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Anonymity and Cooperation: Experimental Evidence from a Public Good Game

Dakota Ryan
Macalester College, dr@dakotaryan.net

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1 Introduction

Empirical studies of behavior in the context of public good provision show that people tend to cooperate more than standard economic theory would predict. For instance, in the first round of a finitely repeated public good game, players typically contribute between 40 and 60 percent of their endowment to the public pool. The fact that in the aggregate this behavior differs significantly from both the social optimum and antisocial Nash equilibrium has led to refreshed interest in determining what factors affect social cooperation. Several institutional solutions have been proposed to curb suboptimal behavior and to prevent the decay toward the Nash equilibrium, including Fehr and Gachter's (2000) innovation of a two-stage game that allows for punishment. Since then there have been a number of experiments that demonstrate how the problem of under-provision of a public good may be remedied through mutual monitoring and the use of decentralized sanctioning when antisocial behavior is observed. This paper aims to unite these recent developments in public good literature with insights from charity experiments, investigating the effect of publicity and anonymity on both contribution and punishment behavior. The simple 2 x 3 experimental design was implemented to build upon work by Bohnet and Frey (1998), Anderson and Putterman (2004), Adreoni and Petrie (2004), Rege and Telle (2004), Nikiforakis (2004), Masclet et al. (2005), Alpizar et al. (2008), and others.

In general, our regression results suggest that contribution and punishment decisions change under various treatments, and specifically that the public disclosure of players' actions typically increases pro-social behavior. While more research is necessary to confirm the robustness of these results using a larger, random sample, this preliminary evidence provides rough coefficient estimates on institutional variables and some direction for future studies. The next section of this paper supplies a more comprehensive review of recent and relevant literature, from which the third section develops a testable theoretical model. The fourth section discusses methodological considerations for the experiment. The fifth section contains the results of several fixed-effects panel regressions run using lagged values of both the dependent and independent variables. This regression analysis is supplemented by a discussion of changes in behavior at different levels of aggregation, using two-sample T-tests to demonstrate the potential link between demographic characteristics and social cooperation. There is a brief conclusion, with suggestions for future empirical research into the factors that may affect social capital and social cooperation.

2 Literature Review

Early empirical studies of public good behavior were characterized by mild deception and a lack of experimental control. Bohm (1972), for instance, set up a small experiment to measure subjects' willingness-to-pay for Swedish public television. Participants were told that 100 other players were simultaneously being interviewed in separate rooms when this was not the case. Furthermore, the instructions given to each participant are controversial in their explicit use of "Counter-strategic" arguments, since the subjects may have been influenced to do what they believe the experimenter wanted. Likewise, Marwell et al. (1977) exaggerated the size of the study group during a phone survey of cooperative behavior in high-schoolers. Faced with the shortcomings of early experiments, Dawes et al. (1977) designed a new laboratory method of measuring free-riding behavior in a voluntary contribution mechanism (VCM) game. Their

payoff matrix created an incentive for participants to choose card X (the private good), but only when they expected that everyone else would choose card Y (the public good). For an overview of other early public goods experiments, see Ledyard (1995) in Roth and Kagel.

Ultimately, these early studies showed that a variable of interest in a public goods environment is the relative payoff between public contributions and private ones. By controlling the marginal per capita return (MPCR), which is the private return on one dollar when it is contributed to the public good, more recent empirical research has been able to simplify the experimental procedure to reduce confusion. Improving upon the VCM technique developed by Dawes et al. (1977), recent research has varied the payoff matrix to allow for both linear and nonlinear relationships between private and public contributions (i.e. a nonconstant MPCR). Likewise, experimenters have grown more interested in revealing hidden behavior through interactive experimental techniques rather than interviews or questionnaires.

This experimental process also allows for increased institutional variation. For instance, in Fehr and Gachter's (2000) seminal paper, participants played a two-stage game in which they first decided how much of a given endowment to contribute to the group pool and then issued costly sanctions to reduce the earnings of selected individuals. They showed that the punishment institution has a significant effect on reducing the decay toward the Nash equilibrium during finitely repeated rounds. However, while punishments are generally directed toward free riders, some experimental evidence suggests that spite may be a powerful motivator as well. For instance, Cinyabuguma et al. (2004) and Masclet et al. (2005) use VCM games with multiple stages of punishment to demonstrate the existence of perverse, second-order punishment (or counterpunishment), in which free riders that receive punishment punish those who punished them. It seems likely that this second-order punishment may arise either strategically or emotionally and that the welfare losses from allowing counterpunishment may offset the welfare gains from allowing punishment.

As several recent studies of charity behavior have shown (List et al. (2004), Adreoni (2006), Vesterlund (2006), Alpizar et al. (2008)), publicizing contribution levels may have an effect similar to allowing punishments. Both function as a form of the decentralized monitoring mechanism where players that act in an antisocial manner risk retribution, either through monetary sanctions or through what is perceived as a costly loss of reputation. Alpizar et al. (2008) performed an experiment in a natural park in Costa Rica to test this theoretical model of reputation, training several park employees to solicit donations of either a private or public amount during interviews with park attendees. They found that telling participants that their level of contribution would be revealed to the interviewer increased the proportion that contributed but lowered the average conditional contribution (i.e. the average amount contributed given that the contribution was nonzero). This result reinforces their theoretical models of reputation, suggesting that those at the margin may pay a small fee to prevent appearing antisocial. They also examine the effect of other social pressures, such as conformity (by announcing a recommended donation) and reciprocity (by giving a small gift), in the context of charitable decision-making.

To date there have been only limited attempts to unite the insights from these two discrete branches of academic inquiry. Charity experiments have primarily been interested in investigating factors that affect individual giving, identifying conformity, reciprocity, and

anonymity as relevant factors in the determination of individual reputation. Likewise, public goods experiments have largely been interested in isolating or debunking institutional characteristics that affect cooperative behavior in a group-based context. By acknowledging that group-based decisions also have an individual component, this study aims to augment both fields, building upon theoretical models of costly reputation while suggesting practical institutions that may be implemented to inhibit antisocial behavior.

3 Theory

This experiment is primarily interested in questions of if, and to what extent, publicity affects contribution levels. In addition, we are also interested in testing recent evidence of second-order punishment found in Cinyabuguma et al. (2004) and Masclet et al. (2005). The recent research lends itself to two testable hypotheses:

Experimental Hypothesis 1. Publicly disclosing contribution decisions will reduce free-riding behavior, as participants will seek to avoid appearing antisocial. Marginal free riders will have an incentive to conform, even if they lack the motivation to reciprocate pro-social behavior.

Experimental Hypothesis 2. Publicly disclosing the source of punishment will reduce punishing behavior. This may, in turn, reduce the threat of punishment and lead to lower levels of contributions. Average aggregate and within-individual punishment severity and frequency in treatments with public punishment will be lower than those in treatments with anonymous punishment, where there is no risk of counterpunishment.

The basic theoretical model that the literature has developed suggests that the observed degree of social cooperation is co-determined by the (unobserved) characteristics and (observed) actions of both the individual and her group members. That is,

Social Cooperation = *f(* Individual and Group member characteristics,
Individual and Group member actions,
Institutions *)*

Contribution Level = *f(* Lagged values of previous contribution levels,
Lagged values of contributions relative to known mean,
Lagged values of contributions relative to group members,
Lagged values of punishment sent/received,
Indicator for lagged increases in contributions,
Indicator for highest/lowest known contribution,
Indicator for last round of a game,
Indicators for treatments *)*

Among these, this study is particularly interested in determining coefficient estimates for the treatment indicator variables in an effort to isolate the effect of different institutional environments on the observed level of social cooperation. Furthermore, due to the weak theoretical framework surrounding the connection between contribution decisions and other salient factors, we make the assumption that players will respond to changes in their environment

in an attempt to maximize their personal earnings. Specifically, we assume that contribution behavior will change in response to changes in individual characteristics (such as frustration, boredom, or amusement), group member actions (such as changes in group membership, or changes in contribution/punishment levels), and changes in the institutions. As a result, we have included several lagged variables to account for the factors that seem most relevant and are both available and salient to the individual player. Furthermore, it seems reasonable to attempt to proxy a player's strategic and emotional state by including information about what has occurred most recently in the game. However, it is necessary to keep in mind that each discrete game is played in a series, and that it may not be strictly feasible to separate a player's most recent contribution decisions from events that occurred in a different game, possibly much earlier in the series. The next section provides a more comprehensive discussion of this and other methodological considerations.

4 Methodology

Over the course of three weeks in April, 2009, 36 participants played a series of modified public goods games under various treatments of publicity and anonymity. Over the six hour-long sessions, each of the six participants present was matched with two other, randomly assigned players for six five-round games. After each game, the matchings were randomly rotated so that each player was with two other, randomly assigned players. The institutional characteristics were altered for each of the six games, and the order of these games was rotated to isolate sequence effects (none were found). The players took part in the experiment at computer terminals, using online software developed by Charles Holt at the University of Virginia, V*e*conlab. Due to the limitations of this software, the six games were divided into three sets of two, and a condition of anonymous punishment (as explained below) was not permitted in the second, fourth, or sixth treatments. After completing the six games (30 rounds) of the session, each player was asked to fill out a demographic questionnaire.

The 36 participants were collected in a non-random, convenient sample through an email distributed *en masse* to students in several departments at Macalester College, in St. Paul, Minnesota. Participants were not rewarded at the time of the experimental session, but rather by participating gained one entry into a raffle for cash prizes. At the beginning of each session, participants were informed that the player with the most (hypothetical) earnings would receive an extra entry into the prize raffle. Because no earnings were paid at the end of the experimental sessions, it is possible that players were not strongly incentivized to maximize their earnings and hence did not behave as they would have given the opportunity to win money on the spot.

The six games that were played during each experimental session were associated with six different experimental treatments. In all games, players were endowed with 25 tokens at the beginning of each round and could allocate these tokens between a private pool and a public one. Each token allocated to the private pool was worth \$0.10 to the individual, and each token contributed to the public pool was worth \$0.05 to the individual and \$0.05 to each of her group members. Three of the games were played with *public contributions*, in which the experimenter announced every player's level of contribution at the end of each round, from highest to lowest; the other three games were played with *anonymous contributions*. Within each of these contribution conditions, participants played games with *no punishment*, *anonymous punishment*,

or *public punishment*. Games with *no punishment* involved only contribution rounds, without the opportunity to purchase costly punishments, and revealed only the aggregated sum of the other group members' contributions. Games with *anonymous punishments* allowed players to purchase costly punishments, and revealed the disaggregated contribution levels of the other two group members (next to an anonymized ID number). Also, players did not see the ID number of the player that punished them, if they happened to receive punishment in a given round. During these treatments, players could not tell with certainty who the other members of their group were, and had no way of determining the source of any punishment received. For all games that allowed punishment, up to ten punishment points could be purchased per round for $0.20 each that would reduce the round earnings of the target individual by 10 percent per point. Finally, during games with *public punishment,* players were given a list of six ID numbers next to the names of the other players in the room; the software also revealed the ID number of the player that punished them, should they happen to receive punishment in a given round. In these games players could, with certainty, identify the other members of their group as well as the source of any punishment received. The different characteristics of these treatments are summarized in the table below (where GM stands for group member):

Contributions	**Punishments**	**Know who GMs are**	**Know contributions of GMs**	**Know contributions of non-GMs**	**Know source of punishment**
Anonymous	None	No	No	No	N/A
	Anonymous	No	Yes	No	No
	Public	Yes	Yes	No	Yes
Public	None	Maybe	Maybe	Yes	N/A
	Anonymous	Maybe	Yes	Yes	No
	Public	Yes	Yes	Yes	Yes

Furthermore, in the next table below, each of the six treatments is designated by a two-letter code and shown in relation to relevant empirical literature that has focused on experiments with similar institutional conditions. For instance, there is some overlap in the upper-left hand treatment, AN, where both early public goods experiments and recent charity experiments have paid some attention. However, while charity experiments have focused on exploring the vertical axis, public goods literature has primarily focused on the sanction institution along the horizontal axis:

	No Punishment	Anonymous Punishment	Public Punishment
	AN	AA	AP
Anonymous Contributions	Earliest PG experiments Recent charity experiments	Fehr & Gachter (2000)	Cinyabuguma et al. (2004) Masclet et al. (2005)
	PN	PA	PP
Public Contributions	Adreoni & Petrie (2004) Alpizar et al. (2008)	???	???

There are several obvious problems with this methodology. First, group familiarity is difficult to control. That is, by coincidence and for the sake of convenience, not all sessions included six complete strangers. As a result, it may be the case that participants are less willing (or more willing) to punish their friends or acquaintances than average. Based on the feedback received on the demographic questionnaire and during the debriefing period, it seems that familiar players were typically less willing to punish, and that treatments with the highest level of aggregate familiarity seemed to exhibit the lowest overall levels of punishment. Since this factor seems to have a marked effect of players' willingness to punish, future studies should attempt to control this variable. Furthermore, it may be interesting to vary levels of familiarity within the laboratory, allowing players to introduce themselves to either specific other participants or to the group as a whole and observing any changes in behavior that may result. Likewise, if it is announced that the experimental session is one in a series of ongoing sessions or that the participants will be required to interact afterward, players may be less likely to act in an antisocial manner.

Another obvious problem with this experimental procedure is the inability to completely control levels of publicity. For instance, in games with publicly announced contributions, allowing anonymous punishments may not be strictly feasible. Likewise, because each player is given a list of ID numbers and names in those games with public punishments, anonymous contributions are not strictly anonymous in the sense that each group member will see what her other two group members have contributed (instead of just an aggregate amount). This is due to limitations in the software used and should be feasible to correct in future studies.

5 Results

5.1 Overview

Even the most highly aggregated form of the data, the grand means of the various treatments, shows an apparent relationship between institutional characteristics and contribution levels. These grand means are plotted on a single dimension below and represent the average amount contributed during a single round of the indicated game. These points seem to cluster in three areas: the lowest grand mean, for games with anonymous contributions and no punishment, is at

the low end of the spectrum (6.4 tokens contributed on average); games with public contributions and no punishment as well as games with anonymous contributions and anonymous punishment cluster between 7.5 and 8 tokens contributed on average; the remaining three games cluster between 9 and 10 tokens contributed.

This preliminary analysis exhibits two interesting results. First, it is important to note that both publicizing contributions and allowing punishment seem to have a similar effect on contribution levels. Second, games that combine punishment with some form of publicity (either of contributions or of punishment) are associated with much higher levels of contribution. This latter result is especially apparent when comparing the grand means of AA and PA, where publicizing contributions (while allowing punishment) results in a marked increase over just allowing punishments.

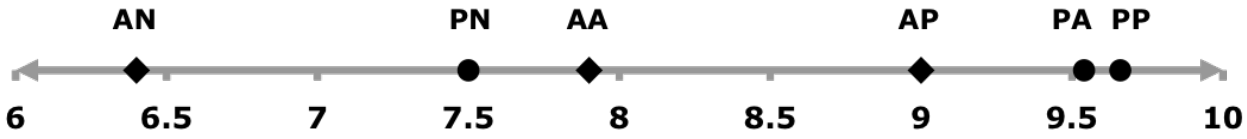
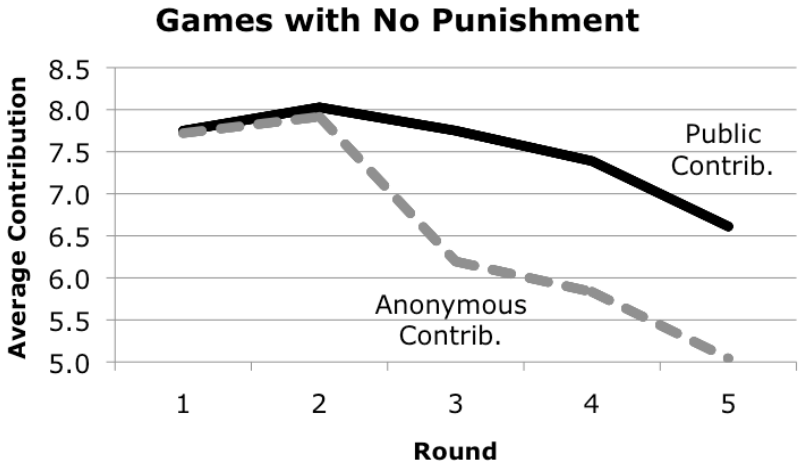


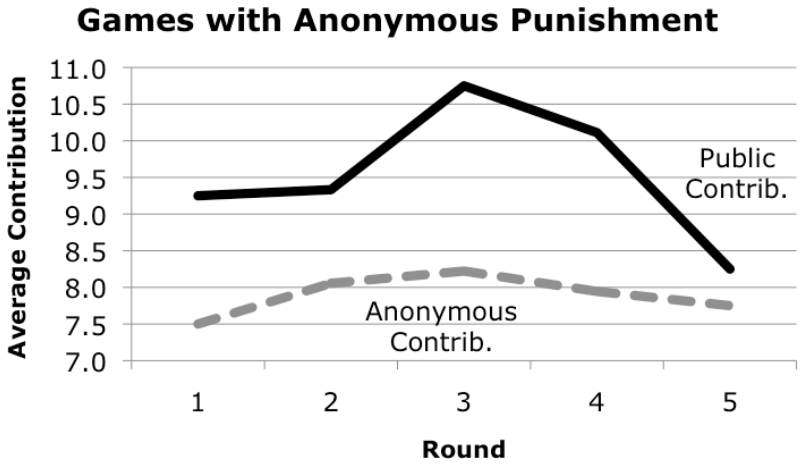
Figure 1. Grand Means of Contribution Levels for Indicated Treatments

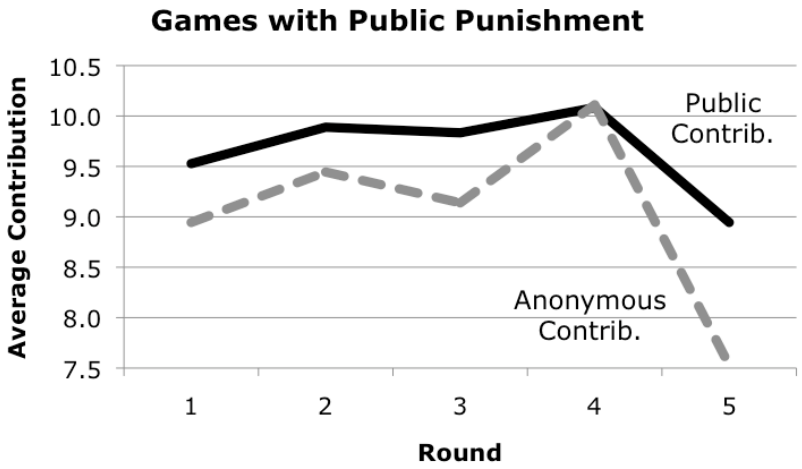
5.2 Aggregate Analysis

If we disaggregate the data to allow for variation in contribution levels over the course of each game, this analysis becomes more nuanced. In the three figures below, the average contribution levels (from six sessions) are plotted over the five rounds of the indicated games.

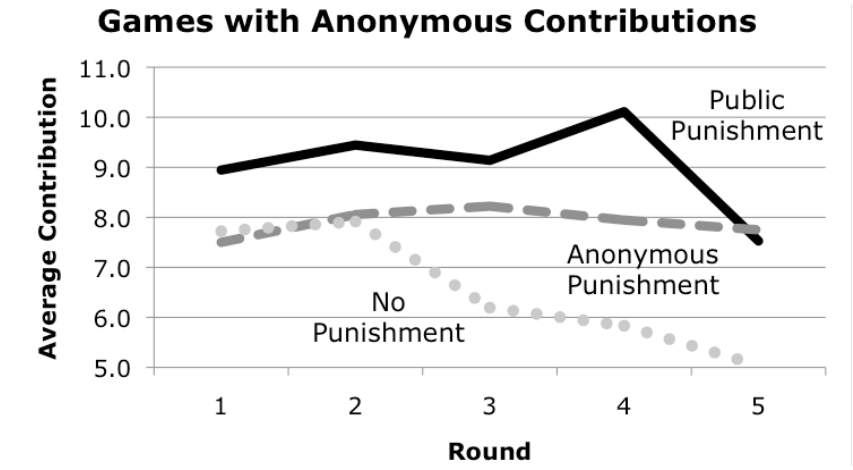


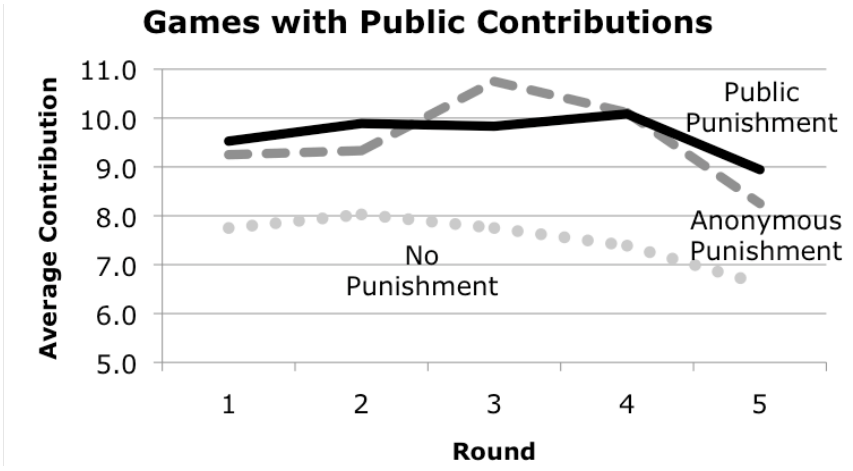
Figures 2 – 4. Average Contribution Levels for Indicated Treatments (grouped by punishment condition)





These graphs show that, especially in games with no punishment or anonymous punishment, publicizing contribution levels encourages players to contribute at a higher level, on average. However, under conditions of public punishment, there may be only limited benefits to publicizing contributions as well. Since the players are given a list of ID numbers and names at the beginning of those games with public punishment, this may be evidence that knowing the contribution levels of their non-group members does not drastically alter contribution decisions.



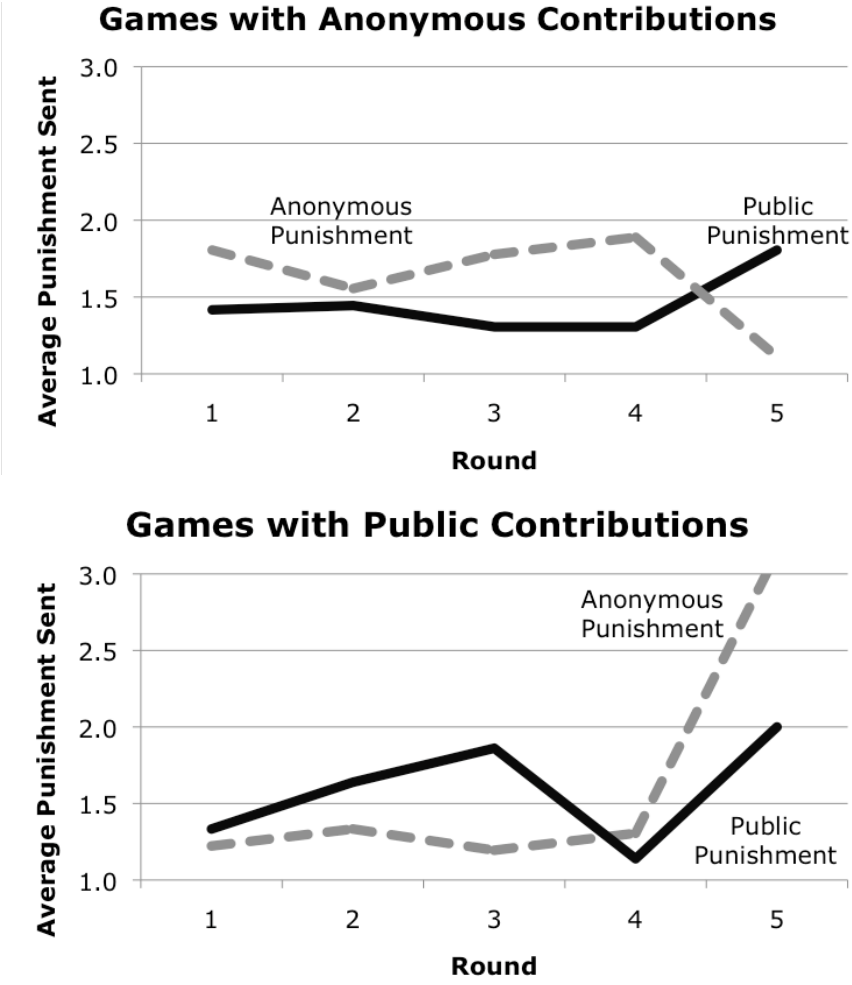


Figures 5 – 6. Average Contribution Levels for Indicated Treatments (grouped by contribution condition)

The graphs above present the same data, group by contribution condition. From these graphs it is also clear that games with public contributions (figure 6) tend to have higher levels of contribution than games with anonymous contribution (figure 5). However, it is still surprising to find that among games with anonymous contributions publicizing punishment leads to increased levels of contribution. Previous theory had suggested that because treatments with public punishments (solid, black lines) allow for counterpunishment, punishing activity should decrease under these conditions, and hence punishment itself would not prove to be a viable threat against antisocial behavior. Since publicizing punishment results in higher contribution levels in games with anonymous contributions and since there is no clear difference between anonymous and public punishment in games with public contributions, allowing for the possibility of counterpunishment does not seem to reduce contribution levels (though it may reduce punishment levels), as theory would suggest.

In the three figures below, average punishment severity levels are plotted over the five rounds of the indicated game. In general, the variance of punishment is much smaller and, except for the final round of the PA treatment in figure 8 below, average punishment levels typically fluctuate between one and two points issued. Notably, in figure 7 the average level of punishment issued is lower for games with public punishment than for games with anonymous punishment, until the final round. This may indicate that players are punishing less than usual when there is the

possibility of counterpunishment (i.e. in games with public punishment). This interpretation is reinforced by the fact that the punishment increases during the final round, when there is no risk of retribution.



Figures 7 – 8. Average Punishment Levels for Indicated Treatments (grouped by contribution condition)

After the experiment was completed, participants were asked to fill out a brief demographic survey with questions regarding their gender, age, year in school, major(s)/minor(s), athleticism, and country/urbanicity of origin. While the sample is not representative of any population, it is still interesting to note several surprising relationships between the demographic information and contribution/punishment decisions. For instance, while there was no discernable difference between male and female contribution levels, males tended to punish significantly more than females. Students that participated in a team sport tended to contribute less and punish less than others. Furthermore, all of the following groups tended to contribute significantly less and punish significantly more than average: urban/suburban students, students of international origin, students majoring in math, science, or economics, and underclassmen or younger students.

Perhaps as a result of these characteristics, the players that earned the most (hypothetical) money were female in 5 out of the 6 sessions, and (rural or suburban) Midwesterners in 4 out of the 6

sessions. Analyzing the winning strategy reveals that, overall, winners contributed more than non-winners, especially in games with anonymous punishment (AA, PA; 2.2 tokens higher) and games with public punishment (AP, PP; 2.7 tokens higher). Winners also tended to punish less than non-winners (0.4 points less, on average).

5.3 Regression Analysis

A comprehensive multivariate regression analysis was also performed on the 1,080 panel data observations collected over the course of the experiment (N = 36, T = 30), as well as several subsets of the data. The primary purpose of this regression analysis was to determine if, and to what extent, the institutional variables had an effect on contribution and punishment levels over the course of each experimental session. A Wooldridge (2002) test for autocorrelation in the panel data identified the existence of first-order autocorrelation. A Hausman test indicated that fixed effects were a consistent estimator of the unobserved heterogeneity in the data, and a vector autoregressive estimation technique was simulated by using lagged values of the dependent and independent variables (due the lack of support for panel VAR analysis in Stata 10.0). In all cases, autocorrelation was computed using the autocorrelation of the residuals with a two-step estimating process. Although the variables included in these regressions correctly predicted only about half of the between-subject variance and about 20 percent of the within-subject variance, the analysis indicated that the institutional variables were all positive and significantly different from the baseline (AN; anonymous contributions with no punishments). This preliminary result suggests that both punishment and publicity independently increase players' contribution levels.

Table 1 shows the results of three panel regressions with autoregressive disturbances (T-statistics greater than 1.50 ($p < 0.13$) are marked in bold). Model 1 provides a baseline, with just one autoregressive term. Model 2 includes additional lagged values of the dependent variable. Model 3 condenses the 6 treatment indicators (AN, AA, AP, PN, PA, PP) into 6 institutional indicators to examine the effect of institutional characteristics that may be shared across several treatments. These condensed indicator variables comprise: whether contributions were public, whether punishment was allowed, and whether punishment was public (still using AN as a baseline). Other variables in models 1 – 3 and subsequent models include:

- *Contribution Level Increased* (an indicator that equals 1 if the player increased their contribution level in the specified round);
- *Amount Contributed below GM [Group Member] Average* (calculated by averaging the total contributions from all group members for the specified round, then subtracting this from the player's contribution);
- *Difference from GM 1 (or 2) Contribution* (calculated by subtracting the specified group member's contribution from the player's contribution for the specified round);
- *Made Highest (or Lowest) Known Contribution* (an indicator that equals 1 if the player made the highest (or lowest) contribution based on either the two other group members' contributions or the publicly disclosed contributions of all six participants);
- *Amount of Punishment Sent/Received* (the number of punishment points the player sent/received during the specified round);
- *Last Round Indicator* (an indicator that equals 1 if the decision occurs during the last (fifth) round of a game); and
- Indicator variables for the various treatments (6 indicators) or the institutional conditions that define the treatments (3 indicators).

Table 1. Regression Coefficients and T-statistics for Models 1 – 3

Variable Name	Model 1		Model 2		Model 3	
Number of Lagged Values	Baseline		With Autoregressive Disturbances (1-5)		AR(1-5) & Condensed Institutional Variables	
Contribution Level (autoregressive)						
One round before	------		------		------	
Two rounds before			**0.125**	1.73	**0.125**	1.76
Three rounds before			**0.101**	2.56	**0.100**	2.51
Four rounds before			-0.042	-1.27	-0.045	-1.36
Five rounds before			0.019	0.59	0.015	0.48
Contribution Level Increased						
One round before	**1.34**	3.44	**1.32**	3.33	**1.36**	3.43
Two rounds before	0.498	1.44	**0.681**	1.63	**0.692**	1.65
Amount Contributed below GM Average						
One round before	**0.379**	5.37	**0.442**	5.95	**0.438**	5.9
Two rounds before	**0.102**	1.50	-0.073	-0.77	-0.070	-0.75
Difference from GM 1 Contribution						
One round before	**-0.095**	-2.67	**-0.103**	-2.79	**-0.098**	-2.67
Two rounds before	-0.037	-1.15	0.039	0.88	0.041	0.94
Difference from GM 2 Contribution						
One round before	**-0.122**	-3.54	**-0.144**	-4.1	**-0.148**	-4.21
Two rounds before	**-0.053**	-1.72	0.027	0.59	0.023	0.5
Made Highest Known Contribution						
One round before	-0.500	-1.15	**-0.665**	-1.51	**-0.690**	-1.57
Made Lowest Known Contribution						
One round before	**0.860**	1.97	**0.815**	1.86	**0.793**	1.81
Amount of Punishment Sent						
One round before	0.008	0.10	-0.017	-0.21	-0.027	-0.34
Two rounds before	**0.127**	1.60	0.080	1.01	0.073	0.93
Three rounds before	**-0.136**	-1.74	**-0.163**	-2.08	**-0.166**	-2.13
Amount of Punishment Received						
One round before	-0.025	-0.38	-0.025	-0.38	-0.033	-0.5
Two rounds before	0.083	1.23	0.069	1.04	0.063	0.95
Three rounds before	0.017	0.26	0.027	0.4	0.024	0.37
Four rounds before	-0.093	-1.38	**-0.112**	-1.68	**-0.112**	-1.68
Last Round Indicator	**-1.10**	-3.11	**-1.14**	-3.27	**-1.19**	-3.4
Treatment Indicators						
Anon. Contrib., Anon. Punishment	**2.98**	4.80	**3.19**	5.02		
Anon. Contrib., Public Punishment	**4.19**	6.81	**4.17**	6.48		
Public Contrib., No Punishment	**1.82**	2.31	**1.99**	2.47		
Public Contrib., Anon. Punishment	**4.64**	7.06	**4.52**	6.71		
Public Contrib., Public Punishment	**4.83**	7.46	**4.74**	6.98		
Contributions Public					**1.11**	2.97
Punishment Allowed					**2.83**	6.42
Punishment Public					**0.64**	1.82
Constant Term	4.25	7.1	2.74	3.33	3.30	4.57
Number of Usable Observations	900		864		864	
Within-R^2	0.2054		0.2231		0.2209	
Between-R^2	0.4882		0.8253		0.8176	
Fraction of Variance due to μ_i	0.4573		0.3873		0.3910	
F-statistic	**14.70**		**3.86**		**4.02**	

These models assume that players' contribution decisions are based on both the immediately salient information (what happened in the previous round) and a longer-term trend (what happened earlier in the game). As a result, multiple lagged values are used to approximate players' recent decisions and observations. While the number of lagged values used is largely arbitrary (meaning that there is no prior theory regarding the proper number of lags), typically at least one lagged value within the five most recent rounds proved to have a significant effect on contribution levels. No lags from more than five rounds before were included because the matchings and institutions changed every five rounds.

With only a single autoregressive disturbance, Model 1 provides a relatively high F-statistic and comparable within-subject R^2. This suggests that adding higher order autoregressive lags does not markedly alter the power of the model to predict changes in behavior within individuals. Nor does their inclusion dramatically change the values of the coefficients on other variables, with the possible exception of those variables that compare the individual's contribution to the other group members'. The largest coefficient in Model 1 is a trend indicator that equals 1 if the contribution level increased in the specific round. This coefficient suggests that players' contribution decisions are partly determined by the recent trend in their contributions; if they recently increased their contribution level, they are likely to contribute 1.34 more tokens than if they did not recently increase their contributions. The coefficient on this trend indicator fluctuates between 1.2 and 1.9 tokens in different specifications.

The next five variables in the model place the individual player's decision in the context of the larger group and demonstrate the existence of conformity. That is, in a group setting there is some regression toward the mean in which players that contribute more than average reduce their contributions and those that contribute less than average increase them. Specifically, the positive coefficient on the amount contributed below the group mean suggests that for every 2 to 2.5 tokens that a player contributes below the group mean in the previous round (as determined by her own contributions and those of her two group members), the player is likely to increase her contributions by one token, on average.

Likewise, the negative coefficients on the differences between the player's contribution and the contribution of each of her group members (which may be more salient in certain treatments than the group mean) suggests that if a group member contributes less than the player, the player will reduce her contribution level (by about a token for every 8-10 tokens of difference). Finally the indicators for the highest/lowest contribution made indicate that if the player believes she has made the highest known contribution (either among her 2 other group members or among those in the room, depending on the treatment) she is likely to decrease her contribution; likewise if the player believes she has made the lowest known contribution she is likely to increase her contribution. However, while both of these effects are significant, they are small in magnitude (typically less than 1 or 2 tokens).

Surprisingly, punishment received does not seem to be a significant predictor of contribution behavior, suggesting that players may not increase contributions in direct response to receiving punishment. However, the treatment indicators suggest that the punishment institution does result in higher contributions, as all treatment coefficients are positive and significantly different from the baseline (AN). As we saw in the graph of grand means by treatment, AA and PN are clustered together (2 to 3 tokens higher) and AP, PA and PP are clustered (4 to 5 tokens higher).

Table 2. Regression Coefficients and T-statistics for Models 4 – 6

Variable Name Number of Lagged Values	Model 4 Model 3, for Games with Punishment		Model 5 Model 3, for Games with Punishment		Model 6 Model 3, for Games with Punishment	
Contribution Level (autoregressive)						
One round before	------		------		------	
Two rounds before	0.027	0.32	0.045	0.54	0.021	0.25
Three rounds before	**0.121**	2.86	**0.122**	2.87	**0.118**	2.79
Four rounds before	**-0.058**	-1.63	**-0.054**	-1.52	**-0.060**	-1.69
Five rounds before	0.043	1.28	0.042	1.24	0.042	1.23
Contribution Level Increased						
One round before	**1.41**	3.34	**1.39**	3.27	**1.41**	3.35
Two rounds before	**0.946**	2.13	**0.968**	2.17	**0.954**	2.15
Amount Contributed below GM Average						
One round before	**0.331**	4.27	**0.323**	4.15	**0.334**	4.31
Two rounds before	0.045	0.44	0.032	0.32	0.052	0.51
Difference from GM 1 Contribution						
One round before	-0.041	-1.04	-0.029	-0.74	-0.040	-1.01
Two rounds before	0.009	0.18	0.027	0.56	0.008	0.15
Difference from GM 2 Contribution						
One round before	**-0.098**	-2.68	**-0.110**	-3.01	**-0.105**	-2.86
Two rounds before	-0.033	-0.65	-0.032	-0.64	-0.037	-0.74
Made Highest Known Contribution						
One round before	-0.689	-1.45	**-1.05**	-2.30	-0.686	-1.45
Made Lowest Known Contribution						
One round before	**0.896**	1.95	0.586	1.32	**0.961**	2.08
Amount of Punishment Sent						
One round before	0.019	0.23	-0.008	-0.09	0.015	0.18
Two rounds before	**0.135**	1.62	**0.125**	1.50	**0.130**	1.56
Three rounds before	-0.119	-1.40	**-0.131**	-1.54	-0.119	-1.40
Amount of Punishment Received						
One round before	-0.048	-0.74	-0.059	-0.90	-0.052	-0.81
Two rounds before	0.090	1.30	0.086	1.24	0.086	1.24
Three rounds before	-0.020	-0.27	-0.023	-0.32	-0.020	-0.28
Four rounds before	**-0.196**	-2.54	**-0.195**	-2.52	**-0.192**	-2.50
Last Round Indicator	**-1.09**	-2.80	**-1.10**	-2.81	**-1.11**	-2.83
Treatment Indicators						
Contributions Public	**1.06**	2.68			**1.08**	2.76
Punishment Public			**0.558**	1.61	**0.602**	1.75
Constant Term	6.79	8.61	7.19	9.30	6.59	8.31
Number of Usable Observations	684		684		684	
Within-R^2	0.1473		0.1402		0.1522	
Between-R^2	0.6706		0.8176		0.6472	
Fraction of Variance due to μ_i	0.5159		0.5061		0.5207	
F-statistic	**4.99**		**4.82**		**5.09**	

Table 2 shows the results from three regressions using data only from those games that allowed punishment (AA, AP, PA, PP). The institutional indicators are varied across Models 4 – 6 to demonstrate the robustness of these point estimates both when used independently and together. The original coefficient estimates obtained from Model 3 indicate that publicizing contributions results in contribution levels that are higher on average by about 1.11 tokens; this result is

confirmed for the subset of the data with punishment in Models 4 – 6. Likewise, Model 3 indicates that publicizing punishment has a much smaller effect on contribution levels (resulting in an increase of about 0.64 tokens on average. Models 4 – 6 confirm that this point estimate was not biased by observations from the subset of data where punishment was not allowed (and hence public punishment was not possible). Furthermore, the fact that these point estimates are consistent when modeled separately and together suggests that they independently affect contribution levels; indeed, including them both in the model (as in Model 6) marginally increases the significance of each variable.

Table 3, below, shows the results of regressions using data from either games with public contributions (Models 7 and 8) or anonymous contributions (Model 9). These results indicate that the model predicts changes in behavior within individuals better in games with anonymous punishment, though it is worse at accounting for the variation between individuals. Likewise, in games with public contributions (as in Models 7 and 8), recent contribution decisions (both in terms of autoregressive lags and the trend indicator) prove to be larger and more significant predictors of contribution levels, possibly because players may act more erratically when their contributions are not publicized every round.

Similarly, the coefficients and t-statistics on the variables that indicate whether the player made the highest/lowest known contribution are much lower and less significant in games with anonymous punishment. This suggests that even if players are aware of the contributions of their two other group members, they may not react as strongly to knowing that they contributed the most (or least) as they would have if their contributions were made public to those in the room. This indicates that conformity plays an observable role in treatments with public contributions, and that players are more likely to conform when the group is larger or when more people know about their contribution decisions.

Games with public contributions also seem to have larger last round effects, while players in games with anonymous contributions respond more significantly to punishment received in the previous round. Both of these results imply that allowing punishment and publicizing contributions may in effect act as substitutes, since the threat of punishment is taken more seriously when players are more likely to act in an antisocial manner (in games with anonymous contributions). Whereas when players already face incentives to act pro-socially, they may not respond to punishment as much, since the threat of a monetary loss may not sufficiently deter antisocial behavior given the reality of a reputational loss.

This interpretation is reinforced by the change in the coefficient on the variable that indicates whether punishment is allowed. That is, allowing punishment has a smaller, less significant effect on contributions in games with public contributions, compared to games with anonymous ones. Specifically, this coefficient more than doubles from 1.68 (in games with public contributions) to 3.89 (in games with anonymous contributions), reinforcing the notion of publicity and punishment as substitutes. Model 8 also demonstrates that publicizing punishment has a much smaller, insignificant effect on contribution levels when contributions are already public. This result may indicate diminishing returns to publicity: although games with public contributions and public punishment have the highest level of average aggregate contributions, there may be only marginal increases in publicity when either contributions or punishment is already public.

Table 3. Regression Coefficients and T-statistics for Models 7 – 9

Variable Name Number of Lagged Values	Model 7 Model 3, for Games with Public Contrib.		Model 8 Model 3, for Games with Public Contrib.		Model 9 Model 3, for Games with Anon. Contrib.	
Contribution Level (autoregressive)						
One round before	------		------		------	
Two rounds before	**0.282**	2.34	**0.328**	2.76	0.116	1.21
Three rounds before	**0.110**	1.72	**0.102**	1.60	0.063	1.15
Four rounds before	-0.014	-0.26	-0.015	-0.28	**-0.099**	-2.20
Five rounds before	-0.011	-0.22	-0.019	-0.36	0.025	0.56
Contribution Level Increased						
One round before	**1.54**	2.39	**1.59**	2.46	**1.18**	2.18
Two rounds before	0.754	1.13	0.724	1.08	0.264	0.46
Amount Contributed below GM Average						
One round before	**0.433**	3.40	**0.417**	3.26	**0.453**	4.12
Two rounds before	-0.100	-0.65	-0.136	-0.89	-0.125	-0.96
Difference from GM 1 Contribution						
One round before	-0.081	-1.37	-0.065	-1.11	**-0.109**	-2.00
Two rounds before	0.073	0.99	0.097	1.33	0.074	1.20
Difference from GM 2 Contribution						
One round before	**-0.149**	-2.44	**-0.147**	-2.39	**-0.104**	-2.02
Two rounds before	**0.130**	1.72	**0.148**	1.94	0.029	0.49
Made Highest Known Contribution						
One round before	**-2.56**	-2.79	**-2.59**	-2.80	0.065	0.11
Made Lowest Known Contribution						
One round before	1.16	1.39	1.13	1.36	0.310	0.54
Amount of Punishment Sent						
One round before	-0.023	-0.17	0.022	0.16	-0.162	-1.36
Two rounds before	0.036	0.25	0.076	0.55	0.133	1.22
Three rounds before	**-0.234**	-1.76	**-0.237**	-1.77	**-0.190**	-1.72
Amount of Punishment Received						
One round before	0.129	1.11	0.166	1.43	**-0.198**	-2.02
Two rounds before	**0.193**	1.67	**0.217**	1.87	0.040	0.43
Three rounds before	-0.003	-0.03	-0.018	-0.16	0.060	0.60
Four rounds before	0.005	0.05	-0.023	-0.23	**-0.302**	-2.94
Last Round Indicator	**-1.33**	-2.42	**-1.44**	-2.63	**-1.09**	-2.34
Treatment Indicators						
Punishment Allowed	**1.68**	2.19			**3.89**	6.18
Punishment Public			0.317	0.57		
Constant Term	4.04	3.38	4.94	4.38	4.11	3.98
Number of Usable Observations	420		420		408	
Within-R^2	0.1653		0.1508		0.2605	
Between-R^2	0.7217		0.6809		0.4902	
Fraction of Variance due to μ_i	0.4075		0.4165		0.5111	
F-statistic	**1.83**		**1.75**		**3.11**	

Table 4, below, provides regression results for the subset of the data with either public punishment (Model 10), anonymous punishment (Model 11) or anonymous or no punishment (Model 12). The results are largely consistent with those from previous models. Interestingly, the coefficient on the highest known contribution indicator is much larger in magnitude and more significant in games with anonymous punishments, compared to games with either public or no

punishments. Players in games with anonymous punishment may have a greater to incentive to conform (i.e. reduce contributions) if they fear being singled out by free riders for second-order punishment. While the literature suggests that public punishment may result in increased second-order punishment, it is not necessarily the case that allowing anonymous punishment will increase pro-social behavior. This is especially true if players are afraid of "sticking out" when they can be punished without repercussions, as these results suggest.

Furthermore, it is interesting that the coefficient on public contributions indicator is larger and more significant in treatments with anonymous punishment. As discussed before, due to the limitations of the V*e*conlab software, it was not strictly possible to keep contributions anonymous during games with public punishment, nor punishment anonymous during games with public contributions. As a result, it is difficult to identify what portion of this coefficient is due to the effect of intentionally publicizing contributions and what portion is due to the effect of unintentionally publicizing punishment (by revealing group membership). It is clear from Model 10, however, that publicizing contributions has an insignificant effect in games where punishment is already public, just as in Model 8.

No significant relationship could be found between institutional characteristics and punishment levels when using the amount of punishment sent as a dependent variable. This may be due to the relatively small sample size, and relatively costly and infrequent punishing activity.

Finally, the residuals for these models were plotted against the dependent variable, over time, and between panels. No noticeable patterns could be identified, suggesting that any heteroskedasticity present in the raw data was minimized in the autocorrelative fixed-effects panel regressions shown above. Samples of these residual plots are in Appendix C, after Summary Statistics and an abbreviated Covariance Matrix, in Appendices A and B, respectively. Appendix D also contains a sample of the instructions provided to the participants.

Table 4. Regression Coefficients and T-statistics for Models 10 – 12

Variable Name Number of Lagged Values	Model 10 Model 3, for Games w/ Pub. Punishments		Model 11 Model 3, for Games w/ Anon. Punishments		Model 12 Model 3, for Games w/ Anon. or No Pun.	
Contribution Level (autoregressive)						
One round before	------		------		------	
Two rounds before	0.155	1.21	**0.307**	3.04	0.187	1.35
Three rounds before	0.055	0.87	0.052	0.92	**0.109**	1.69
Four rounds before	-0.054	-1.04	-0.072	-1.53	-0.029	-0.54
Five rounds before	**0.094**	1.86	**-0.075**	-1.57	0.029	0.52
Contribution Level Increased						
One round before	**1.88**	2.96	**1.65**	2.96	**1.25**	1.92
Two rounds before	0.235	0.35	0.845	1.43	0.636	0.93
Amount Contributed below GM Average						
One round before	**0.292**	2.36	**0.341**	3.13	**0.216**	1.77
Two rounds before	-0.180	-1.17	-0.170	-1.28	0.067	0.41
Difference from GM 1 Contribution						
One round before	-0.017	-0.26	-0.074	-1.48	-0.029	-0.49
Two rounds before	0.078	0.97	**0.115**	1.97	0.056	0.76
Difference from GM 2 Contribution						
One round before	-0.072	-1.25	**-0.116**	-2.17	-0.016	-0.27
Two rounds before	-0.022	-0.30	**0.172**	2.53	0.077	0.89
Made Highest Known Contribution						
One round before	-0.430	-0.59	**-1.08**	-1.76	-0.530	-0.74
Made Lowest Known Contribution						
One round before	1.03	1.40	0.491	0.62	0.364	0.53
Amount of Punishment Sent						
One round before	0.013	0.11	**0.224**	1.79	0.105	0.77
Two rounds before	0.099	0.82	0.120	0.99	0.223	1.60
Three rounds before	-0.012	-0.10	**-0.236**	-2.12	**-0.242**	-1.81
Amount of Punishment Received						
One round before	0.045	0.42	-0.067	-0.68	**-0.205**	-2.04
Two rounds before	**0.237**	2.30	-0.078	-0.79	-0.069	-0.62
Three rounds before	-0.017	-0.16	-0.071	-0.75	-0.158	-1.32
Four rounds before	**-0.289**	-2.55	-0.066	-0.69	-0.096	-0.75
Last Round Indicator	**-1.14**	-1.97	**-1.02**	-2.17	**-1.06**	-1.81
Treatment Indicator						
Contributions Public	0.567	1.05	**1.21**	2.11	0.902	1.43
Constant Term	5.97	4.73	5.05	5.29	6.04	5.02
Number of Usable Observations	324		504		342	
Within-R^2	0.1767		0.1902		0.1948	
Between-R^2	0.7744		0.4889		0.7398	
Fraction of Variance due to μ_i	0.5585		0.4317		0.4868	
F-statistic	**3.48**		**2.46**		**2.79**	

6 Conclusions

This experiment aimed to unite two discrete streams of academic inquiry by examining the effect of publicity on social cooperation in a public good game. Previous literature had speculated that this type of publicity would increase pro-social behavior because marginal non-cooperators would have an incentive to prevent a costly loss of reputation by avoiding full free-ridership. However, recent empirical evidence also suggests that publicity may be counterproductive if the welfare losses from counterpunishment offset the welfare gains from punishment.

With this is mind, the experiment described above used a simple 2 x 3 experimental design to examine changes in aggregate and within-individual behavior under institutions of anonymous or public contributions, as well as anonymous, public or no punishment. Two experimental hypotheses were explored, including the hypothesis that free-ridership would decrease under conditions of public contributions and that public punishment would be suboptimal because it would allow for the possibility of second-order punishment found in Cinyabuguma et al. (2004) and Masclet et al. (2005). This study finds strong evidence in support of the first experimental hypothesis, but further research is necessary to clarify ambiguous results with respect to the second.

The fact that participants tended to contribute slightly more when their actions were made public reinforces theoretical models of costly reputation and implies that public disclosure may serve as a viable substitute to the sanction institution. However, the results also suggest that there may be diminishing returns to publicity, and that the pro-social effect of publicizing contributions may instead have resulted from increased awareness of group norms and normal levels of contribution. Future studies should aim to exercise better experimental control over how contributions and punishments are publicized in an effort to distinguish the effect of conformity from the effect of changing institutional characteristics. Likewise, future research should focus on controlling familiarity, and identifying to what extent group familiarity plays a role in group decision-making. Likewise, the public good game may be modified to investigate other, theoretically relevant factors, such as reciprocity.

Surprisingly, neither lagged values of the amount of punishment sent nor received seemed to have a significant effect on current contribution decisions. Nevertheless, those games that allowed some form of punishment had significantly higher levels of aggregate contribution. As a result, it seems likely that it is the threat of receiving punishment rather than the actual receipt that motivates the decrease in free-riding behavior. As such, the variation in contribution behavior between those treatments that allowed punishment may be due to the participants' perception of the credibility of the threat of punishment. Future studies should consider exploring this factor as well. For instance, making punishment strictly credible (where the lowest contributor(s) always receives some punishment) or more costly (and hence less credible) may affect how much weight players place on the possibility of receiving punishment when making contribution decisions.

Given the recent collapse of the financial sector and calls for increased regulation, it is important to consider that transparency and the public disclosure of actions may serve as a viable substitute or complement to the traditional, centralized monitoring mechanism by also allowing decentralized monitoring to exact a costly loss of reputation on firms with antisocial behavior.

References

Fischbacher, U., Gächter, S., Fehr, E., 2001. "Are people conditionally cooperative? Evidence from a public good experiment." *Economics Letters* 71.

Rabin, M., 1993. "Incorporating fairness into game theory." *American Economic Review* 83, 1281–1302.

Bernheim, D., 1994. "A theory of conformity." *Journal of Political Economy* 102, 841–877.

Andreoni, J., Petrie, R., 2004. "Public good experiments without confidentiality: a glimpse into fund-raising." *Journal of Public Economics* 88.

Bohnet, I., Frey, B., 1999. "The sound of silence in prisoner's dilemma and dictator games." *Journal of Economic Behavior and Organization* 38.

Laury, S.K., Walker, J.M., Williams, A.W., 1995. "Anonymity and the voluntary provision of public goods." *Journal of Economic Behavior and Organization* 27.

Masclet, D., Noussair, C., Tucker, S., Villeval, M.-C., 2004. "Monetary and non-monetary punishment in the voluntary contribution mechanism." *American Economic Review* 93.

Rege, M., Telle, K., 2004. "The impact of social approval and framing on cooperation in public good situations." *Journal of Public Economics* 88.

List, J., Berrens, R., Bohara, A., Kerkvilet, J., 2004. "Examining the role of social isolation on stated preferences." *American Economic Review* 94.

Ledyard, J.O., 1995. "Public goods: a survey of experimental research." In: Kagel, J., Roth, A.E. (Eds.), *Handbook of Experimental Economics*. Princeton, NJ: Princeton University Press.

Bardsley, N., Sausgruber, R., 2005. "Conformity and reciprocity in public good provision." *Journal of Economic Psychology* 26, 664–681.

Johansson-Stenman, O., Martinsson, P., 2006. "Honestly, why are you driving a BMW?" *Journal of Economic Behavior and Organization* 60, 129–146.

Appendix A: Summary Statistics

Variable	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
Contribution Level	1080	8.339815	6.557954	0	25
Contribution Level Increased	1080	0.3231481	0.4678954	0	1
Amt. Contributed below GM Avg.	1080	-0.0180741	3.855784	-11.33	12.83
Difference from GM 1 Contribution	1080	-0.2425926	7.370786	-25	25
Difference from GM 2 Contribution	1080	0.2064815	7.369813	-25	25
Made Highest Known Contribution	1044	0.3208812	0.467039	0	1
Made Lowest Known Contribution	1044	0.3582375	0.4797122	0	1
Amount of Punishment Sent	1080	1.052778	2.351422	0	10
Amount of Punishment Received	1080	1.052778	2.391674	0	20
Last Round	1080	0.2	0.4001853	0	1

Appendix B: Covariance Matrix

	Contrib. Level	Con. Level Increased	Amt. below GM Avg.	Difference from GM 1	Difference from GM 2	Highest Contrib.	Lowest Contrib.	Pun. Sent	Pun. Received
Contribution Level	1								
Contribution Level Increased	0.358	1							
Amt. Contributed below GM Avg.	0.028	-0.050	1						
Difference from GM 1 Contribution	-0.560	-0.201	0.504	1					
Difference from GM 2 Contribution	-0.564	-0.261	0.494	0.527	1				
Made Highest Known Contribution	0.125	-0.222	-0.086	-0.218	-0.190	1			
Made Lowest Known Contribution	-0.269	0.178	0.030	0.197	0.202	-0.312	1		
Amount of Punishment Sent	-0.012	0.045	-0.014	0.084	0.040	-0.031	0.044	1	
Amount of Punishment Received	-0.031	-0.030	-0.073	0.079	0.015	0.010	-0.033	0.265	1
Last Round	-0.084	-0.131	0.017	0.012	0.005	0.014	-0.002	0.054	0.053
AN Treatment	-0.142	-0.136	-0.009	-0.096	0.087	0.136	0.105	-0.196	-0.193
AA Treatment	-0.030	0.064	0.004	0.007	-0.003	0.094	0.156	0.103	0.102
AP Treatment	0.049	0.031	0.008	-0.008	0.016	0.115	0.072	0.070	0.069
PN Treatment	-0.063	-0.007	0.006	0.019	-0.012	-0.102	-0.083	-0.196	-0.193
PA Treatment	0.084	0.026	-0.012	0.070	-0.082	-0.124	-0.114	0.105	0.104
PP Treatment	0.092	0.015	0.003	0.005	-0.002	-0.118	-0.135	0.097	0.095
Public Contributions Institution	0.079	0.022	-0.003	0.072	-0.074	-0.256	-0.244	0.012	0.012
Punishment Allowed Institution	0.160	0.111	0.002	0.061	-0.058	-0.027	-0.017	0.307	0.302
Punishment Public Institution	0.112	0.037	0.008	-0.002	0.011	-0.002	-0.050	0.133	0.131

	Last Round	AN Treatment	AA Treatment	AP Treatment	PN Treatment	PA Treatment	PP Treatment	Public Contrib.	Pun. Allowed
Last Round	1								
AN Treatment	0.016	1							
AA Treatment	-0.008	-0.196	1						
AP Treatment	-0.008	-0.196	-0.208	1					
PN Treatment	0.016	-0.184	-0.196	-0.196	1				
PA Treatment	-0.008	-0.196	-0.208	-0.208	-0.196	1			
PP Treatment	-0.008	-0.196	-0.208	-0.208	-0.196	-0.208	1		
Public Contributions Institution	0.023	-0.434	-0.431	-0.462	0.424	0.451	0.451	1	
Punishment Allowed Institution	-0.025	-0.639	0.306	0.306	-0.639	0.306	0.306	0.008	1
Punishment Public Institution	-0.012	-0.311	-0.331	0.629	-0.311	-0.331	0.629	-0.008	0.487

Appendix C: Residual Plots

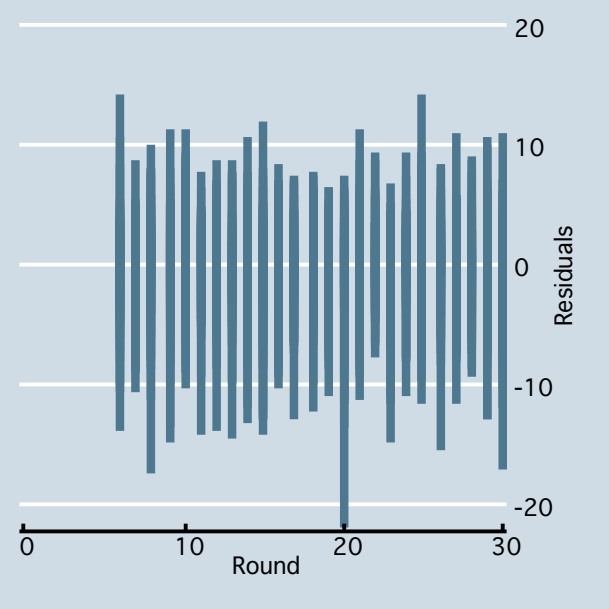


Figure 9. Residual Plot for Model 3 over time

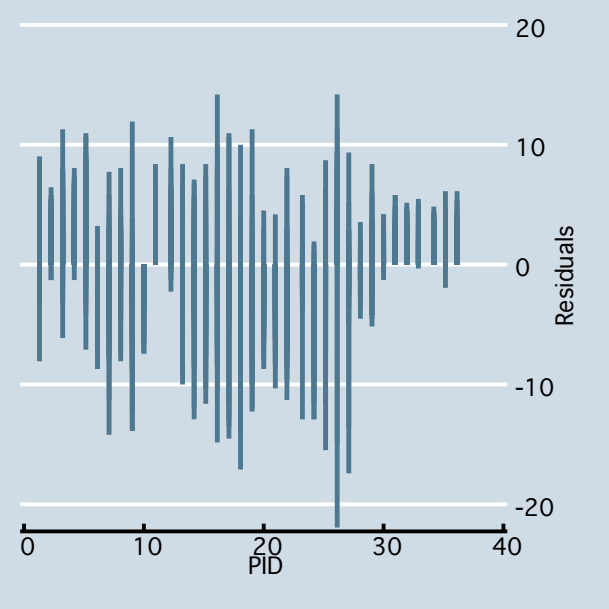


Figure 10. Residual Plot across panels (PID)

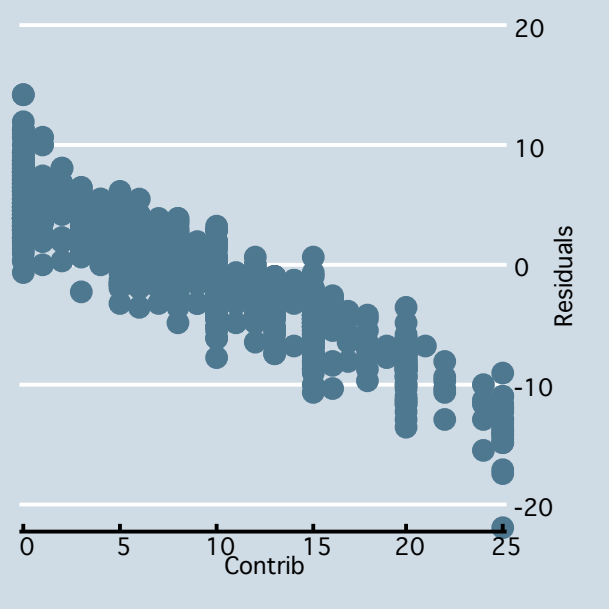


Figure 11. Residual Plot over contribution level

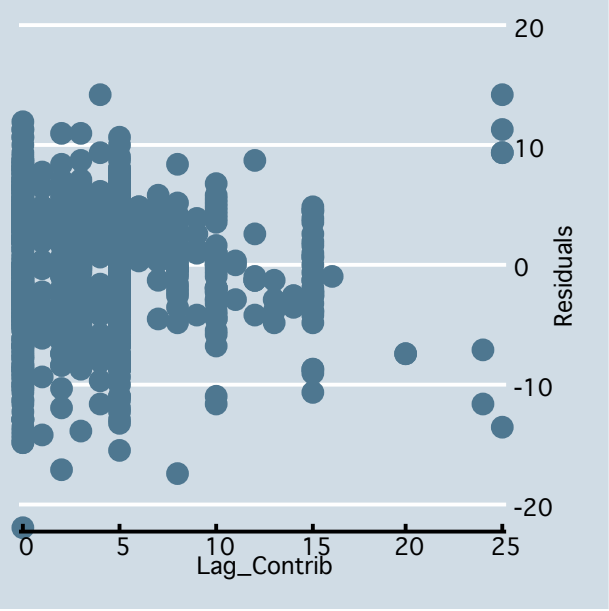


Figure 12. Residual Plot over lagged contribution level

Appendix D: Sample of Experimental Instructions

As part of today's experiment, you will play 6 short games on the computer. In these games there are no right and wrong answers, so you can choose to play however you want.

The 6 short games you will play today must be accessed online at:
http://veconlab.econ.virginia.edu/login1.php

OVERVIEW

- In each game there will be 5 rounds.
- You will be in a group of 3, and you will be with the same 3 people for the whole game (5 rounds).

TOKENS

- At the beginning of each round you will receive 25 tokens.
- You may decide how many tokens to keep for yourself and how many to contribute to the public pool.
- Each token you keep for yourself will be worth $0.10 to you.
- Each token you contribute will be worth $0.05 to each and every person in your group.
- Your earnings will be calculated as: E = 0.10(Num. of tokens you keep) + 0.05(Num. tokens you contribute) + 0.05(Num. tokens that others contribute)
- The person who wins the most (hypothetical) money today will gain one extra entry into the prize raffle.

PUNISHMENT

- In some games you will be able to punish the other members of your group.
- You can punish any player, including those that contribute less than you, those that contribute the same amount as you, and those that contribute more than you.
- Punishment will occur during the second stage of each round, after everyone has chosen their contributions.
- You may purchase up to 10 punishment points in each round, at a cost of $0.20 for each point.
- A punishment point will lower the earnings of the person you punish by 10% for each point.
- For example, if you buy 3 punishment points, and the person you punish would have earned $2, they will instead earn $1.40 (70% of $2)
- In other words, calculating your earnings based on the contribution stage results in earnings of E, and your final earnings after the punishment stage will be: Final Earnings = Earnings - 0.10*Punishment points*Earnings

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After all games are completed, I will email out a brief demographic survey with questions regarding your age, gender, major(s) and minor(s) and country/urbanicity of origin. There will be a short debriefing period with time provided to ask questions.