler and your contribution to the joint account.

Example image: Contribution

Please indicate the amount you wish to deposit into the joint account:



In the contribution table, you specify how many Taler you want to contribute to the joint account for each possible contribution of your team partner. So you make your own contribution decision based on how much your team partner contributes.

Example image: Contribution table

For each possible contribution of your team partner, please indicate the amount you would like to contribute to the joint account (of course, you can choose the same amount more than once):

How many of your 10 Taler do you contribute to the joint account if....

	0	1	2	3	4	5	6	7	8	9	10
...Your team partner contributes 0 Taler?	○	○	○	○	○	○	○	○	○	○	○
...Your team partner contributes 1 Taler?	○	○	○	○	○	○	○	○	○	○	○
...Your team partner contributes 2 Taler?	○	○	○	○	○	○	○	○	○	○	○
...Your team partner contributes 3 Taler?	○	○	○	○	○	○	○	○	○	○	○
...Your team partner contributes 4 Taler?	○	○	○	○	○	○	○	○	○	○	○
...Your team partner contributes 5 Taler?	○	○	○	○	○	○	○	○	○	○	○
...Your team partner contributes 6 Taler?	○	○	○	○	○	○	○	○	○	○	○
...Your team partner contributes 7 Taler?	○	○	○	○	○	○	○	○	○	○	○
...Your team partner contributes 8 Taler?	○	○	○	○	○	○	○	○	○	○	○
...Your team partner contributes 9 Taler?	○	○	○	○	○	○	○	○	○	○	○
...Your team partner contributes 10 Taler?	○	○	○	○	○	○	○	○	○	○	○

After the decision:

You will find out the result of the selected round only at the end of the experiment.

You can now familiarize yourself on the computer monitor with both the submission of preference sequences, as well as the allocation mechanism. After that, you will get some comprehension questions.

Receiver

Part II of the experiment consists of 5 rounds. Each round is structured in the same way. In each round, you will make decisions that affect your payout amount, as well as the payout amount of another participant. One round will be randomly selected for which the achieved amount will be paid out. You will find out which round was selected only at the end of the experiment. Therefore, you should carefully consider your decisions in all rounds, as each may become relevant to you.

You were randomly assigned one of two roles for Part II of the experiment. This role remains the same across all rounds. There are participants of "Type P" and participants of "Type R". You are "Type R". All participants of "Type R" receive identical instructions. Participants of "Type P" are in a similar decision situation. In each round, four "Type P" participants are matched with four "Type R" participants. This means that 8 randomly selected participants interact with each other per round. In each round, you will be randomly selected to interact with other participants.

We will illustrate the process of Part II using one round as an example. We will refer to your group of four "Type P" participants with whom you interact as Group A, and your group of four "Type R" participants as Group B.

Each round consists of three consecutive sections (Section 1, Section 2 and Section 3).

In the final Section 3, you will simultaneously make decisions with one participant from Group A (your team partner) that are payoff-relevant for both of you. In Section 3, one participant from Group A and one participant from Group B thus form a team of 2.

In Section 1, you specify which participant of Group A you want as your team partner in this decision situation. Your choice of team partner is important to you because your team partner's decisions affect your payoffs.

In Section 2, you will be assigned a team partner for Section 3 based on your choice and the choices of the other participants through an assignment mechanism.

Below you find detailed information on all three sections.

Section 1

In the first section, you will see a randomly selected part of the answers of the 4 participants of Group A from the questionnaire. These participants are your possible team partners.

Example image: Answers from the questionnaire

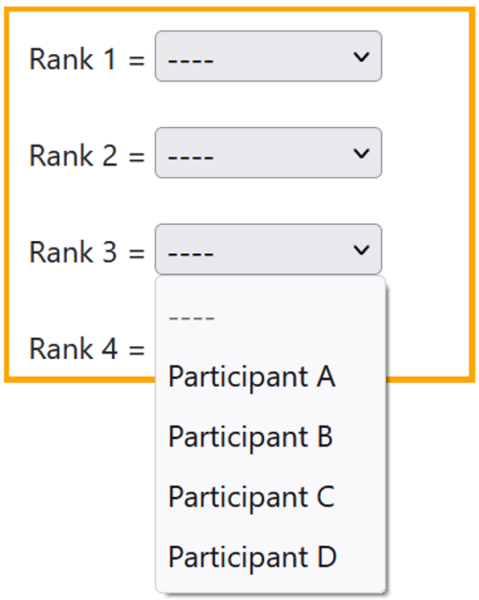
	Participant A	Participant B	Participant C	Participant D
Statement 1: I support quota regulations in the labor market for socially disadvantaged groups (e.g., for women or migrants).	Applies	Tends to apply	Tends not to apply	Tends not to apply
Statement 2: There should be a requirement to wear a bicycle helmet.	Does not apply	Applies	Does not apply	Does not apply
Statement 3: I would rather spend an evening in a bar than partying in a club.	Applies	Tends to apply	Does not apply	Applies
Statement 4: I am easygoing, prone to laziness.	Tends to apply	Tends to apply	Tends to apply	Does not apply
Aussage 5: I prefer to live in a shared apartment than alone.	Does not apply	Does not apply	Tends to apply	Tends to apply

At the same time, the participants of Group A (Participants A-D) see other randomly selected answers from your questionnaire and the questionnaires of the other 3 participants of Group B.

After viewing the profiles, we ask you to submit a preference order.

With this preference order, you indicate with whom of the participants from Group A you would prefer to be in the decision situation in Section 3. Rank 1 means that you would most like to have this participant as your team partner. Rank 2 means that you would second most like to have this participant as your team partner, and so on.

Example image: Preference order



All other participants of Groups A and B will also be asked to submit such a preference order.

Section 2

In this section, a mechanism will determine the allocation for Section 3. The goal of the mechanism is to assign participants their best possible team partner. The mechanism is based on a simple logic: If several participants of Group A want you to be their team partner, the mechanism will always select for you the participant that you have specified further ahead in your preference order.

Example: Suppose you could choose between participants A, B, C or D from Group A. You prefer to have Participant A, second favorite Participant B, third favorite Participant C, and fourth favorite Participant D as your team partner (A>B>C>D). If the assignment mechanism does not assign you Participant A when you state your true preference order, it automatically means that Participant A prefers another participant of Group B over you.

Let us assume that this is the case. Now, if both participant B and C would prefer you to be their team partner, the mechanism will choose the participant you have specified further up in your preference order as your team partner. If you would submit the preference order A>B>C>D, you would get Participant B as your team partner. If you would give the preference order A>C>B>D, you would get Participant C as your team partner. This also means that if you submit a preference order that does not match your true preference order, you may not get your best possible team partner.

Once you have submitted your preference order, you cannot change it.

Section 3

Decision situation

You and your team partner can each put 10 Taler into a private account, or you can put all or part of 10 Taler into a joint account. Any money that you do not deposit into the joint account will automatically be deposited into the private account. You and your team partner will make your decisions independently and secretly in this part.

Income from the private account

Every Taler you put on the private account, you will get paid at the end. If you keep 10 Taler for yourself, you will receive these 10 Taler from the private account. If you keep 6 Taler for yourself, you will receive these 6 Taler from the private account. Nobody but you receives income from your private account.

Income from the joint account

You can also put your Taler into the joint account. For each Taler contributed to the joint account, both you and your team partner will receive 0.75 Taler each. Both of you benefit from the joint

account to the same extent, regardless of your respective deposits. The payoff from the joint account depends only on the sum of the deposits.

The payout of each team member is determined by the following formula.

Individual payout for each team member =
(deposit from you + deposit from your team partner) * 0.75

If you and your team partner deposit 5 Taler each, the sum of the two deposits is 5+5=10. Of these 10 Taler, you and your team partner will each receive 10*0.75 = 7.5 Taler. If you and your team partner deposit a total of 16 Taler, you will both receive 16*0.75 = 12 Taler.

Total income

Your total income is the sum of your income from the personal account and your income from the joint account.

Your input

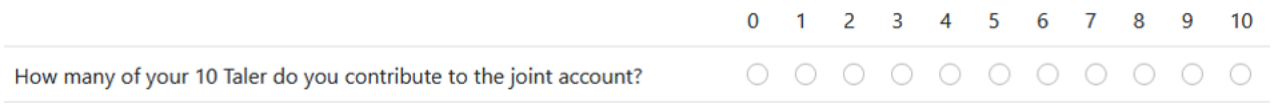
You and your team partner from Group B simultaneously and independently make the decision how many of your 10 Taler you want to contribute to the joint account. We call this decision contribution in the following.

Contribution

With your underlinecontribution to the joint account, you determine how many of the 10 Taler you want to deposit into the joint account. The deposit to your private account is automatically the difference between 10 Taler and your contribution to the joint account.

Example image: Contribution

Please indicate the amount you wish to deposit into the joint account:



After the decision:

You will find out the result of the selected round only at the end of the experiment.

You can now familiarize yourself on the computer monitor with both the submission of preference sequences, as well as the allocation mechanism. After that, you will get some comprehension questions.

B.4 Additional Instructions (Part III)

Beliefs

In this part of the experiment, we ask you to guess the decisions of your respective team partners from Part II. You thus provide an estimate for each of the rounds played. Your payoff depends on whether you estimate the contribution to the joint account of your respective team partner in Part II correctly.

Before each decision, you will again receive the information about your team partner that you had available when you made your own contribution decision. Please provide an estimate of how many Taler your respective team partner put into the joint account. *Note that your team partner made this decision, without knowing your submitted preference order. [only proposer]*

Payoff

If you estimate your team partner's contribution exactly correctly, you will receive 2 Euro for this correct estimation. If you estimate the contribution incorrectly, you will receive 0 Euro.

One of the rounds will be randomly selected for which the amount scored will be paid out. You will find out the result of the selected round only at the end of the experiment (after part IV).

Raven's Matrices

In this part of the experiment we ask you to complete figures. The figures consist of 3x3 elements that are logically connected. In each figure the lower right element is missing. We ask you to complete this with one of the 6 answer choices.

You have a total of 5 minutes to solve as many matrices as you can manage. The maximum number is 10 matrices. You will receive 0.50 Euro for each correctly solved matrix and 0.50 Euro will be deducted for each incorrectly solved matrix. You will receive at least 0.00 Euro for this task. You cannot get a negative payout from this task. Please select the appropriate image in each case and confirm your selection. On the next page you can see an example.

Loss attitudes (Gächter, Johnson, & Herrmann, 2022)

This task consists of 6 decisions where you can accept up to 6 offers.

The offers consist of a lottery through which you can lose or win money. You have to decide for each of the 6 offers whether to accept it or not. For each accepted offer, the computer plays the lottery and hence decides if you lose or win money.

At the end of the experiment, your decision is implemented for one of the 6 offers. The computer

randomly selects (with equal probability) which offer will be implemented.

Decide for each offer whether you want to accept it.

1	With 50% probability you lose 2 Euro; with 50% probability you win 6 Euro.	○ accept ○ reject
2	With 50% probability you lose 3 Euro; with 50% probability you win 6 Euro.	○ accept ○ reject
3	With 50% probability you lose 4 Euro; with 50% probability you win 6 Euro.	○ accept ○ reject
4	With 50% probability you lose 5 Euro; with 50% probability you win 6 Euro.	○ accept ○ reject
5	With 50% probability you lose 6 Euro; with 50% probability you win 6 Euro.	○ accept ○ reject
6	With 50% probability you lose 7 Euro; with 50% probability you win 6 Euro.	○ accept ○ reject

Socio-demographics

Please provide the following statistical information.

- Age [integer]
- Gender [male; female; diverse]
- Field of study (faculty/major) [string]
- What language(s) is (are) your native language(s)? [string]
- What is your high school graduation grade? [number; 1-6]
- What is your high school graduation grade in mathematics? [number; 1-6]
- How many times have you participated in an economic laboratory study (including outside of this laboratory)? [0; 1-2; 3-5; 5+]