Visibility of Contributors and Cost of Information: An Experiment on Public Goods

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Abstract

We experimentally investigate the impact of visibility of contributors and cost of information on public good contributions. First, we vary recognizing all, highest or lowest contributors. Second, we investigate the effect of imposing a cost on viewing contributors. Recognizing all contributors significantly increases contributions relative to the baseline, even when viewing contributors' information is costly. This effect holds even though the identities of contributors are viewed less than ten percent of the time. Recognizing only highest contributors does not increase contributions compared to not recognizing contributors, but recognizing only lowest contributors is as effective as recognizing all contributors. These findings support our conjecture that aversion from shame is a more powerful motivator for giving than anticipation of prestige.

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1. Introduction

The desire for social approval is one of the reasons why individuals will act more generously in public if their generosity is viewable by others (Hollander, 1990). It has been generally acknowledged that recognizing contributors by revealing their identity increases contributions to public goods (Andreoni and Petrie, 2004; Rege and Telle, 2004). Social groups, charity organizations and online communities publicize individuals' contributions for this reason, and very few contributions are actually done anonymously. Social recognition has also been found effective in disparate settings that include voter turnout and blood donation (Gerber et al., 2008; Lacetera and Macis, 2010). While there is agreement among researchers and practitioners that recognizing contributors has a positive effect, the reasons for this effect are less clear.[1] In this paper, we conduct a series of controlled laboratory experiments to systematically investigate whether the increase in contributions is driven by the recognition of the highest contributors (prestige) or of the lowest contributors (shame). We also evaluate whether knowing that one's identity and the corresponding contribution may be viewed by others is a sufficient motivator to increase giving, and whether individuals are willing to incur a cost to view identifiable information about group members.

Following Andreoni and Petrie (2004), we investigate a public goods setting with a baseline treatment in which no identifiable information about participants is displayed and a recognition treatment in which photos and names of participants are displayed. Then we introduce three novel treatments. In the first treatment, individuals decide each period whether or not to incur a cost to view identifiable information about group members' contributions. This treatment gives us insight into the value of recognition information. In the other two treatments,

[1] One laboratory experiment that does not find a positive effect of recognition is the experiment of Dufwenberg and Muren (2006). However, as the authors point out, in their setting the reduction of anonymity may come with additional confounding factors.

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only the highest two or only the lowest two contributors are identified in each period. The latter two treatments allow us to disentangle whether it is the aversion from shame or the anticipation of prestige that causes the observed increase in contributions.

While the link between the public goods game in the laboratory and social organizations in the field is imperfect, public goods games have been studied extensively to answer questions about charitable giving and contributions to social communities (e.g., Ledyard, 1995; Andreoni and Petrie, 2004; Landry et al., 2006; Chen et al., 2010). Abstracting from the interpretation of which specific institutions in the field have more or less similarity to the public goods setting, our findings provide theoretical implications and general inferences for practice.

The new treatments address the effectiveness of several mechanisms that social groups, charities and online communities may employ in practice when publishing contributors' information. While these institutions endeavor to publicize all information, this is often difficult, if not impossible, for several reasons. First, when there are many contributors, publicizing the names of all of them may not be feasible. In this case, organizations that rely on philanthropic donations often publicize the names of the largest contributors, e.g. by naming a building after the highest contributor or by publicly announcing contributors in categories by size of contribution (Harbaugh, 1998; Andreoni and Petrie, 2004; Li and Riyanto, 2009). Second, it is improbable that every member of the social network will view all of the contributor's information, especially when the list of contributors is long. Organizations may recognize all contributors by publishing lists on websites and in other media, but it is not clear that this

information is always viewed due to the time and effort that must be spent in order to locate information about specific contributors.[2]

We find that contributions are significantly increased when contributors are recognized (i.e., photos and names of all contributors are displayed after the contribution stage) relative to when contributors are not recognized. When viewing information about contributors is costly, there is no significant difference in contributions as compared to the case where all contributors are recognized by default, suggesting that just the possibility of being recognized is sufficient to drive the increase in contributions. This effect holds even though the identities of contributors are viewed less than 10% of the time. We also pinpoint which information is most effective at increasing contributions. Recognizing only the highest contributors is not significantly different from not recognizing contributors, while recognizing only the lowest contributors is as effective as recognizing all contributors. This finding suggests that it is the fear of shame, rather than the anticipation of prestige, that drives the identification-related increase in contributions in our experiment.

Our work has implications for the role of social recognition in disparate settings that have been modeled as public goods, including charitable giving, contributions to social and online groups, health behaviors to prevent communicable disease (e.g., vaccination), and collective action problems (e.g., voter turnout and paying property taxes). The results of our experiment suggest that in practice, if participation in the group is fixed, identifiable information about contributors should be displayed, even when it is costly for others to view such information. In instances where monetary sanctions or bonuses are not possible to stimulate participation in socially desirable activities, we find that increasing participation could be achieved through

[2] Time and money are scarce resources affecting the choice to search for information (Gabaix et al., 2006). Empirical studies show that online users tend to ignore information that takes time to find; for example, on eBay, buyers rarely click through to view detailed feedback information about sellers (Resnick et al., 2006).

social recognition by publishing lists of community members who have and have not participated in such activities.

2. Experimental Environment, Design and Procedures

Some of the most fundamental questions about public goods contributions have been answered in the experimental laboratory (Ledyard, 1995). In a simple linear public goods game (Groves and Ledyard, 1977), n identical risk-neutral individuals choose a portion of their endowments e to contribute to a public good. Individual i's contribution c_i to the public good is multiplied by m and given to each of n individuals in the group, where $0 < m < 1$ and $m \times n > 1$. Thus, each individual i maximizes the expected payoff:

$$max\{\pi_i = e - (1-m)c_i + m\sum_{j \neq i} c_j\} \quad \text{s.t.} \quad c_i \in [0,e] \tag{1}$$

We employ the public goods game to study how visibility of contributors and cost of information impact individual contributions. To this end, we conducted five treatments, summarized in Table 1: a baseline treatment in which contributors are not publicly recognized for their contributions (None-Free), a treatment in which only participants who contribute the highest amount are recognized for their contributions (Top-Free), a treatment in which only the participants who contribute the lowest amount are recognized for their contributions (Bottom-Free), a treatment in which all participants are recognized for their contributions (All-Free), and a treatment in which all contributors are recognized but this information is costly for others to view (All-Costly).

Similar to the design of Andreoni and Petrie (2004), we chose to use digital photos to identify individuals to one another.[3] Digital photos capture and preserve the appearance of the

[3] As one reviewer pointed out, anonymity is a hallmark of laboratory experiments. Making group members known to one another moves us closer to a field setting.

person but do not allow for communication, which may confound the effects of identification alone. In addition to the photo, we included first names as part of the identification of individuals. Upon arriving at the lab, each individual wrote his or her first name on a name card, and the experimenter took a photo of the individual holding up the name card. Each individual was then randomly assigned to a computer station in the lab. We used z-Tree (Fischbacher, 2007) to record individual decisions and display photos of individuals.

Individuals were assigned to a group of 5, and stayed in the same group throughout the entire experiment, playing a public goods game for a total of 20 periods.[4] At the beginning of each period, individuals received an endowment of 80 experimental francs and were asked to choose their level of contribution to the public good. Each individual's contribution to the public good was multiplied by $m = 0.4$ and the total of all contributions given to each of the 5 individuals in the group. Each individual kept the remainder of the 80-franc endowment that he did not allocate to the public good. Individuals did not know others' decisions before making their own decisions. After all individuals made their contributions, the computer displayed the total contribution to the group account and the individual contributions of all 5 group members, sorted by contribution amount from largest to smallest.[5]

The photos and names of each group member were displayed on the input screen for all individuals, but we varied the display of identifiable information about contributors on the outcome screen across treatments. In the None-Free treatment, no additional identifiable information about contributors was revealed (including not revealing/assigning any ID numbers).

[4] Unlike Andreoni and Petrie (2004), we decided to employ a fixed matching design. The main reason for this is that by using fixed matching we amplify the effect of prestige and shame, which we argue are one of the main motivating factors for contributions, and hence create the most conducive environment wherein our conjectures could be tested. Moreover, individuals repeatedly participate in social groups and online communities, and thus we fixed matching design better represents these environments.

[5] While social groups of 5 are rarely observed in practice, the choice of small group allows us to assume that all 5 photos are costlessly viewed by participants when they are displayed by default (e.g., no time cost to view).

In the All-Free treatment, the names and photos of each member were displayed below his or her contribution, such that each individual was recognized and also "ranked" (see Figure 1). In the Top-Free treatment, the names and photos of only the top two contributors (those ranked #1 and #2) were displayed below their contributions. Similarly, in the Bottom-Free treatment, the names and photos of only the bottom two contributors (those ranked #4 and #5) were displayed below their contributions. In the All-Costly treatment, after making contribution decisions, and after viewing the default "None-Free" screen with a list of individual contributions but no identification of contributors, individuals had the option to pay a small cost (3 experimental francs; equivalent of $0.15) to view the identifiable information about all contributors (as in the All-Free treatment) on the screen. Whether or not information was viewed was not disclosed to individuals at any time during the experiment.

The experiment was conducted at the Vernon Smith Experimental Economics Laboratory. Participants were recruited from a pool of undergraduate students at Purdue University. A total of 200 individuals participated in 10 sessions, with 20 individuals participating in each session. All individuals participated in only one session of this study. Some individuals had participated in other economics experiments that were unrelated to this research. At the end of the experiment, 2 out of 20 periods were selected for payment using a random draw from a bingo cage. Experimental francs were used throughout the experiment, with a conversion rate of 20 francs = $1. Individuals earned $14 on average, and sessions (including instruction time) lasted approximately 60 minutes. Individuals also completed a demographic questionnaire at the end of each session.

3. Hypothesis Development

3.1. Visibility and Cost of Information

Our goal is to document behavior when display of identifiable information is varied. The standard Nash equilibrium prediction of the public goods game is to contribute nothing (free-ride), i.e. $c^* = 0$. To account for the empirical finding that individuals tend to contribute significant amounts on average (see Ledyard et al, 1995; Fehr and Gachter, 2000), recent theoretical work has incorporated prosocial preferences and preference for social image into the framework of public goods. Some behavioral arguments for the intrinsic motivation to contribute positive amounts to public goods include pure altruism, "warm glow" (Andreoni, 1989, 1990), inequality aversion (Fehr and Schmidt, 1999), fairness and efficiency concerns (Rabin, 1993).[6]

Social recognition introduces prestige and shame as additional motivators for giving (Harbaugh, 1998; Tadelis, 2011). Similar to the model of Benabou and Tirole (2006), we assume that individuals have intrinsic motivations and are concerned about social image (Andreoni and Bernheim, 2009; Ariely et al., 2009).[7] Each individual i draws a social preference type $v_i \in \Re$ from some distribution with mean $\underline{v}$.[8] The intrinsic utility $v_i u(c_i)$, $u'(.)>0$, from contributing to the public good depends on the level of contribution c_i and the social preference type v_i. The realization of v_i is private information, known only to individual i, and not observable by others. The individual also has a preference for social image, denoted by preference parameter s_i, reflecting the idea that the individual has a preference to appear prosocial, either in the instrumental or hedonic sense (e.g., social esteem as a signaling device or social esteem as a consumption good). Group members have an *ex post* belief about the individual's type v_i,

[6] An additional behavioral motivator that has been cited as important is signaling wealth (Glazer and Konrad, 1996).
[7] Several additional theories of the link between social image concerns and prosocial behavior have been advanced. Rege (2004) propose a model that includes "contributor" or "non-contributor" types.
[8] By social preference type we mean a baseline preferred contribution level, different from the commonly held notion of type that includes Nash players, or conditional cooperators, etc.

denoted by $E(v_i|c_i)$. The utility from social image $s_i u(E(v_i|c_i))$ depends on whether the individual contribution is visible ($I_v = 1$) or not ($I_v = 0$).[9] Given this, the expected payoff of an individual i can be written as:

$$max\{\pi_i = e - (1-m)c_i + v_i u(c_i) + s_i u(E(v_i|c_i))I_v + m\sum_{j\neq i} c_j\} \quad \text{s.t.} \quad c_i \in [0,e] \qquad (2)$$

In the All-Free treatment, $I_v = 1$ since full information about all contributions and contributors' identities is visible; however, the *ex post* realization of each individual's type is still determined via the expectation function $E(v_i|c_i)$ that depends on observed c_i. On the other hand, in the None treatment, $I_v = 0$ since there is no viewing and thus there is no social image (i.e., $s_i u(E(v_i|c_i))I_v = 0$). Given that the first order condition on $u(E(v_i|c_i))$ is positive, our profit function (2) leads us to the first hypothesis:

Hypothesis 1: Recognizing all contributors increases contributions to the public good.

This hypothesis is also consistent with previous research, showing that displaying identifying information increases contributions in public good and dictator games (Andreoni and Petrie, 2004; Rege and Telle, 2004; Soetevent, 2005; Charness and Gneezy, 2008), encourages voter turnout (Gerber et al., 2008), blood donation (Lacetera and Macis, 2010), and more pro-social behavior in contests (Mago et al., 2012).

In a novel All-Costly treatment, we also investigate contribution behavior when group members have the option to incur a cost to view identifiable information. Any cost of information greater than 0 results in I_v between 0 and 1. Because choosing to view information is endogenous to the problem (i.e., we do not set an exogenous probability of view), we may also consider I_{vi}, the individual's perceived probability of being viewed, as a more relevant measure

[9] In the original model, Benabou and Tirole (2006) also include a preference parameter to appear *disinterested*, but for simplicity we do not include this parameter. In their paper, this parameter is not necessary to derive predictions, except in instances of understanding how small rewards may crowd out prosocial behavior.

of visibility. Any probability distribution of I_{vi} in the interval strictly between 0 and 1, results in the following hypothesis:

Hypothesis 2: Imposing a cost on recognizing contributors increases contributions relative to the baseline, but it decreases contributions relative to the case where there is no cost of recognizing contributors.

This hypothesis is also in line with related empirical work. In a recent study, Eckel and Petrie (2011) find that individuals in a trust game are willing to incur a cost to see the photos of their counterparts, and this leads to more cooperation and higher efficiency. However, efficiency increases only for individuals who buy the information. In related work, List et al. (2004) find that individuals are more likely to vote "yes" to contribute funds to a public project when there is a chance that their vote will be viewed by others. Using a similar approach, Lopez et al. (2012) find that a random public revelation of an individual's contribution is a sufficient motivator to increase public goods contributions. Finally, Kurzban and Descoli (2008) report an experiment in which participants could access information about the lowest, median or highest contribution to the public good. They find that individuals are willing to purchase information on previous-round behavior at a small cost, although imposing the cost decreases aggregate contributions.

3.2. Prestige and Shame

In the Top-Free and Bottom-Free treatments, we compare the effect of identifying only the highest or only the lowest contributors. We propose that identifying top contributors, as in the Top-Free treatment, activates prestige or pride (Hollander, 1990; Gilbert, 1998; Harbaugh, 1998). Pride is a powerful positive emotion that arises when one is approved of or admired by others (Hollander, 1990; Gilbert, 1998). In economic terms, Harbaugh (1998) refers to prestige

as the increase in utility that comes from having the amount of a contribution publicly known. We will use the term 'prestige' to refer to any increase in utility due to being recognized. We suggest that individuals in our experiment experience prestige when their contributions are visible (i.e., $I_v = 1$) and when these contributions signal higher than average social preference type (i.e., $E(v_i|c_i) > \underline{v}$). The Top-Free treatment satisfies both of these conditions. Therefore, both the documented existence of prestige and pride in the literature and the predictions of our model suggest that recognizing the highest contributors in Top-Free treatment will increase overall contributions relative to the baseline None-Free treatment.

Hypothesis 3: Recognizing the highest contributors increases contributions to the public good due to prestige.

Another argument for why people give is to avoid feeling shame and guilt (Frank, 1988; Ketelaar, 2004). Shame (and guilt) may arise when an individual has committed a moral transgression, such as choosing to free-ride on others' contributions. In the literature, shame is defined as an emotion that induces behavior due to the fear of what others will think, and it is associated with a decrease in utility due to being believed to have acted inadequately (Tangney et al., 1992; Keltner and Buswell, 1996; Tadelis, 2011). Similarly, guilt arises when an individual realizes that she has hurt someone with her behavior and thus perceives herself as a bad person, independent of being recognized (Lewis, 1971; Baumeister et al., 1994).[10] We suggest that individuals in our experiment experience shame when their contributions are visible (i.e., $I_v = 1$) and when these contributions signal lower than average social preference type (i.e., $E(v_i|c_i) < \underline{v}$).

[10] Psychologists have found that priming individuals with feelings of guilt, but not shame, increased cooperativeness in a social dilemma game with anonymous participants (Ketelaar and Au, 2003; de Hooge et al., 2007). Guilt was only effective for selfish individuals and did not increase the contributions of prosocial individuals who were already contributing (de Hooge et al., 2007). While guilt is expected to result in an increase in prosocial behavior (to make up for wrongdoing), according to psychologists, shame is expected to result in hiding or withdrawing from the situation and from others (Tangney et al., 1996). In our experiment, hiding from the situation comes from increasing contributions to avoid being recognized again as a low contributor.

Therefore, both the documented existence of shame and the predictions of our model suggest that recognizing the lowest contributors in the Bottom-Free treatment will increase contributions relative to the baseline None-Free treatment.

Hypothesis 4: Recognizing the lowest contributors increases contributions to the public good due to shame.

Our design also allows us to measure the relative effect of shame and prestige on giving, by comparing the Top-Free to the Bottom-Free treatment. We provide a hypothesis as to the relative impact of prestige and shame based on social image and loss aversion theory. We suggest that prestige and shame are polar opposites: prestige increases, while shame decreases, social image and utility. According to prospect theory (Tversky and Kahneman, 1991), loss aversion causes individuals to weigh losses more heavily than gains. In line with this theory, we propose that individuals may be concerned more with avoiding loss in utility and social image due to shame than with seeking a gain in utility and social image due to prestige. Identifying the highest contributors, as in the Top-Free treatment, measures the preference for a gain in utility and social image, as individuals motivated by prestige will contribute more. On the other hand, identifying the lowest contributors, as in the Bottom-Free treatment, measures the preference for a loss in utility and social image, as individuals will contribute more to avoid shame.

Prospect theory conjectures that a value function exists that is (i) measured over deviations from a reference points, (ii) convex for losses and concave for gains, and (iii) initially steeper for losses than for gains (Tversky and Kahneman, 1991). Assume that p and q are the value functions of prospect theory, where p is increasing and concave in $E(v_i|c_i)$ (recall $E(v_i|c_i)$ is the *ex post* perception of the individual's type v_i) and q is increasing and convex. It is reasonable to assume that individuals use the average perception of individual's type $\underline{v}$ as a reference

point.[11] Therefore, the individual's utility from social image $s_i u(\mathrm{E}(v_i|c_i))$ is derived in relation to the reference point $\underline{v}$:

$$s_i u(\mathrm{E}(v_i|c_i)) = \{s_i p(\mathrm{E}(v_i|c_i) - \underline{v}) \text{ if } \mathrm{E}(v_i|c_i) \geq \underline{v}\} \text{ and } \{s_i q(\mathrm{E}(v_i|c_i) - \underline{v}) \text{ if } \mathrm{E}(v_i|c_i) < \underline{v}\} \quad (3)$$

Estimates of the ratio of p and q (when linearity is assumed) is found to be $-q(-v)/p(v) \approx 2$ (see Tversky and Kahneman, 1991). Given this, the negative utility from a loss in social image should be greater than the positive utility from a gain in social image. Our hypothesis, therefore, is that due to loss aversion, recognizing the lowest contributors will have a greater effect on increasing contributions than recognizing the highest contributors.

Hypothesis 5: Recognizing the lowest contributors increases contributions more than recognizing the highest contributors.

4. Experiment Results

4.1. Overview

We use the results of our experiment to test the hypotheses from the previous section. The summary statistics of our experiment are reported in Table 2 and the average contributions over all 20 periods are displayed in Figure 2. Although contributions are declining over time in all treatments, they are significantly higher than the standard theoretical benchmark of zero ($c^* = 0$).[12] As a result of positive contributions, individuals' payoffs are significantly higher than standard Nash equilibrium predictions. These results are consistent with previous studies of public goods games, and point to the existence of pro-social preferences (Ledyard, 1995). For example, the results from our baseline treatment None-Free indicate that on average

[11] This is a plausible assumption in light of the prevalence of conditional cooperators, whose contributions follow the average observed contributions (Fischbacher et al., 2001). Moreover, related work finds that individuals punish below-average contributors in public goods games (Fehr and Fischbacher, 2004).

[12] A t-test, comparing average contributions to 0, gives the p-values of less than 0.05 for all treatments.

contributions are at 29.3% of the endowment over all periods. Andreoni (1988, 1995) reported overall contributions at 33.2%, while Croson (1996) reported contributions at 35.7% of the endowment.

4.2. The Effect of Visibility and Cost of Information

When comparing contributions in the None-Free treatment to contributions in the All-Free treatment, we find that, consistent with Hypothesis 1, recognizing all contributors significantly increases overall contributions relative to the baseline (44.2 versus 23.4).[13] This finding is consistent with previous findings of Andreoni and Petrie (2004), Rege and Telle (2004) and Soetevent (2005). For example, while Andreoni and Petrie (2004) find average contribution of 48.1% in their recognition treatment, we find marginally higher contributions, 55.3% of endowment.[14]

Result 1: Recognizing all contributors significantly increases contributions relative to no recognition.

In the novel All-Costly treatment, we impose a small cost on individuals who wish to view the identities of all contributors. Consistent with Hypothesis 2, we find a significant increase in contributions in the All-Costly treatment relative to the baseline None-Free treatment (39.3 versus 23.4). As predicted by Hypothesis 2, the All-Free treatment results in greater

[13] A Wilcoxon rank-sum test shows that average contributions over all periods in the None-Free treatment are significantly lower than average contributions over all periods in the All-Free treatment (p-value < 0.05). The same conclusion holds when looking at periods 6-20 (p-value < 0.05).

[14] One difference between our work and Andreoni and Petrie, is that we use a fixed matching while they use a random matching design. Another difference is that we also display the first name of each individual. Other experimental design aspects, such as ranking of the individuals and overall endowment, are also different.

average contributions than the All-Costly treatment, but this result is not statistically significant (44.2 versus 39.3).[15]

Result 2: Imposing a cost on recognizing contributors increases contributions relative to no recognition, but it does not decrease contributions relative to the case when identifiable information is available by default.

The fact that contributions in the All-Costly treatment are not significantly different from contributions in the All-Free treatment is unexpected, highlighting the practical importance of making information about identities of all contributions publicly available, even if this information is costly to access.[16] Looking closer at the data, we find that participants choose to view the identity of group members less than 10% of the time, even though the price to view is small ($0.15 per view).[17] As displayed by Figure 3, the viewing frequency decreases over time, from 10% of individuals choosing to view in the first five periods to only 5% of individuals choosing to view in the last five periods. The modal number of total views per individual across all 20 periods is 1, with 47.5% of individuals (38 out of 80) choosing to never view the identifiable information, 23.8% of individuals (19 out of 80) viewing once, and the remaining 28.7% of individuals viewing 2-10 times.[18]

The finding that some individuals are willing to pay a small cost to view identities of others is in line with the recent findings of Eckel and Petrie (2011), who investigate the

[15] A Wilcoxon rank-sum test shows that average contributions over all periods in the All-Costly treatment are not significantly different from average contributions in the All-Free treatment, but are significantly different from average contributions in the None-Free treatment (p-values 0.47 and 0.00, respectively). The same conclusion holds when we use only periods 6-20 (p-value < 0.05).

[16] The increase in contributions in the All-Costly treatment may be driven by different factors. First, individuals may believe that group members are viewing their information at a high rate, or close to the rate of views in the All-Free treatment. Second, simply the chance that one may be recognized is a strong enough motivator to avoid free-riding. These two explanations can be explored in future experiments that control for expectations.

[17] With 20 periods and 40 individuals in the All-Free treatment, the number of times photos are viewed is 74/800 (9.2%).

[18] No individual chose to view more than 10 times over the 20 rounds.

informational value of a photo in a trust game and find that at a similar, low price, a fraction of individuals purchase the photos of their matches (50% at the rate of $0.20 per view). The difference between our study and the work of Eckel and Petrie is that in our experiment, individuals already have information about identity of group members in the input screen, and purchase information about what each group member contributed at the end of the period, while in Eckel and Petrie individuals purchase the photo of the match prior to the start of the game.

4.3. The Effect of Prestige and Shame

In the Top-Free and Bottom-Free treatments, we compare the effect of recognizing only the highest or lowest contributors. We find that displaying the identities of only the top contributors, as in the Top-Free treatment, marginally increases contributions, and average contributions in this treatment are not significantly different from contributions in the None-Free baseline treatment (27.8 versus 23.4).[19] This finding differs from Hypothesis 3, indicating that in our experiment displaying only top contributors is not an effective way to increase overall contributions to the public goods.

Result 3: Displaying the identity of only the highest contributors marginally increases contributions relative to no recognition, but the effect is not significant.

When comparing contributions between the Top-Free and All-Free treatments, we find that contributions in the Top-Free treatment are significantly lower than in the All-Free treatment (27.8 versus 44.2).[20] This finding further indicates the ineffectiveness of displaying only top

[19] A Wilcoxon rank-sum test shows that contributions are not significantly different between None-Free and Top-Free treatments (p-value = 0.35). Based on the power test, this difference would have been significant if we had 236 independent observations per each treatment. However, contributions are significantly different between All-Free and Top-Free (p-value < 0.05).

[20] A Wilcoxon rank-sum test shows that contributions are significantly lower in Top-Free than All-Free treatment (p-value = 0.00).

contributors. It also suggests that the increase in contribution levels in the All-Free treatment relative to the None-Free treatment (Result 1) is not caused by the display of top contributors.

The findings from the Top-Free treatment may seem surprising given the recent literature on prestige and the success of increasing giving through categorizing contributors by size of contribution (Harbaugh, 1998; Li and Riyanto, 2009). We suggest that one reason why we do not find a significant effect of prestige is that in our experiment, prestige is relative. That is, one has to give more than three individuals in the group in order to gain prestige. On the other hand, when contributors are categorized by gift amount as in Harbaugh (1998), prestige is absolute. It is also possible that individuals who give more in the Top-Free treatment do not want to be viewed as 'suckers', and thus, after being displayed as top contributors, they may want to reduce their subsequent contributions to the public good. We provide evidence for this conjecture in Section 4.4.

In the Bottom-Free treatment, we find that displaying the identities of only the lowest contributors significantly increases contributions relative to both the None-Free and Top-Free treatments (44.9 versus 23.4 and 27.8). Moreover, contributions in the Bottom-Free treatment are not significantly different from contributions in the All-Free treatment (44.9 versus 44.3).[21] This finding is consistent with Hypothesis 4, indicating that recognizing only the bottom contributors is an effective way to increase contributions. Moreover, recognizing only the bottom contributors seems as effective as recognizing all contributors.

Result 4: Displaying the identity of only the lowest contributors significantly increases contributions relative to the case where no identities are displayed, and is not significantly different from displaying the identities of all contributors.

[21] A Wilcoxon rank-sum test shows that contributions in the Bottom-Free treatment are significantly higher than in the None-Free and Top-Free treatments (both p-values < 0.05). However, contributions are not different between the Bottom-Free and All-Free treatments (p-value = 0.60).

Displaying only the bottom contributors can serve as an exogenous punishment mechanism for low contributors. It has been shown in the literature that social disapproval or sanctioning are powerful mechanisms that improve individual contributions to public goods in anonymous environments (Yamagishi, 1986; Ostrom et al., 1992; Fehr and Gaechter, 2000, 2002; Masclet et al., 2003). Masclet et al. (2003) find that informal sanctions that do not carry a monetary fine are also effective. Therefore, individuals trying to avoid social disapproval should contribute sufficient amounts in order to avoid being the lowest contributors. In fact, in Section 4.4, we provide evidence that in the Bottom-Free treatment individuals who are seen as low contributors choose to increase their subsequent contributions to the public good.

The finding that contributions in the Top-Free treatment are not significantly different from contributions in the None-Free treatment, but contributions in Bottom-Free are significantly greater than contributions in the None-Free treatment, indicates that the effect from identifying contributors is primarily driven by motivators such as avoiding shame from being a low contributor, rather than by motivators such as seeking prestige from being a high contributor. These findings are in support of Hypothesis 5, which suggests that individuals may in fact be loss averse when it comes to social image.[22]

The finding that shame may be more effective than prestige is also in line with the findings of several recent field experiments on voter turnout. Gerber et al. (2010) compared information on past voting versus past abstaining behavior on the decision to vote, and found that being reminded that one did not vote (shame) is more effective than being reminded that one did vote (pride). Panagopoulos (2010) compared giving potential voters information that non-voters'

[22] Note that a potential drawback of our design is that some prestige may come from not being identified as a low contributor in Bottom-Free, and some shame may occur from not being identified as a high contributor in Top-Free. Recall that there are 5 individuals total in each group, and either the top 2 or bottom 2 are identified in each treatment. Thus, not being identified at the top (bottom) means that one is either the median contributor or the bottom (top) two contributors.

or voters' names would be published in a newspaper, and found that publicizing non-voters had the most pronounced effect. Our finding is also in line with the work on sanctions and rewards. Sefton et al. (2007) find that monetary rewards by themselves cannot sustain cooperation the way that monetary sanctions can.

4.4. Behavior Across Periods

Next, we examine the dynamics of contributions over the duration of the experiment. Table 3 shows the estimation results of panel regressions separately for each treatment. The sum of group members' contributions in the previous period (*group-contribution-lag*), as well as the individual's contribution in the previous period (*own-contribution-lag*), significantly increase the individual's contribution in each period. These findings indicate the presence of conditional cooperation, also observed in related work (Fischbacher et al., 2001). Conditional cooperators tend to cooperate when others in the group do so, and tend not to cooperate when they observe defection. Conditional cooperation could exist concurrently with prestige and shame in our setting, and would not invalidate our findings unless it interacts with treatments. However, there are no significant differences in conditional cooperation when comparing treatments and control (Chow test p-values > 0.10).

Interestingly, being viewed as a top contributor in the previous period (*photo-view-lag*) significantly decreases contributions in the Top-Free treatment (see specification 3). This finding is unexpected. It suggests that the treatment attempting to induce prestige and thus more contributions is actually counterproductive. One possible reason for this result is that individuals who give more when others free-ride in the public goods setting may not want to be viewed as 'suckers,' and that the relative effect counter-balances any prestige motivation.. On the other

hand, being viewed as a low contributor increases (although not significantly) contributions in the Bottom-Free treatment, which we would expect if individuals try to avoid shame (see specification 4).

Finally, a significant and negative period trend (*period-trend*) is present in all treatments, which is in line with related findings in the public goods literature. Interestingly, we observe a steeper decline in contributions in the most effective treatments – using a Chow test, we find that in the Bottom-Free and All-Free treatments contributions decline more rapidly than in the None-Free treatment (coefficients -1.06 and -0.3 versus -0.10, p-values < 0.01 and 0.05, respectively).[23] The decline is not significantly different when comparing the None-Free to All-Costly treatment or the None-Free to Top-Free treatment.

The differences in rates of decline of contribution by treatment are particularly relevant in light of practical implications of our research. While outside the scope of our research, it is important to learn whether the greater declining trend in the most effective treatments is simply an artifact of an experiment using a public goods game, or whether the declining trend would be present in practice, such that individuals who are consistently recognized for 'bad' behavior choose to cease participating in the group. Despite the declining trend, we still see significant differences in contributions for the Bottom-Free and All-Costly treatments in the last periods of the experiment. For example, in periods 16-20, we observe the average contribution rates of 32% in the All-Costly, 34% in the All-Free, and 29% in the Bottom-Free treatment, and only 15% in the None-Free and 17% in Top-Free treatment. Using non-parametric tests, the differences between these contribution levels remain significant between the Bottom-Free and None-Free treatments, and between the All-Costly, All-Free and None-Free treatments.

[23] Noussair and Tucker (2007) also find that contributions under recognition display a greater decrease over periods.

4.5. Leaders and Laggards

Similar to Gunnthorsdottir et al. (2001) and Andreoni and Petrie (2004), we investigate the presence of leaders and laggards in our experiment. We use a simple classification system to discover "leaders" and "laggards," where a leader is defined as any individual who contributed 60 or more experimental francs (75% of the endowment) and a laggard is defined as any individual contributed 20 or fewer experimental francs (25% of the endowment) in the first period.[24] The remaining individuals are therefore neither leaders nor laggards. The analysis of behavior in the first period allows us to consider the effect of visibility of contributors independent of the reputation that forms when participating in the game over several periods.

We conjecture that treatments All-Free and All-Costly should increase leaders and decrease laggards relative to treatment None-Free. In the Top-Free treatment, leaders are more likely while laggards are less likely to be revealed, so the proportion of leaders should be increased but the proportion of laggards should not change relative to treatment None-Free. In the Bottom-Free treatment, leaders are less likely while laggards are more likely to be revealed, so the proportion of leaders should not change while the proportion of laggards should decrease relative to the None-Free treatment.

Table 4 shows the distribution of leaders and laggards as a percentage of total number of individuals. Comparing treatment None-Free with All-Free, we find that in treatment All-Free there are almost twice as many leaders (52.5% versus 30.0%), and almost four times fewer

[24] Andreoni and Petrie (2004) use a similar approach of classifying leaders who contributed 15 or more tokens out of 20 and as laggards as those who contributed 5 or fewer tokens out of 20. However, the difference is that we use only one set of 20 periods while in Andreoni and Petrie (2004), individuals complete 5 sequences of contributions with different group members. In that case, they use the measure for "leaders" as those who contributed 15 or more in 4 out of 5 sequences, and as "laggards" as those who contributed 5 or fewer tokens in 4 out of 5 sequences.

laggards (10.0% versus 35.0%), and these differences are significant.[25] Leaders contribute an average of 92.5% of their endowment, while laggards contribute an average of 11.6%.

While treatment All-Free, compared to treatment All-Costly, does not result in significantly different contributions on average, the effect on the proportion of leaders and laggards is different. Imposing a cost on viewing information does not reduce the number of leaders in the All-Costly relative to the All-Free treatment, but it more than doubles the number of laggards.[26] Thus, lowering the probability of being identified has an effect on the lowest contributors, but not on the highest contributors. However, no significant difference in choice to view photos is observed between leaders and laggards. Over the course of the experiment, leaders view photos 9.5% of the time, while laggards view photos 13.2% of the time, and individuals who are neither leaders nor laggards view photos 4.5% of the time.[27]

If individuals care about prestige of being displayed as one of the top two contributors, we should expect to see a greater number of leaders in the Top-Free relative to the None-Free treatment. However, we do not find this in the data. The proportion of leaders in both treatments is the same.[28] Moreover, Figure 4, which displays the distribution of contributions in all treatments, indicates that there are almost no differences in distributions between treatments

[25] A Chi^2 goodness of fit test has a p-value of 0.04 when comparing leaders, and a p-value of 0.01 when comparing laggards.
[26] A Chi^2 goodness of fit test has a p-value of 0.66 when comparing leaders and p-value of 0.05 when comparing laggards.
[27] A Wilcoxon rank-sum test for pairwise comparisons of proportion of times viewed aggregated for each individual results in *p*-values above 0.10 in all cases; e.g. Leader versus Laggard *p*-value = 0.88, Leader versus Follower *p*-value = 0.22, Laggard versus Follower *p*-value = 0.38. Moreover, no significant correlation exists between amount given in period 1 and proportion of times photos are viewed (Spearman's rank correlation coefficient = -0.03 with *p*-value = 0.81).
[28] Interestingly, there are more laggards in the Top-Free treatment even compared to the None-Free treatment. This may be because highlighting only the top contributors implicitly emphasizes that the rest of individuals are laggards and thus they should not contribute as much. It is also possible that highlighting only top contributors may implicitly de-emphasize the guilt effect, and thus cause more laggards in the Top-Free treatment relative to the None-Free treatment.

None-Free and Top-Free. This finding further supports our earlier suggestion that prestige is not the primary factor that causes higher contributions from identifying contributors.[29]

If individuals are concerned about feeling shame by being displayed as one of the bottom two contributors, we should expect to see a lower number of laggards in the Bottom-Free relative to the None-Free treatment. This is exactly what our data indicate. There are significantly fewer laggards in the Bottom-Free than in the None-Free treatment (17.5% versus 35.0%).[30] Similar conclusions can be drawn by comparing aggregate distribution of contributions (Figure 4). This finding, therefore, further supports our Hypothesis 5 that shame is one of the main factors in increasing contributions when participants are identified.[31] It is also interesting to note that there are more leaders in the Bottom-Free than in the None-Free treatment (42.5% versus 30.0%).[32] It is likely that individuals who are trying to avoid shame are doing so by contributing very substantial amounts, which brings them into the category of leaders. This, again, could be due to the relative nature of being identified as a bottom contributor.

5. Discussion

The results of our experiment suggest that displaying information about the identities of all contributors, even if this information is not readily available and takes effort to discover, may be a very effective way to increase contributions in practice. The improvement resulting from recognizing only top contributors relative to not recognizing any contributor is only marginal, while recognizing only the lowest contributors is very effective. These results provide practical

[29] This finding also may be due to the fact that prestige is relative in this setting, and depends heavily on participants' expectations. If participants do not expect the highest contributors to give over 75% of the endowment, then we may not find a high proportion of leaders.
[30] A Chi^2 goodness of fit test has a p-value of 0.08 when comparing laggards.
[31] The proportion of leaders and laggards in the Bottom-Free is not significantly different from the All-Free (p-values are 0.37 and 0.33).
[32] This difference is not significant, however. A Chi^2 goodness of fit test has a p-value of 0.25 when comparing leaders.

implications for increasing contributions to public goods through changing display of information. Our findings suggest that all identifying information should be displayed, even if it is costly to view.

Because shame appears to be a powerful motivator to contribute, one may ask the question: why don't social groups, charity organizations and online communities practice displaying only bottom contributors? While these institutions face the problem of increasing contributions, they also face the first-order problem of attracting and retaining contributors. Given the opportunity of free entry and exit, individuals may simply avoid contributing to communal and charity groups that identify the lowest contributors.[33] Although future work should explore in detail how the possibility of entry and exit affects contributions, our findings may be relevant for increasing socially desirable participation and contribution within organizations or communities when entry and exit is costly or impossible. For example, alumni donations make up a large portion of a university's endowment. One becomes an alumnus through receipt of a diploma from a particular university, and it is fairly difficult to remove oneself from this group due to social ties to fellow alumni. Alumni giving, thus, represents a potential community in which exit is costly. In this case, alumni organizations may choose to publish lists of alumni in which both high, low and no gifts are displayed to others.[34] In fact, as a news article recently revealed, senior class gift campaigns at several universities used publicizing non-givers as a tactic to drive over 99% of students to contribute (relative to 50% when using

[33] Related work on monetary sanctions and incentive schemes has similarly identified a preference for bonuses over fines. For example, Sutter et al. (2010) found that while punishment points are more effective than reward points in a public goods game, groups prefer to use reward option when given a choice. In principal-agent settings with financial incentives, the principal prefers to use a bonus contract for the agent, and this is more effective than combining a bonus with a fine (Fehr and Schmidt, 2007).

[34] Of course, these lists could be prohibitively long for larger universities, which is why these lists could be published online.

standard approaches).[35] As noted by the news article, the goal of these campaigns is to encourage a habit of giving for the long-term, and the long-term effects of these tactics are less clear.

The findings of our experiment also have practical implications for online communities that rely on user-provided content to be successful. Similar to charity organizations, online communities can increase contributions of effort through publicly acknowledging members. In online communities and forums, contributions usually take the form of user-provided content such as responding to questions on a Question and Answer forum or rating items on the site. Recognizing contributors is often done by online communities through publicly available rankings with lists of all contributors or through publicly recognizing only top contributors. There are a number of research studies investigating contributions to various online communities and forums (Ludford et al., 2004; Rafaeli et al., 2004; Rana and Hinze, 2004; Harper et al., 2007; Yang et al., 2008;). For example, a related study suggests that contributors to Wikipedia, an online encyclopedia based on user contributions, receive social benefits that increase in the number of group members (Zhang and Zhu, 2011). Another study finds that social comparison information affects the behavior of users in the online movie-rating community MovieLens (Chen et al., 2010). We contributed to this growing literature by providing concrete suggestions for the display and visibility of identifiable contributor information, which can also be implemented in online settings.

6. Conclusion

The observed effects of inducing prestige and shame through recognition are of general importance. Recognition may play a role in maintaining social norms in diverse settings such as charity contributions, online community participation, team production, health choices and

[35] http://chronicle.com/article/Students-at-2-Ivy-League/125056/

collective action. Our work provides a step in understanding how different ways of recognizing contributors affects contribution behavior. The results of our experiment replicate previous findings that revealing identities of contributors significantly increases overall contributions. We find that imposing a cost for viewing identifiable information about contributors does not have a significant effect on contributions as compared to the case when identifiable information is publicly available. We also find that recognizing only the top contributors is not significantly different from not recognizing contributors, while recognizing only the lowest contributors is as effective as recognizing all contributors. Therefore, our results suggest that shame is a greater motivator than prestige in this setting, and that the risk of being identified is sufficient to increase contributions.

Future work should study channels through which costly identification operates. It would be interesting to learn whether it is a high expectation of being viewed or whether it is the anticipated impact on utility from being viewed that is the primary driving force of increasing contributions. We may also expect behavior to be different if the psychic or monetary cost to view group members' contributions changes. For example, Kurzban and Descioli (2007) have found in a different setting that individuals choose to punish moral actions more frequently when they are observed by someone else. Likewise, making viewing decisions public information may alter behavior. In addition, Carpenter (2007) finds that monitoring is less effective when the effort is spread across many, rather than few group members. Charging different costs to view different parts of the information would be an interesting extension in this setting. Finally, the impact of shame and prestige in environments where entry and exit are costless is of great interest and should be subject to future research.

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Table 1: Summary of Treatments

Treatment	Display of Identities	Cost of Information	Number of Individuals	Number of Independent Observations
None-Free	None	Free	40	8
All-Free	All players	Free	40	8
Top-Free	Top 2 players	Free	40	8
Bottom-Free	Bottom 2 players	Free	40	8
All-Costly	All players	Costly	40	8

Table 2: Average Statistics

Treatment	Average Contribution	Contribution as % of Endowment	% of Contributions = 0	% of Contributions = Endowment
None-Free	23.4 (0.9)	29.3%	34.4%	8.3%
All-Free	44.2 (1.2)	55.3%	22.0%	32.8%
Top-Free	27.8 (1.0)	34.8%	24.4%	10.9%
Bottom-Free	44.9 (1.0)	56.1%	12.4%	25.1%
All-Costly	39.3 (1.2)	49.1%	33.6%	32.8%

The standard error of the mean is in parentheses.

Table 3: Panel Estimation of Determinants of Contributions

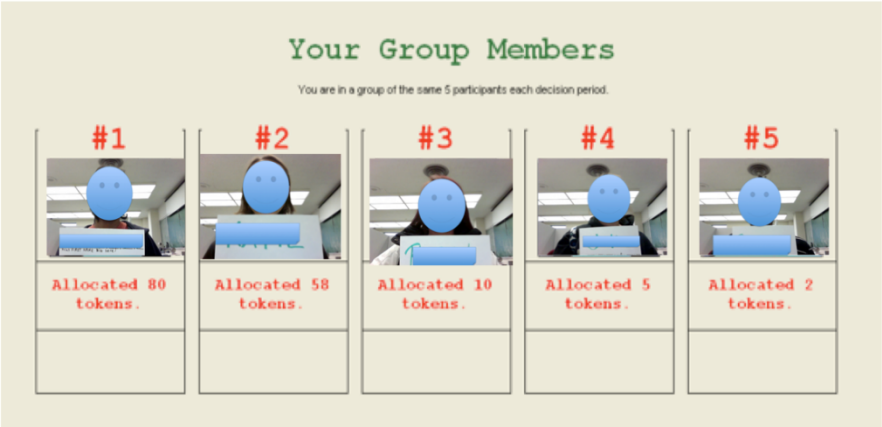
	(1) None-Free	(2) All-Free	(3) Top-Free	(4) Bottom-Free	(5) All-Costly
group-contribution-lag	0.09***	0.07***	0.08***	0.06***	0.13***
[excluding oneself]	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
own-contribution-lag	0.49***	0.66***	0.52***	0.34***	0.39***
[own contribution in *t*-1]	(0.09)	(0.09)	(0.09)	(0.08)	(0.06)
photo-view-lag			-5.50*	2.86	
[1 if own photo was viewed]			(3.05)	(2.83)	
period-trend	-0.13*	-0.27***	-0.22**	-1.06***	-0.31**
[period]	(0.07)	(0.09)	(0.10)	(0.28)	(0.15)
constant	3.70*	4.11**	7.37**	27.61***	4.98**
	(1.95)	(1.93)	(3.60)	(8.62)	(2.44)
Observations	760	760	760	760	760
Number of individuals	40	40	40	40	40

* significant at 10%, ** significant at 5%, *** significant at 1%.
The standard errors in parentheses are clustered at the group level. All models include a random effects error structure, with the individual as the random effect, to account for the multiple decisions made by individuals.

Table 4: Distribution of Leaders and Laggards

	None-Free	All-Free	Top-Free	Bottom-Free	All-Costly
Leaders	30.0%	52.5%	30.0%	42.5%	47.5%
Laggards	35.0%	10.0%	32.5%	17.5%	27.5%

Figure 1: Output Screens (Names and Photos are Removed)



Treatment All-Free



Treatment Top-Free



Treatment None-Free

Note that the numbers above the photo refer to the rank number, not an ID number. Rank number changes in each round based on the ranking of the participant on contribution amount relative to group members.

Figure 2: Average Contribution as Percentage of the Endowment over Time

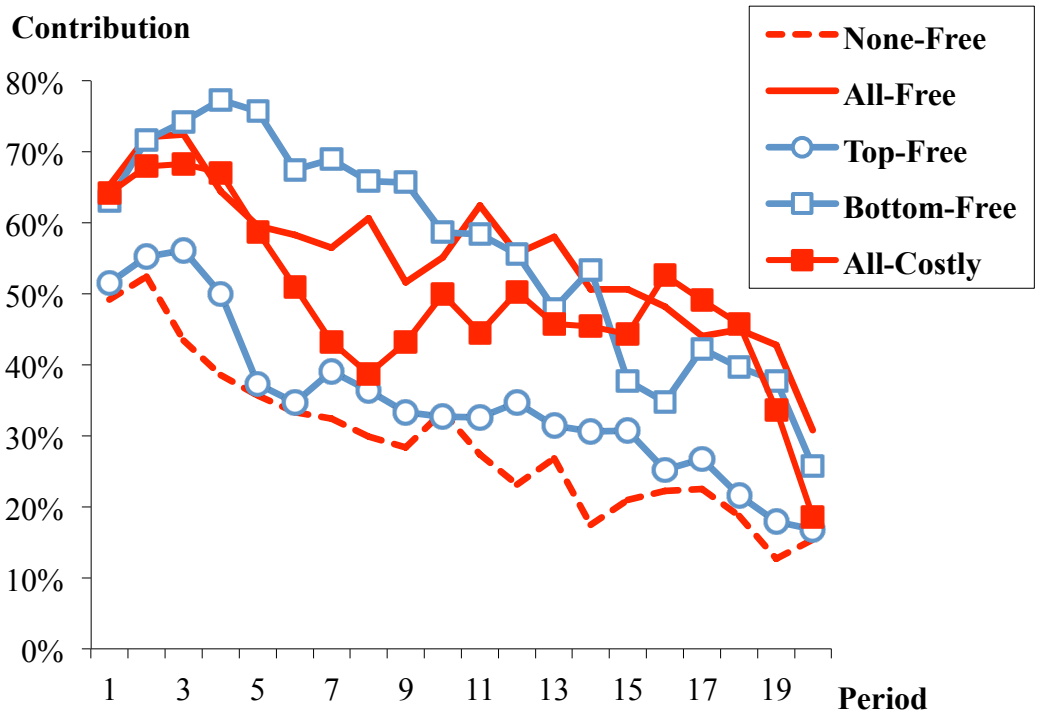


Figure 3: Viewing Photos of Members over Time (All-Costly Treatment)

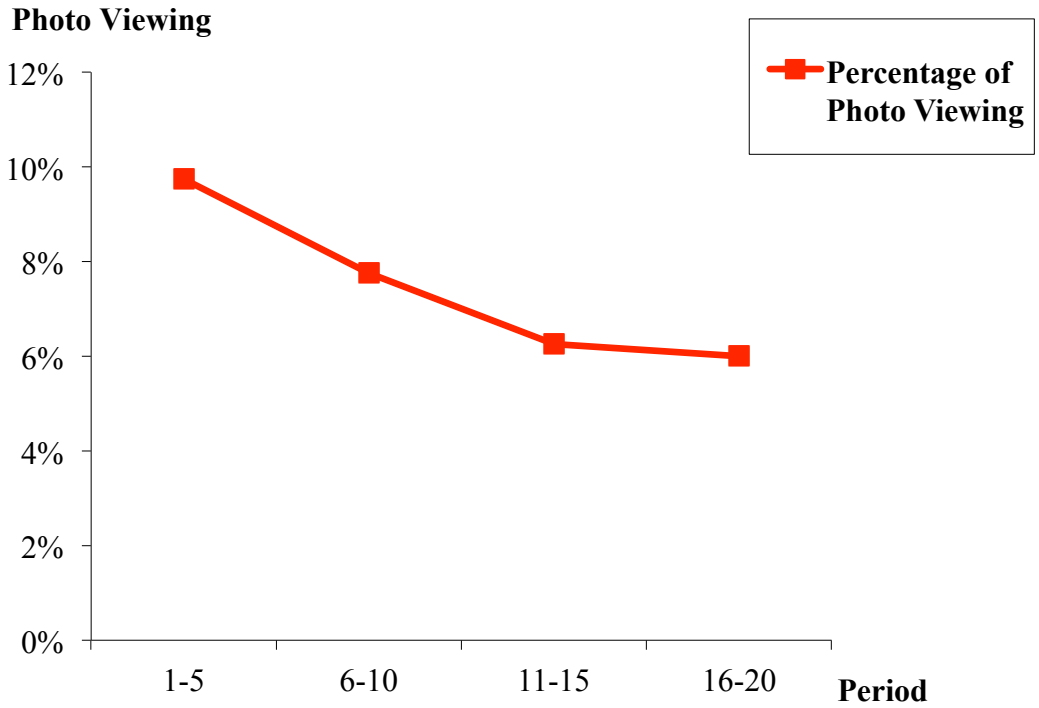
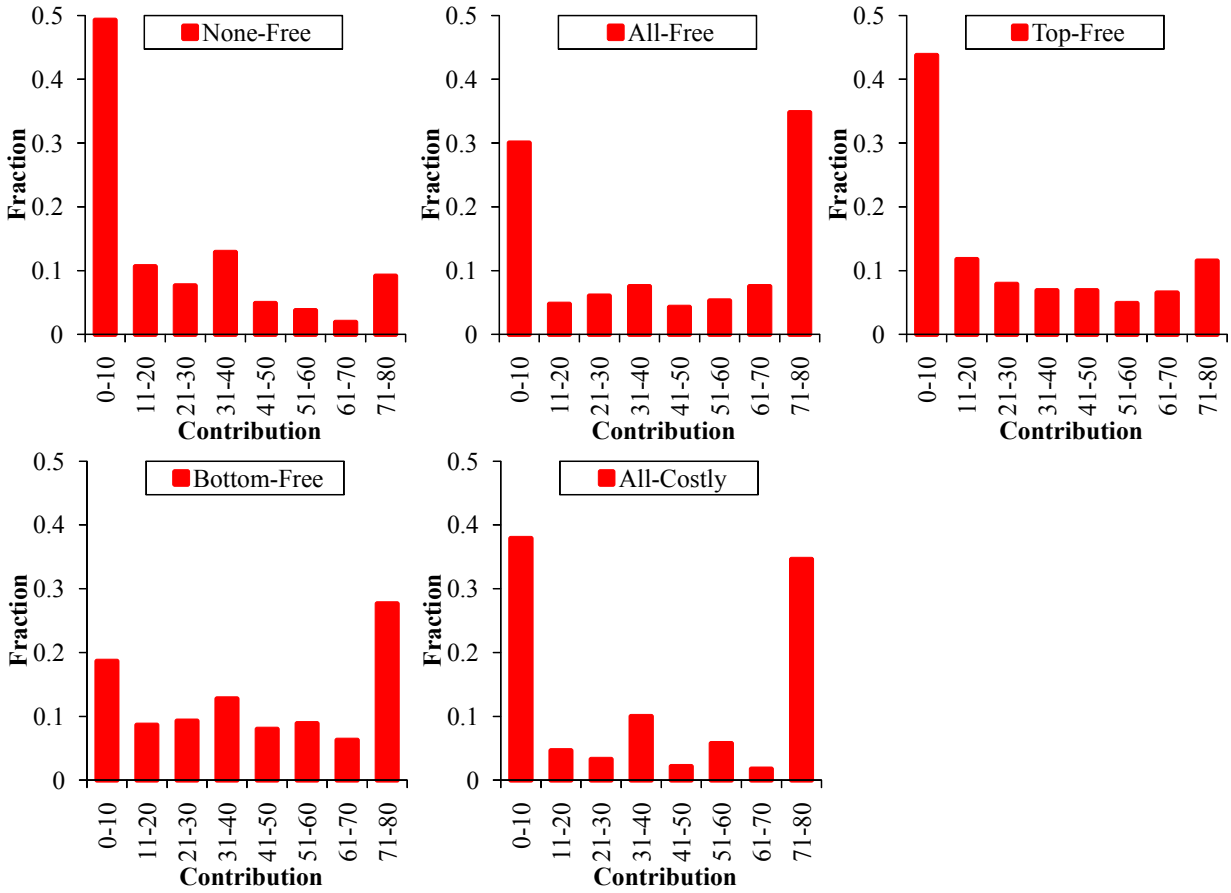


Figure 4: Distribution of Contributions in all 20 Periods

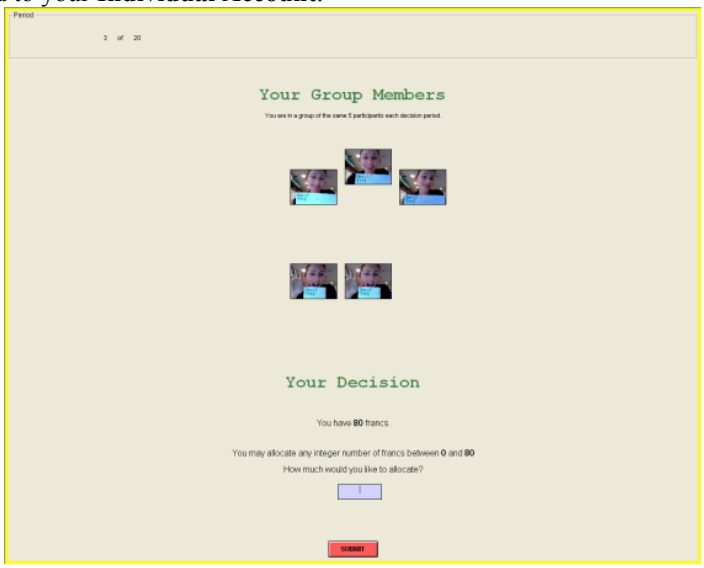


Appendix (For Online Publication): Instructions for AC Treatment

INSTRUCTIONS

In this experiment you will be placed in a group of **5 participants** (including you). You will remain in the same group for the entire experiment. The experiment will consist of **20 periods**. At the end of the experiment **2 out of 20** periods will be randomly selected for payment. After you have completed all periods two tokens will be randomly drawn out of a bingo cage containing tokens numbered from **1 to 20**. The token numbers determine which two periods are going to be paid in the game.

Each period you will be given **80 francs.** Francs will be converted to U.S. dollars at the end of the experiment at the rate of **20 francs = $1.** Each period you will be asked to decide how many francs you want to allocate to a **Group Account**. You may allocate any integer number of francs between **0** and **80**. The remainder will be automatically allocated to your **Individual Account**.



EARNINGS

After all participants have made their decisions, your earnings for the period are calculated. These earnings will be converted to cash and paid at the end of the experiment if the current period is the period that is randomly chosen for payment. Your earnings consist of two parts:

1) Your earnings from the **Individual Account**

2) Your earnings from the **Group Account**

Your earnings from the Individual Account equal to the francs that you keep for yourself and do not depend on the decisions of others. Therefore, for **every franc** you keep for yourself in your Individual Account, you earn **1 franc**.

Your earnings from the Group Account depend on the total number of francs allocated to the Group Account by all 5 group members (including you). In particular, your earnings from the Group Account are **40 percent** of the **total allocation of all 5 group members** (including you) to the Group Account. Therefore, for every franc you allocate to the Group Account, you increase the total allocation to the Group Account by 1 franc. Therefore, your earnings from the Group Account rise by 0.4×1=0.4 francs. And the earnings of the other group members also rise by 0.4 francs each, so that the total earnings of the group from the Group Account rise by 2.4 francs.

In summary, your period earnings are determined as follows:

Your earnings = earnings from the Individual Account + earnings from the Group Account =

= 80 - (your allocation to the Group Account) + 0.4×(allocation of 5 group members to the Group Account)

***Example**:* Suppose that you allocated 40 francs to the Group Account and that the other four members of your group allocated a total of 120 francs. This makes a total of 160 francs in the Group Account. In this case each member of the group receives earnings from the Group Account of 0.4×160 = 64 francs. In addition, you also receive 40 francs from your Individual Account since you have kept 40 francs to your Individual Account.

OUTCOME SCREEN

At the end of each period, your allocation and the sum of all allocations in your group are reported on the outcome screen as shown below. To aid you in your calculation, you are also shown your earnings from your individual account and your earnings from the group account. Once the outcome screen is displayed you should record your results for the period on your **Personal Record Sheet** under the appropriate heading.

The photos and names of each member of your group will be displayed on the top of your screen at all times. At the end of each period, the photos of all group members will be re-arranged by the number of francs allocated to the Group Account in that period.

The allocations will be **ranked** from highest allocation to lowest allocation, and the amount of each group member's allocation will be listed on the screen.

RANKING

Further, each member in the group will be given a **ranking**, corresponding to the number of tokens allocated in that period within the group. For example, the member with the highest allocation in the group will be given the ranking of #1, the group member with the second-highest allocation will be given the ranking of #2, and so on. You have the choice to see the **ranking** of each group member as well as your own **ranking**. If you choose to view the rankings, click on "yes" for the question "Would you like to view the rankings?" If you choose to view the rankings, you will pay 3 experimental dollars, which will be subtracted from your outcome in each period, and the **photo** and **name** of each group member will be listed below his or her ranking on the screen. If you choose not to view the **rankings,** click on "no" for the question "Would you like to view the rankings?" If you do not view the rankings, you will not pay 3 experimental dollars.

