Public goods provision in complex contexts: Does inequality matter when contributors are revealed?

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Abstract

This paper experimentally examines the question of how inequality in wealth affects contributions to public goods in a setting where contributors observe each other's actions. The results show that in the context where contributors are observed, inequality reduces public goods funding, but only in the case of extreme inequality. At least nominally, for low to medium levels of inequality, the opposite is observed: total contributions to public goods is higher in low to medium levels of inequality. At the subject level, rich subjects significantly increased their contributions to public goods relative to contributions observed in equality. However, as inequality gets even higher, the rich kept their contributions at the level observed in equality. These findings contrast with prior studies in anonymous settings where a uniformly negative relationship between inequality and contributions is generally observed. This paper develops an economic theory integrating inequality and social image concerns, which contextualizes and corroborates the experimental results.

JEL Codes: C72, D64, C91, H41, D91

Keywords: Public Goods Game, Laboratory Experiment, Information, Social Image

1 Introduction

Recognizing or observing prosocial behavior is a powerful tool to incentivize behavior change in people. When actions are observed, firms are incentivized to increase tax compliance, people become more charitable, worker tenure is incentivized, and workers become more productive. The market alone for employee recognition was valued at $46 Billion as of 2012, and some companies spend up to 2% of their payroll on employee recognition (Bersin, 2012). This emphasizes the role that revealing prosocial behavior can play in human behavior. Economic theory often classifies actions such as charitable giving or group participation as a public goods provision problem, and contributor identification can be seen as one way of encouraging more participation and contribution to public goods. Finding ways of encouraging more participation and contributions is an important issue as anecdotes and laboratory studies have shown that when individuals are asked to voluntarily contribute to public goods projects without incentives, under-provision relative to the first-best level is common because of the free-rider problem (Bergstrom et al. 1986; Andreoni, 1988; Isaac and Walker, 1988).

The effectiveness of a public goods provision scheme relies on the complex contexts it is implemented in. One such context is intergroup wealth inequality. Prior studies have used anonymous settings to examine how wealth inequality impacts contributions to public goods projects. This paper examines the question of how inequality affects contributions to public goods in a setting where contributors observe each other's actions. By doing so, this paper will be the first to provide a nuanced understanding of how inequality shapes prosocial behavior in a setting where the actions of contributors are observed. This allows for a more comprehensive analysis of public goods provision in real-world settings, where both inequality and visibility of contributions often coexist.[1]

[1]For example, consider a work environment where employees are asked to contribute to a charity. If workers observe the contribution of their colleagues and have, at minimum, a rough idea of the wealth of their colleague, then these observations may impact behavior and how much is contributed to the charity.

The research question will be examined through the lens of controlled laboratory experiments, where each experiment is conducted in a setting where contributors observe each other's actions. In these experiments, subjects are given an endowment and have the choice of contributing some (or all) of it to a common pot that everyone benefits from, or keep some (or all) of it for themselves. The experiments use a between-subjects design with 3 treatments of inequality and a baseline (no-inequality) treatment. In all treatments, subjects observe the contributions of each person in their group. Furthermore, subjects observed (with some error) the level of endowment that other group members had. This was done to mimic real world situations where people often observe the wealth of others with some error.

There is a large experimental literature studying the effects of inequality on cooperation, with almost all the results showing either a negative or null effects. For example, when individuals are asked to voluntarily contribute and individual specific contributions are private knowledge (pure Voluntary Contribution Mechanism, or VCM), prior studies generally found that higher inequality lowers contributions to public goods (e.g. Rapoport, 1993; Cherry et al. 2005; Cadigan et al. 2011; Seçilmiş and Güran, 2012; Balafoutas et al. 2013; Fung and Au, 2014; Keser et al. 2014; Nitta, 2014; Hargreaves Heap et al. 2016; Gächter et al. 2017; and Duquette and Hargaden, 2021), although some studies found inequality to have no effect (e.g. Chan et al. 1996, 1999; Bergstrom et al. 1986, Buckley and Croson, 2006; Hofmeyr et al. 2007). Furthermore, many of these studies also show that the poor tend to over-contribute, which may then result in wealth being redistributed away from the poor in public goods provision. On the other hand, when individuals are incentivized to contribute because it gives them a chance of winning a lottery prize (Lottery mechanism), a recent study has shown the opposite result: inequality increases contribution (Oconnor et al., 2022). All these studies on how inequality affects cooperation are done in anonymous settings, which leaves the question of whether these results will hold in settings where con-

tributions are observed. This paper builds on these studies by removing confidentiality to examine how inequality effects prosocial behavior in a complex setting that mimics many real world situations.

There has been recent attention given to how motivations and behavior of agents change when their actions are observed or revealed. Overall, these studies show that revealing the actions of agents (individuals or firms) does lead to their behavior becoming more prosocial (e.g. Razen and Kupfer, 2023; Dannenberg et al., 2022; Kessler et al., 2021; Henry and Louis-Sidois, 2020; Christens et al., 2019; Clingingsmith and Sheremeta, 2018; Samek and Sheremeta, 2017; Krieg and Samek, 2017; Cason et al., 2016; Houser et al., 2016; and Samek and Sheremeta, 2014). On the other hand, revealing contributors to public goods projects may lead to "image rewards" that induces the "overjustification effect"; a situation where extrinsic incentives such as image rewards can crowd-out or completely erase intrinsic motivation to be more participatory (Bénabou and Tirole, 2006; Lepper et al., 1973).[2] Absent in these studies are considerations of how wealth inequality interacts with participatory behavior when actions are observed.[3] A key result from Bénabou and Tirole (2006) may allude to the possible relationship between the two. They found that when individuals are heterogeneous in their image concerns, this may reduce the effectiveness of "image rewards" that may be inducing prosocial behavior.[4] If heterogeneity in wealth creates heterogeneity in image concerns, then this implies that wealth inequality may reduce contributions to public goods.

[2]For example, a donor to a charity may decide to no longer contribute if the charity starts to publicize the name of their donors. This is because they may think their contribution may be viewed so unfavorably that the image concerns erase the previously dominant intrinsic motivation.

[3]A few other studies have examined the effect of heterogeneity in other forms on public goods provision in a setting where contributions are observed, such as heterogeneity in individual returns from the public good (Fellner-Röhling et al., 2020) and in extraction capacity (Brent et al., 2019).

[4]They attributed this to the idea that heterogeneity increases the noise-to-signal ratio, which means that a person may be concerned that their good actions will be suspected of being motivated by appearances, which makes them want to do less of these good actions.

As a preview of the results, in a setting where contributors observe each other's actions, the findings present a novel pattern where low to medium levels of inequality at least nominally increase contributions, while high levels reduce them, providing a more nuanced understanding of inequality's role in public goods provision. At the subject level, for low to medium levels of inequality, rich subjects (that is, those who had a higher endowment level than the endowment level in equality) significantly increase their contributions to public goods relative to contributions observed in equality. However, as inequality gets even higher, the rich made contributions at the same level observed in equality. This result contrasts with the results of recent studies such as Duquette and Hargaden (2021) who finds that inequality reduces giving in a setting where anonymity was maintained, and Oconnor (2022) who, also in an anonymous setting, finds that inequality increases total contributions when a lottery prize is randomly awarded to one of the contributors. This therefore underscores the importance of studying inequality in a context where contributors to public goods projects are observed.

The results are also consistent with predictions from an economic theory of inequality interacting with social image as developed in this paper. This theoretic framework is presented in the next section (section 2) and is used to contextualize the results of the paper. In section 3, an overview of the experimental design and procedures is provided. Section 4 and 5 presents the results and provides a brief discussion, respectively. Section 6 concludes.

2 Theoretical framework

To develop the theoretical framework, insights from the literature on public goods provision is combined with insights from the literature on the impact of behavior on social image. Consider a group of agents who are endowed with an individual specific level of wealth (ω_i).

These agents have to then decide how much of their wealth to contribute towards a public good (g_i) and a private good (x_i). For each unit of wealth that is contributed towards the public good by anyone, each person receives a portion, $\alpha \in (\frac{1}{N}, 1)$, back regardless of their own personal contribution. Furthermore, α represents the marginal per capita return (MPCR) and ensures that there is an incentive for agents to free-ride and prioritize their private consumption. With these preliminaries, we can define the following linear public goods problem *without* recognition:

$$\max_{g_i} \omega_i - g_i + \alpha(g_i + G_{-i}) \qquad \text{subject to } g_i \leq \omega_i - x_i \tag{1}$$

Total contribution to the public good is $g_i + G_{-i}$. It is easy to verify that since $\alpha \in (\frac{1}{N}, 1)$, the equilibrium condition would entail $g^* = 0$ to maximize payoff. However, $g^* = 0$ is rarely observed in public goods experiments. Explanations for this includes 1) Warm Glow: warm-glow models predict that inequality will increase giving (Duquette and Hargaden, 2021);[5] 2) Inequality Aversion: Predicts that high income subjects will contribute more towards a public good the more inequality averse they are (e.g. Derin-Güre and Uler, 2010). These explanations help to generate an interior optimum. On the other hand, there has been no study that has theoretically explored specifically how inequality affects contributions in a setting where contributors are observed/recognized. To develop this theory, ϕ_i is defined as a sufficient statistic that summarizes the distribution of income and person $i's$ position in it (as in Duquette and Hargaden, 2021). In particular, in this paper higher values of ϕ_i can be interpreted as indicating that a larger mass of total wealth is concentrated in person i which simultaneously comes with higher inequality in the distribution of a given level of total endowment. In other words, person i does not care about inequality *per se*, but only their place in the distribution as the distribution changes. Moreover, it is assumed that

[5] As outlined in the Introduction, the opposite of this prediction have generally been observed in laboratory settings.

ϕ_i affects person $i's$ decisions only when decisions are observed. The degree of visibility is denoted as μ. That is, only after revealing a person's characteristics tied to their contribution is their welfare affected through the impact on perceived social image due to reputational concerns. Following Ali and Bénabou (2020), a social image function is defined as $R(.)$, but with the novel addition of inequality concerns: $R(g_i; \phi_i)$.[6] Incorporating $R(.)$ and allowing for warm glow ($v(.)$) into a more general formulation of (1) yields the following individual maximization problem:

$$\max_{g_i} u(x_i) + v(g_i) + \alpha(g_i + G_{-i}) + \mu(R(g_i; \phi_i) - \overline{z}) \qquad \text{subject to } g_i \leq \omega_i - x_i \tag{2}$$

Where $\overline{z}$ is the standard for what constitutes an "acceptable" social image.[7] Moreover $u(.)$, $v(.)$ and $R(.)$ are concave utility functions, and $u(0) = 0$, $v(0) = 0$ and $R(0) = 0$. The first order condition reveals:

$$u^{'} = v^{'} + \alpha + \mu R^{'} \tag{3}$$

Where $R^{'}$ will be referred to as the "social image effect of giving". The goal of this section is to gain insights into how inequality affects contributions. Therefore, g^* will not be derived from (3), but rather (3) and the constraint will be used to derive conditions for how inequality affects contributions. Taking the total derivative of the constraint and (3) reveals:[8]

$$dx_i = d\omega_i - dg_i \tag{4}$$

[6] See also Butera et al. (2022) for an extension of this framework to a model of shame and pride.

[7] For example, $\overline{z}$ may represent 1) the average revealed social image of other members of person $i's$ group, or 2) person $i's$ intrinsic standard for socially acceptable behavior.

[8] Note: α and μ are parameters that in principle could vary overtime as determined by a social planner/the experimenter.

$$u^{''}dx_i = v^{''}dg_i + d\alpha + \mu R^{''}dg_i + \mu\frac{\partial R^{'}}{\partial \phi_i}d\phi_i + R^{'}d\mu \tag{5}$$

Plugging (4) into (5) and solving for dg_i results in:

$$dg_i = \frac{u^{''}d\omega_i - d\alpha - \mu\frac{\partial R^{'}}{\partial \phi_i}d\phi_i - R^{'}d\mu}{v^{''} + \mu R^{''} + u^{''}} \tag{6}$$

Denoting $T = \frac{1}{v^{''}+\mu R^{''}+u^{''}} < 0$, and dividing (6) by $d\phi_i$ reveals:

$$\frac{dg_i}{d\phi_i} = T\left(u^{''}\frac{d\omega_i}{d\phi_i} - \frac{d\alpha}{d\phi_i} - \mu\frac{\partial R^{'}}{\partial \phi_i} - R^{'}\frac{d\mu}{d\phi_i}\right) \tag{7}$$

The parameters α and μ are set by a social planner (or the experimenter) independent of ϕ_i. Equation (7) therefore becomes:

$$\frac{dg_i}{d\phi_i} = \underbrace{-T}_{+\text{ve}}\left\{\underbrace{\mu\frac{\partial R'}{\partial \phi_i}}_{\text{-ve/+ve}}\underbrace{-u''\frac{d\omega_i}{d\phi_i}}_{+\text{ve}}\right\} \tag{8}$$

From (7), $\frac{d\omega_i}{d\phi_i}$ represents how the total change in the income of person i is induced by a total change in the distribution of wealth. Since ϕ_i is only increasing when there is higher income inequality and greater mass of wealth for person i (holding constant total wealth in a group), $\frac{d\omega_i}{d\phi_i}$ is necessarily positive. The term $\frac{\partial R^{'}}{\partial \phi_i}$ disciplines the way by which changes in public goods contributions affect social image while holding all other factors constant. To more precisely evaluate how the "social image effect of giving" $(R^{'})$ responds to changes in ϕ_i, it is assumed that g_i and ϕ_i enters $R(.)$ in two continuous and differentiable functions:

$$R(g_i;\phi_i) = H(g_i) - g_i f(\phi_i) \tag{9}$$

Here, $H(g_i)$ is assumed to be a concave utility function, and $f(\phi_i)$ enters as a convex utility cost function reflecting the idea that people higher up in the wealth distribution are assessed at a higher standard for any level of giving (g_i). For some values of ϕ_i, $f(\phi_i)$ is an increasing function, and for other values of ϕ_i it is a decreasing function. This implies that when the inequality parameter ϕ_i changes, people may behave in different ways. Equations (8) and (9) will be used to make predictions of how behavior will respond to changes in distribution under different scenarios.

Case 1: $\frac{\partial R^{'}}{\partial \phi_i} < 0$ for high ϕ_i, and $\frac{\partial R^{'}}{\partial \phi_i} > 0$ for ϕ_i

In this case, the way by which contribution to the public good responds to changes in income will depend on $\frac{\partial R^{'}}{\partial \phi_i}$. If $\frac{\partial R^{'}}{\partial \phi_i} < 0$ for a sufficiently high ϕ_i, it implies that the rate by which contributions add to social status is lowered when increases in inequality increases the share of wealth belonging to a person. Intuitively, when someone is higher up in the wealth distribution, the marginal contribution they made to the public good is not as impressive as when they were lower down in the wealth distribution. In this case, above a sufficiently high level of ϕ_i, $\mu\frac{\partial R'}{\partial \phi_i} - u^{''}\frac{d\omega_i}{d\phi_i} < 0$ and correspondingly $\frac{dg_i}{d\phi_i} < 0$. This leads to prediction 1 below. On the other hand, if $\frac{\partial R^{'}}{\partial \phi_i} > 0$ for a sufficiently low ϕ_i, then for an infinitesimal change in its value, the social image effect of giving ($R^{'}$) is still large enough such that giving is effective in increasing social image. In this case, below a sufficiently low level of ϕ_i, $\mu\frac{\partial R'}{\partial \phi_i} - u^{''}\frac{d\omega_i}{d\phi_i} > 0$ and correspondingly $\frac{dg_i}{d\phi_i} > 0$. This leads to prediction 2 below.

Prediction 1: When the mass of total wealth concentrated in person i is sufficiently high, then as inequality increases, person i would decrease their contribution to the public good. Intuitively, when a person has a large mass of income from the distribution, any amount of

g_i given with a lower mass of wealth is now viewed unfavorably and that person is better off consuming privately.[9]

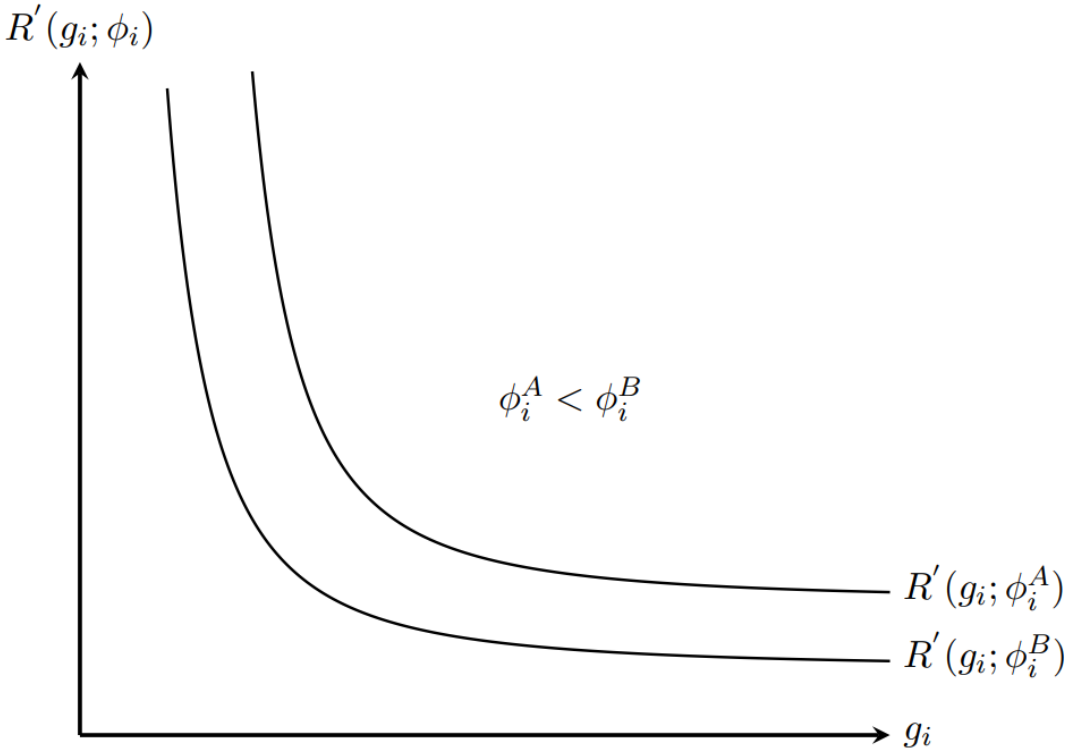
Prediction 2: When the mass of total wealth concentrated in person i is sufficiently low, then as inequality increases, person i would increase their contribution to the public good. Intuitively, the amount contributed is viewed favorably in this scenario. As person i gets even further up the wealth distribution, s/he is able to enjoy more public recognition from giving as the penalty from higher inequality is not great.

Figures 1A and 1B provide a visual depiction of how contributions might be impacted by changes in ϕ_i as implied by equations (8) and (9), and Case 1 predictions. Figure 1A illustrates the idea that, when ϕ_i is "sufficiently high", the rate by which increases in giving impacts social image (the "social image effect of giving") is itself negatively impacted by increases in inequality for any level of giving. The opposite shift in $R^{'}(.)$ happens when ϕ_i is "sufficiently low". Figure 1B reflects the idea that giving increases as ϕ_i increases at low levels of inequality, and decreases as ϕ_i increases at high levels of inequality, as outlined in Predictions 1 and 2. ϕ_i^L and g^* represents a given level of equilibrium contributions to the public good at a given level of ϕ_i, such as the level corresponding to equality. Here, ϕ_i^M/ϕ_i^H can be interpreted as a medium/large values of ϕ_i.

The design of the experiment will allow for the testing of some implications of figure 1B directly. For example, figure 1B implies that as long as the distribution of wealth is wide enough with inequality, then contributions for subjects made better off with medium

[9]For more insight, consider a person who may contribute to a charity in two states of nature. In the first state, she is very wealthy; if she contributes a small amount which is observed, this may negatively impact her social image as she is seen as ungenerous. On the other hand, in the second state of nature she is poor but contributes the same amount as the wealthy state. Here, she is judged by a different standard and a higher social image is maintained.

Figure 1a: Impact of increasing inequality on the social image effect of giving

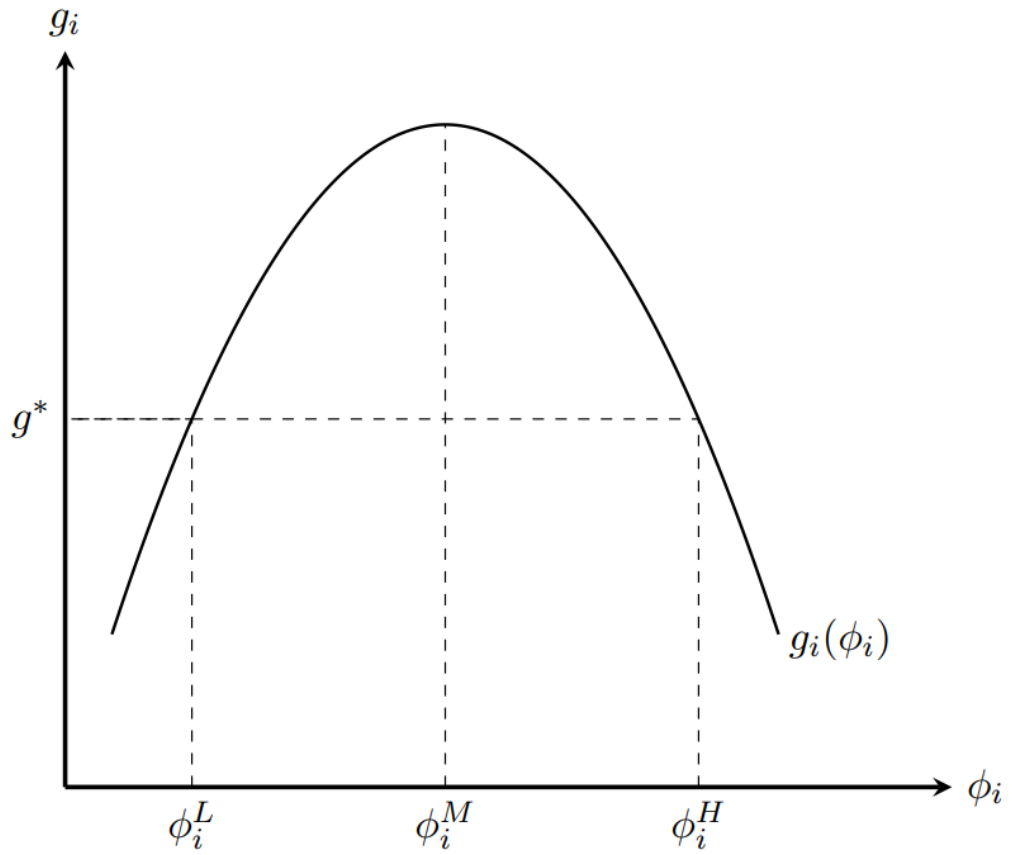


Note: This figure illustrates that for a "sufficiently high" ϕ_i, the rate by which increases in giving impacts social image is itself negatively impacted by increases in inequality for any level of giving. When ϕ_i is "sufficient low", the opposite shift in $R'(.)$ will occur.

levels of inequality should be greater than: 1) contributions of subjects made better off in very high levels of inequality; and 2) contributions of subjects with lower share of wealth in inequality. Another example is with regards to total contributions. If equality gives a value of ϕ_i between ϕ_i^L and ϕ_i^M, then when a subject's wealth increases to a very large ϕ_i (such as ϕ_i^H), other subjects in their group must have a very low ϕ_i leading to a large spread in the share of wealth. The shape of the function in figure 1B then suggests that this large spread of ϕ_i away from equality will result in lower total contributions to the public good compared to a smaller spread of ϕ_i away from equality. These implications will be checked against experimental data.

Case 2: $\frac{\partial R'}{\partial \phi_i}$ is such that $\mu \frac{\partial R'}{\partial \phi_i} - u'' \frac{d\omega_i}{d\phi_i} > 0$ always holds.

Figure 1b: Impact of increasing inequality on giving



This figure shows that for low levels of ϕ_i, giving increases as ϕ_i increases, and for high levels of ϕ_i, giving decreases as ϕ_i increases.

If the negative values of $\frac{\partial R^{'}}{\partial \phi_i}$ are such that $\mu \frac{\partial R'}{\partial \phi_i} - u^{''} \frac{d\omega_i}{d\phi_i} > 0$ always holds, then this ensures that $\frac{dg_i}{d\phi_i} > 0$ for any ϕ_i.

3 Experimental Design

With virtually no exceptions, previous literature has found that inequality either has no effect or reduced contributions to public goods projects when there is no observability. With those results established, this research study is investigating the interaction between inequality and contributions in the setting where contributors are observed. Thus, these two dimensions have to be apparent in the research design. For the inequality dimension, three inequality treatments and one treatment with equality (hereafter referred to simply as the

"treatments") in a between-groups design are utilized. That is, each group (and the subjects within) was exposed to only one specific treatment. Inequality was achieved by varying the level of endowment that each group member receives. The total amount of endowment does not vary across treatments. Furthermore, the endowment amount that each subject received was fixed across rounds (partners protocol). All treatments were a voluntary contribution mechanism where contributors are revealed (RVCM). Since in this study inequality is hypothesized to impact behavior through the level of visibility of actions, a group size of 4 was chosen to maximize visibility of each subject's actions and make it easier to identify effects.

Table 1 provides a summary of the different treatment levels. In the baseline treatment, which is termed the *No Inequality* treatment, all subjects had the same level of endowment of 180 tokens each (yielding a Gini coefficient of 0).[10] For the three treatments with inequality, the Gini coefficients were 0.139, 0.347 and 0.521. These are, respectively, the *Low Inequality*, *Mid Inequality*, and *High Inequality* treatments. They were designed to yield numbers approximately equal to reference points of World Bank cross country estimates. The Gini coefficient in the *Low Inequality* treatment is lower than the lowest country-level Gini coefficient reported by the World Bank in a reference period spanning 2010 to 2019. The *Mid Inequality* and *High Inequality* treatments respectively corresponds to approximately the 50th and 95th percentile of national level GINI coefficients around the world in the same 2010 to 2019 reference period. The distribution of endowments in the *Low Inequality treatment* aligns with Corazzini et al. (2010) and Oconnor et al. (2022), where the latter study varied inequality in an experiment involving funding public goods, and the former kept all groups with this level of inequality.

For the contributor observation dimension, this was achieved by following the design of

[10]The Gini coefficient is a measure of inequality that ranges from 0 to 1, where 1 indicates perfect inequality (all wealth concentrated in one person) and 0 indicates perfect equality.

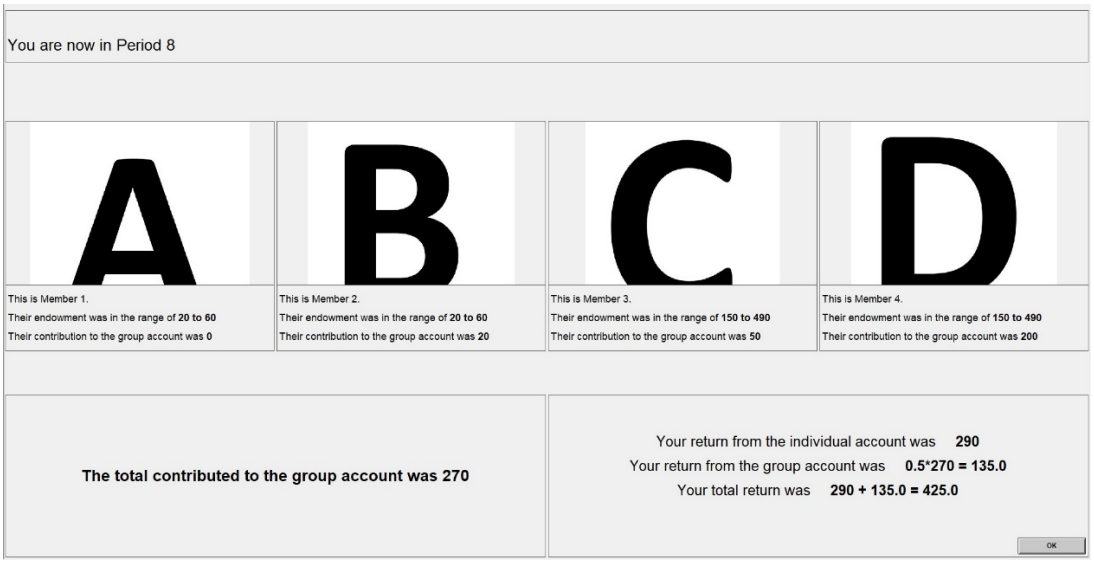
Table 1: Summary of Treatment Parameters

	No Inequality	*Low Inequality*	*Mid Inequality*	*High Inequality*
Subject	Endowment	Endowment	Endowment	Endowment
1	180	120	60	20
2	180	160	80	60
3	180	200	240	150
4	180	240	340	490
$\sum$	**720**	**720**	**720**	**720**
Initial GINI Coefficient	0	0.139	0.347	0.521

several other public goods experiments where individual contributions were revealed in a laboratory setting; they do this by showing photos and revealing the economic decision of each subject to others in their own group. Examples of studies that have done this includes Andreoni and Petrie (2004), Samek and Sheremeta (2014) and Christens et al. (2019). In addition, subjects were also in visual sight of each other, but were at computer stations separated by at least 10 feet. There are other choices for the method of identification, such as Kessler et al. (2021) where subjects wear name tags and were in visual sight of each other during a break, and Samek and Sheremeta (2017) who displays the names of subjects attached to their decisions. To the best of my knowledge, there is no study that has examined the superiority of any specific technique of identification. The photo method was chosen as several other studies have implemented it successfully and visual cues are usually stronger. As noted by Andreoni and Petrie (2004), researchers often preserve confidentiality because they fear that the social consequences of identifying subjects and their choices would significantly alter the economic incentives of the game. However, these may be the same social effects that institutions are relying on to help overcome free riding (Andreoni and Petrie, 2004). Therefore, while a consequence of removing anonymity is that social image effects outside the laboratory environment may come into play, it is these social image effects that are partly relied on to strengthen the social image dimension of the research design and make it easier to identify effects.

Figure 2 below provides an illustration of the results page that subjects would have seen. Note that they observed (with some error) the level of endowment that other group members had. This was done to mimic real world situations where people often observe the wealth of others with some error. However, each subject knew their own exact endowment amount. Furthermore, subjects in groups with equality knew they all had the same endowment level so they were shown the exact endowment of other subjects in their group. Subjects also observed the contribution of each group member and the return they received from the public good.[11]

Figure 2: Result screen



This image shows a sample of the results screen that was displayed to participants. The actual image of participants would be where the letters A,B,C,D are.

[11]The contribution of each group member was observed after the 5th period/round. Before that, all the details in figure 2 were still seen by subjects except for the individual specific contributions. Virtually all the data analyzed in this paper utilizes information captured in rounds 11-20 (there were 20 rounds in total, see section on Study Procedures).

4 Study Procedures

The study took place in two computer labs at College of the Holy Cross in Massachusetts, USA. The subjects who participated were all students of the college. The experiment took place on a computer and was programmed using z-Tree (Fischbacher, 2007). Subjects were asked to show up 10 minutes early to a session to participate. In a session there were 1-2 groups of 4 subjects per group, and each group was self-contained. Subjects were paid $8 to show up on time, which was added to their earnings from the actual experiment. Subjects were paid using Giftcards, which they were informed about during the recruitment stage and in the consent sheet. After showing up, subjects were randomly assigned to a computer station, directed to read the consent sheet, and once the consent sheet was signed their photos were taken. The photos were labeled according to their computer station. For example, the person sitting at the computer station assigned to "Member 1" had their photo labeled "Member 1". Using photos for revealing contributors follows the practice of several other pubic goods studies that recognize contributors, as discussed in the Experimental Design section above. No identifiable information on any of the subjects were stored; subjects were informed of this and informed that their photos will be permanently deleted at the end of the session.

The experimental procedure follows that of Andreoni and Petrie (2004) and Samek and Sheremeta (2014). For each treatment, there will be 4 subjects in each group. There were 24 unique groups for a total of 96 subjects. Each group is self-contained where subjects make decisions within their group. While the groups were fixed, it is not clear that fixed groups lead to more (or less) cooperation relative to random rematching as is done is some other studies (Oconnor et al., 2022). For example, Morgan and Sefton (2000) use both fixed and rematched groups and found that the base level behavior does not vary substantially between the two. On the other hand, studies such as Andreoni (1988) and Palfrey and Prisbrey (1996) found that fixed groups made lower contributions, while other studies such as Keser

(1996), and Keser and van Winden (2000) found the opposite. Moreover, as Samek and Sheremeta (2014) pointed out, 1) a fixed group is likely to amplify the effects of recognition, 2) in practice, individuals do participate in social groups where their status is apparent, and thus the fixed groups design better represents these environments, and 3) a fixed matching provides an opportunity to investigate group dynamics over rounds.

This will be a repeated public goods game where each subject receives an endowment from the researcher and simultaneously decide how much they want to contribute to a common pot/group account (the public good) and how much they want to keep for themselves. For every lab dollar (token) that is contributed to the public good by anyone, each subject receives a return of 0.5 lab dollars (that is, the marginal per capita return from the public good is 0.5). Subjects made these decisions for a total of 20 rounds, with the group members and endowments fixed in each round. In each round, subjects will be shown digital photos of each group member along with their endowment level, but information about each individual specific contribution was not provided until after the 5th round. Beginning in the 6th round, at the end of each round subjects were shown digital photos of each group member along with that member's corresponding contribution as illustrated in figure 2. Communication was not allowed as this could confound the effects of pure recognition. Each session lasted up to 45 minutes, and experimental earnings ranged from $2 to $26.[12]

5 Results

Experimental data were analyzed to determine both group and individual behavior in the presence of inequality. In this section, the findings of the experiment will be summarized

[12]Since payments were made via Giftcards, they were rounded up to the nearest dollar.

with brief contextualization, and in the following section a deeper discussion of what the results mean in the context of previous studies and the theoretical undertones as presented in the second section of this paper will be provided.

Figure 3: Percentage contribution to the public good by treatment

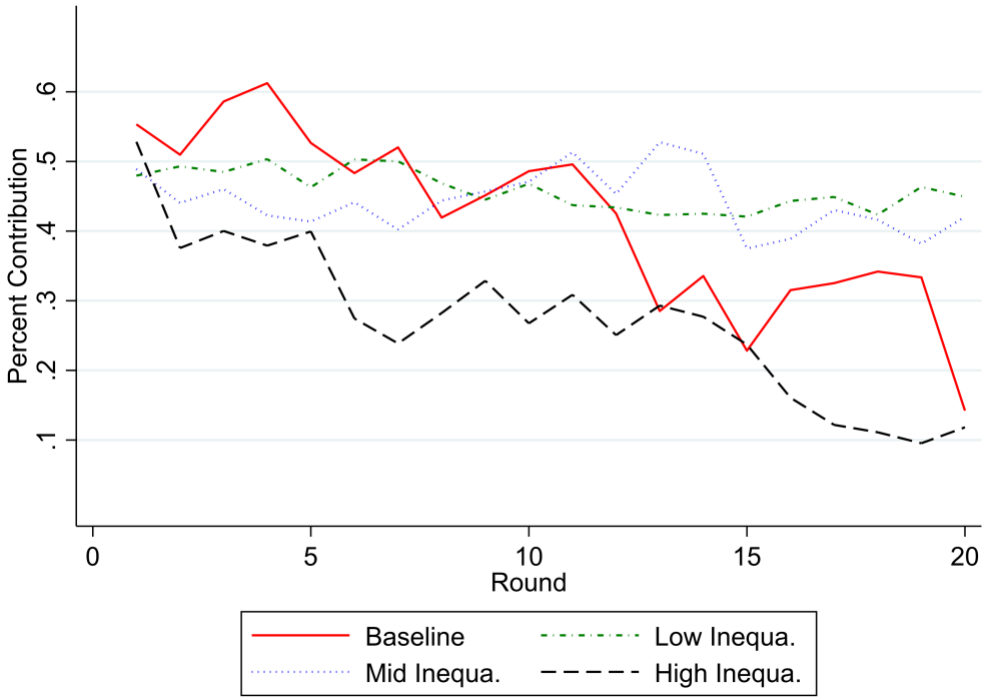


Figure 3 shows the average percent of total endowment that was contributed to the "group account" (the public good) for each round. The figure shows that across all treatments, the contributions to the public goods started around the same percentage (49%-55%). This could be due to a number of reasons, such as subjects not sure how to behave at the onset which leads to similar behavior on average due to randomization of subjects into treatment, or due to inequality *per-se* not having any effect on contributions until it is observed. While contributions to the public good remained generally stable between 40% and 50% of total endowment for the *Low Inequality* and *Mid Inequality* treatments, contribution for the *No Inequality* and *High Inequality* treatments decreased over rounds. Furthermore, visually, contributions (as a percentage of total endowment) were falling faster for the *High Inequality*

than for the *No Inequality* treatment.

Table 2 shows the results of a regression analysis of the amount contributed to the public good by treatment, as well as percentage contribution (of endowment). This analysis is done both at the subject and group levels, with standard errors clustered at the respective levels. In this table and all other tables, analysis was carried out on rounds 11-20 to account for learning. The results in column (1) show that generally for low to medium levels of inequality, subjects on average contributed more of their tokens towards the public good than those in the *No Inequality* treatment, with the results being statistically significant for the *Low Inequality* group. On the other hand, for *High Inequality* groups, they contributed fewer tokens on average towards the public goods. While column (1) of table 2 gives information on how many tokens subjects contributed on average, column (2) gives more insights into the contribution rates across treatment. Subjects in *Low Inequality* and *Mid Inequality* groups gave a higher share of their endowment towards the public good, while subjects in *High Inequality* groups gave a similar share (on average) as subjects in the *No Inequality* groups. The result for *High Inequality* groups is particularly interesting; while subjects on average gave less of their tokens towards the public good (column 1 of table 2), the fact that the contribution rate is the same as equality suggests there is important heterogeneity in the behavior of subjects. This will be examined below in table 3. Column (3) of table 2 is consistent with the subject level result.[13] The positive (albeit statistically insignificant likely due to larger standard errors from smaller sample size) sign on the coefficient for the *Low Inequality* and *Mid Inequality* groups is consistent with the subject level analysis of tokens

[13]Simulations were carried out to determine the likelihood of obtaining a regression coefficient for treatments 2-4 as extreme as the coefficient observed in the data, with the assumption that contributions from the baseline group were done at random. This is done by generating pseudo samples from a normal distribution with the same mean as observed with baseline groups, but with the observed variances for treatments 2-4. The result of the simulation suggests that a regression coefficient as extreme or more extreme than what was observed for treatment 4 would occur by chance with a probability less than 0.001. For treatments 2-3, these would occur by chance with a probability less than 0.25.

contributed in column (1). Furthermore, the coefficient for the *High Inequality* groups is negative and statistically significant which is also consistent with the column (1). Taken together, this analysis leads to the first result:

Result 1: Inequality reduces PG funding, but only in the case of extreme inequality. At least nominally, for low to medium levels of inequality, the opposite is observed.

Table 2: Regression Analysis of Group level Total Contribution

	(1) Subject Tokens Contribution	(2) Subject percentage Contribution	(3) Group Token Contribution
Constant	71.94	0.395	388.34
	(7.96)***	(0.023)***	(73.70)***
Low Inequality	20.53	0.120	88.11
	(11.61)*	(0.06)**	(72.82)
Mid Inequality	21.41	0.163	85.65
	(13.54)	(0.058)***	(65.15)
High	-22.59	-0.017	-90.36
	(11.25)**	(0.065)	(48.43)*
Round	-2.5	-0.01	-10.06
	(4.28)***	(.004)**	(4.28)**
Observations	960	960	240

Data used is from rounds 11-20. Standard errors are clustered at the subject level for columns (1) and (2), and at the group level for column (3). The constant term is for the No Inequality treatment. The coefficients in column (2) are estimated via fractional probit and are marginal effects, dy/dx.

To gain more insights into heterogeneity in behavior as inequality is introduced, the way subjects behave when they have more (or less) endowment compared to the endowment level in the *No Inequality* treatment is examined. This analysis is presented in table 3. Furthermore, in table 4, the contribution rates of the richest and poorest subjects in each group is compared to the contribution rates in equality. Henceforth, subjects who have more endowment relative to the endowment level in equality will be referred to as the "rich", and those

who have less will be referred to as the "poor".

From table 3, it is observed that for the *Low Inequality* and *Mid Inequality* groups, rich subjects increased contributions to the public goods relative to contribution observed in the *No Inequality* treatment. On the other hand, rich subjects in the *High Inequality* groups did not change how many tokens they contributions to the public good even though they gained endowment relative to the level in the *No Inequality* treatment. These results imply that the (at least nominally) higher contributions of tokens to the public good by subjects in *Low Inequality* and *Mid Inequality* groups observed in columns (1) and (3) of table 2 are being driven by the rich in those treatments, while the lower contributions by subjects in *High Inequality* groups are being driven by the poor in that treatment.

Analysis of table 4 gives insight into the contribution rates (percentages) observed in table 2. Table 4 uses the same independent variables as table 3, but with a fractional dependent variable and estimation strategy. Table 4 implies that the higher contributions rates (as a percentage of total endowment) to the public good by subjects in *Low Inequality* and *Mid Inequality* groups observed in column (2) of table 2 are being driven by the poor, while the rich contributed the same statistically.[14] On the other hand, rich subjects in *High Inequality* groups contributed a lower percentage of their endowment, while poor subjects contributed at a similar rate to equality. Since in *High Inequality* groups all subjects, except for one, were poor and contributed at a rate similar to equality, they helped to mitigate the lower contribution rate observed by the rich subject in their group. This resulted in the average contribution rate in *High Inequality* groups being overall similar compared to the rate in the *No Inequality* treatment (as observed in column 2 of table 2). Taken together, this leads to

[14]Even though the RICH in *Low Inequality* and *Mid Inequality* groups contributed the same percentage statistically, due to them having a higher endowment than equality it resulted in more endowment being contributed as observed in table 3.

my second and third results:

Result 2: At low to medium levels of inequality, the rich significantly increased their contributions to public goods relative to contributions observed in equality. However, as inequality gets even higher, the rich contributed at the level observed in equality.

Result 3: At high levels of inequality, the rich significantly lowered their contribution *rate* relative to the rates observed in equality, while it is similar for the poor. For low to medium levels of inequality, the rich contributed at a similar *rate* to the rate observed in equality.

Table 3: Contribution for those who had higher/lower endowments across Treatments

	Coefficient
Constant	71.94
	(7.97)***
Low*RICH	37.20
	(16.64)**
Low*POOR	3.85
	(11.56)
Mid*RICH	60.97
	(19.17)***
Mid*POOR	-18.14
	(7.58)**
High*RICH	2.735
	(27.82)
High*POOR	-31.03
	(9.79)***
Round	-2.51
	(0.835)***

Number of observations = 960 with data from rounds 11-20. Standard errors are clustered at the subject level. "RICH" refers to subjects whose endowment level is higher than the level in the No Inequality treatment. "POOR" refers to subjects whose endowment level is lower than the level in the No Inequality treatment.

Table 3 can also be interpreted in the context of figure 1B in section 2. This figure illus-

Table 4: Contribution rates for those who had higher/lower endowments across Treatments

	Coefficient
Low*RICH	0.301
	(0.204)
Low*POOR	0.333
	(0.201)*
Mid*RICH	0.199
	(0.199)
Mid*POOR	0.651
	(0.173)***
High*RICH	-0.704
	(0.287)**
High*POOR	0.119
	(0.197)
Round	-0.038
	(0.011)***

Number of observations = 960 with data from rounds 11-20. Standard errors are clustered at the subject level. "RICH" refers to subjects whose endowment level is higher than the level in the No Inequality treatment. "POOR" refers to subjects whose endowment level is lower than the level in the No Inequality treatment. Estimates are done via fractional probit. The sign on the coefficients would be the same sign as marginal effects dy/dx, but the coefficients themselves are not marginal effects.

trates the main predicted behavior based on economic theory. An implication of figure 1B is that contributions for subjects whose wealth expanded only a little with increases in inequality (that is, the rich in the *Low Inequality* and *Mid Inequality* groups) should be greater than contributions for subjects whose wealth expanded a lot with increases in inequality (that is, the rich in the *High Inequality* groups) and those whose wealth did not expand (subjects in the *No Inequality* treatment). This is what is inferred from the data. As table 3 shows, those who gained a small amount of wealth as inequality expands (the rich in the lower inequality groups) increased their contribution relative to equality, while those who gained wealth in the high inequality groups contributed similar to equality. This is consistent with the dynamic predicted from economic theory and illustrated in figure 1B. Furthermore, the poor either kept their contributions the same or reduced it relative to equality. This is again as illustrated in figure 1B.

Table 5 presents the final set of results analyzed. Here the extent to which group inequality is affected by contributions to the public good is considered. Contributions to the public good during the round will result in some redistribution of wealth for that round. For each round, the Gini coefficient of each group after redistribution is computed. The Gini coefficient for a group is then averaged across rounds 11-20, and this represents the average realized Gini coefficient for a group. This group level average Gini after redistribution was then compared to the Gini coefficient before redistribution to examine the extent to which wealth is redistributed across treatments. As the results from table 5 show, for all treatments with inequality, the Gini coefficient fell after redistribution. For the No Inequality treatment, any unequal level of contribution (across subjects) to the public good would necessarily lead to higher inequality, which was observed. This result also helps to put in context the result from tables 3 and 4 for *High Inequality* groups, which are the groups that contributed the lowest number of tokens overall to the public good. In particular, while it was observed that the rich contributed a lower percentage of their wealth to the public good than the poor in

that treatment (as seen in table 4), they still contributed a higher amount of tokens towards the public goods (as seen in table 3). These two dynamics resulted in the Gini coefficient falling for the *High Inequality* group.

Table 5: Public Good Funding and ex-post inequality

	Average Realized GINI Coefficient	p-value for Test that Realized Inequality = Initial Inequality
No Inequality	0.092	0.0431
Low Inequality	0.09	0.0464
Mid Inequality	0.20	0.018
High Inequality	0.403	0.0277

Observation is at the group level. Results are based on the normal approximation to the Wilcoxon signed rank sum paired sample test.

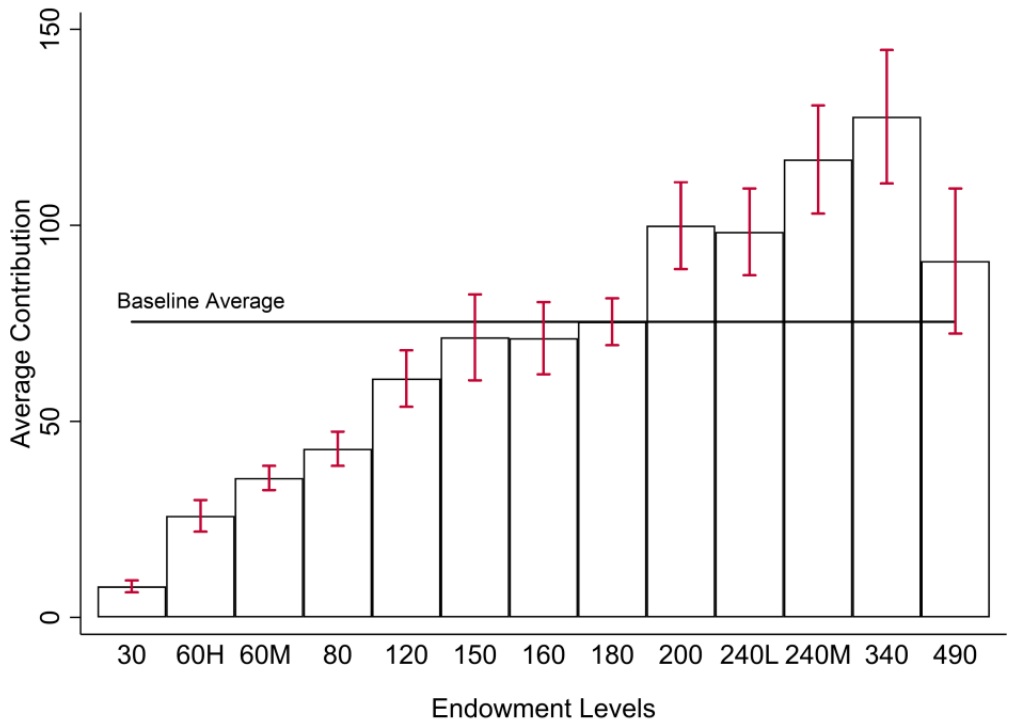
6 Discussion

Revealing contributors is a non-coercive method that may be used to increase contributions to public goods projects. In real world contexts, inequality may play an important role in determining the effect that revealing contributors has on public goods contributions. In this section, the results of the experimental analysis are tied together with the context of the theoretical model presented in section 2 of this paper, and in the context of previous studies.

An implication of the economic theory as illustrated in figure 1B is that as a subject's share of wealth increases to be very large, and consequently the share of wealth is very low for other subjects in their group, this will then result in lower total contributions to the public good compared to a lower spread of wealth away from equality. The is consistent with the main result of this paper which is that inequality reduces public goods funding in the case of extreme inequality. The consistency between the results and predictions can also be seen at the subject level. Since subjects were randomly assigned into treatment, ran-

domization implies that rich subjects would have behaved the same (on average) as subjects in the groups with equality if not for the expansion in wealth (with inequality increasing correspondingly). The theoretical predictions of section 2 (Case 1) imply that as the share of wealth that a subject has increases from a low level, they should respond by contributing even more to the public good (Prediction 2); however, as the share of wealth increases even further, they should respond by contributing less (Prediction 1). Both of these predictions are observed in the data. Figure 4 illustrates this further by showing how contributions increases as the share of total endowment increases, before decreasing for subjects with the largest share of endowment (total endowment in a group was held fixed across all treatments).

Figure 4: Contribution to the public good by endowment share



Note: Total endowment in a group was fixed across all treatments. Confidence intervals are at the 5% level. L, M and H refers to endowment levels in the Low, Medium and High Inequality groups, respectively.

The results are not consistent with Case 2 from section 2. In this case, rich subjects would always contribute more to the public good. This behavior was not observed. Subject behavior observed during the experiment was more consistent with Case 1 predictions.

It can be argued that the results are more likely to be consistent with models where observation is important, such as social image models as discussed in this paper, rather than models where observation is not important. This is because for most previous studies with inequality that maintained anonymity, it is generally observed that inequality reduced contributions even though those studies utilized varying levels of inequality between them (for e.g. Fung and Au, 2014; Keser et al. 2014; Nitta, 2014; Hargreaves Heap et al. 2016; and Gächter et al. 2017). For example, the Gini coefficient in Hargreaves Heap et al. (2016) was 0.27, which would be between the *Low Inequality* and *Mid Inequality* treatments in this paper, but they found that this level of inequality reduced contributions. For almost all the remaining papers compiled from the literature, they found that inequality has no effect on contributions (for e.g. Bergstrom et al. 1986, Buckley and Croson, 2006; Hofmeyr et al. 2007). Only one paper (Oconnor et al., 2022) found a positive impact of inequality on giving, but that study observed this behavior for all levels of inequality and in a setting where subjects were incentivized by a lottery prize. Therefore, the departure from the typical result of previous studies is likely due to the fact that contributors were revealed in the setup of this paper.

Finally, while speculative, the study gives some insight into which non-coercive technique may be better suited to increase contributions to public goods in the presence of inequality. This insight can be gained by comparing the results of this paper to two other studies: Corazzini et al. (2010) and Oconnor et al. (2022). This is because some of the endowment levels in the present paper were designed to match the endowment levels from those two studies. In particular, the *Low Inequality* treatment matched the endowment level in Corazzini et al. (2010). Furthermore, all endowment levels (except for the *Mid Inequality* treatment) closely match the endowment levels from Oconnor et al. (2022). From Corazzini et al. (2010), it was shown that the lottery mechanism was superior to two other non-coercive methods: All-Pay-Auctions and pure Voluntary Contribution Mechanism. Therefore, the

lottery mechanism is a useful benchmark to compare with the effects of revealing contributors. Using similar ¬¬level of endowments—and correspondingly a similar Gini coefficient of 0.5 for *High Inequality* groups—Oconnor et al. (2022) found that after redistribution the realized Gini coefficient (augmented by expected lottery winnings) reduced inequality from 0.5 to 0.189 for the *High Inequality* treatment. On the other hand, this paper finds that recognition reduces inequality more modestly for the *High Inequality* treatment, from 0.521 to 0.403. In Oconnor et al. (2022), the lottery prize was quite large, which may have elicited a stronger participatory effect in subjects. There is no way to check for this without further experiments, but these dynamics may point to an interesting area for further research.

7 Conclusion

Several non-coercive methods exist to increase contributions to public goods projects relative to simply asking individuals to voluntarily contribute. These include lotteries, all-pay-auctions, and recognizing contributions. Contributor observation is used in may contexts, such as situations where the names of donors to a charity are published. While many studies have shown how revealing contributors increases contributions to public goods, in real world contexts, revealing contributors does involve some complexities that needs to be considered. One such complexity is inequality in wealth. Studies that have examined how inequality impacts public goods contribution have shown mixed results; while most studies show how it reduces contributions, others show that it has no effect and at least one other study shows a positive impact. There has been no previous study that has examined how inequality impacts contributions to public goods projects when contributors are revealed. Considering the mixed results in the literature so far on the impact of inequality of contributions to public goods projects, this impact cannot be inferred and warrants important investigation.

Using experimental data collected in a lab, this paper examines how inequality affects contributions to public goods when contributors are revealed. This paper first uses economic theory to predict that in the presence of medium levels of inequality, the rich (that is, those at the upper end of the wealth distribution) will contribute more to the public good. However, for high levels of inequality, the rich will contribute a lower amount to the public good than the amount observed in medium levels of inequality. Experimental data were consistent with these predictions. Results show that in the presence of low to medium levels of inequality, rich subjects increased their contributions to the public good. However, in the presence of high levels of inequality, the rich reduced their contributions. The results also show that at the group level, total contributions to the public good was at least the same or higher in low to medium levels of inequality compared to equality, but at high levels of inequality total contributions decreased. In terms on contribution rates (percentage of wealth contributed to the public good), subjects in groups of low to medium levels on inequality contributed a higher share of their wealth to the public good compared to equality, while subjects in high levels of inequality contributed a similar share to equality. Overall, this paper shows that inequality may play an important role in determining the effectiveness that revealing contributors has on contributions to public goods projects.

References

Ali, S. N. & Bénabou, R. (2020). Image versus Information: Changing Societal Norms and Optimal Privacy. *American Economic Journal: Microeconomics*, 12(3), 116-164.

Andreoni, J. (1988). Privately Provided Public Goods in a Large Economy. *Journal of Public Economics*, 35. 57-73.

Andreoni, J., & Petrie, R. (2004). Public goods experiments without confidentiality: a glimpse into fundraising. *Journal of Public Economics*, 88, 1605–1623.

Balafoutas, L., Kocher, M. G., Putterman, L. & Sutter, M. (2013). Equality, equity and incentives: An experiment. *European Economic Review*, 60. 32-51.

Bénabou, R. & Tirole, J. (2006). Incentives and Prosocial Behavior. *American Economic Review*, 96(5). 1652-1678.

Bergstrom, T., Blume, L. & Varian, H. (1986). On the private provision of public goods. *Journal of Public Economics*, 29. 25-49.

Bersin, J. (2012). New Research Unlocks the Secret of Employee Recognition. Forbes.com.

https://www.forbes.com/sites/joshbersin/2012/06/13/new-research-unlocks-the-secret-of-employee-recognition/?sh=4938b8d65276. Retrieved February 2024.

Brent, D. A., Gangadharan, L., Mihut, A. & Villeval, M. C. (2019). Taxation, redistribution, and observability in social dilemmas. *Journal of Public Economic Theory*, 21(5). 826-846.

Buckley, E. & Croson, R. (2006). Income and wealth heterogeneity in the voluntary provision of linear public goods. *Journal of Public Economics*, 90(4-5). 935-955.

Butera, L., Metcalfe, R., Morrison, W. & Taubinsky, D. (2022). Measuring the Welfare Effects of Shame and Pride. *American Economic Review*, 112(1), 122-168.

Cadigan, J., Wayland, P. T., Schmitt, P. & Swope, K. (2011). An experimental dynamic public goods game with carryover. *Journal of Economic Behavior and Organization*, 80.

523–531.

Cason, T. N., Friesen, L. & Gangadharan, L. (2016). Regulatory performance of audit tournaments and compliance observability. *European Economic Review*, 85. 288-306.

Chan, K. S., Mestelman, S., Moir, R. & Muller, R. (1996). The voluntary provision of public goods under varying income distributions. *The Canadian Journal of Economics*, 29(1). 54-69.

Chan, K. S., Mestelman, S., Moir, R. & Muller, R. (1999). Heterogeneity and the voluntary provision of public goods. *Experimental Economics*, 2. 5-30.

Cherry, T. L, Kroll, S. & Shogren, J. F. (2005). The impact of endowment heterogeneity and origin on public good contributions: evidence from the lab. *Journal of Economic Behavior and Organization*, 57. 357–365.

Christens, S., Dannenberg, A. & Sachs, F. (2019). Identification of individuals and groups in a public goods experiment. *Journal of Behavioral and Experimental Economics*, 82. 944-967.

Clingingsmith, D. & Sheremeta, R. M. (2018). Status and the demand for visible goods: experimental evidence on conspicuous consumption. *Experimental Economics*, 21. 877–904.

Corazzini, L., Faravelli, M. & Stanca, L. (2010). A prize to give for: An experiment on public goods funding mechanism. *The Economic Journal*, 120. 944-967.

Dannenberg, A., Johansson-Stenman, O. & Wetzel, H. (2022). Status for the good guys: An experiment on charitable giving. *Economic Inquiry*, 60(2). 721-740.

Derin-Güre, P. & Uler, N. (2010). Charitable giving under inequality aversion. *Economic Letters*. 107 (2), 208–210.

Fellner-Röhling, G., Kröger, S. & Seki, E. (2020). Public good production in heterogeneous groups: An experimental analysis on the relation between external return and information. *Journal of Behavioral and Experimental Economics*, 84.

Fischbacher, U. (2007). z-Tree: Zurich toolbox for ready-made economic experiments. *Ex-*

perimental Economics, 10. 171-178.

Fung, J. M. Y. & Au, W. (2014). Effect of inequality on cooperation: Heterogeneity and hegemony in public goods dilemma. *Organizational Behavior and Human Decision Processes*, 123. 9-22.

Gächter, S., Mengel, F., Tsakas, E. & Vostroknutov, A. (2017). Growth and inequality in public good provision. *Journal of Public Economics*, 150. 1-13.

Hargreaves Heap, S. P., Ramalingam, A. & Stoddard, B. V. (2016). Endowment inequality in public goods games: A re-examination. *Economics Letters*, 146. 4-7.

Henry, E. & Louis-Sidois, C. (2020). Voting and Contributing When the Group Is Watching. *American Economic Journal: Microeconomics*, 12(3). 246-276.

Hofmeyr, A., Burns, J. & Visser, M. (2007). Income inequality, reciprocity and public good provision: An experimental analysis. *South African Journal of Economics*, 75. 508-520.

Houser, D., List, J. A., Piovesan, M., Samek, A. & Winter, J. (2016). Dishonesty: From parents to children. *European Economic Review*, 82. 242-254.

Isaac, R. M. & Walker, J. M. (1988). Group size effects in public goods provision: The voluntary contributions mechanism. *The Quarterly Journal of Economics*, 103. 179-199.

Keser, C. (1996). Voluntary contributions to a public good when partial contribution is a dominant strategy. *Economics Letters*, 50(3). 359-66.

Keser, C. & van Winden, F. (2000). Conditional cooperation in voluntary contributions to public goods. *Scandinavian Journal of Economics*, 102(1), 23-39.

Keser, C., Markstädter, A., Schmidtc, M. & Schnitzlerd, C. (2014). Social costs of inequality: heterogeneous endowments in public-good experiments. cege Discussion Papers, No. 217, University of Göttingen, Center for European, Governance and Economic Development Research (cege), Göttingen.

Kessler, J. B., Low, C. & Singhal, M. (2021). Social policy instruments and the compliance

environment. *Journal of Economic Behavior & Organization*, 192. 248-267.

Krieg, J. & Samek, A. (2017). When charities compete: A laboratory experiment with simultaneous public goods. *Journal of Behavioral and Experimental Economics*, 66. 40-57.

Lepper, M., Greene, D. & Nisbett, R. (1973). Undermining Children's Interest with Extrinsic Rewards: A Test of the 'Overjustification Hypothesis'. *Journal of Personality and Social Psychology*, 28(1). 129-137.

Morgan, J. & Sefton, M. (2000). Financing public goods by means of lotteries: Experimental evidence. *The Review of Economic Studies*, 67. 785-710.

Nitta, K. (2014). The effect of income heterogeneity in an experiment with global and local public goods. University of Hawai'i at Mānoa Department of Economics Working Paper.

Oconnor, C., Zhang, L. & Deck, C. A. (2022). An examination of the effect of inequality on lotteries for funding public goods. *Journal of Public Economic Theory*, 22(4). 733-755.

Palfrey, T. R. & Prisbrey, J. E. (1996). Altruism, reputation and noise in linear public goods experiments. *Journal of Public Economics*, 61(3). 409-427.

Rapoport, A. (1993). Incremental contribution in step-level public goods games with asymmetric players. *Organizational Behavior and Decision Processes*, 55. 171-194.

Razen, M. & Kupfer, A. (2023). The effect of tax transparency on consumer and firm behavior: Experimental evidence. *Journal of Behavioral and Experimental Economics*, 104.

Samek, A. S. & Sheremeta, R. M. (2014). Recognizing contributors: an experiment on public goods. *Experimental Economics*, 17. 673-690.

Samek, A. S. & Sheremeta, R. M. (2017). Selective recognition: How to recognize donors to increase charitable giving. *Economic Inquiry*, 55(3). 1489-1496.

Seçilmiş, I. E. & Güran, M. C. (2012). Income heterogeneity in the voluntary provision of dynamic public goods. *Pacific Economic Review*, 17(5). 693-707.

Appendix: Experiment Instructions, and Sample Decision and Results Screen

This section gives a sample of what subjects would have seen when they participated. The first 8 images would have been universally the same for all subjects. The 9th image was also the same for subjects, with only slight differences to explain any of test questions (image 8) subjects got wrong, and provide corroborative information for test question subjects got right. The information viewed on images after the 9th image is treatment specific and differences explained under each image.

Image 1

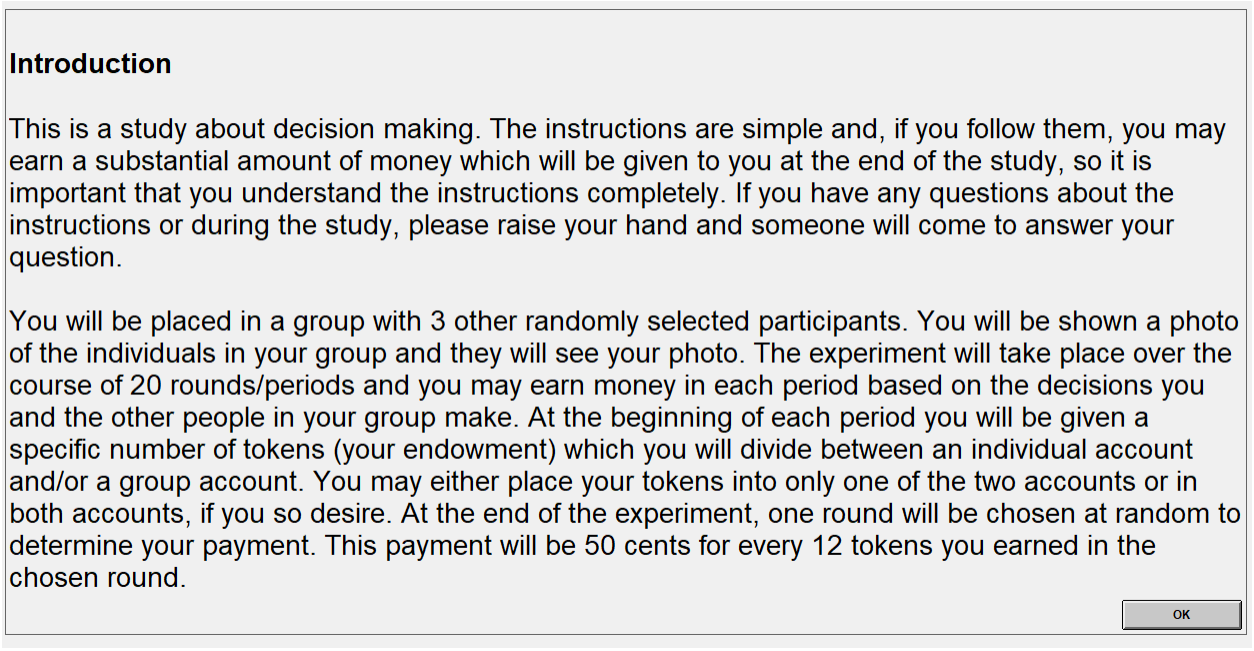


Image 2

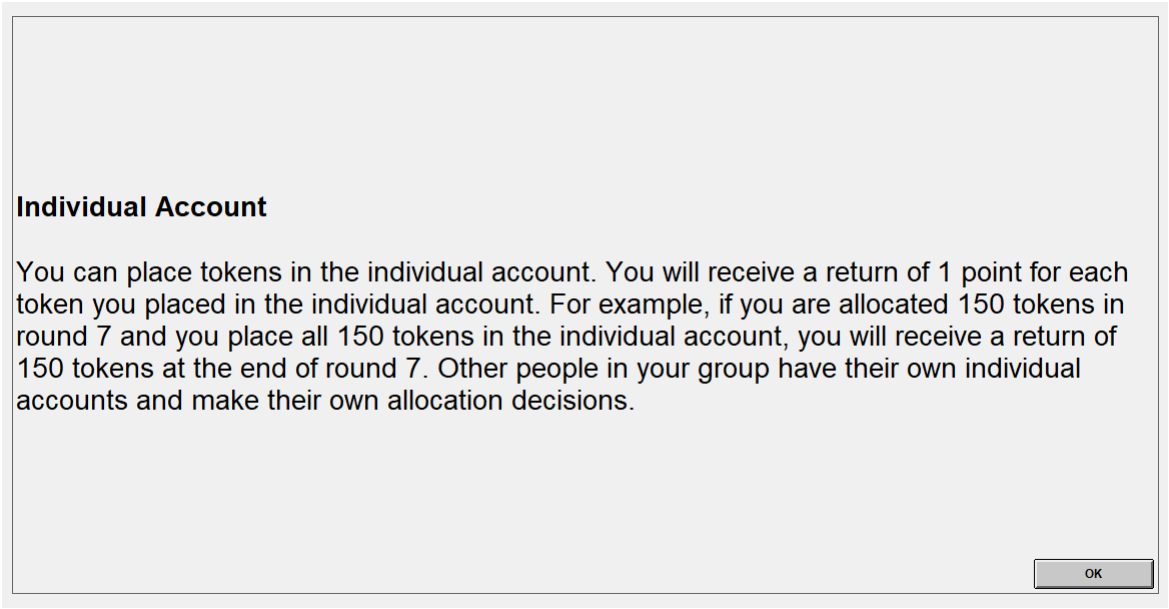


Image 3

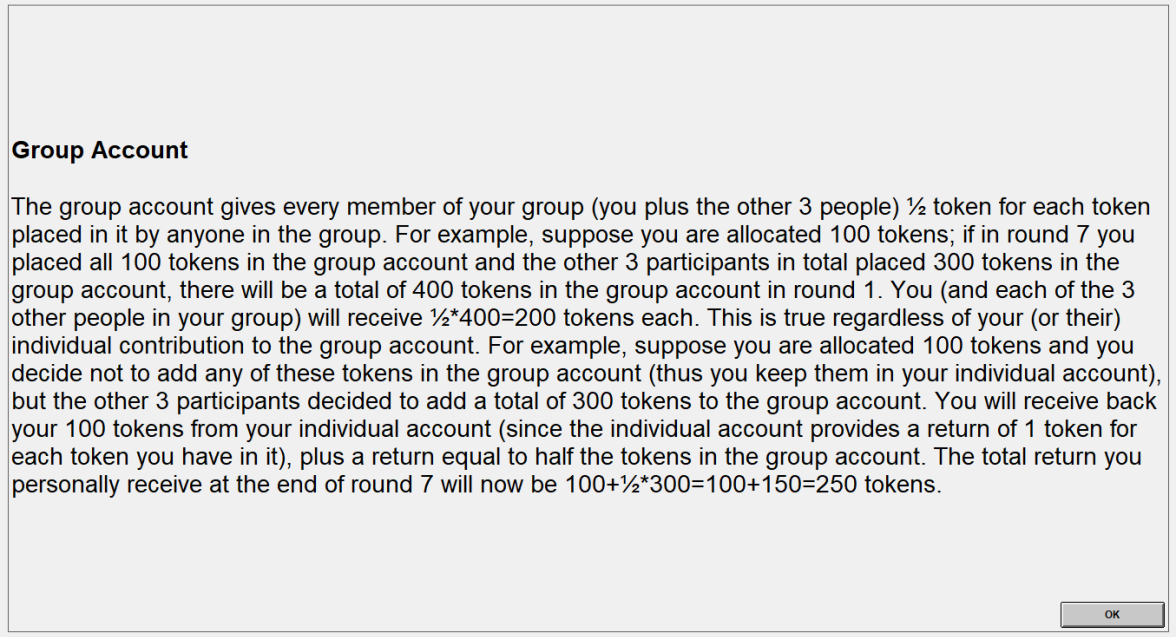


Image 4

In every round, you will be shown a photo of all the members of your group and a distribution that contains their endowment of tokens. Note that some participants may receive the same number of tokens, and others may receive different number of tokens. The number of tokens that you and the other participants receive in each round will not change from round to round. After tokens have been distributed, you and all other participants will simultaneously decide how much of your tokens that you would like to allocate to the group account. Only after decisions have been made by all participants in your group will the contributions of all participants be visible.

On the next few pages you will be shown three examples to clarify the earnings structure:

OK

Image 5

Example 1						
	Columns					
	1	2	3	4	5	6
Subject	Endowments	Group Account Allocation	Individual Account Allocation (col 1 minus col 2)	Return from group account (0.5*Total Group)	Return from Individual Account (=col 3)	Total Return (col 4 + col 5)
a	120	120	0	360	0	360
b	160	160	0	360	0	360
c	200	200	0	360	0	360
d	240	240	0	360	0	360
Total		720				

Suppose that there are 4 persons in your group and their endowments are given in the table above (column 1). In this example everyone allocates all their tokens to the group account. The total allocated to the group account is therefore 720 tokens. The total return from the group account for each subject is 360 tokens (720*0.5=360). Total return received by each person is given in column 6 which is the sum of columns 4 and 5.

OK

Image 6

Example 2						
	Columns					
	1	2	3	4	5	6
Subject	Endowments	Group Account Allocation	Individual Account Allocation (col 1 minus col 2)	Return from group account (0.5*Total Group)	Return from Individual Account (=col 3)	Total Return (col 4 + col 5)
a	120	0	120	300	120	420
b	160	160	0	300	0	300
c	200	200	0	300	0	300
d	240	240	0	300	0	300
Total		600				

Suppose that there are 4 persons in your group and their endowments are given in the table above (column 1). Subject "a" decides to not add any of their endowment to the group account and thus kept it in their individual account. Subjects "b" through "d" made their own contribution to the group account, totaling 600 tokens. Everyone, including subject "a", receives a return from the group account. This return in a half of the total in the group account; that is 300 tokens (0.5*600=300). Total return received by each person is given in column 6 which is the sum of columns 4 and 5.

OK

Image 7

Example 3						
	Columns					
	1	2	3	4	5	6
Subject	Endowments	Group Account Allocation	Individual Account Allocation (col 1 minus col 2)	Return from group account (0.5*Total Group)	Return from Individual Account (=col 3)	Total Return (col 4 + col 5)
a	120	0	120	0	120	120
b	160	0	160	0	160	160
c	200	0	200	0	200	200
d	240	0	240	0	240	240
Total		0				

Suppose that there are 4 persons in your group and their endowments are given in the table above (column 1). In this example, nobody allocates any of their tokens to the group account. There is no return from the group account and thus all return earned comes from whatever is in the individual account. Total return received by each person is given in column 6 which is the sum of columns 4 and 5.

OK

Image 8

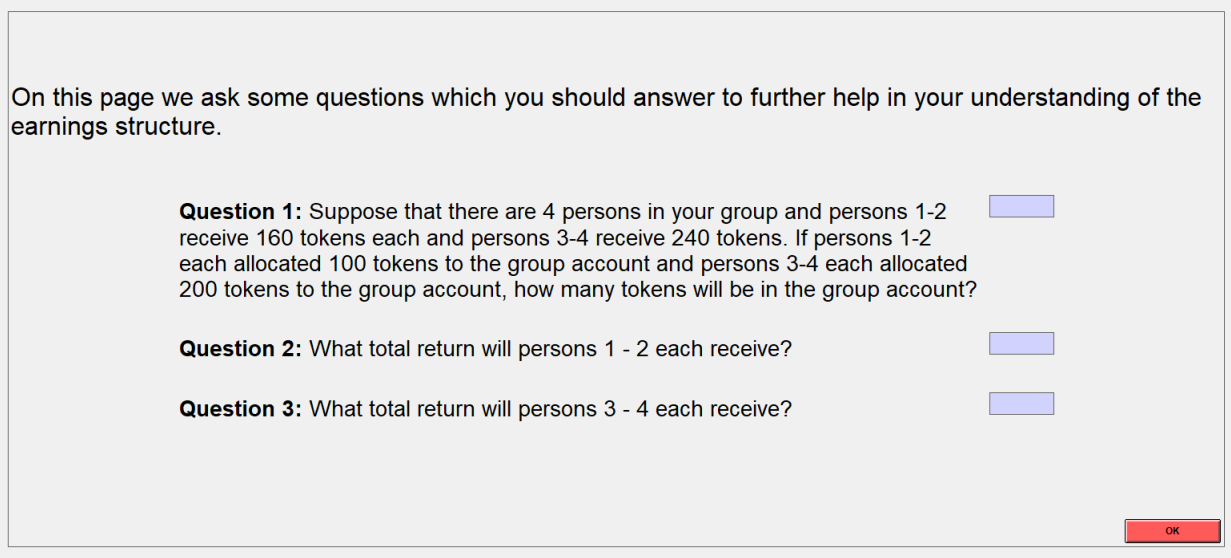
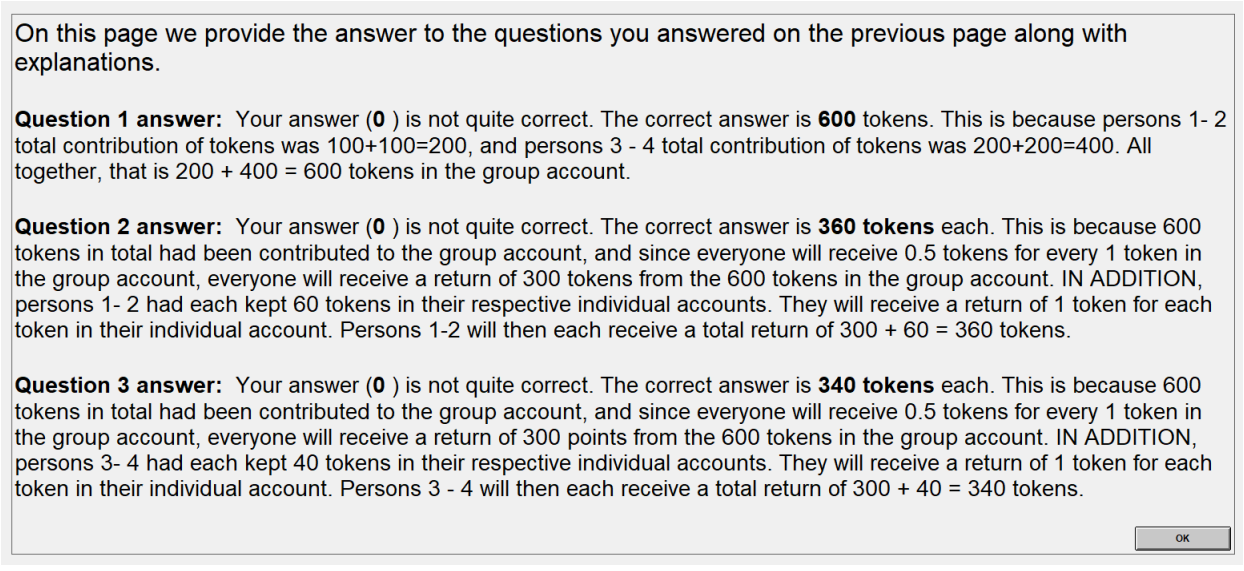
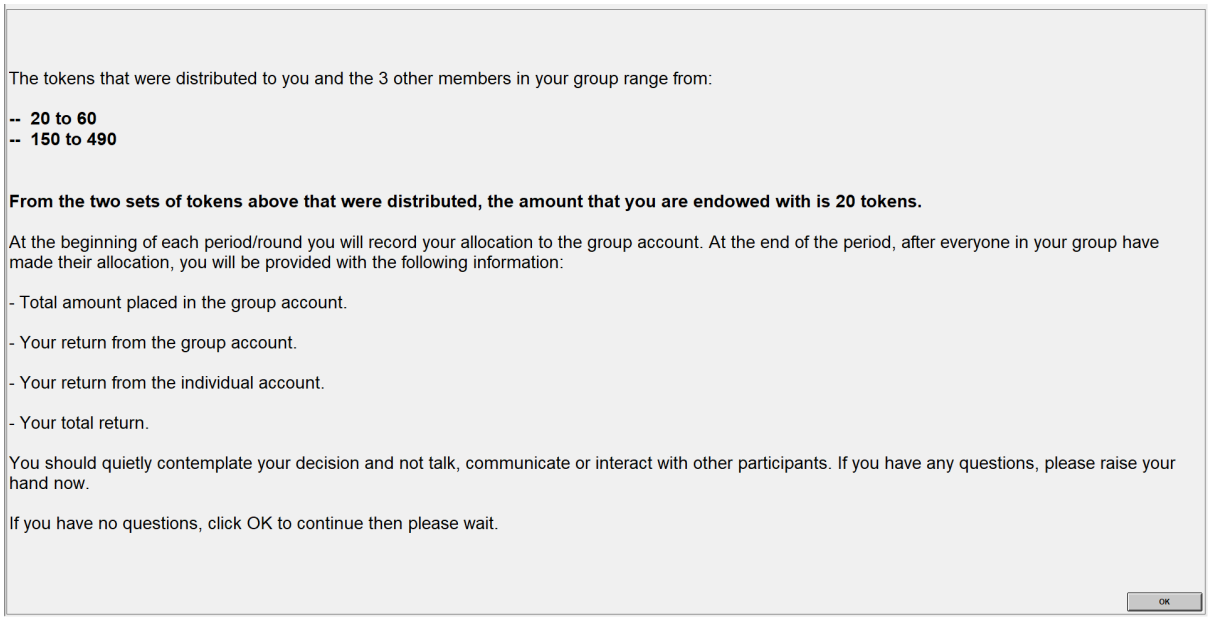


Image 9



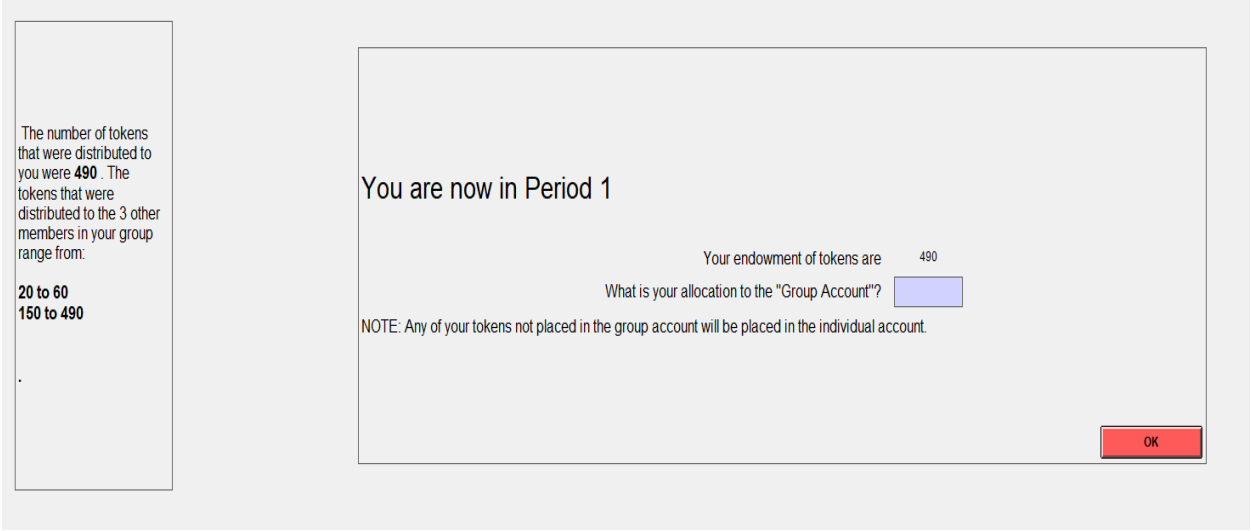
This screen illustrates what subjects would have seen if they entered wrong answers for the practice questions (image 8).

Image 10



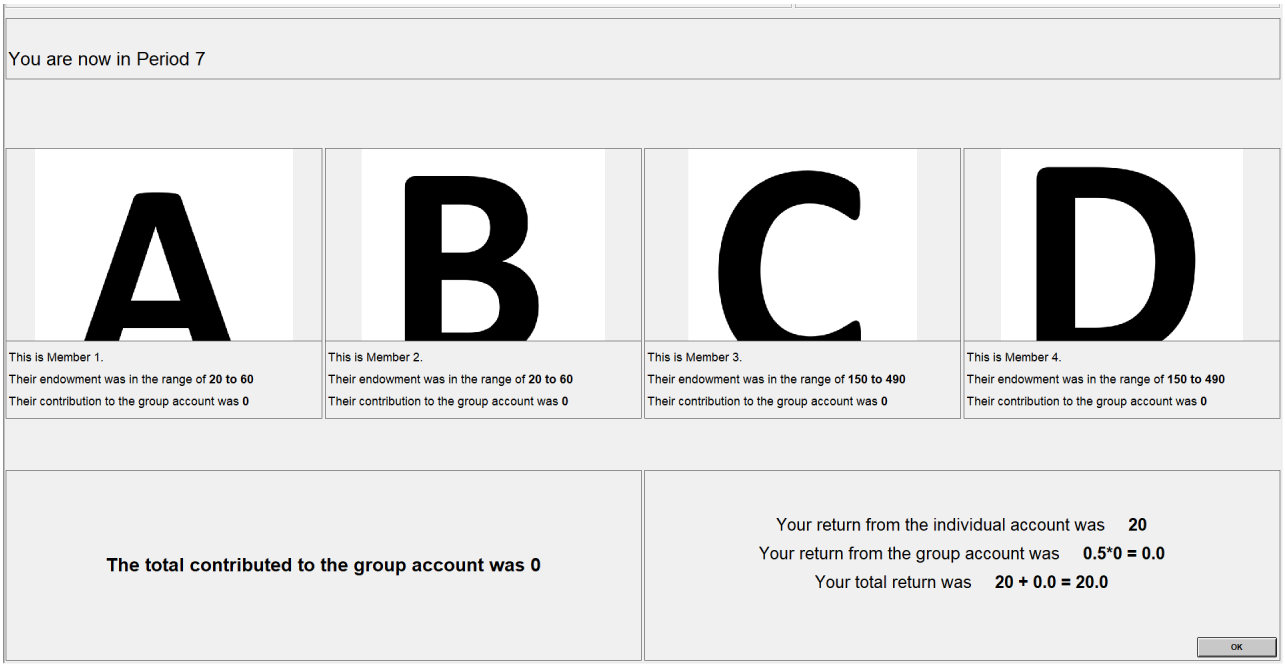
Note: Information on the distribution of tokens and the tokens allocated to the subject viewing the screen will differ by treatment and subject.

Image 11



Note: Information on the distribution of tokens and the tokens allocated to the subject viewing the screen will differ by treatment and subject.

Image 12



Note: The actual image of participants would be where the letters A,B,C,D are. This is the information that subjects viewed after period 5. In the first 5 periods, subjects were shown identical information as displayed here, except for information on the contribution of individual subjects. Subjects in groups with equality would have seen the exact endowment level below each photo as they knew they all had the same endowment level.