The Effect of Seed Money and Matching Gifts in Fundraising: A Lab Experiment *

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Abstract

Existing experimental studies find weak support for the theoretical prediction that matching leadership giving alleviates free-riding and raises more voluntary contributions for public goods relative to seed money. However, while most experimental studies use exogenous variations of the leadership gift, theoretical models allow for this choice to be made by a strategic lead donor. In order to provide a more direct test of the theoretical prediction, we conduct a laboratory experiment with three sequential strategic players: a fundraiser, a lead donor, and a follower donor. The fundraiser chooses between a matching and a seed money fundraising scheme, followed by sequential contributions by the two donors. We find that matching increases total contributions by almost 10% relative to seed money. Moreover, compared to seed money, matching results in lower contributions by the lead donor and significantly higher contributions by the follower donor, corroborating the theoretical prediction that matching alleviates free-riding by the follower donors. Interestingly, despite the effectiveness of the matching scheme, fundraisers in the lab solicit for a matching gift only one-third of the time.

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1 Introduction

With the size of the charitable giving market surpassing \$440 billion in 2019,[1] both practitioners and academics have turned their attention to identifying best fundraising practices. A particular area of interest has been the role of leadership giving in encouraging contributions of individual donors. A leadership gift is a large public commitment to donate to a fundraising campaign, which has the goal of spurring additional giving by other potential donors. Leadership gifts are most frequently structured as an unconditional lump sum called "seed money" or as a promise to match subsequent donations by a fixed ratio called "matching gift". Securing a seed money gift prior to launching a public campaign is a common recommendation among fundraising experts.[2] The prevalence of matching gifts has also been growing with an estimated \$2-\$3 billion donated through matching gift programs annually in the United States.[3]

In this paper, we implement a laboratory experiment to compare the effectiveness of these two schemes and to establish the fundraiser's preference over them. A defining feature of our theoretical and experimental framework is that the form and the size of the leadership gift are determined by strategic players. This is a significant departure from most of the existing experimental literature, in which the leadership gift is varied exogenously by the experimenters. In contrast to such exogenous variations, our setting aims to evaluate the equilibrium incentives underlying the two schemes and measure their relative effectiveness at the equilibrium levels of giving by the lead donor. As such, our experimental design provides a closer test of the existing equilibrium models of giving that point to the effectiveness of matching due to its ability to reduce free-riding incentives by donors (Guttman, 1978, 1987; Danziger and Schnytzer, 1991; Boadway et al., 2007; Buchholz et al., 2012; Krasteva and Saboury, 2019).

Our theoretical framework and experimental design consist of three players: a fundraiser, a lead donor, and a follower donor. The two donors contribute sequentially to a public good. The lead donor's contribution plays the role of a leadership gift that is observed by the follower donor and aims to incentivize contributions by the follower donor. In the endogenous treatment, the fundraiser chooses whether to solicit the lead donor for a seed money or a matching gift. The seed money solicitation simply asks the lead donor to make a lump sum contribution to the public good. The matching solicitation asks the lead donor to commit to a match ratio that increases the follower donor's gift by the size of the match. In theory, the fundraiser should prefer the scheme that maximizes the total contributions to the public good.

Donors' returns from contributing to the public good depend on the marginal per-capita return (MPCR), which is common knowledge. In particular, we use a piece-wise linear public good with an MPCR less than one. This payoff structure gives rise to the standard free-riding incentives inherent in public good provision. Moreover, the MPCR falls below $\frac{1}{2}$ after some provision level G_0, making further contributions payoff-reducing for the donors. This allows us to explore donors'

[1]Source: Giving USA 2020 report, `https://givingusa.org/tag/giving-usa-2020/`.

[2]For a discussion about the tendency of fundraising experts to recommend securing seed money as a first step in fundraising, see Andreoni (1998) and List and Lucking-Reiley (2002).

[3]Source: Double the Donation's project, `https://doublethedonation.com/tips/matching-grant-resources/matching-gift-statistics/`.

willingness to give not only for the donors' benefit, but also for the fundraiser's benefit. Moreover, this structure also avoids situations in which the donors' giving is limited by their endowment due to a binding budget constraint. Such binding budget constraints (i.e., donors contributing their entire wealth to the public good) are unlikely to play a significant role in the field and thus we want to avoid such scenario impacting the comparison of the two schemes.[4]

Under seed money, it is individually payoff-maximizing for each donor to fully free-ride and contribute zero. This prediction, however, fails to hold in experimental settings where a majority of subjects contribute positive amounts.[5] To rationalize such positive contributions, we present a theoretical model of social pressure, in which the follower donor derives disutility from giving less than the lead donor's contribution. If the follower donor is sufficiently susceptible to social pressure, this theoretical model gives rise to an equilibrium, in which both donors contribute to the public good. The follower donor contributes to the public good in response to social pressure, while the lead donor contributes in order to induce such social pressure. An interesting feature of this equilibrium is that the lead donor makes a higher expected contribution relative to the follower donor. The reason is that not all donors are susceptible to social pressure and thus only a fraction of the follower donors make a contribution in equilibrium.

In contrast to seed money, the matching gift, due to its conditional nature, does not exert social pressure on the follower donor. Instead, it amplifies the marginal impact of the follower donor's gift. Thus, instead of relying on social pressure susceptibility, the lead donor can induce giving by the follower donor by offering a sufficiently high match ratio. Similar to the contribution equilibrium under seed money, the unique equilibrium under matching results in positive contributions by both donors. However, the lead donor under matching ends up giving a lower amount than the follower donor since the match ratio that induces the follower donor to contribute is less than one. Thus, matching reverses the relative contribution amounts of the two donors compared to seed money. More importantly, we find that matching raises (weakly) higher total contributions relative to seed money. In fact, the two schemes are equivalent only if all donors are susceptible to social pressure. With less than perfect social pressure susceptibility, matching strictly dominates seed money because it does not rely on the follower donor's other-regarding considerations, but rather induces giving as a payoff-optimal strategy.

Our theoretical model gives rise to three hypotheses: 1) matching raises (weakly) higher expected contributions; 2) the follower donor contributes significantly more under matching than under seed money; 3) the fundraiser chooses matching over seed money in order to maximize total contributions. We test these three hypotheses in an induced value laboratory public good game. Our experimental design follows closely our theoretical model and consists of three between-subject treatments: *Exogenous Seed*, *Exogenous Match*, *Endogenous Scheme*. The first two treatments set the scheme exogenously to seed money or matching and aim to test the first two hypotheses. The

[4]Section 2.1 provides a more detailed discussion about this modeling choice.

[5]This behavior is largely attributed to conditionally cooperative subjects who tend to increase their contributions as a response to higher giving by others. For instance, Arifovic and Ledyard (2012) find that only a third of the subjects can be classified as free-riders, whereas 50% are conditional cooperators. For further discussion of the existing experimental literature, see footnote 12.

choice of scheme in the last treatment is made by the subjects who play the role of the fundraiser. The goal of this treatment is to study the fundraiser's preference over the two schemes.

Our experimental results support Hypotheses 1 and 2. The *Exogenous Seed* treatment has consistently lower average contributions compared to the *Exogenous Match* treatment across the ten rounds of the contribution game. Interestingly, the difference between the two schemes is fairly small (21.73 tokens under seed money and 23.87 tokens under matching, t-test $p=0.0597$), suggesting that the giving behavior under seed money is consistent with our equilibrium under significant social pressure. Analyzing the giving behavior of the lead and the follower donors, we find that seed money generates more giving by the lead donor, while matching generates significantly higher giving by the follower donor. This is in line with our theoretical model and Hypothesis 2.

We do not find support for Hypothesis 3. In the *Endogenous Scheme* treatment, the fundraiser chooses matching 35.8% of the time. Moreover, the fundraisers vacillate between the two schemes over the course of the experiment. The latter, combined with the small difference between the two schemes, suggests that the effectiveness of matching is not obvious to fundraisers. In fact, compared to the two exogenous treatments, in the *Endogenous Scheme* treatment the gap between the two schemes is smaller (17.98 tokens under seed money and 18.21 tokens under matching, t-test $p=0.7921$) and not persistent over time. This finding suggests that donors' response to the fundraising mechanism may depend on who chooses the mechanism. We also observe an interesting gender difference. While in early rounds both males and females are less likely to choose matching compared to seed money, females (unlike males) learn and choose matching more often as they progress through the experiment and in the final three rounds of the game, their probability of choosing matching is not statistically different from 50% (proportions test $p=0.4142$).

Our work is related to a growing theoretical and experimental literature on leadership giving, which has largely established the benefits of leadership gifts. On the theory front, the benefit of seed money can be attributed to the donors' other-regarding preferences (Romano and Yildirim, 2001), which cause donors to increase their giving as a response to higher contributions by others; or the presence of fixed-cost public goods (Andreoni, 1998), for which the leadership gift makes donors more optimistic about the likelihood of meeting the provision threshold. The benefit of seed money has also been studied in the context of incomplete information, where the lead donor's contribution may inform subsequent donors of the quality of the public good and increase contributions to more efficient causes (e.g., Vesterlund, 2003; Andreoni, 2006; Krasteva and Saboury, 2019).

The theoretical argument in favor of matching is even stronger since the conditional nature of the matching leadership gift reduces subsequent donors' ability to free-ride on the lead donor's contribution (e.g., Guttman, 1978, 1987; Danziger and Schnytzer, 1991; Boadway et al., 2007; Buchholz et al., 2012). Under purely altruistic donors and complete information about the public good's value, Krasteva and Saboury (2019) show that matching dominates seed money in a large economy.[6,7] In this paper, we extend the standard altruistic preferences to include social pressure that drives giving behavior under seed money. Our analysis reveals that the benefit of seed money fundraising and the relative performance of the two schemes depend on the donors' susceptibility to social pressure.

A growing experimental literature has mostly confirmed the theoretical benefits of leadership giving. Lab experiments involving seed money have shown that leadership giving may be an effective fundraising strategy due to donors' other-regarding motivations such as reciprocity (e.g., Meidinger and Villeval, 2002; Güth et al., 2007; Bracha et al., 2011), the reduction in the risk of underprovision in threshold public goods (e.g., Bracha et al., 2011), and the ability of the leadership gift to inform downstream donors about the public goods' value (Potters et al., 2005, 2007). Field experiments both with an explicit threshold (e.g., List and Lucking-Reiley, 2002; Rondeau and List, 2008) and without an explicit threshold (e.g., Huck and Rasul, 2011; Gneezy et al., 2014; Huck et al., 2015) have found that the anouncement of seed money increases total contributions as a result of a higher response rate by donors as well as a larger average contribution.

The use of matching leadership giving has also found some support in the laboratory (e.g., Eckel and Grossman, 2006; Eckel et al., 2007; Charness and Holder, 2019) and in the field (e.g., Meier and Frey, 2004; Martin and Randal, 2009; Gneezy et al., 2014; Bekkers, 2015). However, the literature is far from conclusive. For instance, Eckel and Grossman (2003) and Davis et al. (2005) find that donations do not change as a response to increases in the match ratio. Karlan and List (2007) find that announcing a matching gift has a positive effect on both the response rate and the revenue per solicitation, but the magnitude of the match does not have a significant impact. Karlan et al. (2011) confirm the latter finding that giving does not change across different match rates but they also find that in general matching has little effect on fundraising. Meier (2007) finds that the positive effect of a matching gift is short-lived with contributions diminishing substantially in the period after the matching donations have expired. Green et al. (2015) find that reminding potential donors of a matching scheme does not have any effect on giving. Kesternich et al. (2016) find that donations increase only when a specific match ratio (100%) is introduced and they are unresponsive to other match ratios. In a field experiment, Eckel and Grossman (2008) find that giving by some donors diminished in response to a matching gift. More recently, Adena and Huck (2017) conduct a field and a subsequent lab experiment and find matching to have a negative effect on donations but at the same time increasing the match ratio results in an increase in donations. In contrast, Karlan and List (2020) conduct a field experiment and find that a matching grant from the Bill and Melinda Gates Foundation increases giving both in the short run and the long run.

Most of the above experimental studies have considered the two types of leadership gifts in

[6] Krasteva and Saboury (2019) also show that this relationship may reverse under incomplete information, in which seed money could emerge as a costly signal of high quality. In this paper, we focus our attention on a complete information environment in order to study the relative performance of the two schemes without confounding informational effects.

[7] In a small economy, Gong and Grundy (2014) illustrate the possibility of a reverse ranking with seed money dominating matching if the donors' marginal utility of the public good responds elastically to changes in the level of the public good. This result, however, is limited to isolated examples and does not generalize to settings with a large number of donors.

isolation. In contrast, our lab experiment aims to provide a direct comparison of the effectiveness of the two schemes. In this respect, our work is closest to a small number of studies (Rondeau and List, 2008; Huck and Rasul, 2011; Gneezy et al., 2014; Huck et al., 2015) that have varied the two schemes in the field. Interestingly, in contrast to our theoretical prediction, Rondeau and List (2008), Huck and Rasul (2011), and Huck et al. (2015) find that seed money results in higher contributions relative to matching. Gneezy et al. (2014) find that the total contributions raised by the two schemes are not statistically different from each other, but both are higher than the contributions without a leadership gift. In addition, Rondeau and List (2008) compare their field findings to a lab experiment with a threshold public good and complete information, in which the two schemes are theoretically equivalent.[8] They find that seed money is more effective in the field relative to the lab and hypothesize that this is due to its signaling value in the field.

Our paper differs from the above studies in two important dimensions. First, it considers a controlled environment with known and continuous returns from the public good. This setting provides a closer test of the theoretical prediction that matching alleviates free-riding and as a result raises more contibutions relative to seed money. The presence of either a threshold or incomplete information about the value of the public good may introduce confounding incentives that affect this comparison. Second, in line with the theoretical models that compare the two schemes (e.g., Gong and Grundy, 2014; Krasteva and Saboury, 2019), our design allows for the leadership gift to be chosen endogenously by strategic players. Besides providing an environment that is closer to the actual economic choices of fundraisers and lead donors, this experimental setting also allows for a comparison of the two schemes at their equilibrium leadership contributions. This feature is important because the two schemes might differ in their relative effectiveness at arbitrary levels of the leadership gift while having a consistent ranking when evaluated at their equilibrium levels.[9] To our knowledge, the only other experiments that include a strategic lead donor are Potters et al. (2005, 2007); Güth et al. (2007); Bracha et al. (2011), none of which include a matching gift scheme.

The rest of the paper proceeds as follows: Section 2 presents the theoretical model and testable implications emerging from the equilibrium analysis. Section 3 describes the experimental design, followed by the description of the data collection process in Section 4, and the experimental findings in Section 5. Section 6 concludes.

[8]In their setting, the size of the leadership gift is the same under both schemes and is realized only when the donors contribute the remainder necessary to reach the thresholds. Once the threshold is reached, the entire leadership gift is realized and no further matching takes place. Thus, the two schemes differ only in their framing, and Rondeau and List find that the two schemes are equally effective in the lab. This would not be the case in a more general setting, in which the matching gift affects contributions beyond the threshold.

[9]For instance, in Huck and Rasul (2011) and Huck et al. (2015), the two matching treatments of 50% and 100% result in a leadership gift contribution of only €$7,853$ and €$14,310$ respectively, which are significantly lower than the €$60,000$ unconditional commitment by the lead donor. Thus, it is not clear that these two match ratios are close to what the lead donor would have chosen strategically in the absence of a designed experiment.

2 Theoretical Model and Predictions

2.1 Model

Consider the following three-person voluntary contribution environment. A fundraiser, F, sequentially solicits two donors, $i = \{1, 2\}$, for contributions to a public good. At the beginning of the game, the fundraiser has zero endowment and her payoff is simply the total contributions by the two donors, G. In contrast, each donor is endowed with wealth w, which can be allocated between private and public consumption. Donor i's monetary payoff upon contributing an amount g_i to the project is:

$$\pi_i(w, g_i, G) = w - g_i + v(G), \tag{1}$$

where $v(G)$ denotes donor's return from the public project. We depart from the standard linear public good setting by assuming that this return follows a piece-wise linear function:

$$v(G) = \begin{cases} \overline{\alpha}G & \text{if} \quad G \leq G_0 \\ \overline{\alpha}G_0 + \underline{\alpha}(G - G_0) & \text{if} \quad G > G_0, \end{cases} \tag{2}$$

where $\underline{\alpha} \leq \frac{1}{2} < \overline{\alpha} < 1$ and $\overline{\alpha}G_0 \leq w \leq G_0$. A straightforward calculation reveals that a total contribution of G_0 is jointly payoff-maximizing for the donors, while giving zero is the individually payoff-maximizing contribution for each donor. The reason for setting $\underline{\alpha} \leq \frac{1}{2}$ is two-fold. First, it allows us to experimentally explore the donors' willingness to give not only for their joint benefit, but also for the fundraiser's benefit. Second, as we demonstrate in our analysis in the subsequent sections, this parameter specification avoids equilibria with a binding budget constraint, in which donors' giving is limited by their endowment. Such outcome is highly unlikely in the field which typically features many potential donors.[10] Moreover, such binding constraint exogenously reduces the donors' ability to increase their giving in response to the fundraising scheme. As a result, donors' contributions fail to fully reveal their willingness to give, which in turn may impact the comparison between the two solicitation schemes that we study.[11] In order to avoid such a scenario, the public good's return falls below $\frac{1}{2}$ after total contributions reach G_0, making it payoff-reducing for donors to contribute their entire endowment.

We consider sequential giving by the two donors using two solicitation schemes. Under seed money, the lead donor publicly chooses her lump sump contribution g_1, followed by a lump sum contribution g_2 by the follower donor. Under matching, the lead donor publicly commits to a match ratio m, followed by a lump sum contribution g_2 by the follower donor, giving rise to $g_1 = mg_2$. The total amount raised under each scheme is $G = g_1 + g_2$.

[10]In a setting with many donors, even if an individual donor's budget constraint is binding, the aggregate contributions are unlikely to be constrained by the donors' aggregate budget.

[11]Since $\underline{\alpha} < \frac{1}{2}$, joint payoff maximization caps donors' willingness to give to G_0. Without the kink at G_0, such that $\underline{\alpha} = \overline{\alpha} > \frac{1}{2}$, a donor's willingness to give may exceed her budget w. This may adversely impact the matching scheme more than seed money. This is because the lead donor's ability to use a higher match ratio to encourage more giving by the follower donor is limited by the follower donor's budget. Thus, in this case, it is possible for seed money to result in higher total contributions, but this is entirely due to the follower donor's binding budget constraint. A formal proof is available upon request.

To understand how the two schemes impact donors' incentives, Section 2.2 and Section 2.3 characterize the subgame perfect Nash equilibrium under each scheme. We discuss the equilibrium choice of scheme by the fundraiser in Section 2.4.

2.2 Seed Money

Given $\overline{\alpha} < 1$, it is well-known that the unique payoff-maximizing strategy for the follower donor is to contribute zero. Anticipating this, the lead donor must, in turn, also contribute zero. This non-cooperative behavior, however, is inconsistent with existing experimental studies which document positive contributions by donors. Moreover, donors often increase their own contributions as a response to higher contributions by others.[12] In our sequential environment, such behavior can be rationalized by the lead donor's contribution creating *social pressure* on the subsequent contributor to reciprocate the lead donor's generosity. In particular, following DellaVigna et al. (2012) and Name-Correa and Yildirim (2016), we allow for the follower donor to derive disutility from falling short of the contribution made by the lead donor.[13] Thus, the utility of the follower donor is given by:

$$u_2(\pi_2, s_2) = \pi_2 - s_2 \max\{g_1 - g_2, 0\}. \tag{3}$$

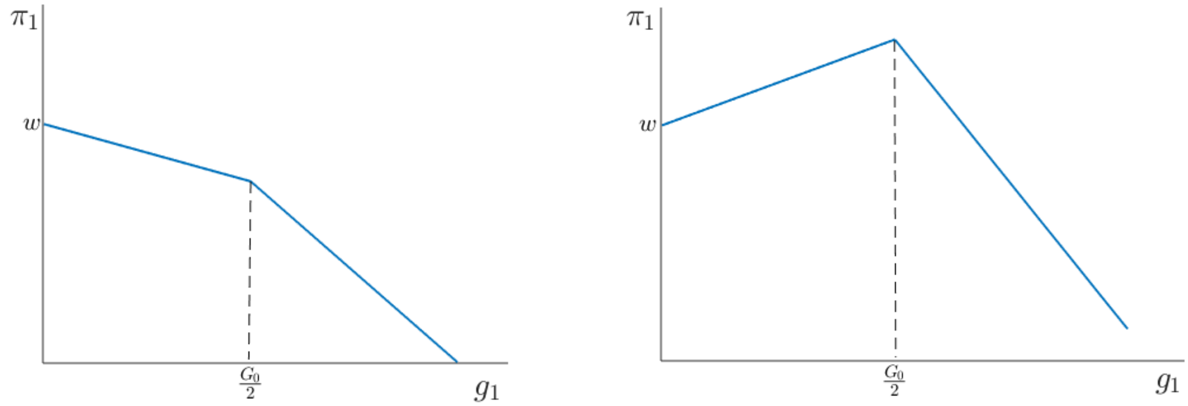
The parameter s_2 captures the extent of social pressure experienced by the follower donor. We denote by $F(\cdot)$ the distribution of s_2 in the population. Straightforward differentiation of eq. (3) yields the following best response function for the follower donor:

$$g_2^*(g_1) = \begin{cases} 0 & \text{if} \quad s_2 \leq 1 - \overline{\alpha} \\ \min\{g_1, G_0 - g_1\} & \text{if} \quad s_2 \in (1 - \overline{\alpha}, 1 - \underline{\alpha}] \\ g_1 & \text{if} \quad s_2 > 1 - \underline{\alpha} \end{cases} \tag{4}$$

To understand the above best response, note that the follower donor's contribution can never exceed that of the lead donor since then the marginal value of contributing is at most $-1 + \overline{\alpha} < 0$. Given $g_2 < g_1$, if $g_2 < G_0 - g_1$, the follower donor's marginal value of contributing is $-1 + \overline{\alpha} + s_2$, while for $g_2 > G_0 - g_1$ it is $-1 + \underline{\alpha} + s_2$. Therefore, it is clear that for $s_2 \leq 1 - \overline{\alpha}$, the social pressure is sufficiently weak and the utility maximizing strategy coincides with the payoff-maximizing strategy of 0. For $s_2 \in (1 - \overline{\alpha}, 1 - \underline{\alpha}]$, the follower donor feels sufficient social pressure to match the lead donor's contribution as long as the total giving does not exceed G_0, since at that point the MPCR drops to $\underline{\alpha}$. This implies a gift of g_1 for $g_1 \leq \frac{G_0}{2}$ and $G_0 - g_1$ for $g_1 > \frac{G_0}{2}$. Finally, for $s_2 > 1 - \underline{\alpha}$, the social pressure is significant enough for the follower donor to always match the lead donor's gift.

[12] The literature on the cooperative behavior by donors observed in the lab is extensive. For a review of the earlier literature, see Ladyard (1995). These studies have spurred further work to understand donors' giving behavior and motivations (e.g., Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000; Fehr and Gachter, 2000; Fischbacher et al., 2001; Falk and Fischbacher, 2006; Ambrus and Pathak, 2011, Arifovic and Ledyard, 2012).

[13] Our model is also closely related to alternative utility specification that include reciprocity and inequality aversion as a motivation for the positive response by the follower donor to the lead donors' gift (e.g., Fehr and Schmidt, 1999; Arifovic and Ledyard, 2012).



(a) $\overline{\alpha}(2 - F(1 - \overline{\alpha})) < 1$ (b) $\overline{\alpha}(2 - F(1 - \overline{\alpha})) > 1$

Figure 1: Lead donor's expected payoff $\pi_1(w, g_1, E[g_2^*|g_1])$

Given eq. (4) and the distribution $F(\cdot)$, the expected contribution of the follower donor is given by:

$$E[g_2^*|g_1] = \begin{cases} (1 - F(1 - \overline{\alpha}))\, g_1 & \text{if} \quad g_1 \leq \frac{G_0}{2} \\ (F(1 - \underline{\alpha}) - F(1 - \overline{\alpha}))\,(G_0 - g_1) + (1 - F(1 - \underline{\alpha}))g_1 & \text{if} \quad g_1 > \frac{G_0}{2} \end{cases} \tag{5}$$

For $g_1 \leq \frac{G_0}{2}$, the follower donor either experiences low social pressure ($s_2 \leq 1 - \overline{\alpha}$) and gives nothing or high social pressure ($s_2 > 1 - \overline{\alpha}$) and gives g_1. Thus, for $g_1 \leq \frac{G_0}{2}$, the expected contribution by the follower donor is always increasing in g_1. For $g_1 > \frac{G_0}{2}$, the follower donor's response is decreasing in g_1 if the social pressure is moderate (i.e., $s_i \in (1 - \overline{\alpha}, 1 - \underline{\alpha}]$) and increasing in g_1 if the social pressure is strong (i.e., $s_i > 1 - \underline{\alpha}$). Thus, the expectation of the follower donor's response to increasing g_1 beyond $\frac{G_0}{2}$ depends on the relative likelihood of moderate and strong social pressure. The following lemma summarizes this observation.

Lemma 1 *If $\underline{\alpha} > 1 - F^{-1}\left(\frac{F(1-\overline{\alpha})+1}{2}\right)$, $E[g_2^*|g_1]$ is strictly increasing in g_1. Otherwise, $E[g_2^*|g_1]$ is non-monotonic in g_1: it is increasing in g_1 for $g_1 < \frac{G_0}{2}$ and (weakly) decreasing in g_1 for $g_1 > \frac{G_0}{2}$.*

Given the above characterization of the follower donor's best response, we can turn to the lead donor's optimal giving. In particular, the lead donor chooses g_1 to maximize:

$$\pi_1(w, g_1, E[g_2^*|g_1]) = \begin{cases} w - g_1 + (2 - F(1 - \overline{\alpha}))\overline{\alpha} g_1 & \text{if} \quad g_1 \leq \frac{G_0}{2} \\ \\ w - g_1 + F(1 - \overline{\alpha})\overline{\alpha} g_1 + (1 - F(1 - \overline{\alpha}))\overline{\alpha} G_0 & \text{if} \quad g_1 > \frac{G_0}{2} \\ \quad +(1 - F(1 - \underline{\alpha}))\underline{\alpha}(2g_1 - G_0) & \end{cases} \tag{6}$$

The above payoff is illustrated in Figure 1. For $g_1 \leq \frac{G_0}{2}$, the total giving never exceeds G_0 and from the above expression, the lead donor's payoff is increasing in g_1 if $F(1 - \overline{\alpha}) < \frac{1}{\overline{\alpha}} - 2$ and decreasing otherwise. For $g_1 > \frac{G_0}{2}$, the total giving exceeds G_0 only in the event of $s_2 > 1 - \underline{\alpha}$, in which case there is an incremental value of $\underline{\alpha}(2g_1 - G_0)$. However, since $\underline{\alpha} \leq \frac{1}{2}$, the marginal value of increasing g_1 beyond $\frac{G_0}{2}$ is always negative. Thus, $\pi_1(w, g_1, E[g_2^*|g_1])$ is always decreasing beyond $\frac{G_0}{2}$. As a result, as Figure 1 illustrates, there are two possible candidates for an equilibrium, mainly $g_1 \in \{0, \frac{G_0}{2}\}$. The following proposition formalizes this finding.

Proposition 1 *Under seed money, the equilibrium expected total contributions G^s and the individual expected contributions g_1^s and g_2^s are as follows:*

- *If $F(1-\overline{\alpha}) > \frac{1}{\overline{\alpha}} - 2$, then $G^s = g_1^s = g_2^s = 0$.*
- *If $F(1-\overline{\alpha}) < \frac{1}{\overline{\alpha}} - 2$, then $G^s = G_0(2 - F(1-\overline{\alpha}))/2$ with $g_1^s = \frac{G_0}{2}$ and $g_2^s = (1 - F(1-\overline{\alpha}))\,\frac{G_0}{2}$.*

The above proposition states that the equilibrium giving under seed money will depart from the payoff-maximizing strategy of zero contributions as long as $F(1-\overline{\alpha})$ is sufficiently small. That is, the lead donor contributes $\frac{G_0}{2}$ as long as the lead donor expects that the follower donor is sufficiently susceptible to social pressure and likely to match the lead donor's contribution. Conversely, if the likelihood of free-riding behavior by the follower donor is sufficiently strong, the equilibrium giving will revert to the non-cooperative outcome of no giving.

Notice that in the giving equilibrium, the lead donor leads by example and ends up giving a higher equilibrium amount relative to the follower donor's expected contribution. As $\overline{\alpha} \to 1$, so that the individual cost of giving disappears, or $F(1-\overline{\alpha}) \to 0$, so that the free-riding behavior by the follower donor vanishes, the two donors converge to coordinating on the jointly payoff-maximizing giving of G_0. Thus, stronger social pressure tends to increase giving up to G_0.

Next, we turn to the matching scheme to understand donors' contribution incentives induced by matching and compare them to the equilibrium giving under the seed money scheme given by Proposition 1.

2.3 Matching

Under the matching scheme, the lead donor's contribution is conditional on the follower donor's giving. Thus, this contribution no longer creates social pressure for the follower donor. Instead, it increases the marginal impact of the follower donor's gift by the size of the match m. Formally, the follower donor's payoff is given by:

$$\pi_2(w, m, g_2) = w - g_2 + v((1+m)g_2). \tag{7}$$

Substituting for $v(G)$ given by eq. (2), the marginal value of increasing g_2 is:

$$\frac{\partial \pi_2(w, m, g_2)}{\partial g_2} = \begin{cases} -1 + (1+m)\overline{\alpha} & \text{if} \quad g_2 \leq \frac{G_0}{1+m}, \\ -1 + (1+m)\underline{\alpha} & \text{if} \quad g_2 > \frac{G_0}{1+m}. \end{cases}$$

Taking into account the above marginal value, it immediately follows that the follower donor's optimal gift is:

$$g_2^*(m) = \begin{cases} 0 & \text{if} \quad m < \frac{1}{\overline{\alpha}} - 1, \\ min\{\frac{w}{m}, \frac{G_0}{1+m}\} & \text{if} \quad m \in [\frac{1}{\overline{\alpha}} - 1, \frac{1}{\underline{\alpha}} - 1), \\ \frac{w}{m} & \text{if} \quad m \geq \frac{1}{\underline{\alpha}} - 1. \end{cases} \tag{8}$$

A match ratio lower than $\frac{1}{\overline{\alpha}} - 1$ would always result in a negative marginal value of giving and thus the follower donor would never contribute to the public good. For an intermediate match ratio, i.e., $[\frac{1}{\overline{\alpha}} - 1, \frac{1}{\underline{\alpha}} - 1)$, the follower donor has incentives to contribute until the total contribution $(1+m)g_2$ reaches G_0. This would induce giving of $\frac{G_0}{1+m}$ by the follower donor, except when the lead donor's wealth is exhausted at a total contribution level below G_0. In the latter case, the follower donor will give $\frac{w}{m}$ that is just enough to induce the lead donor to give everything. Finally, for a high match ratio of $m > \frac{1}{\underline{\alpha}} - 1 > 1$, the follower donor will always contribute $\frac{w}{m}$ to exhaust the lead donor's wealth. Any giving beyond that would not be matched and thus would be sub-optimal for the follower donor to further increase her contribution.

It is clear from eq. (8) that the match ratio plays a similar role as the social pressure parameter in eq. (4) by inflating the perceived return from the public good. Thus, offering a high enough match ($m \geq \frac{1}{\overline{\alpha}} - 1$) will induce giving by the follower donor. Interestingly, however, the follower donor's gift amount is not necessarily increasing in m. In fact, within each of the matching intervals, the follower donor's contribution is decreasing in the match ratio. This is because a higher match ratio requires a lower contribution by the follower donor in order to meet the threshold of G_0 or exhaust the lead donor's budget. Thus, from the lead donor's point of view, a match is potentially advantageous only to the extent that it incentivizes the follower donor to move to a higher interval. This is evident in the lead donor's payoff:

$$\pi_1(w, m, g_2^*(m)) = \begin{cases} w & \text{if} \quad m < \frac{1}{\overline{\alpha}} - 1 \\ w + (\overline{\alpha} - \frac{m}{1+m})G_0 & \text{if} \quad m \in [\frac{1}{\overline{\alpha}} - 1, min\{\frac{1}{\underline{\alpha}} - 1, \frac{w}{G_0 - w}\}) \\ \frac{\overline{\alpha}(1+m)}{m} w & \text{if} \quad w \leq (1 - \underline{\alpha})G_0 \ \& \ m \geq \frac{w}{G_0 - w} \\ \frac{\underline{\alpha}(1+m)}{m} w + (\overline{\alpha} - \underline{\alpha})G_0 & \text{if} \quad w > (1 - \underline{\alpha})G_0 \ \& \ m \geq \frac{1}{\underline{\alpha}} - 1. \end{cases} \tag{9}$$

From the above equation, it is evident that the lead donor's payoff is (weakly) decreasing in m in each interval. This limits the equilibrium candidates to only four payoff relevant match ratios: $m^* \in \{0, \frac{1}{\overline{\alpha}} - 1, \frac{1}{\underline{\alpha}} - 1, \frac{w}{G_0 - w}\}$. Comparing the payoffs of these matching levels leads to the following proposition.

Proposition 2 *Under matching, the optimal match ratio for the lead donor is $m^* = \frac{1}{\overline{\alpha}} - 1$, giving rise to total contributions of $G^m = G_0$ and individual contributions of $g_1^m = (1 - \overline{\alpha})G_0$ and $g_2^m = \overline{\alpha}G_0$.*

Similar to the seed money case, the lead donor under matching aims to implement the jointly payoff-maximizing contribution of G_0. However, comparing Propositions 1 and 2, it is evident that the lead donor is able to induce coordination by the follower donor more easily under matching than seed money. That is, under matching the equilibrium contribution to the public good is G_0, while under seed money it is below G_0 apart from the knife-edge case of complete susceptibility to social pressure (i.e., $F(1-\overline{\alpha})=0$). This is due to the fact that under matching the lead donor can induce giving by the follower donor regardless of the follower donor's susceptibility to social pressure. In contrast, under seed money, the lead donor's ability to encourage contribution by the follower donor explicitly relies on the follower donor's response to social pressure.

Given our characterization of the equilibrium behavior under the two schemes, a few testable implications emerge that we discuss in the following section.

2.4 Testable Implications

Our theoretical analysis reveals that both seed money and matching may alleviate free-riding incentives by the follower donor. Nonetheless, while there always exists a match ratio that induces giving by the follower donor, under seed money the lead donor's contribution only impacts follower donors that are susceptible to social pressure. Thus, matching is more effective at avoiding a non-cooperative giving of zero by the follower donor. Consequently, as revealed by Propositions 1 and 2, matching always (weakly) outperforms seed money in terms of total contributions to the public good.

Observation 1: *Matching raises (weakly) higher total contributions relative to seed money. The difference between the two depends on the degree to which the follower donor is susceptible to social pressure and willing to match the lead donor's contribution under seed money.*

Comparing the individual giving amounts, it is evident that seed money induces higher giving by the lead donor as compared to the follower donor, while the reverse is true for matching. This again goes back to the fact that matching is more effective at incentivizing giving by the follower donor compared to seed money. Moreover, while by Proposition 2, the lead donor's giving under matching is fixed at $(1-\overline{\alpha})G_0$, by Proposition 1, under seed money she gives either zero (non-giving equilibrium) or $\frac{G_0}{2}$ (giving equilibrium). Thus, since $\overline{\alpha} > \frac{1}{2}$, conditional on giving, the lead donor gives more under seed money than matching and vice versa. Nonetheless, regardless of which equilibrium occurs under seed money, the follower donor, always contributes more to the public good when the fundraising scheme employed is matching.

Observation 2: *The follower donor is expected to contribute a higher amount under matching relative to seed money.*

Finally, considering the two schemes from the fundraiser's point of view, it is clear that matching should be the preferred scheme by the fundraiser since it always (weakly) outperforms seed money.

Observation 3: *The fundraiser is more likely to choose matching over seed money when soliciting the two donors.*

This last observation relies on the fundraiser's ability to correctly anticipate the donors' behavior and respond optimally by choosing the matching scheme. Since the difference between the two depends on the extent to which the follower donor responds to social pressure, it is not obvious that the fundraiser will be able to easily anticipate the outcome from the contribution game.

In the next section, we present our experimental design and the hypotheses corresponding to Observations 1-3.

3 The Experiment

3.1 Design

Our experimental design follows closely the theoretical model presented in Section 2. It consists of three players: Player 1 (the fundraiser), Player 2 (the lead donor), and Player 3 (the follower donor). The fundraiser is initially endowed with 0 tokens and seeks contributions for a "group project" (the public good) from the other two players. Her payoff is the sum of all contributions. The exchange rate in our experiment is 1 token equals \$0.20 for all players.

The game played by the lead donor and the follower donor depends on the "contribution form" (i.e., the fundraising scheme) that can be either "matching" or "lump sum" (seed money). In particular, we implement a between subjects design, in which participants are randomly assigned to one of three treatments: *Exogenous Seed*, *Exogenous Match*, *Endogenous Scheme*. In the first two treatments, the contribution form is exogenously set by the experimenter to seed money or matching, respectively. In both of these treatments, the fundraiser is non-strategic and simply collects a payoff based on the contributions of the other two players. In the *Endogenous Scheme* treatment, we allow the fundraiser to choose the fundraising scheme prior to the contribution choices of the other two players.

The lead donor and the follower donor are initially given an endowment of 40 tokens each, i.e., $w = 40$. After observing the contribution form chosen by the fundraiser (or set by the experimenter in the exogenous treatments), the two donors make sequential decisions about how much to contribute to the group project. The follower donor, who moves last, also observes the lead donor's contribution decision. The payoff for each donor is given by eq. (1) where the group project returns in eq. (2) correspond to the parameter values of $\overline{\alpha} = 0.7$, $\underline{\alpha} = 0.1$, and $G_0 = 40$. Given these values, the maximum possible total contribution is 80 tokens, but contributions are jointly payoff-maximizing for the donors only up to 40 tokens. The fundraiser's payoff, however, is monotonically increasing in total contributions up to 80 tokens.

In order to avoid computationally burdensome decisions by the subjects in the lab, we discretize the choice sets of the two donors by only allowing contributions in multiples of 10. Therefore, under both schemes, the total contributions are between 0 and 80 in increments of 10. This allows us to present the returns from the group project (i.e., $v(G)$) to the subjects in the form of the table shown in Figure 2.

TOTAL CONTRIBUTIONS TO GROUP PROJECT (PLAYER 2 + PLEYER 3)	Individual return for each of PLAYER 2 and PLEYER 3	Additional return from just the last 10 tokens for each of PLAYER 2 and PLEYER 3
0	0	--
10	7	7
20	14	7
30	21	7
40	28	7
50	29	1
60	30	1
70	31	1
80	32	1

Figure 2: Group Project Payoff Table

Under seed money, each donor is allowed to make a lump sum contribution in multiples of 10 up to their endowment of 40 tokens. This results in five possible actions for each player given by the set $\{0, 10, 20, 30, 40\}$. Under matching, the follower donor's choice set remains the same as under seed money, but the lead donor makes a commitment to match a percentage of the follower donor's contribution. To keep the number of choices consistent across the two treatments, we allow for five possible match ratios in the set $\{0\%, 25\%, 50\%, 75\%, 100\%\}$. Furthermore, in order to keep the set of possible contribution amounts of the lead donor the same across the two schemes and avoid dealing with fractions or decimals, the resulting matching contribution by the lead donor is rounded down to the nearest multiple of 10.[14]

While the fundraiser has only two choices in the endogenous treatment and none in the exogenous treatments, each donor has five choices that make a total of 25 choice combinations under each scheme. Moreover, calculating the payoffs under matching might be slightly more complicated for the subjects than under seed money.[15] Therefore, to further simplify the decision making process for the subjects and avoid calculation errors or complexity impacting subjects' choices, we provide them with pre-calculated "earnings tables" depicted in Figure 3. The matrix on the left (right) provides the total tokens earned by each group member for every possible contribution to the group project under seed money (matching). The top number in each square (orange on the game screen) corresponds to the earnings for the fundraiser, the bottom left number (blue on the game screen) corresponds to the earnings for the lead donor, and the bottom right number (yellow on the game screen) corresponds to the earnings for the follower donor.

[14]For example, if the lead donor chooses 50% and the follower donor contributes 30 tokens to the group project, then 50% of 30 tokens is equal to 15 tokens, but the lead donor's contribution will be rounded down to be 10 tokens. The reason for rounding down the lead donor's contribution is to avoid a situation where simple rounding forces the lead donor to give more than she intended. In the above example, for instance, simply rounding 15 to the nearest multiple of 10 results in the lead donor contributing 20 tokens that is more than the 50% match they chose.

[15]The greater complexity of the matching contribution form is due to the additional step that subjects need to make when calculating the contribution amount of the lead donor from the match ratio and the contribution amount of the follower donor.

Player 2 \ Player 3	0	10	20	30	40
0	0 40 40	10 47 37	20 54 34	30 61 31	40 68 28
10	10 37 47	20 44 44	30 51 41	40 58 38	50 59 29
20	20 34 54	30 41 51	40 48 48	50 49 39	60 50 30
30	30 31 61	40 38 58	50 39 49	60 40 40	70 41 31
40	40 28 68	50 29 59	60 30 50	70 31 41	80 32 32

Player 2 \ Player 3	0	10	20	30	40
0%	0 40 40	10 47 37	20 54 34	30 61 31	40 68 28
25%	0 40 40	10 47 37	20 54 34	30 61 31	50 59 29
50%	0 40 40	10 47 37	30 51 41	40 58 38	60 50 30
75%	0 40 40	10 47 37	30 51 41	50 49 39	70 41 31
100%	0 40 40	20 44 44	40 48 48	60 40 40	80 32 32

Figure 3: Earnings tables for seed money (left) and matching (right) with equilibrium payoffs marked with a black box for the payoff-maximizing equilibrium prediction and a gray box for the social pressure equilibrium prediction.

3.2 Hypotheses

The seed money earnings table in Figure 3 reveals that with purely payoff-maximizing players, no contributions (marked by a black box) would be the subgame perfect Nash equilibrium of the game. Moreover, by Proposition 1, this would also be the outcome if the lead donor is pessimistic and believes that the follower donor is not very likely to respond to social pressure. More formally, if $F(0.3) > \frac{4}{7}$ or the social pressure parameter s_2 for the follower donor is below 0.3 with a probability higher than 57%, then the lead donor will be pessimistic about the follower donor's response to her contribution. Consequently, the lead donor will contribute nothing and so will the follower donor, resulting in no overall contributions. In contrast, if the lead donor is optimistic about the likelihood of the follower donor responding to social pressure, i.e. $F(0.3) < \frac{4}{7}$, then by Proposition 1, she will contribute 20 tokens and in response, the follower donor will choose to give either 20 tokens if she is susceptible to social pressure or zero if she is not. These two possible outcomes are marked by the two gray boxes in the seed money earnings table in Figure 3. In this case, the expected total contribution is $20F(0.3) + 40(1 - F(0.3)) \in [20, 40]$.

Even though our theoretical analysis assumes that in equilibrium all players correctly infer the distribution of the follower donor's types (i.e., the social pressure parameter), in the laboratory not all subjects assigned to the role of lead donor will have the correct (or even similar) perception about the type distribution. Therefore, we should expect to observe a variation in the lead donor's behavior based on different conjectures about the distribution $F(s_2)$. As a result, the expected total contribution under seed money depends not only on $F(s_2)$, but also on the distribution of the lead donor's beliefs about $F(s_2)$. Suppose that the lead donor is optimistic and believes $F(0.3) < \frac{4}{7}$ with probability γ. Then, the expected total contribution to the public good would be:

$$E(G^s) = \gamma[20F(0.3) + 40(1 - F(0.3))] \in [0, 40]. \tag{10}$$

Eq. (10) states that any contribution amount between zero and 40 tokens is possible under some distribution of types. Nonetheless, mid-range predictions are probably more reasonable. For example, if we use the distribution of types found in Krupka and Weber (2013) and set $F(0.3) = \frac{1}{3}$ and further assume that the lead donor is optimistic with probability $\gamma = \frac{2}{3}$, then the expected contributions by the lead donor and the follower donor would be 13.33 and 8.89 tokens respectively.[16] This will result in total expected contributions of 22.22 tokens.

Under the matching contribution form, the equilibrium prediction is rather straightforward as marked by the black boxes on the matching earnings table in Figure 3. The optimal match ratio for the lead donor is 50% or 75% and the best response of the follower donor is to contribute 20 tokens. This results in the lead donor giving 10 tokens and total contributions of 30 tokens.[17] Comparing this prediction to Proposition 2 that allows for a continuous choice set reveals that the optimal match ratio is $m^* = \frac{1}{.7} - 1 \approx 42.86\%$, giving rise to total contributions of 40 tokens. Thus, discretization and rounding puts matching at a disadvantage. Given the nature of matching and our emphasis on designing a game that is simple enough for a lab setting made this deviation from a continuous game unavoidable. Nevertheless, 30 tokens is still greater than our expected contributions under seed money as long as the social pressure effect is not too strong. Thus, we expect the qualitative comparison between the two schemes to be consistent with our theoretical analysis and the fundraiser's optimal choice to be the matching contribution form.

Turning to the individual behavior, the numerical conjectures reveals that consistent with our continuous theoretical model in Section 2, the bigger contribution share shifts from the lead donor to the follower donor when switching from seed money to matching. Furthermore, while the lead donor is always expected to contribute 10 tokens under matching, her expected contribution under seed money varies between zero and 20 tokens depending on the probability γ. For example, as discussed above, for $\gamma = \frac{2}{3}$, the lead donor's expected contribution is 13.33 tokens, which is higher than matching. Their order would reverse for $\gamma < \frac{1}{2}$. Finally, the follower donor's expected contribution under seed money that varies between 0 and 20 tokens depending on the probabilities γ and $F(0.3)$ is always lower than the 20 tokens that she contributes in the matching equilibrium.

To summaze the above discussion, we expect the following hypotheses to hold:

- **Hypothesis 1**: Total contributions in the *Exogenous Seed* treatment do not exceed total contributions in the *Exogenous Match* treatment.
- **Hypothesis 2**: The follower donor contributes more in the *Exogenous Match* treatment than the *Exogenous Seed* treatment.
- **Hypothesis 3**: The fundraiser is more likely to choose matching than seed money in the *Endogenous Scheme* treatment.

3.3 Experimental Procedures

As explained in Subsection 3.2, the study has a between subjects design, in which each session is assigned to one of the three treatments: *Exogenous Seed*, *Exogenous Match*, *Endogenous Scheme*. The order of play, actions, and payoffs are summarized in Table 1.

[16] Krupka and Weber (2013) report that almost a third of their study population were pure payoff maximizers and did not respond to social pressure. The rest were susceptible to social pressure to some extent. Hence, assuming $F(0.3) = \frac{1}{3}$ is a rather conservative lower bound.

[17] The existence of two equilibria that are payoff-equivalent for all players is a result of the rounding down of the lead donor's contribution under matching.

Table 1: Game Summary
g_1 and g_2 correspond to the contributions of the lead donor and the follower donor, respectively; $G = g_1 + g_2$ corresponds to the total contributions; and $v(G)$ is the payoff function given by eq. (2).

Players in order of play	Initial Endowment	Choice Set *Exogenous Seed*	Choice Set *Exogenous Match*	Choice Set *Endogenous Scheme*	Payoff
Player 1 (fundraiser)	0	None	None	{matching, seed money}	$g_1 + g_2$
Player 2 (lead donor)	40	$\{0, 10, 20, 30, 40\}$	$\{0\%, 25\%, 50\%, 75\%, 100\%\}$	If matching $\{0\%, 25\%, 50\%, 75\%, 100\%\}$ If seed money $\{0, 10, 20, 30, 40\}$	$40 - g_1 + v(G)$
Player 3 (follower donor)	40	$\{0, 10, 20, 30, 40\}$	$\{0, 10, 20, 30, 40\}$	$\{0, 10, 20, 30, 40\}$	$40 - g_2 + v(G)$

At the beginning of each session, subjects are seated at study stations equipped with eye-tracking devices and the system is calibrated using a 9-point calibration procedure. The instructions are read by the experimenter while subjects follow them on their computer screens. Following the instructions, three test questions are presented to ensure that the subjects understand the game. They must answer all the questions correctly before proceeding to the game. Subjects are then randomly assigned to the three possible roles: Player 1 (the fundraiser), Player 2 (the lead donor), or Player 3 (the follower donor).

In all three treatments, the lead donor observes the contribution form chosen by the fundraiser or the experimenter prior to making her contribution decision. She either chooses a lump sum amount (under the seed money scheme) or a percentage of the follower donor's contribution (under the matching scheme) to contribute to the group project. Then, the follower donor, who observes the contribution form and the lead donor's choice, decides on her own lump sum contribution. As explained in Subsection 3.1, subjects see the earnings tables depicted in Figure 3 during the instructions and whenever they make a decision, precluding the need for them to make any calculations.

All players know in which treatment they are participating. More specifically, the lead donor and the follower donor know whether the contribution form was set by the experimenter or chosen by Player 1. Furthermore, we deliberately avoid the use of terms such as donation, public good, charity, fundraising, seed money, and matching gift, in order to avoid priming the subjects by the fact that this is a study about charitable giving.

Subjects play the game for 3 practice and 10 incentivized rounds. One of the incentivized rounds is randomly chosen to determine the monetary payments based on the choices made in that round. In each round, subjects are randomly and anonymously (re)matched into groups of 3 with one subject for each role. Moreover, the roles remain the same throughout the session. After the last round of the game, subjects fill out a survey about demographics, educational background, math skills, Cognitive Reflection Test (CRT), family background, and charitable activity. At the end of the experiment, subjects are paid (in cash and privately) a $10 show-up fee plus 20 cents per token earned in the randomly chosen round of the game.

4 Data Collection

A total of 396 subjects from the undergraduate student population at Texas A&M University participated in 46 sessions during April and November, 2019 at the TAMU Human Behavior Laboratory. They were recruited via a university-wide bulk email. Table 2 summarizes the main individual characteristics of the sample by treatment. Kruskal-Wallis tests show that individual characteristics are fairly balanced across treatments. Nevertheless, we control for these characteristics in our regressions.

Table 2: Summary statistics of subject characteristics per treatment (Standard deviations in parentheses)

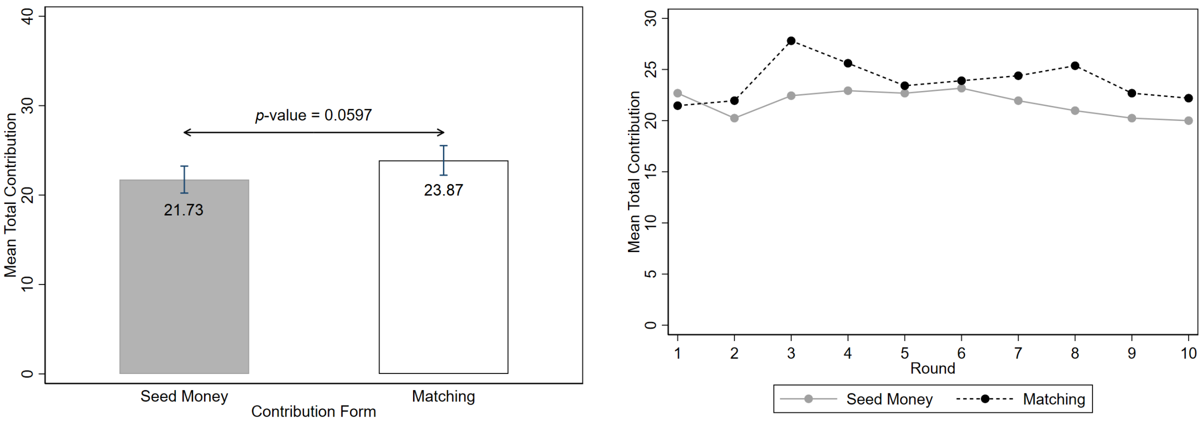
	Endogenous Scheme treatment	Exogenous Seed treatment	Exogenous Match treatment	Kruskal-Wallis test p-value
No. of sessions	16	14	15	
No. of subjects	150	123	123	
Female (%)	59.33 (49.29)	52.03 (50.16)	51.22 (50.19)	0.3257
Junior or higher academic level (%)	50.67 (50.16)	48.78 (50.19)	57.72 (49.60)	0.3303
Family income below $75,000 (%)	45.33 (49.95)	41.46 (49.47)	41.46 (49.47)	0.7527
Donated $5 or more in the past month (%)	32 (46.80)	30.08 (46.05)	28.46 (45.30)	0.8166
Past experiments participated	2.09 (2.50)	2.18 (2.84)	2.27 (2.50)	0.4529
Math courses taken	2.53 (2.42)	2.59 (1.76)	2.94 (2.24)	0.1549

We collected data on the lead donor and the follower donor's contribution decisions in each round of all treatments. In the *Endogenous Scheme* treatment, we also collected data on the fundraiser's choice of contribution form. All decision times are also recorded. Additionally, we elicited incentivized beliefs by the fundraiser and the lead donor regarding the decisions made by downstream players by asking them to make a guess about these decisions. Correct guesses were compensated by a bonus of 4 tokens. We also collected eye-tracking data using Tobii Spectrum eye-tracking devices to reveal visual attention to the presented information. The eye-tracking devices collect at a rate of 60 data points per second. The information collected includes the time to first fixation (i.e., how long it takes participants to look at an area of interest for the first time); fixation duration (i.e., how long they look at each area); and fixation count (i.e., how many times they look at an area). All data collection was synchronized and recorded simultaneously to obtain a complete behavioral picture of the participants' decision process.

5 Results

5.1 Total contributions under each contribution mechanism

Figure 4 Panel (a) summarizes total contributions under each of the exogenous scheme treatments. The average total contributions to the group project under the *Exogenous Seed* treatment (21.73 tokens) was about 10% lower (t-test $p=0.0597$) than those under the *Exogenous Match* treatment



(a) Average fundraising (with 95% confidence intervals) (b) Fundraising over time

Figure 4: The comparison between matching and seed money

(23.87 tokens).[18] Thus, consistent with Hypothesis 1, total fundraising under seed money does not exceed that of matching. Moreover, the gap between matching and seed money is persistent over time as presented in Figure 4 Panel (b).

Table 3 presents regression estimates of the effect of the contribution form on total contributions that controls for a time trend (rounds of the game) and individual characteristics. Matching is the coefficient of interest that measures the effect of matching in fundraising compared to seed money, which is the baseline.[19] We use two-way clustering to adjust the standard errors for correlations between observations that either share the same lead donor or the same follower donor. After correcting the standard errors, the effect of matching is not statistically significant. Nonetheless, this is not inconsistent with our Hypothesis 1, which only requires matching to weakly dominate seed money in fundraising.

Based on our theory, the fact that fundraising under seed money is close to that of matching, suggests that a large number of observations in the *Exogenous Seed* treatment must entail positive contributions by the lead donor. The latter occurs if a large number of subjects assigned to the role of lead donor expect the follower donor to respond to social pressure. Then, by Propositions 1 and 2, if the lead donor under seed money contributes a positive amount, her contribution under seed money exceeds the one under matching. Thus, in the presence of significant giving by the lead donor under seed money, we would expect the lead donor's giving under seed money to be larger

[18] Mann–Whitney U-test $p = 0.0538$

[19] The controls Week 2 and Week 3 refer to the second and third weeks of the experiments that lasted for 2 weeks in April 2019 and 1 week in November 2019. Small Session indicates that the session had 6 (as opposed to 9-12) participants. Year 3+ indicates that the student was a junior or higher. Income refers to family income. Experience above mean indicates that the average number of experimental studies the lead donor and the follower donor in a group had participated in, prior to this study was above the average of the sample. Found it Easy indicates that the lead donor and follower donor (on average) rated this study to be easier than 2 out of 10. 5+ Math Courses indicates that on average the lead donor and the follower donor had taken more than 4 math courses. Math Question is 1 if both the lead donor and the follower donor answered the math question correctly in the survey, 0.5 if only one answered correctly, and 0 if neither did. CRT Score is the average Cognitive Reflection Test score (out of 3) of the lead donor and the follower donor.

Table 3: Effect of contribution scheme on total contributions to the public good

	(1)	(2)	(3)
Matching	2.146 (2.756)	2.003 (2.661)	3.019 (2.526)
Round	-0.114 (0.123)	-0.114 (0.124)	-0.119 (0.133)
Week 2		3.350 (4.003)	3.533 (4.062)
Week 3		6.599* (3.333)	6.382* (3.356)
Small Group		-0.235 (3.146)	0.449 (3.319)
Female Player 2			-3.888 (2.505)
Female Player 3			-0.978 (2.386)
Year 3+ Player 2			-0.327 (2.645)
Year 3+ Player 3			-5.303** (2.125)
Income<\$75K Player 2			0.0570 (2.349)
Income<\$75K Player 3			4.984** (2.069)
Experience above mean			1.255 (2.146)
Found it Easy			2.457 (2.586)
5+ Math Courses			-1.726 (4.174)
Math Question			3.982 (3.682)
CRT Score			0.555 (1.759)
Constant	22.36*** (1.928)	18.46*** (3.159)	16.04*** (5.298)
Observations	820	820	820

Standard errors in parentheses are clustered at the individual level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

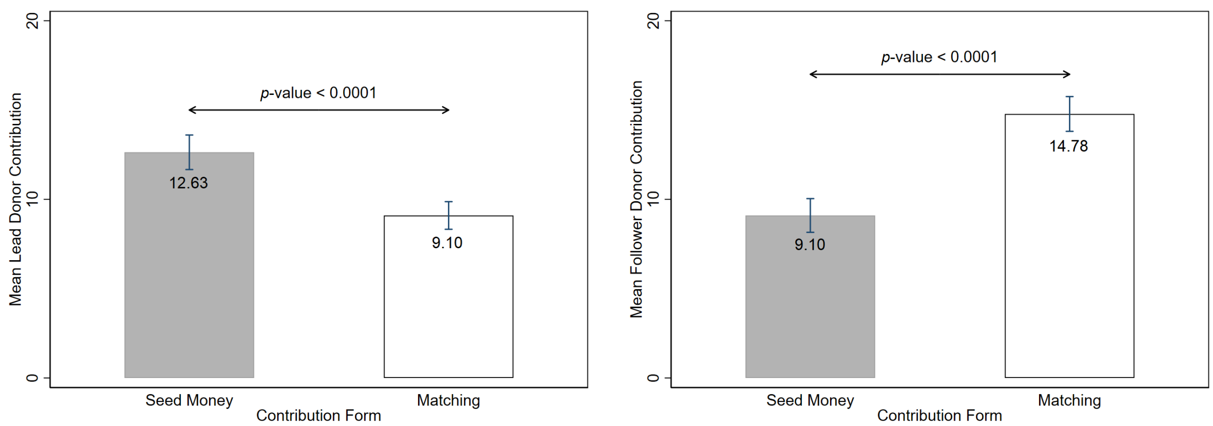
than the one under matching. The same two propositions also state that the opposite is true for the follower donor who contributes a higher amount under matching than seed money. In the next section, we turn to the individual contributions by each of the two donors in the experiment in order to investigate these predictions.

5.2 Individual contributions for seed money and matching gift

In line with our theoretical analysis, the lead donor contributes on average 12.63 tokens in the *Exogenous Seed* treatment, which is significantly higher than the 9.10 tokens under the *Exogenous Match* treatment (t-test $p< 0.0001$).[20] The opposite is true for the follower donor's contribution with 9.10 tokens in the *Exogenous Seed* treatment and 14.78 tokens in the *Exogenous Match* treatment (t-test $p< 0.0001$).[21] Thus, while the lead donor has the biggest share of contributions under seed money, the follower donor contributes the most under matching. The fact that the follower donor's average contribution under matching is 62% higher than the average contribution under seed money strongly supports Hypothesis 2. Moreover, these effects are persistent in all rounds of the game (Figure 6).

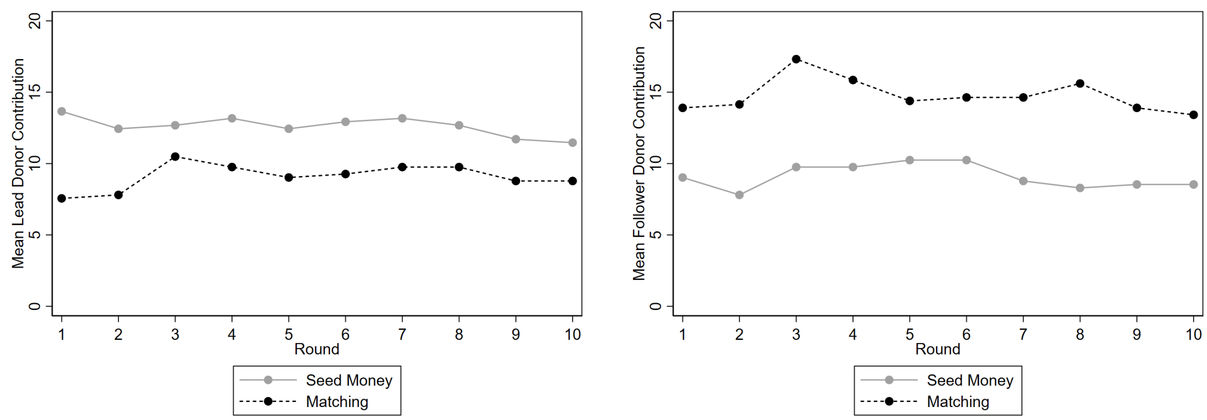
The distributions of contribution choices by donors corroborate our theoretical analysis. Under matching, the contribution choices of the lead donor (Figure 7 Panel (b)) have a distinct peak at the match ratio of 50%. Recall that, as shown in Figure 3, 50% and 75% are the payoff-maximizing choices that encourage the follower donor to contribute 20 tokens ($\frac{G_0}{2}$), resulting in the lead donor contributing half of that (10 tokens). Turning to the follower donor's behavior, Figure 8 Panel (b)

[20]Mann-Whitney U-test $p< 0.0001$
[21]Mann-Whitney U-test $p< 0.0001$



(a) Lead Donor (b) Follower Donor

Figure 5: Average individual contributions (with 95% confidence intervals)

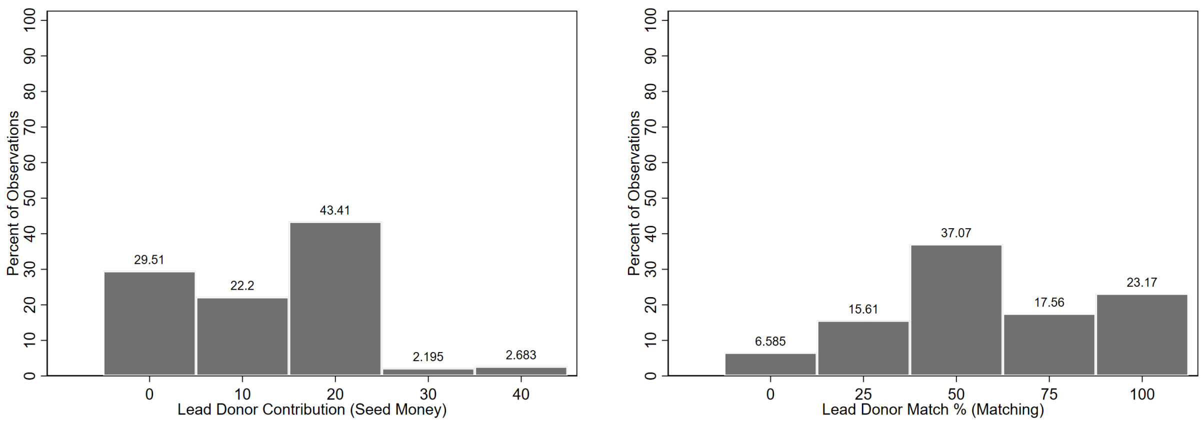


(a) Lead Donor (b) Follower Donor

Figure 6: Individual contributions over time

presents the distribution of their response to match ratios of 50% or more.[22] A strong majority (76.18%) choose the theoretically predicted payoff-maximizing contribution $g_2^*(m)$. Furthermore, the histogram in Figure 8 Panel (d) demonstrates that 84.64% of the time the lead donor also expects the follower donor to make the payoff-maximizing contribution $g_2^*(m)$. Hence, a strong majority of subjects behave (and expect others to behave) according to our theoretical predictions that stipulate a total contribution of 30 tokens under matching. However, as depicted in Figures 7 Panel (b) and 8 Panel (b), slightly more than 20% of the time the lead donor chooses low match ratios of 0% or 25%, and just above 15% of the time the follower donor gives below the payoff-maximizing level. As a result, average total contributions under matching fall somewhat short of the theoretically predicted 30 tokens.

[22] The reason for focusing on a match ratio of 50% or more is that for lower match ratios, the optimal response for the follower donor is to contribute zero. Thus, there are no choices below the optimal level for the follower donor. As a result, the observed distribution would underrepresent those who prefer to give below the payoff-maximizing level.



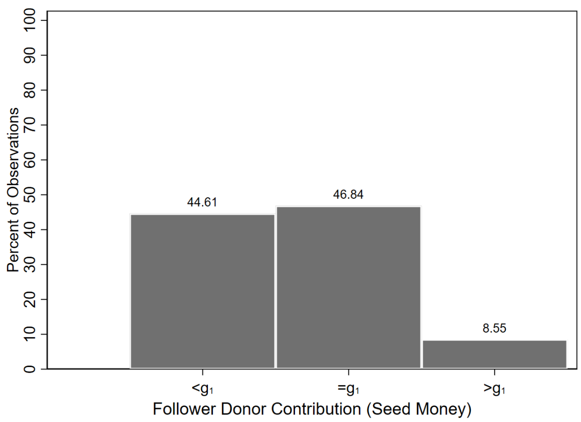
(a) Seed Money (b) Matching

Figure 7: Distribution of the lead donor's decision

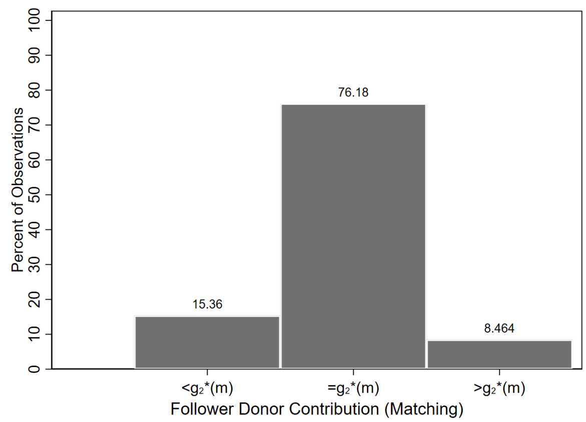
Under seed money, the distribution of the lead donor's choices has two peaks at zero and 20 tokens with the latter being the most popular choice (Figure 7 Panel (a)). As depicted in Figure 3, and explained in the corresponding discussion, 20 tokens is payoff-maximizing for the lead donor if she is optimistic and believes that the follower donor is likely to respond to social pressure with a probability of 0.43 or higher. The other peak of the distribution, which is contributing nothing, is payoff-maximizing for the lead donor if she is pessimistic about the likelihood of the follower donor responding to social pressure. In order to verify that the lead donor's most popular choice of 20 tokens is consistent with our theory, we need to estimate the probability that the susceptibility of the follower donor to social pressure, i.e. s_2, is below 0.3. Recalling that F denotes the distribution of s_2, this probability can be simply written as $F(0.3)$.

First, note that the follower donor's choice fully reveals her type, i.e. $s_i > 0.3$ or $s_i < 0.3$, only when the lead donor's contribution is positive and not above 20 tokens.[23] The distribution of the follower donor's choices based on how she responds to the lead donor when the latter chooses to contribute 10 or 20 tokens is depicted in Figure 8 Panel (a). Consistent with our theoretical analysis, contributions exceeding that of the lead donor are very rare (8.55% of observations). The proportion of observations where the follower donor contributes less than the lead donor is 44.61%, which is a good estimate for $F(0.3)$ or the likelihood that the follower donor is not susceptible to social pressure. This estimate has a standard error of 0.0303. Thus, the threshold of 57%, calculated in Section 3.2, is outside the 95% confidence interval of $[0.3867, 0.5055]$. Therefore, the likelihood that the follower donor is susceptible to social pressure is high enough for the lead donor to contribute 20 tokens ($\frac{G_0}{2}$), which in turn is consistent with the observation that 20 tokens is the most popular choice for the lead donor. Furthermore, the distribution of the elicited beliefs of

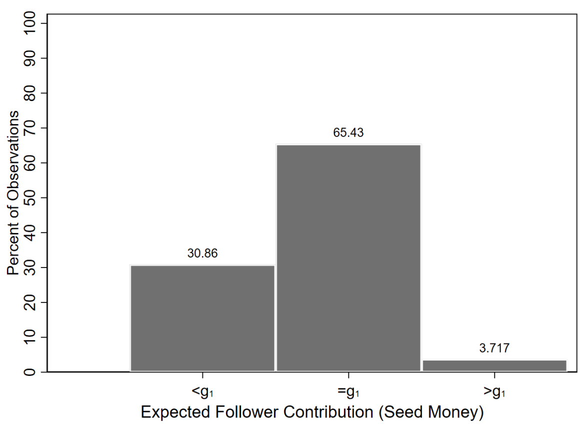
[23]As discussed in Section 2.2, when the lead donor chooses zero, the best response by the follower donor is zero regardless of whether or not she is susceptible to social pressure. Also, when the lead donor chooses 40 tokens, the follower donor should contribute nothing unless she is extremely susceptible to social pressure ($s_i > 0.9$). Finally the best response to 30 tokens is only 10 tokens for those who are susceptible to social pressure and zero otherwise, unless $s_i > 0.9$. Therefore, the observations of the follower donor's contribution in these cases do not reveal whether $s_i > 0.3$ or $s_i < 0.3$.



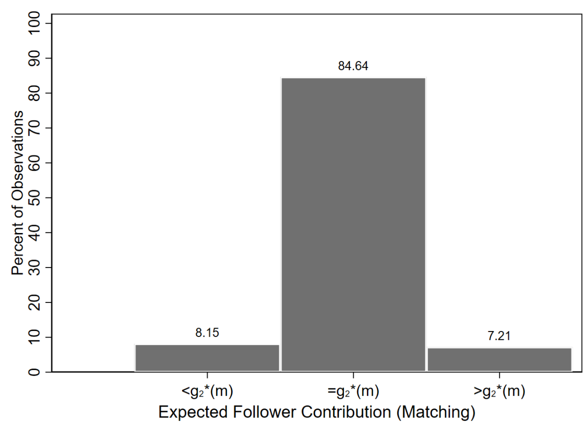
(a) Follower Donor's Choice (Seed Money)



(b) Follower Donor's Choice (Matching)



(c) Lead Donor's Expectation (Seed Money)



(d) Lead Donor's Expectation (Matching)

Figure 8: The data is limited to when the lead donor contributes 10 to 20 tokens under seed money and when the lead donor chooses a 50% or higher match ratio under matching. g_1 stands for lead donor's contribution and $g_2^*(m)$ stands for follower donor's best response (payoff-maximizing choice).

the lead donors who contribute 10 or 20 tokens (Figure 8 Panel (c)) reveals that they are indeed optimistic and expect the follower donor to match their contribution more than 65% of the time.

The above findings with the assumption that all subjects are somewhat aware of the estimate of $F(0.3) = 44.61\%$ might lead one to expect the lead donor to choose to contribute 20 tokens all the time. Then, along with the fact that the follower donor matches the lead donor's contribution just above half of the time, one should expect average total contributions under seed money to be just above 30 tokens. However, as discussed in Section 3.2, it is more realistic to expect some subjects in the role of lead donor to be pessimistic and overestimate $F(0.3)$, especially in light of the fact that both 44.61% and the threshold of 57% are close to 50%. Such pessimistic type's payoff-maximizing choice is to contribute nothing, which is consistent with the second peak at zero in the distribution of the lead donor's contribution choices depicted in Figure 7 Panel (a). We also find that the lead donors who choose not to contribute to the public good expect the follower donor to give nothing 92% of the time. Since the follower donor's best response to a zero leadership gift is to also not contribute anything, total contributions in this case will be zero. The latter justifies

Table 4: Effect of contribution scheme on the lead donor's contribution

	(1)	(2)	(3)
Matching	-3.537** (1.469)	-3.565** (1.355)	-2.598* (1.447)
Round	-0.0303 (0.0736)	-0.0303 (0.0737)	-0.0303 (0.0741)
Week 2		1.657 (2.286)	1.895 (2.242)
Week 3		2.579 (2.548)	1.442 (2.437)
Small Session		-0.721 (2.051)	-0.357 (2.045)
Female			-1.572 (1.723)
Year 3+			0.908 (1.807)
Income<$75K			0.270 (1.486)
Donated >$5 past month			-1.870 (1.779)
Experience above mean			1.358 (1.668)
Found it Easy			2.801* (1.409)
5+ Math Courses			-1.319 (2.375)
Math Question			-1.145 (1.957)
CRT Score			1.032 (1.005)
Constant	12.80*** (1.237)	11.37*** (2.786)	9.558*** (3.281)
Observations	820	820	820

Standard errors in parentheses are clustered at the individual level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

our main finding that the average total contributions under seed money are less than 30 tokens.

We also collected eye-tracking data on visual attention that corroborate our theoretical predictions. The eye-tracking results are presented in Appendix B. Figure B-3 shows the heat map of the aggregate eye fixations of the lead donor. Table B-3 provides the statistical tests comparing the visual attention to the equilibrium boxes and the visual attention to the whole earnings table divided equally over all boxes. Similarly, the follower donor's eye fixations heat map and corresponding statistical tests are presented in Figure B-4 and Table B-4. The results reveal that under both schemes, donors pay 2-3 times more visual attention to the equilibrium boxes as marked in Figure 3, which further supports the notion that subjects make decisions with an understanding of the game and the payoffs associated with their choices.

We end this section by presenting regression estimates of the effect of the contribution form on individual contributions, controlling for a time trend (rounds of game) and individual characteristics. The results are presented in Tables 4 and 5.[24] Matching is the coefficient of interest that measures the increase in contribution due to matching compared to seed money, which is the baseline. The effect on the lead donor's contribution (Table 4) is negative. In contrast, we estimate a positive, large (almost 6 tokens), and statistically significant effect of matching on the follower donor's contribution (Table 5). Hence, for the same (or a smaller) leadership gift, the follower donor contributes more under matching, which is consistent with our theoretical predictions and

[24]In the controls Week 2, Week 3, Small Session, Year 3+, and Income are defined as before. Experience above mean indicates that the number of experimental studies the lead donor (or the follower donor) had participated in, prior to this study was above the average of the sample. Found it Easy indicates the lead donor (or the follower donor) rated this study to be easier than 2 out of 10. 5+ Math Courses indicates that the lead donor (or the follower donor) had taken more than 4 math courses. Math Question indicates that the lead donor (or the follower donor) answered the math question correctly in the survey. CRT Score is the Cognitive Reflection Test score (out of 3) of the lead donor (or the follower donor).

Table 5: Effect of contribution scheme on the follower donor's contribution

	(1)	(2)	(3)
Matching	5.683*** (1.648)	5.568*** (1.630)	5.965*** (1.555)
Round	-0.0835 (0.0821)	-0.0835 (0.0822)	-0.0835 (0.0827)
Week 2		1.693 (2.347)	1.823 (2.294)
Week 3		4.020* (2.065)	5.215** (2.098)
Small Session		0.486 (2.055)	1.382 (1.960)
Female			0.543 (2.009)
Year 3+			-4.507** (1.739)
Income<$75K			3.197* (1.609)
Donated >$5 past month			0.283 (1.931)
Experience above mean			-1.408 (2.005)
Found it Easy			3.249 (2.062)
5+ Math Courses			2.258 (2.531)
Math Question			2.219 (1.762)
CRT Score			0.200 (0.840)
Constant	9.557*** (1.325)	7.090*** (1.934)	2.757 (3.889)
Observations	820	820	820

Standard errors in parentheses are clustered at the individual level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

further supports Hypothesis 2.

5.3 The Endogenous Choice of Contribution Mechanism

In the *Endogenous Scheme* treatment, the fundraiser chooses matching in 35.8% of observations. Moreover, we strongly reject (proportions test $p< 0.0001$) that the fundraiser is equally likely to choose matching or seed money. Figure 9 depicts the proportion of fundraisers who choose matching in each round. It reveals that many subjects alternate between matching and seed money during the 10 rounds of the game.

We rather surprisingly observe that in the *Endogenous Scheme* treatment, donors contribute less under both schemes compared to the other two treatments, and the difference between the two schemes diminishes as shown in Figure 10 Panel (a). Interestingly, as shown in Figure 10 Panel (c), the fundraiser's expectation of fundraising in both schemes is even more pessimistic than the observed levels. Moreover, unlike the exogenous scheme treatments, the evolution of funds raised under the two schemes (Figure 10 Panel (b)) and the fundraiser's belief (Figure 10 Panel (d)) do not have a persistent order. These observations can explain the fundraisers' lack of interest in matching. These findings also suggest that the donors' response to each fundraising scheme depends on whether the scheme is set exogenously or chosen by a strategic fundraiser. One channel through which the fundraiser might potentially affect donors' choices is alternating between matching and seed money in order to learn by experience (see Figure 9). Such behavior affects the experience of downstream players whose choices determine the fundraiser's observations. More accurately, when the fundraiser alternates between the two mechanisms, the lead and follower donors are bound to play under both matching and seed money from one round to another. This lack of consistency might impede learning and prevent convergence to the observed choices under the two exogenous

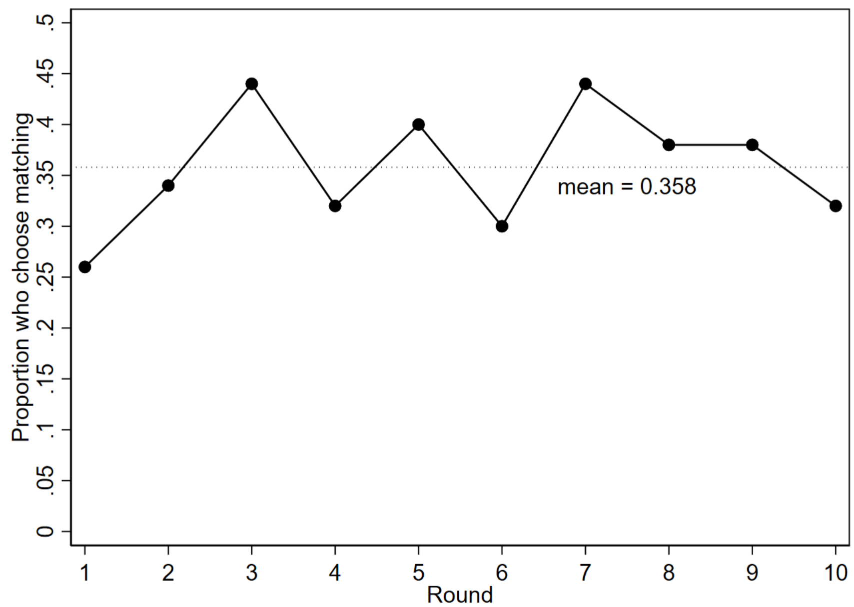
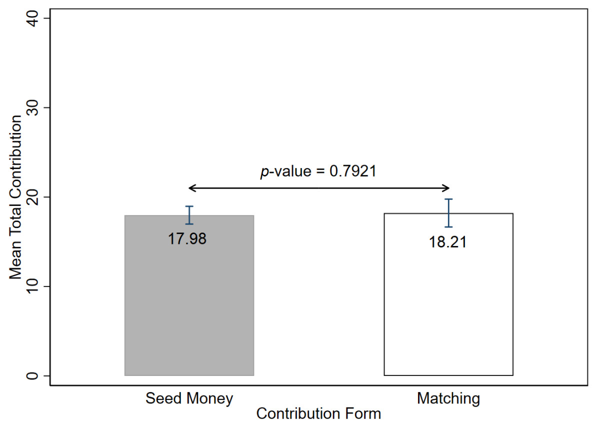


Figure 9: Probability of choosing matching by the fundraiser

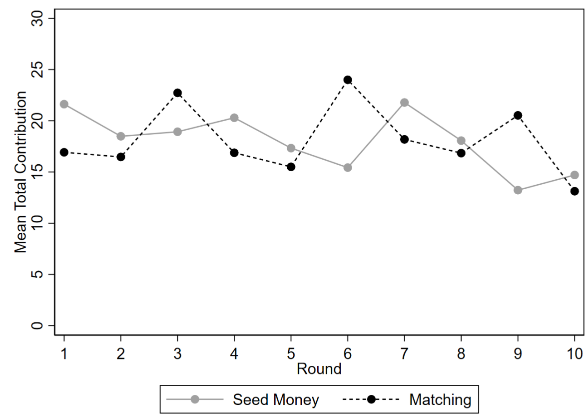
scheme treatments.

After analyzing the eye-tracking data, we do not find any evidence that subjects' attention is focused only on one scheme. The eye-tracking data suggest that subjects pay equal attention to both schemes since there is no imbalance in fixations and the amount of time spent on the seed money and the matching earnings tables. Also, there does not seem to be significant difference between time to first fixation on the two tables, meaning that subjects are almost equally likely to start looking at either table. However, we find that, unlike the donors in the exogenous scheme treatments, the fundraiser's attention is less focused on the equilibrium boxes. The relevant heat maps and statistical tests are presented in Appendix B in Figures B-1 and B-2 and Tables B-1 and B-2.

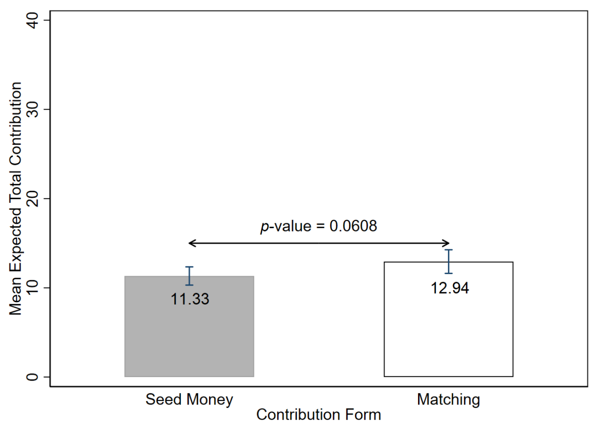
Another interesting finding is that females are much more likely than males to choose matching. While females choose matching in 41.88% of observations, males do so in only 25.00% of observations and the difference is statistically significant (proportions test $p=0.0002$). Furthermore, as depicted in Figure 11, the average choice of the two groups is very similar in earlier rounds. For example, in the first three rounds, 33.33% of males and 35.42% of females choose matching (proportions test $p=0.7969$). However, as the experiment progresses, the proportion of females choosing matching steadily increases. Males in contrast, alternate between the two schemes and remain more likely to choose seed money. For instance, in the last three rounds, 18.52% of males and 45.83% of females choose matching (proportions test $p=0.0008$). Moreover, the proportion of females choosing matching in the last three rounds is not statistically different than 0.5 (proportions test $p=0.4142$). Thus, we fail to reject the null hypothesis that females are equally likely to choose matching or seed money in later rounds of the game. The same test for males however, strongly rejects the null hypothesis (proportions test $p<0.0001$).



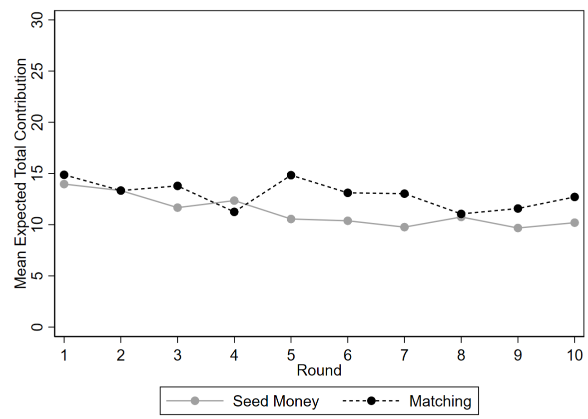
(a) Average fundraising (with 95% confidence intervals)



(b) Fundraising over time



(c) Fundraiser's average expected funds (with 95% confidence intervals)



(d) Fundraiser's expected funds over time

Figure 10: The comparison between matching and seed money when a fundraiser chooses contribution schemes

The observation that the scheme choice is initially similar for males and females but diverges in later rounds of the game, suggests that female subjects, unlike their male counterparts, learn during the experiment. Another possible explanation for the gender difference may be attention. However, after analyzing the eye-tracking data, we do not find any statistically significant difference in visual attention between males and females to any of the important elements in the instructions or decision screens.[25] The relevant statistical analyses are presented in Appendix B in Tables B-5 through B-7. A third possible explanation may be differences in cognitive reflection but interestingly, females on average score almost 1 point (out of 3) less than males in the Cognitive Reflection Test (CRT).

To conclude, we present the regression estimates of the effects of gender, round, and their interaction on the probability of choosing matching in Table 6. We control for various characteristics.[26] The coefficient Female represents the effect of gender (with male as the baseline) excluding any

[25] We measured eye fixations and amount of time spent fixating on the payoff table and earnings tables in the instructions and the earnings tables in the decision screen.

[26] All controls are defined as in footnote 24.

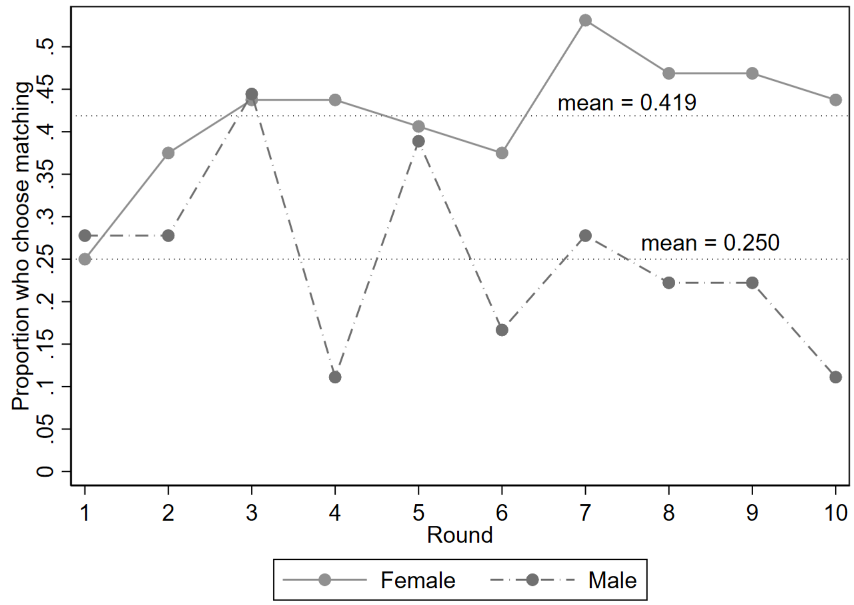


Figure 11: Probability of choosing matching by the fundraiser by gender

Table 6: Effect of fundraiser gender and round on the portability of choosing matching

	Linear	Probit	Logit
Female	0.0846 (0.116)	0.229 (0.352)	0.357 (0.597)
Round	-0.0165 (0.0114)	-0.0573 (0.0381)	-0.0980 (0.0681)
Female*Round	0.0332** (0.0141)	0.105** (0.0452)	0.176** (0.0786)
Week 2	0.182* (0.101)	0.534* (0.320)	0.888 (0.546)
Week 3	0.115 (0.122)	0.339 (0.346)	0.561 (0.590)
Small Session	-0.0929 (0.0976)	-0.292 (0.288)	-0.486 (0.470)
Year 3+	0.0785 (0.0952)	0.274 (0.273)	0.422 (0.487)
Income<$75K	-0.143** (0.0646)	-0.405** (0.193)	-0.703** (0.332)
Donated >$5 past month	0.165** (0.0720)	0.490** (0.209)	0.787** (0.350)
Experience above mean	-0.160** (0.0753)	-0.473** (0.217)	-0.762** (0.366)
Found it Easy	-0.0347 (0.0817)	-0.126 (0.258)	-0.192 (0.453)
5+ Math Courses	0.188 (0.122)	0.578 (0.368)	0.926 (0.664)
Math Question	-0.119 (0.0937)	-0.326 (0.263)	-0.552 (0.434)
CRT Score	0.0679* (0.0388)	0.182 (0.118)	0.313 (0.208)
Constant	0.215 (0.180)	-0.809 (0.527)	-1.290 (0.860)
Observations	500	500	500

Standard errors in parentheses are clustered at the individual level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

learning and it is not statistically significant. Thus, there does not seem to be any difference between males and females in the first round of the experiment. The variable Round that represents the effect of repetitions on the probability of choosing matching by males is also not statistically significant. However, the interaction of Round and Female is positive and statistically significant, which shows that while the males' choice does not change over time, females become increasingly more likely to choose matching. Overall, our findings suggest that even though initially subjects seem to be less likely to choose matching compared to seed money, females learn over the course of the experiment and become more likely to choose matching.

6 Concluding Remarks

In this paper, we consider a public good fundraising game with known returns and find that a matching fundraising scheme (weakly) outperforms a seed money fundraising scheme. Moreover, we find that a matching gift scheme alleviates the downstream donor's free-riding incentives, resulting in significantly higher contribution by the follower donor under matching as compared to seed money. Therefore, the matching gift scheme is found to be more effective per each dollar of leadership giving. This might not seem very important in a lab setting, where there is only one follower donor. However, in a fundraising campaign, there are usually a large number of such donors. Thus, the effect of the scheme on downstream donors becomes very important, which in turn points to the significant benefit of the matching leadership gift over seed money in alleviating free-riding. Moreover, while soliciting the lead donor in the lab is automatic, soliciting a wealthy donor in the field is costly. This further highlights the value of the matching gift in using those hard-obtained dollars efficiently by maximizing downstream donations. However, we should emphasize that our study has been conducted in a context of information symmetry, and as discussed in Section 1, informational frictions can affect the relative effectiveness of the two leadership gift schemes. Hence, investigating the effects of the informational environment on the relative performance of the two types of leadership giving is an area that requires more experimental and empirical research.

We also find that despite the observed superiority of the matching scheme, only about one-third of fundraisers choose it. However, female subjects become more likely to choose matching as the experiment progresses. Based on our findings, learning is a plausible explanation. Nonetheless, the fundraisers' behavior is a rather understudied area and merits further research.

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Appendix A

Proofs

Proof of Lemma 1

Differentiating eq. (5) yields:

$$\frac{\partial E[g_2^*|g_1]}{\partial g_1} = \begin{cases} 1 - F(1-\overline{\alpha}) & \text{if} \quad g_1 < \frac{G_0}{2} \\ 1 + F(1-\overline{\alpha}) - 2F(1-\underline{\alpha}) & \text{if} \quad g_1 > \frac{G_0}{2} \end{cases} \tag{A-1}$$

Thus, since $F(1-\overline{\alpha}) < 1$, if $\underline{\alpha} > 1 - F^{-1}\left(\frac{F(1-\overline{\alpha})+1}{2}\right) \Rightarrow 1 + F(1-\overline{\alpha}) - 2F(1-\underline{\alpha}) > 0$, then $\frac{\partial E[g_2^*|g_1]}{\partial g_1} > 0$ for all g_1. Otherwise, $\frac{\partial E[g_2^*|g_1]}{\partial g_1} > 0$ for $g_1 < \frac{G_0}{2}$ and $\frac{\partial E[g_2^*|g_1]}{\partial g_1} \leq 0$ for $g_1 > \frac{G_0}{2}$. ■

Proof of Proposition 1

Differentiating eq. (6) yields:

$$\frac{\partial \pi_1(w, g_1, E[g_2^*|g_1])}{\partial g_1} = \begin{cases} (2 - F(1-\overline{\alpha}))\overline{\alpha} - 1 & \text{if} \quad g_1 < \frac{G_0}{2} \\ \\ -1 + F(1-\overline{\alpha})\overline{\alpha} + 2(1 - F(1-\underline{\alpha}))\underline{\alpha} & \text{if} \quad g_1 > \frac{G_0}{2} \end{cases} \tag{A-2}$$

Since $\overline{\alpha} < 1$ and $\underline{\alpha} < \frac{1}{2}$ it holds that $F(1-\overline{\alpha})\overline{\alpha} + 2(1 - F(1-\underline{\alpha}))\underline{\alpha} < 1$. Hence, $\frac{\partial \pi_1}{\partial g_1} < 0$ for all $g_1 > \frac{G_0}{2}$. Thus, if $F(1-\overline{\alpha}) > 2 - \frac{1}{\overline{\alpha}} \Rightarrow (2 - F(1-\overline{\alpha}))\overline{\alpha} - 1 < 0$, then $\frac{\partial \pi_1}{\partial g_1} < 0$ for all g_1. As a result, the lead donor chooses $g_1^s = 0$ and by eq. (4) $g_2^s = g_2^*(g_1^s) = 0$. Otherwise, if $F(1-\overline{\alpha}) < 2 - \frac{1}{\overline{\alpha}}$ then $\frac{\partial \pi_1}{\partial g_1} > 0$ for all $g_1 < \frac{G_0}{2}$. As a result, the lead donor chooses $g_1^s = \frac{G_0}{2}$ and by eq. (5) $g_2^s = E[g_2^*|g_1^s] = (1 - F(1-\overline{\alpha}))\frac{G_0}{2}$. ■

Proof of Proposition 2

Differentiating eq. (9) yields:

$$\frac{\partial \pi_1(w, m, g_2^*(m))}{\partial m} = \begin{cases} 0 & \text{if} & m < \frac{1}{\overline{\alpha}} - 1 \\ \frac{-G_0}{(1+m)^2} & \text{if} & m \in [\frac{1}{\overline{\alpha}} - 1, min\{\frac{1}{\underline{\alpha}} - 1, \frac{w}{G_0 - w}\}) \\ \frac{-\overline{\alpha}w}{m^2} & \text{if} & w \leq (1-\underline{\alpha})G_0 \ \&\ m \geq \frac{w}{G_0 - w} \\ \frac{-\underline{\alpha}w}{m^2} & \text{if} & w > (1-\underline{\alpha})G_0 \ \&\ m \geq \frac{1}{\underline{\alpha}} - 1. \end{cases} \tag{A-3}$$

Thus, since π_1 is decreasing in m within each interval, the only candidates for a maximum are $m_1 \in [0, \frac{1}{\overline{\alpha}-1})$, $m_2 = \frac{1}{\overline{\alpha}} - 1$, and $m_3 = \min\{\frac{1}{\underline{\alpha}} - 1, \frac{w}{G_0 - w}\}$. From eq. (9), the lead donor's payoff at each of these values is:

$$\pi_1(w, m_1, g_2^*(m_1)) = w \tag{A-4}$$

$$\pi_1(w, m_2, g_2^*(m_2)) = w + (2\overline{\alpha} - 1)G_0 \tag{A-5}$$

$$\pi_1(w, m_3, g_2^*(m_3)) = \begin{cases} \overline{\alpha}G_0 & if \quad w \leq (1-\underline{\alpha})G_0 \\ \frac{\underline{\alpha}}{1-\underline{\alpha}}w + (\overline{\alpha} - \underline{\alpha})G_0 & if \quad w > (1-\underline{\alpha})G_0. \end{cases} \tag{A-6}$$

Comparing eqs. (A-4) and (A-5) and noting that by assumption $\overline{\alpha} > \frac{1}{2}$, it follows immediately that $\pi_1(w, m_2, g_2^*(m_2)) > \pi_1(w, m_1, g_2^*(m_1))$. Comparing $\pi_1(w, m_2, g_2^*(m_2))$ and $\pi_1(w, m_3, g_2^*(m_3))$, note that for $w \leq (1-\underline{\alpha})G_0$, $\overline{\alpha}G_0 \leq w$ (by assumption) immediately implies that $\pi_1(w, m_3, g_2^*(m_3)) = \overline{\alpha}G_0 < w + (2\overline{\alpha} - 1)G_0 = \pi_1(w, m_2, g_2^*(m_2))$ since $\overline{\alpha} > \frac{1}{2}$. For $w > (1 - \underline{\alpha})G_0$, note that $\pi_1(w, m_3, g_2^*(m_3)) = \frac{\alpha}{1-\underline{\alpha}}w + (\overline{\alpha} - \underline{\alpha})G_0 < w + (2\overline{\alpha} - 1)G_0 = \pi_1(w, m_2, g_2^*(m_2))$ requires $(1 - \overline{\alpha} - \underline{\alpha})G_0 < \frac{1-\overline{\alpha}-\alpha}{1-\underline{\alpha}}w \Rightarrow w > (1 - \underline{\alpha})G_0$. Therefore, this confirms that for $w > (1 - \underline{\alpha})G_0$, $\pi_1(w, m_2, g_2^*(m_2)) > \pi_1(w, m_3, g_2^*(m_3))$. This establishes that $m^* = m_2 = \frac{1}{\overline{\alpha}} - 1$ and by eq. (8), $g_2^m = \overline{\alpha}G_0$ and $g_1^m = (1 - \overline{\alpha})G_0$. ■

Appendix B

Eye-tracking Data

Figure B-1: Heat map of fundraisers' eye fixations on their decision screen

Table B-1: Statistical comparison between fundraisers' eye fixations on each table in Figure B-1 (Standard errors in parentheses)

	Seed Money (Lump Sum)	Matching	p-value (paired t-test)	p-value (signed-rank test)
Mean time to first fixation (seconds)	15.7231 (3.8433)	21.0584 (4.2336)	0.1166	0.0397
Mean number of fixations	45.3061 (7.7670)	53.0816 (9.9224)	0.2278	0.9744
Mean time spent fixating (seconds)	9.2651 (1.8309)	11.8916 (2.4625)	0.1161	0.9843
49 Observations				

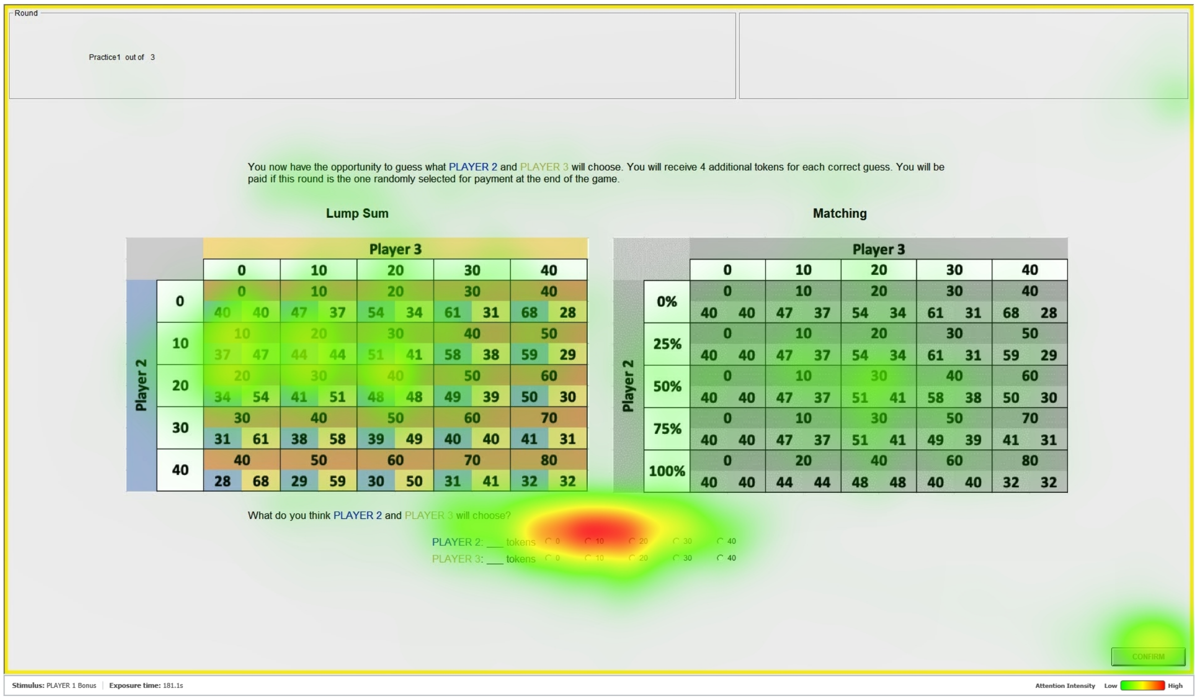

Figure B-2: Heat map of fundraisers' eye fixations on their bonus screen (the screen where the fundraiser is asked to guess what the subsequent players will do and is rewarded for a correct guess)

Table B-2: Statistical comparison between fundraisers' eye fixations on the equilibrium boxes (as displayed in Figure 3) and the table averages in Figures B-1 and B-2 (Standard errors in parentheses)

		Equilibrium boxes	Table average for equal no. of boxes	p-value (paired t-test)	p-value (signed-rank test)
Mean no. of fixations	Decision screen				
	Seed Money	7.90 (1.91)	5.44 (.93)	0.0260	0.2377
	Matching	6.14 (1.75)	4.25 (0.79)	0.1032	0.8494
	Bonus screen				
	Seed Money	16.55 (3.89)	10.55 (1.98)	0.0072	0.0024
	Matching	8.98 (2.05)	4.57 (.82)	0.0023	0.0009
Mean time fixating (seconds)	Decision screen				
	Seed Money	1.71 (0.46)	1.11 (0.22)	0.0199	0.1743
	Matching	1.44 (0.45)	0.95 (0.20)	0.1103	0.8206
	Bonus screen				
	Seed Money	3.71 (0.96)	2.26 (0.46)	0.0119	0.0022
	Matching	2.02 (0.50)	0.99 (0.19)	0.0051	0.0002
49 Observations					

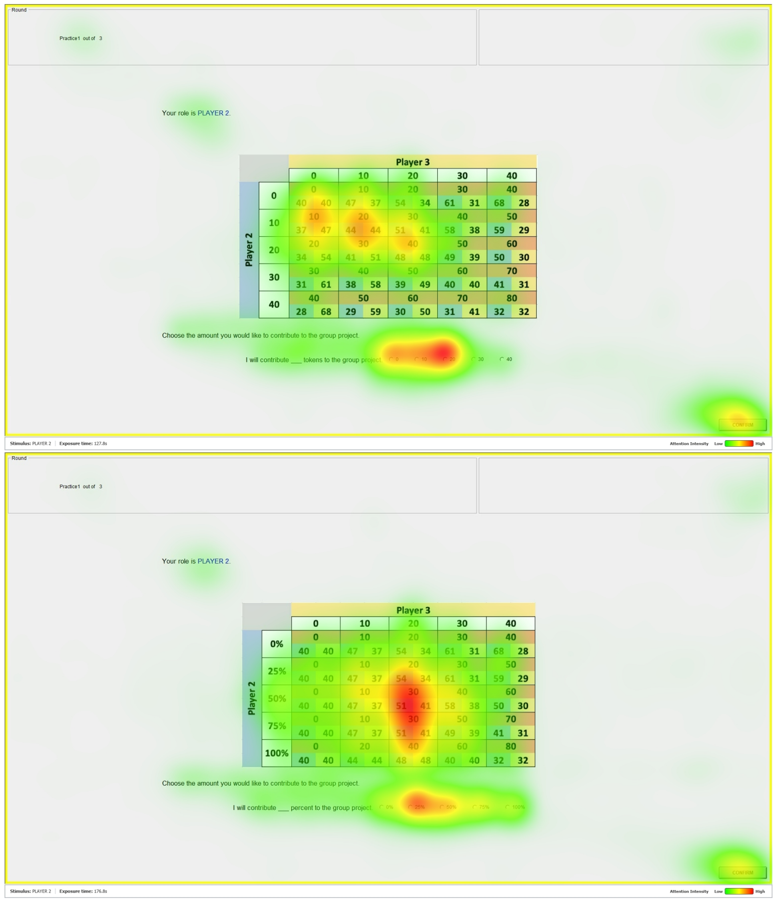

Figure B-3: Heat maps of lead donors' eye fixations on their decision screen under seed money (top) and matching (bottom)

Table B-3: Statistical comparison between lead donors' eye fixations on the equilibrium boxes (as displayed in Figure 3) and the table averages (Standard errors in parentheses)

		Equilibrium boxes	Table average for equal no. of boxes	p-value (paired t-test)	p-value (signed-rank test)
Mean no. of fixations	Exogenous Seed Money	35.35 (6.54)	16.88 (2.80)	< 0.0001	< 0.0001
	Exogenous Matching	41.62 (7.76)	13.64 (2.24)	< 0.0001	< 0.0001
Mean time fixating (seconds)	Exogenous Seed Money	7.88 (1.61)	3.70 (0.68)	0.0002	< 0.0001
	Exogenous Matching	7.97 (1.63)	2.63 (0.48)	0.0001	< 0.0001
40 Obs. (Seed Money)					
39 Obs. (Matching)					

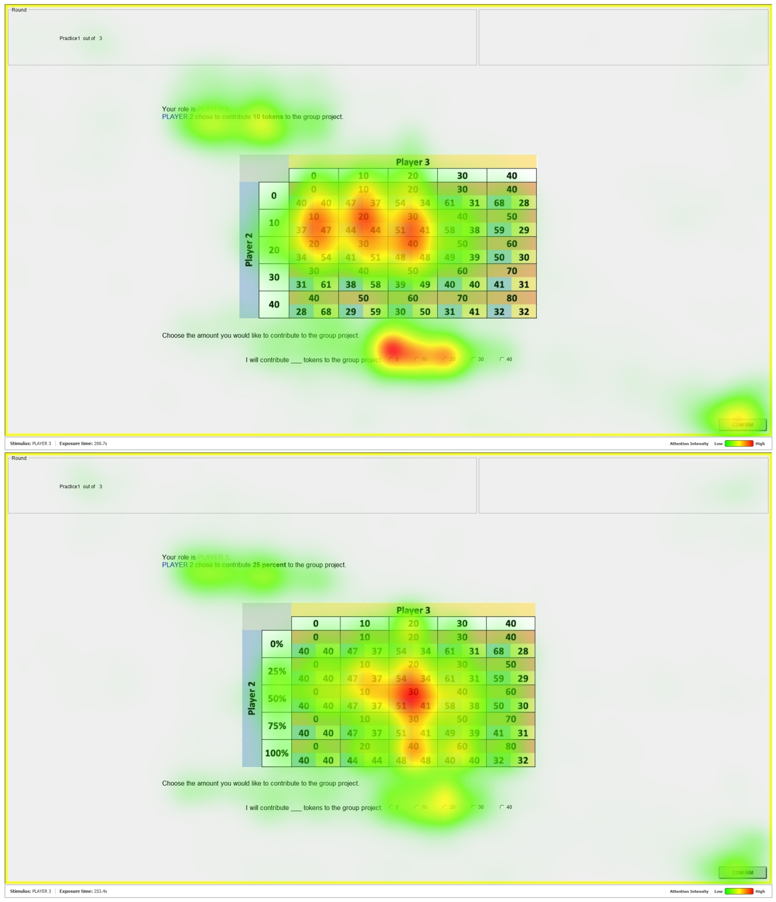

Figure B-4: Heat maps of follower donors' eye fixations on their decision screen under seed money (top) and matching (bottom)

Table B-4: Statistical comparison between follower donors' eye fixations on the equilibrium boxes (as displayed in Figure 3) and the table averages (Standard errors in parentheses)

		Equilibrium boxes	Table average for equal no. of boxes	p-value (paired t-test)	p-value (signed-rank test)
Mean no. of fixations	Exogenous Seed Money	51.98 (7.78)	26.10 (3.18)	< 0.0001	< 0.0001
	Exogenous Matching	61.12 (9.76)	20.43 (3.04)	< 0.0001	< 0.0001
Mean time fixating (seconds)	Exogenous Seed Money	12.16 (2.11)	5.96 (0.90)	< 0.0001	< 0.0001
	Exogenous Matching	12.99 (2.24)	4.32 (0.75)	< 0.0001	< 0.0001
41 Obs. (Seed Money) 41 Obs. (Matching)					

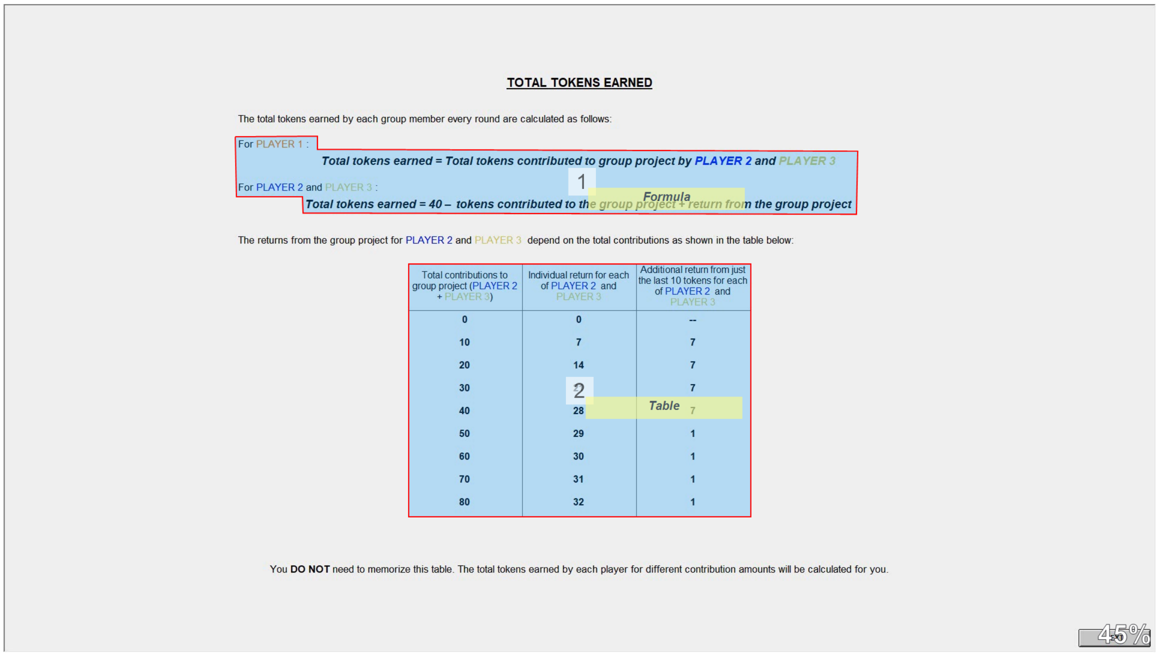

Figure B-5: Areas of interest in the instruction page explaining the payoff calculations (Area 1 is the earnings formula explanations and area 2 is the group project payoff table.)

Table B-5: Statistical comparison between males' and females' eye fixations on the earnings formula (area 1 in Figure B-5) and the group project payoff table (area 2 in Figure B-5). Standard errors are in parentheses.

		Females	Males	p-value (t-test)	p-value (Mann-Whitney U-test)
Mean no. of fixations	Earnings formula	53.82 (4.31)	45.25 (3.89)	0.1616	0.2988
	Payoff table	210.36 (15.36)	203.08 (19.12)	0.7656	0.6898
Mean time fixating (seconds)	Earnings formula	10.47 (0.89)	9.25 (0.98)	0.3665	0.3926
	Payoff table	47.89 (4.41)	48.53 (5.90)	0.9297	0.8460
148 Observations					

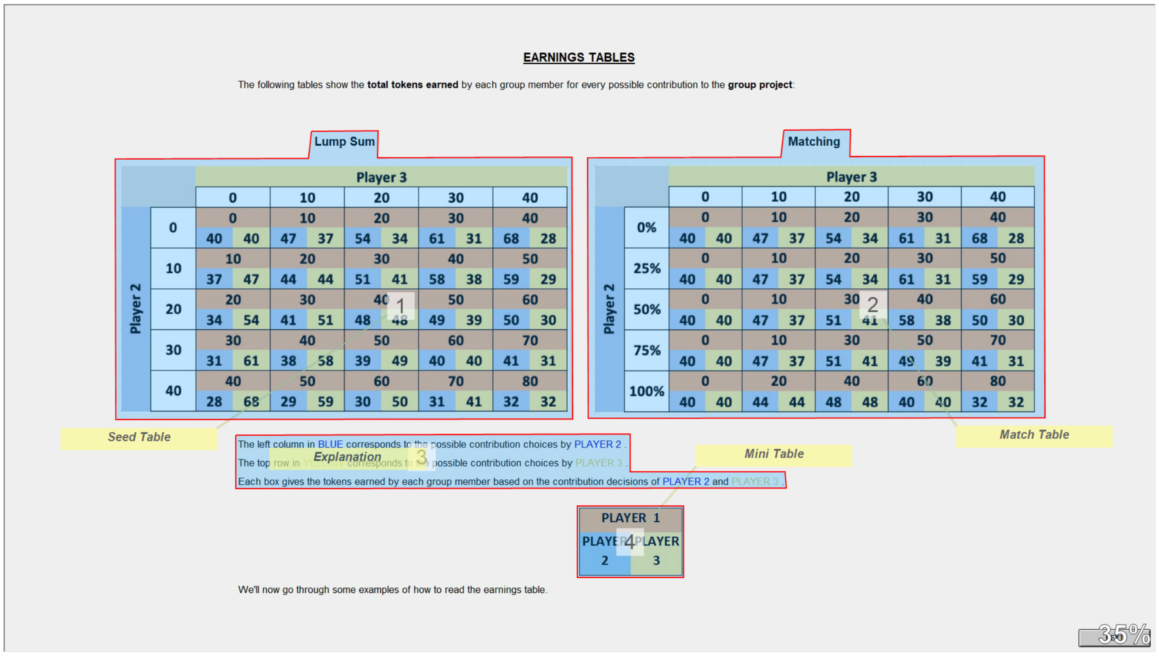

Figure B-6: Areas of interest in the instruction page explaining the earnings tables (Areas 1 and 2 are seed money and matching earnings tables, area 3 is the explanation, and area 4 explains each player's earnings in each box on the earnings tables.)

Table B-6: Statistical comparison between males' and females' eye fixations on the seed money earnings table (area 1 in Figure B-6), matching earnings table (area 2 in Figure B-6), the explanation (area 3 in Figure B-6), and the players' earnings sample box (area 4 in Figure B-6). Standard errors are in parentheses.

		Females	Males	p-value (t-test)	p-value (Mann-Whitney U-test)
Mean no. of fixations	Seed money table	145.26 (11.69)	143.75 (15.56)	0.9371	0.7970
	Matching table	106.05 (9.77)	111.30 (12.37)	0.7370	0.7865
	Explanation	18.45 (2.69)	14.25 (2.51)	0.2755	0.2621
	Sample box	5.95 (1.01)	4.95 (0.96)	0.4915	0.5848
Mean time fixating (seconds)	Seed money table	31.37 (2.87)	31.31 (3.97)	0.9901	0.7384
	Matching table	22.73 (2.31)	24.34 (3.05)	0.6684	0.8255
	Explanation	3.66 (0.58)	2.82 (0.57)	0.3184	0.2812
	Sample box	1.10 (0.20)	1.09 (0.22)	0.9738	0.7493
148 Observations					

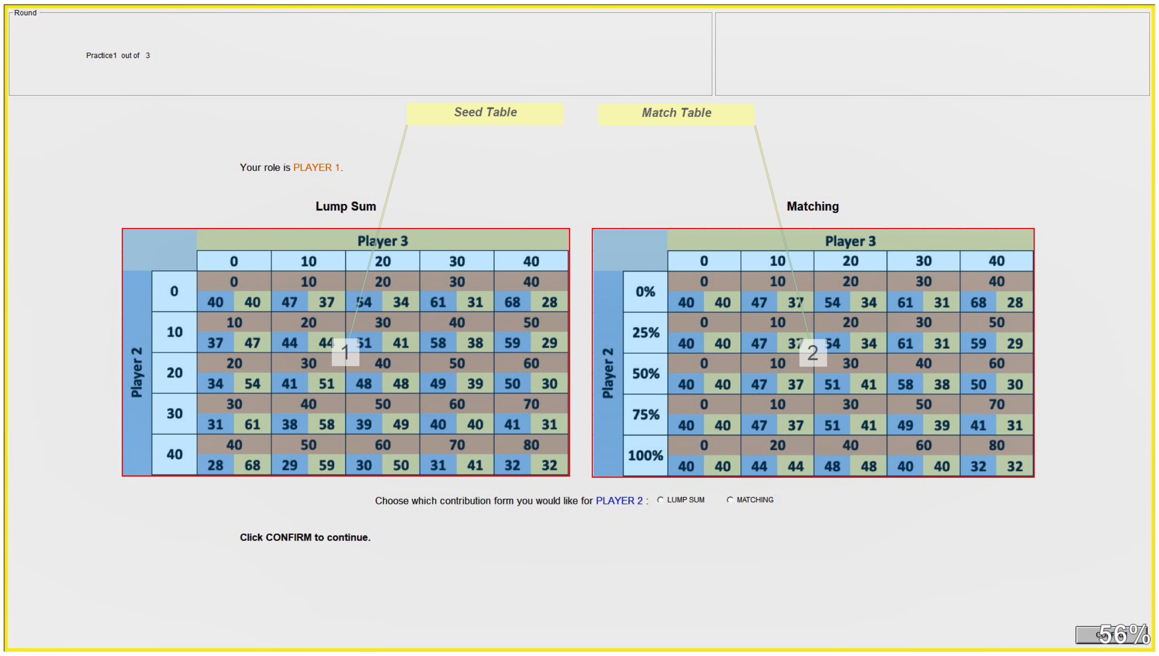

Figure B-7: Areas of interest in the fundraiser's decision screen (Areas 1 and 2 are seed money and matching earnings tables, respectively.)

Table B-7: Statistical comparison between males' and females' eye fixations on the seed money earnings table (area 1 in Figure B-7) and matching earnings table (area 2 in Figure B-7). Standard errors are in parentheses.

		Females	Males	p-value (t-test)	p-value (Mann-Whitney U-test)
Mean no. of fixations	Seed money table	44.81 (8.69)	71 (19.22)	0.1636	0.2860
	Matching table	67.81 (16.01)	82.5 (20.82)	0.5794	0.3621
Mean time fixating (seconds)	Seed money table	8.72 (1.85)	15.17 (4.67)	0.1398	0.2909
	Matching table	15.19 (4.16)	19.00 (5.16)	0.5734	0.2885
49 Observations					