Warm-Glow Versus Cold-Prickle: The Effects of Positive and Negative Framing on Cooperation in Experiments
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WARM-GLOW VERSUS COLD-PRICKLE: THE EFFECTS OF POSITIVE AND NEGATIVE FRAMING ON COOPERATION IN EXPERIMENTS*

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Experiments on privately provided public goods generally find that subjects are far more cooperative than predicted, while experiments on oligopolies and the commons almost always obtain the Nash-equilibrium predictions, despite being very similar games. This paper examines whether this difference could be due to the fact that with public goods there is a positive externality, while with the others the externality is negative. The result of the experiments is that subjects are more willing to cooperate when the externality is positive, even though the potential outcomes are the same. This suggests a behavioral asymmetry between the warm-glow of doing something good and cold-prickle of doing something bad.

INTRODUCTION

The fact that a large fraction of people voluntarily contribute to public goods, despite strong incentives to free ride, has been a long-standing puzzle for economists. This is true for economists studying public goods in the real world, such as charitable giving, and for researchers looking at voluntary contributions in the laboratory. In both settings people appear to give too much.[1]

This paper focuses on voluntary public goods provision in the laboratory. The lack of free riding in experiments presents an

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1. See Davis and Holt [1992] and Ledyard [1994] for summaries of public goods experiments, and see Andreoni [1988a] for a discussion of the puzzle regarding public goods outside the laboratory.

especially interesting challenge for economists. First, free riding is a dominant-strategy Nash equilibrium in these experiments, so the prediction for free riding is particularly sharp. Second, these results are in strong contrast to other experiments in which subjects' choices create externalities for each other. For instance, oligopoly experiments and common-pool resource experiments, among others, generally produce Nash equilibria in the laboratory, even with relatively small numbers of subjects and few iterations. Hence, there is an important collection of other experiments with externalities that, unlike public goods experiments, tends to confirm the Nash equilibrium prediction.

One main difference between these experiments and public goods experiments is that in the public goods experiments subjects are asked to generate positive externalities, while in all the other experiments subjects generate negative externalities. It is possible that this difference alone could be generating at least some of the gap between these two bodies of experimental results.

This paper will examine the effects of positive and negative framing on cooperation. This is done by considering two experimental conditions. The *positive-frame* condition is the regular public goods game that experimental economists have studied in the past. This frames the subject's choice as contributing to a public good, which will have a positive benefit to other subjects. The second condition is the *negative-frame* condition. The incentives of this game are identical to the positive-frame condition. However, this time the subjects' choice is framed as purchasing a private good that, since the opportunity cost is the purchase of the public good, makes the other subjects worse off. The result of this experiment is that subjects in the positive-frame condition are much more cooperative than subjects in the negative-frame condition. This indicates that much of the cooperation observed in public goods experiments is due to framing, and that the warm-glow of creating a positive externality appears to be stronger than the cold-prickle of creating a negative externality. Intuitively, this result appears to match well with what is observed in the real world. Competition is thought to work well, even with relatively small numbers of firms, and many common-pool resources must be tightly managed. In addition, most fund-raising activities for charities appeal to the benefits to be gained by contributing, while few point to the losses due to free riding. Given the appeal of this result, such a strong framing effect raises many interesting and important questions about economic behavior, the design of institutions, and experimental methodology.

Section II discusses the differences between experiments with positive and negative externalities. Section III describes the experiment conducted in this paper. Section IV presents the results of the experiment, and Section V discusses these results. Section VI compares the results with other framing phenomena, and Section VII concludes.

II. Positive and Negative Framing

The standard public goods experiment gives subjects a budget of tokens that they can place in a public good or a private good. The payoff function is linear and is designed so that purchasing only the private good is the dominant strategy Nash equilibrium, while contributing all tokens in the public good is the symmetric Pareto efficient allocation. Figure I illustrates a representative sample of results from linear public goods experiments. While changing group size and marginal returns to the public good affects outcomes, the general pattern remains the same: about 50 percent of tokens are put into the public good in round 1, and 20 to 40 percent

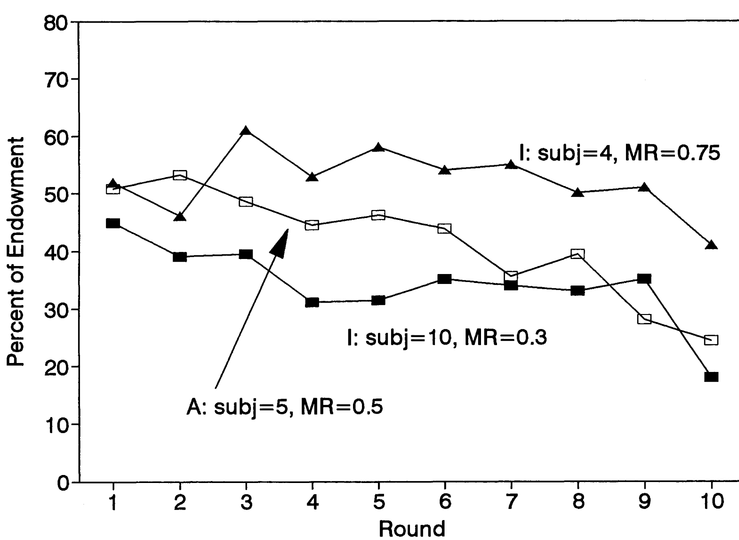

FIGURE I
Public Goods Provision in Experiments by [A] Andreoni [1988] and [I] Isaac, Walker, and Williams [1990]

are by round 10. While choices seem to be tending toward the equilibrium prediction, the convergence seems too slow to fully support the theory.

These results can be compared with Plott's [1983] findings. He conducted a double auction in which each contract transacted generated a negative externality on all traders. In the experiment this externality was referred to as "damage" created by a transaction; after each trading period subjects count the number of contracts and calculate damage on a table that reflects increasing marginal costs. Plott found that traders basically ignore the externality, and within two or three periods are trading at the Nash equilibrium. Similarly, Walker and Gardner [1992] and Walker, Gardner, and Ostrom [1990] looked at common-pool resources. Here subjects can invest in an asset whose average return is a decreasing function of the total invested. They find rapid and complete depletion of the resource. In many instances the rates of depletion exceed the Nash-equilibrium prediction. As pointed out by Davis and Holt [1992], the incentives in experiments on the commons are identical to Cournot oligopoly experiments, which generate similar results in groups of three or more.[2] Likewise, in price-setting games Alger [1987] found that prices fall to competitive levels—and often *below* competitive levels—in markets with four or more firms.

Clearly, these differences are very stark. Public goods experiments have been conducted by many researchers at many different universities and results like those in Figure I have been accepted as robust.[3] Similarly, a body of evidence on markets with negative externalities points to an equally robust collection of findings of the opposite sort. The next section will discuss a method for converting the positive-externality public goods experiment to an identical decision problem with a negative externality to see whether this difference alone can explain part of the divergence in these results.

III. A Negatively Framed Public Goods Experiment

The basic public goods experiment used here is typical of those just described. Subjects play in groups of five. Each subject is given a budget of 60 tokens. Every token placed in the private good x_i earns one cent for the subject, while every token given to the public

2. See Davis and Holt [1992] for a discussion and review of these experiments.
3. See, for instance, reviews by Davis and Holt [1992] and Ledyard [1994].

good g_i earns one half cent for all five group members. Hence, subjects are induced to maximize the payoff function,

$$\pi_i = x_i + \frac{1}{2} g_i + \frac{1}{2} \sum_{j \neq i} g_j, \tag{1}$$

subject to the budget constraint $x_i + g_i = 60$. This is how this experiment describes a payoff function of this type in the instructions to subjects:[4] "Every token you invest in the Individual Exchange will yield you a return of one. Every token invested in the Group Exchange will yield a return of one half for *every member of the group,* not just the person who invested it. It does not matter who invests tokens in the Group Exchange. Everyone will get a return from every token invested—whether they invest in the group exchange or not." Isaac and Walker [1988] and Isaac, Walker, and Williams [1990] use similar language in their subject's instructions: "You will earn $0.01 for each token that you retain in your private account in any decision-making round. . . . Each token placed in the group account will generate earnings for the entire group. Everyone in the group will receive the same portion of the earnings from the group account. . . . This is true for each individual regardless of the number of tokens that the individual places in the group account."

These experimental instructions make it clear that an action of contributing to the public good will generate a positive externality for other subjects. Notice, however, that the opportunity cost of investing in the private good is that one did not invest in the public good. Hence, saying that an investment in the public good will make others better off is equivalent to stating that an investment in the private good will make others worse off. Mathematically, the first statement can be converted into the second statement by substituting the budget constraint of the other players, $x_j + g_j = 60$, into the payoff function (1):

$$\begin{aligned} \pi_i &= x_i + \frac{1}{2} g_i + \frac{1}{2} \sum_{j \neq i} (60 - x_j) \\ &= x_i + \frac{1}{2} g_i - \frac{1}{2} \sum_{j \neq i} x_j + 120. \end{aligned} \tag{2}$$

Now the problem is framed as though investing in the public good has no external benefit, but investing in the private good will have

4. Identical instructions were used in Andreoni [1988b, 1993b]

an external cost. Aside from this framing of the decision, equations (1) and (2) have identical payoff spaces. In words, this framing of the problem is expressed this way (complete copies of instructions for both conditions can be found in the Appendix): "Every token you invest in the Individual Exchange will yield you a return of one. However, each token you invest in the Individual Exchange will reduce the earnings of the other players by one half cent each. . . . It will also be true that when the other members of your group invest in the Individual Exchange then your earnings will be reduced by ½ times their investment in the Individual Exchange. . . . Every token you invest in the Group Exchange yields a return of ½ for you." So that all the incentives are preserved, subjects in this condition must also be given 120 each round in "automatic" earnings. Hence, subjects are also told: "You will also get automatic earnings each round. These automatic earnings will not depend on any decisions you make, and will be the same each round. Your automatic earnings will be 120 each round."

These instructions have no effect on the incentives of subjects; a self-interested subject still has a dominant strategy to free ride. The only effect is to frame the actions of the subject as creating a negative externality for the other subjects. The change in frames is similar to shifting the point on the budget constraint where people are endowed. For instance, the original *positive-frame* experiments suggest that the game is beginning with all the tokens already placed in the private good—Isaac, Walker, and Williams [1990] even use the word "retain" to describe purchasing the private good—and by moving them to the public good all can be better off. In the *negative-frame* condition, the opposite is true. The frame suggests that subjects are endowed with their opponents' tokens in the public good, that is the 120 of automatic earnings, which will be eroded only if subjects move the tokens to the private good.

This describes the two experimental conditions that will be examined in this paper. The incentives in the conditions are identical, and the two differ only by their frame. If framing externalities as positive can explain why we observe much more cooperation in public goods experiments than in other experiments with negative externalities, then we should expect the positive-frame experiments to be more cooperative than the negative-frame experiments. The next section discusses the results of these experiments.

IV. Experimental Results

Forty subjects are used in each condition, for a total of 80 subjects used in this experiment. The data are collected in two separate sessions. To conduct one session, 40 subjects are recruited from intermediate level economics classes and are randomly divided into two rooms of 20 each. In each room a different condition of the experiment is conducted. This is done to maintain the greatest control over random assignments to conditions. In a particular room the subjects are again randomly assigned to numbered desks. They are given instructions and a packet of ten "investment decision forms," which subjects use to record their decisions. One computer and printer is in the back of each room. In each iteration of the game, the experimenter collects a decision form from each subject and types the subject number and decision into the computer. The computer then randomly assigns subjects to groups of five, calculates payoffs, and prints an "earnings report form" for each subject. These reports are then returned to each individual. The earnings report tells subjects their investment decision, the group's investment in the public good, and their monetary earnings. All of the parameters of the experiment are known to all subjects, but the information on individual payoffs is all private. The subjects play the game for ten rounds, and are randomly assigned to new groups each round.[5] This is important in order to avoid the possibility of reputation building. Each experiment lasted about 50 minutes, with average earnings of $8.24 per subject.

Table I lists the percent of the endowment subjects contribute to the public good each round. The first thing to note is that the results from the positive-frame condition are very similar to the results described in Section II. Contributions start out at 47 percent and decay to 21 percent, which is very similar to nearly identical experiments run by Andreoni [1988b, 1993b].[6] Overall

5. Group assignments are made on a purely random basis by the computer program.

6. Andreoni [1988b] found cooperation starting at 51 percent and falling to 24 percent, and Andreoni [1993b] found a 56 percent to 26 percent range. Also note that the averages in the early iterations of the second positive-frame condition are somewhat lower than typical results, although this difference disappears by round 4. Looking at this more carefully with a Mann-Whitney rank-sum test, we find no significant difference between the two sessions of the positive-frame condition ($z = 0.216$). To the extent that the positive 2 condition is less cooperative than expected, however, it will work against the hypothesis of significant framing effects. The statistical tests compare subjects' average choices over the experiment.

TABLE I
PERCENT OF ENDOWMENT CONTRIBUTED TO THE PUBLIC GOOD PER ROUND

	Round										
	1	2	3	4	5	6	7	8	9	10	All
Positive 1	58.3	62.9	52.5	32.9	42.9	34.2	19.8	27.5	27.5	18.6	37.71
Positive 2	36.7	34.3	35.8	32.5	30.0	35.5	22.8	23.8	19.8	23.3	29.44
Average	47.5	48.6	44.2	32.7	36.5	34.8	21.3	25.6	23.7	20.9	33.58
Negative 1	22.9	25.7	17.8	19.2	11.0	10.3	14.5	15.6	16.2	2.1	15.53
Negative 2	32.7	22.6	18.3	19.7	21.3	18.3	18.4	10.3	7.3	0.0	16.88
Average	27.8	24.1	18.1	19.5	16.1	14.3	16.5	12.9	11.7	1.0	16.20
Difference	19.7	24.5	26.1	13.3	20.3	20.5	4.9	12.7	12.0	19.9	17.38

cooperation is 34 percent. Comparing this with the negative-frame condition, we see that the difference is quite striking. There cooperation begins at just 27 percent of the endowment, and decays to only 1 percent by round 10. Overall cooperation is 16.2 percent, which is half the level of the positive-frame condition. On average, the subjects in the negative frame condition contribute 48.2 percent as much as the positive-frame subjects.

We can examine the significance of this difference by using a Mann-Whitney rank-sum test. This test organizes the data by subjects and is normally distributed.[7] The test statistic has a value of $z = 3.44$ which is significant beyond the $\alpha \leq 0.001$ level. This means that the positive frame significantly increases the amount of the endowment contributed to the public good.[8]

We can also look at the effect framing has on the propensity of subjects to free ride. Table II lists the percent of subjects choosing the dominant strategy of free riding during each iteration of the game. Again the differences are quite dramatic. The positive-frame starts with 30 percent of subjects free riding, rising to 42.5 percent by round 10, with a ten-round average of 34.5 percent. In the negative-frame, 47.5 percent of the subjects free ride in round 1. This is a higher percentage of free riding than the positive-frame subjects reach over the course of the entire experiment. The

7. This test is conducted by first calculating the mean contribution level for each subject and then ranking subjects by these means in the joint sample. Under the null hypothesis of no difference between conditions, the sum of the ranks should be equal across conditions. See Freund [1971], pp. 347–49.

8. If we look at data only from the first round, which will guarantee independence of the observations, the result still holds. Here $z = 2.174$ which is highly significant.

TABLE II
PERCENT OF SUBJECTS CONTRIBUTING ZERO TO THE PUBLIC GOOD PER ROUND

	Round										
	1	2	3	4	5	6	7	8	9	10	All
Positive 1	20	15	20	40	30	35	35	40	40	50	32.5
Positive 2	40	35	35	35	35	30	45	40	35	35	36.5
Average	30.0	25.0	27.5	37.5	32.5	32.5	40.0	40.0	37.5	42.5	34.5
Negative 1	50	45	45	50	60	70	55	65	65	80	58.5
Negative 2	45	65	65	60	60	70	70	75	75	100	68.5
Average	47.5	55.0	55.0	55.0	60.0	70.0	62.5	70.0	70.0	90.0	63.5
Difference	17.5	30.0	27.5	17.5	27.5	37.5	22.5	30.0	32.5	47.5	29.0

negative-frame subjects continue to increase free riding until round 10 when 90 percent of the subjects free ride. On average, 63.5 percent of negative-frame subjects free ride in any round, which is nearly twice the rate of positive-frame subjects. The difference between the positive and negative frames also increases over the course of the experiment. Over rounds 1 to 5 the difference averages 24 percent, and in rounds 6 to 10 the average difference increases to 34 percent.

We can again examine this difference statistically. The Mann-Whitney rank-sum test yields a $z = 3.50$, which is significant beyond the $\alpha \leq 0.001$ level. As above, the negative framing of the public goods problem significantly reduces the level of cooperation.[9]

A simple hypothesis for this difference is that somehow the negative-frame condition makes the incentives clearer to the subjects. To check this, a post-experiment questionnaire was administered to test subjects' understanding of the incentives. Subjects were given two hypothetical situations and were asked to state what choices on their part would maximize their payoffs. Only one subject (in the Positive 1 session) failed to answer these questions correctly. Hence, it seems unlikely that a difference in understanding of the incentives could account for the patterns observed.

In summary, this experiment finds a rather substantial effect of positive and negative framing on cooperation. Even though the incentives of the experiment are identical in the two conditions,

9. If we look at the data only from round 1, again to assure independence among the observations, the difference is significant with a one-sided t-test, $t = 1.633$.

framing the choice as a positive externality substantially increases cooperation over framing the decision as a negative externality.

V. How Important Are Negative and Positive Framing Effects?

Given the perhaps surprisingly strong significance of positive- and negative-framing effects on cooperation, we must ask how this result will affect our thinking about experiments with externalities, and how this result will help shape our understanding of altruistic behavior both inside and outside the laboratory.

Perhaps the fundamental first question to ask is how experimental science would have interpreted the evidence on free riding if we had only seen the findings on the negative-frame condition just presented. Could these results be taken as evidence for the Nash-equilibrium free riding prediction? In the negative-frame experiments the amount invested in the private good deviates from equilibrium by 16.2 percent overall and 11.3 percent over the last five rounds. On average, 36.5 percent of subjects fail to adopt the dominant strategy, and 27.5 percent fail to do so over the last five rounds. Nonetheless, the Nash-equilibrium prediction is almost perfectly met in the final round of the game. While the evidence is not as favorable toward Nash equilibrium as it is in many other experiments, one could reasonably conjecture that if public goods experiments had been judged by the results of the negative-frame condition there may not have been such an important puzzle.

The fact remains, however, that cooperation in public goods games is significant, and the positive frame of the game appears to be an important factor in this result. This level of cooperation is not a mere experimental fluke, but appears to be a fundamental part of human interactions in these games. The current experiment reveals that the positive frame of the game triggers certain behaviors that are not activated to the same degree by framing the decision as a negative externality. This raises further questions about the motivations of subjects and revisions of the theoretical models that may be necessary to describe these and related results.

Many previous experiments have found behavior that is consistent with various altruistic motives on the parts of subjects.[10]

10. See, for instance, Palfrey and Rosenthal [1988], McKelvey and Palfrey [1992], Palfrey and Prisbrey [1992], Dawes [1980], Andreoni [1993a, 1993b], and Andreoni and Miller [1993], among others.

One hypothesis, which could be called pure altruism, is that subjects care about the payoffs of the other subjects. An alternative is that subjects care about the act of doing good for other people. This motive has been called impure altruism or "warm-glow" giving [Andreoni 1989, 1990]. While there is no theory for the disutility individuals may get from the act of doing bad, an analog to the warm-glow is, naturally enough, the "cold-prickle."

To explain the data presented in this paper, it is obvious that our theories must go beyond an assumption of pure altruism. Since the payoff space is identical for both frames, caring only about the payoffs of other players is not sufficient to generate the differences observed. Note also that simply caring about the changes in the levels of an opponent's payoff is not sufficient either, since such changes are affected equally well in both frames. Instead, it must be that the perceived sign of the change is also important, and moreover, the strength of the warm-glow from doing good must exceed that of the cold-prickle from doing bad. Stated differently, it must be that people enjoy doing a good deed more than they enjoy not doing a bad deed.

VI. Comparison with Other Framing Effects and Related Literature

One may ask whether the findings in this paper have anything in common with other settings in which the presentation of the game has an effect. These other effects generally do not involve any interdependence between subjects of the sort found in public goods experiments, but instead relate to an isolated choice by the subject. These include, for instance, preference reversals and Prospect Theory. Some effects, such as asymmetric loss aversion and the willingness-to-pay/willingness-to-accept paradox, have some features in common with the result of this paper in that they pit positive changes against negative ones. Perhaps there is a fundamental psychological principle that switches a person's problem-solving strategy when the changes considered are negative rather than positive, and such a potential could merit further research.

In the psychology literature there has been some interest in comparing the effect of positive and negative frames in various social dilemmas, some of which are similar to the public goods problem. Unfortunately, the results are inconclusive. The experiment that is most like the one examined here is Schwartz-Shea [1983]. In a single-shot game of public goods, she found 85 percent cooperation, significantly higher than the 65 percent cooperation in the public "bads" experiments. This clearly supports the results of this paper. Other psychological experiments that I am aware of are not strictly comparable to the one reported here. One reason is that they did not present neutral environments. In particular, these experiments instructed subjects to "give some" in positive frames and to "take some" in negative frames, which could influence outcomes. A second problem is that many of these experiments gave false feedback to subjects about their partner's choices. A third difficulty is that the games often had step-level payoffs or "provision points" which generated Nash equilibria at cooperative outcomes. It is well-known that provision points greatly enhance the likelihood of reaching such cooperative outcomes, which should work against finding significant differences (see Bagnoli and McKee [1991] and Davis and Holt [1993]). Nonetheless, of the six other psychological studies, one is consistent with this paper, four find no significant effect, and one finds slightly more cooperation in the take-some condition.[11]

In other related work, psychologists and decision scientists have identified a strong effect of the "status quo" in decision making that appears to be driven by a bias toward "omission" rather than "commission" of an act.[12] If the outcome of an action is uncertain, then people tend to refrain from that action. However, if the consequences of the action are positive, people feel much happier from having taken action than if the consequences are negative and the same result occurs.[13] This last effect could help us understand what was observed here. If people invest in the public good in the positive-frame condition, they may see the outcome as a positive one in which many others cooperated as well. However, the same outcome in the negative-frame condition may be seen as a negative one, since many people invested in private good to the detriment of others. Hence, the same level of cooperation may make people happier in the positive-frame than in the negative-frame condition. This could in turn lead to more sustained cooperation, as was observed.

Finally, one can conjecture about how these static asymme-

11. The finding of Allison and Messick [1985] are consistent with this paper, the results of Brewer and Kramer [1986] are not, and no significant effects were found by Schwartz-Shea and Simmons [1985], Rutte, Wilke, and Messick [1987], Fleishman [1988], and Messick, Allison, and Samuelson [1993].

12. See, e.g., Samuelson and Zeckhauser [1988], Kahneman, Knetsch, and Thaler [1990], and Ritov and Baron [1992].

13. See Kahneman and Tversky [1982] and Landman [1987].

tries may be influencing the dynamic of these games. Moral philosophers conjecture that "social inhibition" or shared responsibility may make it easier for people to avoid regret when bad outcomes occur, and psychological studies seem to confirm this view.[14] If an action is described as being associated with the bad outcome, as it is in the negative-frame condition, then the guilt from taking that action may be diminished the more the others do the same. In contrast, the pride one takes in choosing the action that creates the positive externality may not be diminished if others also do not choose the positive action. This could also lead to faster convergence to the equilibrium among the negative-frame subjects, as was observed.

VII. Conclusion

This paper has identified what could be called an asymmetric marginal utility of helping. People are significantly more willing to cooperate in a public goods experiment when the problem is posed as a positive externality rather than as a negative externality. In fact, when the positive externality is rephrased to be presented as a negative externality—even though the incentives do not change—the provision of the public good converges to the dominant strategy Nash prediction after ten iterations in almost all cases. This suggests that cooperation in public goods experiments cannot be explained by pure altruism that subjects may have for each other, since opportunities for this altruism are the same regardless of the frame. Instead, there must be some asymmetry in the way people feel personally about doing good for others versus not doing bad: the warm-glow must be stronger than the cold-prickle.

While more work obviously needs to be done before we can state firmly that an asymmetry between positive and negative externalities is generalizable to other aspects of human interactions, we can assess whether such a conclusion is intuitively appealing. One place to look for an effect of the asymmetry may be in the actions of fund-raisers and in the advertisements of charitable organizations. It seems much more common to hear appeals to the virtue that one's contribution will do rather than to the tragedies that will occur if a contribution is not made. Some even appeal directly to the good feeling to be had by contributing. If such a positive-negative asymmetry exists, it may have taught fund-

14. See Wilson [1993, pp. 35–40] for a discussion of these issues.

raisers that positive appeals are more productive in generating contributions to public goods.

APPENDIX: SUBJECTS' INSTRUCTIONS

A1. Negative Frame

Subjects' Instructions.

WELCOME.

This experiment is a study of group and individual investment behavior. The instructions are simple. If you follow them carefully and make good investment decisions, you may earn a considerable amount of money.

The money you earn will be paid to you, in cash, at the end of the experiment. A research foundation has provided the funds for this study.

page 1

MAKING CASH EARNINGS FROM YOUR INVESTMENT RETURN

In this experiment you will make a series of 10 investment decisions. For each investment decision you will be placed in a group with five other subjects. Your investment returns will depend on the investment decision that you and the other four members of your group make.

Each investment decision you make will result in an *investment return.* Your investment return from each decision will be turned into *cash earnings.* In particular, your investment return will equal your earnings in the experiment. For example, if your investment return from one investment decision is 95, your earnings will be $.95, and if your investment return is 65, then your earnings will be $.65.

In the following pages, we will describe how your investment returns are determined.

page 2

THE INVESTMENT OPPORTUNITIES

You have been assigned to a group of 5 people. Each of you will be given an investment account with 60 tokens in it.

You will be choosing how to divide your tokens between two investment opportunities:

1. The Individual Exchange

Every token you invest in the Individual Exchange will yield you a return of one. However, each token you invest in the individual exchange will reduce the earnings of the other players by one half cent each. This is best illustrated with some examples.

Example. Suppose you invested 60 tokens in the Individual Exchange. Then you would get a return of 60 from this exchange. However, each of the four other members of your group would have their earnings reduced by 30 each.

Example. Suppose you invested 30 tokens in the Individual Exchange. Then you would get a return of 30 from this exchange. However, each of the four other members of your group would have their earnings reduced by 15 each.

Example. Suppose you invested 0 tokens in the Individual Exchange. Then you would get no return from this exchange. Likewise, the other four members of your group would not have their earnings reduced.

It will also be true that when the other members of your group invest in the Individual Exchange, then your earnings will be reduced by ½ times their investment in the Individual exchange. This is illustrated below:

Example. Suppose that the other four members of your group invested a total of 100 in the Individual Exchange. Then this would reduce your earnings by 50.

Example. Suppose that the other four members of your group invested a total of 90 tokens in the Individual Exchange. Then this would reduce your earnings by 45.

Example. Suppose that the other four members of your group invested no tokens in the Individual Exchange. Then this would not reduce your earnings at all.

2. The Group Exchange

Every token you invest in the Group Exchange yields a return of ½ for you. The other members of your group are not affected by your investment in the Group Exchange.

Example. Suppose that you decided to invest no tokens in the Group Exchange. Then your return from the Group Exchange would be 0.

Example. Suppose that you invested 30 tokens in the Group Exchange. Your return from the Group Exchange would be 15.

Example. Suppose that you invested 50 tokens in the Group Exchange. Your return from the Group Exchange would be 25.

Automatic Earnings

In addition to the earnings you accumulate from the Individual Exchange and the Group Exchange, you will also get automatic earnings each round. These automatic earnings will not depend on any decisions you make, and will be the same each round. Your automatic earnings will be 120 each round. Hence, your total earnings each round will be your earnings from the Individual Exchange plus your earnings from the Group Exchange plus 120 in automatic earnings.

page 4

THE INVESTMENT DECISION

Your task is to decide how many of your tokens to invest in the Individual Exchange and how many to invest in the Group Exchange. You are free to put some tokens into the Individual Exchange and some into the Group Exchange. Alternatively, you can put all of them into the Group Exchange or all of them into the Individual Exchange.

YOUR INVESTMENT ACCOUNT

You and every other member of your group will have 60 tokens in your investment account each decision round. The total number of tokens in each group in every decision round is 300.

STAGES OF INVESTMENT

There will be 10 decision rounds in which you will be asked to make investment decisions. At the end of each round your earnings will be recorded by the experimenter. After the last round you will be paid the total of your earnings from all 10 rounds.

At the beginning of each round you will be given a fresh investment account with 60 tokens. You will also be given an INVESTMENT DECISION FORM. You are to record your decision using this form. Be sure that your investment in the Individual Exchange plus your investment in the Group Exchange equals 60, i.e. the number of tokens in your account. You must make your investment decisions *without* knowing what the others in your group are deciding.

Do not discuss your decision with any other participant!

The experimenter will collect the form when you have filled it out. The experimenter will then calculate your return from the Individual and Group Exchanges, and calculate your cash earnings. This information will be conveyed to you on an EARNINGS REPORT.

IMPORTANT NOTICE: The Earnings Report tells you the total investment in the Group Exchange, your investment return, and your cash earnings. Your Earnings Report does not tell you the investment decisions or earnings of the other members of your group. YOUR INVESTMENT DECISIONS AND EARNINGS ARE CONFIDENTIAL.

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YOUR GROUP

The composition of your group will be changing *every* decision round. After each decision round you will be **reassigned** to a **new group** of 5 participants. The 5 group members will never have been members of the same group in the past.

At no point in the experiment will the identities of the other members of the group be made known to you, nor will your identity be made known to them.

YOUR CASH EARNINGS

Remember, your cash earnings from each investment decision will equal your investment return. For instance, if you earn 100 from your investment decision, your earnings will be $1.00. If you earn 50 from your investment decision, your earnings will be $.50.

GOOD LUCK!

You may begin by completing the first Investment Decision Form.

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A2. Positive Frame

The positive frame instructions are identical to the negative frame, except for pages 3 and 4, which are provided below.

THE INVESTMENT OPPORTUNITIES

You have been assigned to a group of 5 people. Each of you will be given an investment account with 60 tokens in it.

You will be choosing how to divide your tokens between two investment opportunities:

1. The Individual Exchange

Every token you invest in the Individual Exchange will yield you a return of one. The other members of your group are not affected by your investment in the Individual Exchange.

Example. Suppose you invested 60 tokens in the Individual Exchange. Then you would get a return of 60 from this exchange.

Example. Suppose you invested 30 tokens in the Individual Exchange. Then you would get a return of 30 from this exchange.

Example. Suppose you invested 0 tokens in the Individual Exchange. Then you would get no return from this exchange.

page 3

2. The Group Exchange

Your return from the Group Exchange will depend on the *total number of tokens* that you and the other four members of your group invest in the Group Exchange. The more the *group* invests in the Group Exchange, the greater the return to *each member of the group.*

Every token invested in the Group Exchange yields a return of ½ for *each* member of the group, *not just the person who invested it.* The process is best explained by a number of examples:

Example. Suppose that you decided to invest no tokens in the Group Exchange, but that the four other members invested a total of 100 tokens. Then your return from the Group Exchange would be 50. Everyone else in your group would also get a return of 50.

Example. Suppose that you invested 30 tokens in the Group Exchange and that the other four members of your group invested a total of 90 tokens. This makes a total of 120 tokens. Your return from the Group Exchange would be 60. The other four members of the group would also get a return of 60.

Example. Suppose that you invested 50 tokens in the Group Exchange, but that the other four members of the group invest nothing. Then you, and everyone else in the group, would get a return from the Group Exchange of 25.

As you can see, every token invested in the Group Exchange will yield a return of one half for *every* member of the group, not just the person who invested it. *It does not matter who invests tokens in the Group Exchange. Everyone will get a return from every token invested—whether they invest in the Group Exchange or not.*

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