The "Spite" Dilemma: Spite or No Spite, is there a Dilemma?

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Abstract

The results are reported for five laboratory sessions in which a voluntary contribution mechanism is used to collect resources to provide a public good. The individually rational action for each subject coincides with the collectively rational action. Group contributions do not generally converge to the conventional equilibrium level. Deviations from the predicted equilibrium are not explained by the value orientations of the members of the groups.

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"dilemma, n. 2. A situation involving choice between equally unsatisfactory alternatives."
(Webster's New Collegiate Dictionary, G. & C. Merriam Co., 1949)

1. Introduction

Many public goods experiments which study a voluntary contribution mechanism have been conducted by economists since the results of Isaac, Walker and Thomas (1984) appeared in *Public Choice*.[1] The voluntary contribution mechanism environments may be divided into two types. In one type, the socially optimal outcome and the individually rational (Nash equilibrium) outcome are at a boundary (but not necessarily the same boundary) of the participants' resource endowment sets. In the second type, the socially optimal and individually rational outcomes require voluntary contributions which lie within the participants' endowment sets.

The first type of environment is usually characterized by a group of participants whose induced values for private and public activities are represented by the function

$$\delta_i = a_i (e_i - c_i) + b_i (\Sigma_j c_j) \qquad \textbf{(1)}$$

where δ_i is the payoff to participant i from making a voluntary contribution of c_i resource units to the group activity from an endowment of e_i resource units and $\Sigma_j c_j$ is the sum of the contributions made by all j members of the group (including individual i). a_i is the return to a unit invested in the private activity by individual i while b_i is the return to individual i from a unit invested in the group activity by any individual. This environment is typically described as a *linear public good* environment.

In the linear public good environment, $a_i > b_i$ leads to the prediction that in the absence of

[1] In fact, this experiment was conducted after that conducted by Isaac, McCue and Plott (1985), but due to publication lags preceded it in print. A good survey of the work by economists since these two papers were published is included in Ledyard (1995).

binding commitments, individually rational participants will contribute nothing to the group activity while collective rationality requires a voluntary contribution of e_i from each participant. The laboratory implementation of this environment has led to a very wide range of outcomes. In particular, when subjects participate repeatedly with the same group of people, the prediction of no voluntary contributions is not supported by the data.

Figure 1 provides data from a selection of sessions which display the range of results for the proportion of the optimal contribution to the group activity obtained from linear public goods environments. The solid symbols are data from four sessions with seven participants in a group conducted by Saijo and Nakamura (1995) for which $b_i = 0.70$ for all individuals. The open symbols are data from four sessions with group size of either 4 or 10 and b_i of either 0.75 or 0.30 (for all individuals in a group) conducted by Isaac, Walker and Thomas (1984). The eight sessions used subjects who were inexperienced with this environment and who could not communicate with each other. There were differences in endowments and in the presentation of the payoff information, but conventional theory predicted that neither these differences nor the differences in b_i nor group size would affect voluntary contributions; a_i was unity in all cases.

Economists have joined other social scientists who have studied social dilemmas in search of an explanation for voluntary contributions in public good environments which consistently exceed zero. Explanations include the existence of altruism or a warm glow from giving in the preferences of at least some subjects or notions of inherent cooperative values which lead individuals to make contributions which appear to be inconsistent with individual rationality, but are consistent with maximizing the payoff of the group. More recently, Anderson *et al*. (1998) apply a notion of decision error to the linear public good environment which leads to a prediction

that voluntary contributions will exceed zero.[2]

The dominant characteristic of this environment is the tension between the individually rational contribution of zero and the collectively rational contribution of e_i. As shown in Figure 1, the bold line at the top of the figure and the bold line along the horizontal axis both attract the subjects participating in this environment. The group results are distributed between these values of 0 and 1. What happens if this tension is removed?

Saijo and Nakamura study the removal of this tension. They create a public good environment in which a_i is unity while b_i is 1.428. The individually rational outcome is for each participant to make a voluntary contribution of e_i to the group activity. This is also the collectively rational action. Figure 2 displays the proportions reported by Saijo and Nakamura of the optimal contribution made in each of ten decision rounds by four groups of seven inexperienced subjects who each have an endowment of 10 tokens to allocate between a private and a group activity. Although contributions never fall below thirty percent of the group endowment in any period, they rarely exceed seventy percent (and only early in the sessions). In the absence of a difference between the individually and collectively rational actions, the data again fail to support the individually rational contribution.

Saijo and Nakamura suggest that spiteful behaviour is responsible for the less than optimal voluntary contributions. They argue that individuals who wish to maximize the difference

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[2] It is interesting to note that the decision-error model predicts that individuals in linear public goods environments will make voluntary contributions between the Nash equilibrium prediction of zero and half of their endowment. While the results for the Saijo and Nakamura sessions and the Isaac, Walker and Thomas sessions with low b_i are consistent with this prediction, the other two Isaac, Walker and Thomas sessions show group contributions which consistently *exceed* fifty percent of the group total endowment. The decision-error model is supported by the data of neither of these sessions.

between their income and the income of others will contribute less than their full endowment. For these spiteful individuals, each token not contributed to the group activity will reduce their payoffs by 0.428 tokens. The income of each of the other individuals in the group will fall by 1.428 tokens. The existence of spiteful individuals, therefore, offers an explanation for the less than optimal contributions which occur in this environment. The dilemma exists because the spiteful person would like to make more money, but would also like to make more than others. Satisfying one objective requires giving up on the other. Hence, the dilemma. A confirmation of the spite dilemma has not yet been published.

2. New Sessions

The psychology literature offers several mechanisms for identifying spiteful individuals, as characterized by Saijo and Nakamura. Liebrand and van Run (1985) present a comparison of two different mechanisms for identifying *value orientations*, such as competitive or spiteful behaviour, which are being introduced into the work of economists (see Offerman 1997). In this section the results of five laboratory sessions are described. In these sessions the value orientations of participants in linear public goods environments are identified. An attempt is made to evaluate the success of the Nash equilibrium prediction when the individually rational and collectively rational actions coincide and the conjecture that it is an orientation towards spiteful behaviour on the part of at least some subjects that leads to the realization of contributions less than the conventional prediction.

Each of the five sessions contained ten decision rounds. In two sessions there are seven participants, in one there is five, and in two there are four. All of the subjects were recruited from the population of McMaster University undergraduate students. For each session a_i is unity for all

of the subjects and b_i is 1.428. Each individual has an endowment, e_i, of 10 tokens. Subjects had copies of instructions and detailed payoff tables. The instructions were read aloud to the subjects prior to the start of the decision rounds. The sessions were conducted manually.[3] Payoffs to the twenty-seven participants range from $5 to $12.50 for about forty-five to sixty minutes of their time. The average payoff was $9.13.

The subjects first participated in a series of three *decomposed games* in which they had to select one of two distributions of resources between themselves and an anonymous peer. The results of these games permit us to identify individuals with competitive value orientations.[4] Subjects are randomly paired in the decomposed games and paid privately according to the resource distributions they chose.

3. Predictions and Results

Of the twenty-seven participants, only two were identified as having competitive value orientations. One was in a four-person session and one was in a five-person session. This suggests that spiteful behaviour, as described by Saijo and Nakamura, should emerge only in these two sessions. Furthermore, given the induced payoffs, the spiteful (or competitive) subjects

[3] Instructions and detailed payoff tables are available from the authors.

[4] Value orientation categories are altruism, cooperation, individualism, competition, and aggression. Altruistic individuals will select distributions in which the anonymous peers receive the greatest possible payoff, regardless of their own payoff, cooperative individuals maximize the sum of the resources to themselves and their anonymous peers, individualists will select the distribution that gives them the greatest amount of resources, competitive individuals will maximize the difference in their resources and their anonymous peer's and aggressive individuals will select the distribution which gives the lowest payoff to the anonymous peer regardless of what they receive themselves. It is important to note that the value orientations are not self-proclaimed by subjects, but are derived from their performance in the decomposed games. The subjects are not informed of their value orientation. The specific distributions used to elicit value orientations are available from the authors.

should contribute nothing to the group activity (regardless of the behaviour of the other people in the group), while the other subjects (individualistic, cooperative, or altruistic) should contribute all of their tokens to the group activity (again, regardless of the behaviour of the others in the group).

The competitive subject in the four-person group contributed an average of 6.5 tokens to the group activity (as compared with an average of 5.8 tokens by the others in the group) while the competitive subject in the five-person group contributed an average of 6.6 tokens (as compared with an average of 6.9 tokens by the others in the group). The range of the contributions made by these two subjects across ten decision periods was from 2 through 9 tokens while the range of contributions made by the non-competitive subjects in these two sessions was from 1 through 10. The contributions made by the competitive subjects were not substantially different from those made by the other subjects. Figure 3 displays the proportions of the optimal contribution made for each period of each session.[5] The distributions of the Saijo and Nakamura sessions (solid triangles) overlap the distributions for the new sessions. Using an exact randomization test it is not possible to reject in any period, at a five percent significance level for a two-tail test, the null hypothesis that the mean of the new observations differs from the mean of the Saijo and Nakamura observations (p-values range from 0.11 in period 6 to 0.99 in period 10; all values, except for the period 6 value, exceed 0.20).

4. Discussion

This paper reports the results of five laboratory sessions in which the predicted individually

[5] Data for only five periods are reported for the seven-person sessions. After the fifth period, a new treatment, not discussed in this paper, is introduced.

rational and collectively rational voluntary contributions of subjects in a linear public goods environment coincide. The results obtained by Saijo and Nakamura in a comparable environment are generally confirmed even though nearly all of the subjects identified themselves as having individualistic, cooperative or altruistic value orientations (implying that they should have contributed all of their tokens to the group activity in this environment).[6] The two subjects who were identified as competitors through a pre-test did *not* behave differently from the others, as spiteful individuals were predicted to behave.

An alternative to spiteful behaviour, which predicts the pattern of contributions displayed in these laboratory sessions, is offered by the decision-error model. This model predicts contributions to the group activity will be between fifty percent of the optimal contribution and the optimal contribution. This is the range which contains most of the observations from the Saijo and Nakamura sessions and the five new sessions. However, the decision-error model does not offer an explanation of why subjects in this environment should make decision errors. The transparency of this environment relative to the environment in which the individually rational and

[6] The two four-person and one five-person sessions reported in this paper were preceded by ten decision rounds during which the subjects participated in a voluntary contribution game in which the parameter $b_i = 0.70$. The twenty decision rounds completed by these subjects are comparable to the (DH, DL) treatment conducted by Saijo and Nakamura, whose results for the DH portion of the treatment are reported in Figure 2. Saijo and Nakamura report that 57% of their subjects can be classified as free-riding and spiteful (according to their contributions in the low and high b_i environments. Only 29% are classified as theoretical (making contributions relatively consistent with their dominant strategies). This high proportion of free-riding and spiteful subjects provides support for the "spite" dilemma. In the three new sessions reported here, only 23% of the subjects can be classified as free-riding and spiteful, while 54% are theoretical and 23% are, in Saijo's and Nakamura's terminology, altruistic and pay-riding. Even though the number of spiteful subjects are very much lower in the new sessions than in the Saijo and Nakamura sessions, comparable results are obtained (period by period, the four observations from the Saijo and Nakamura sessions overlap the three observations of the sessions described here).

collectively rational actions do not coincide makes it difficult to accept decision-error as an intellectually satisfying explanation for the under-contribution observed in this environment.

Bolton and Ockenfels (2000, 166) present a model of equity, reciprocity, and competition (ERC) which promises applicability to environments in which "people are motivated by both their pecuniary payoff and their relative standing." However, their ERC model specifically excludes competitive, or status-seeking, behaviour. Bolton and Ockenfels (2000, 172) write that to the extent "that *some* are status-seeking ... the model misses this aspect of these people's motivation." Without fully developing a formal model in which some people generally can trade off income for standing, it is clear that a model in the spirit of ERC, but accommodating status-seeking individuals, can lead to an outcome in which contributions are expected to be less than under the conventional model without having to believe that the participants make decision errors.[7] If this model accurately captures preferences, what was originally described as a dilemma is in fact not a dilemma.

A useful extension of this work would incorporate a more rigorous measurement of the value orientations of the subjects participating in the voluntary contribution mechanism in an environment in which individually and collectively rational actions coincide.[8] However, the results

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[7] If subjects responded to an objective function of the form $v_i = h_i y_i + k_i r_i$, where y_i is the individual's income, r_i is the share of the total group income accruing to the individual, and h_i and k_i are weights on these variables for the individual, for appropriate values of the weights across all contributors, the best response of an individual in a linear public good game, such as that associated with Saijo's and Nakamura's spite dilemma, may be to contribute something less than his entire endowment to public good provision.

[8] The psychology literature provides references which claim that the use of various sorts of decomposed games lead to measurements of value orientation which are both reliable and valid (see Buckley *et al*. (2000) for a discussion). It is not clear, however, that the value orientation elicited in a non-strategic environment will successfully predict behaviour in a strategic

reported here suggest that spite alone may be an inappropriate explanation for the behaviour identified by Saijo and Nakamura and confirmed by the five sessions reported here.

environment. This may account for the failure of the value orientation measures used here to predict spiteful behaviour in a strategic environment. In support of the independently derived value orientation measure's validity in strategic environments, Offerman, Sonnemans, and Schram (1996) present evidence that individuals with cooperative value orientations make greater voluntary contributions to public goods than do individualist or competitive individuals.

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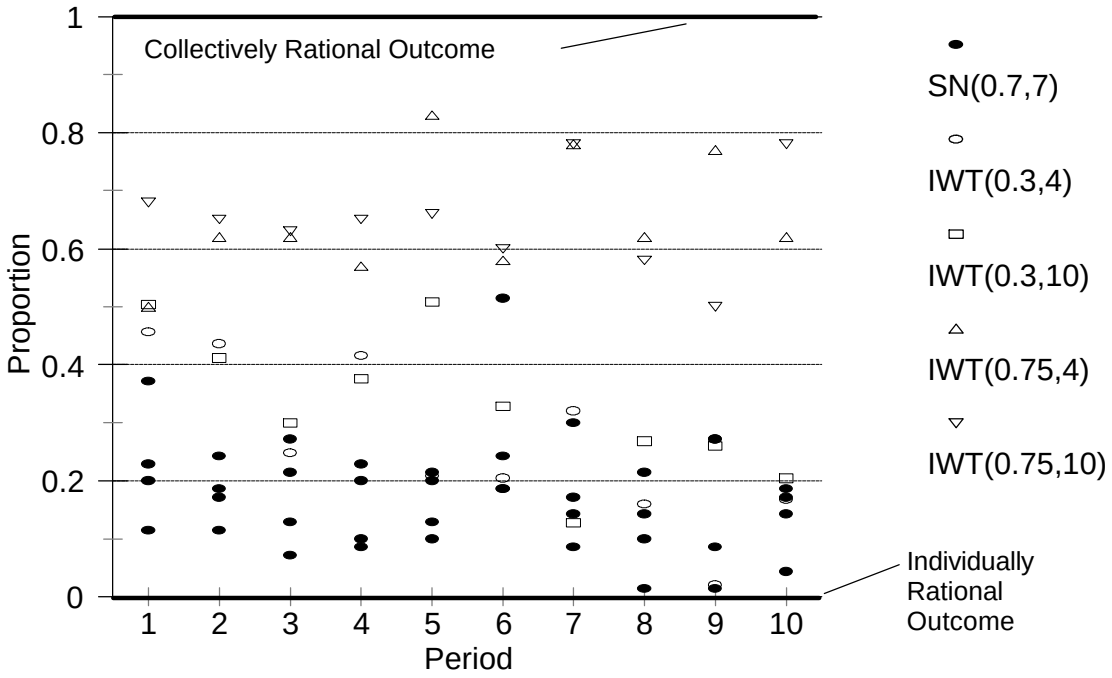

Figure 1 Proportion of Optimal Contributions Made by Eight Different Groups of Subjects Across Ten Decision Rounds When the Individual Return to the Private Activity Exceeds the Individual Return to the Group Activity (SN and IWT identify sessions from Saijo and Nakamura (1995) and Isaac, Walker and Thomas (1984) respectively; the first number in the parentheses is the marginal per capita return to the group activity and the second number in the parentheses is the number of subjects in a group)

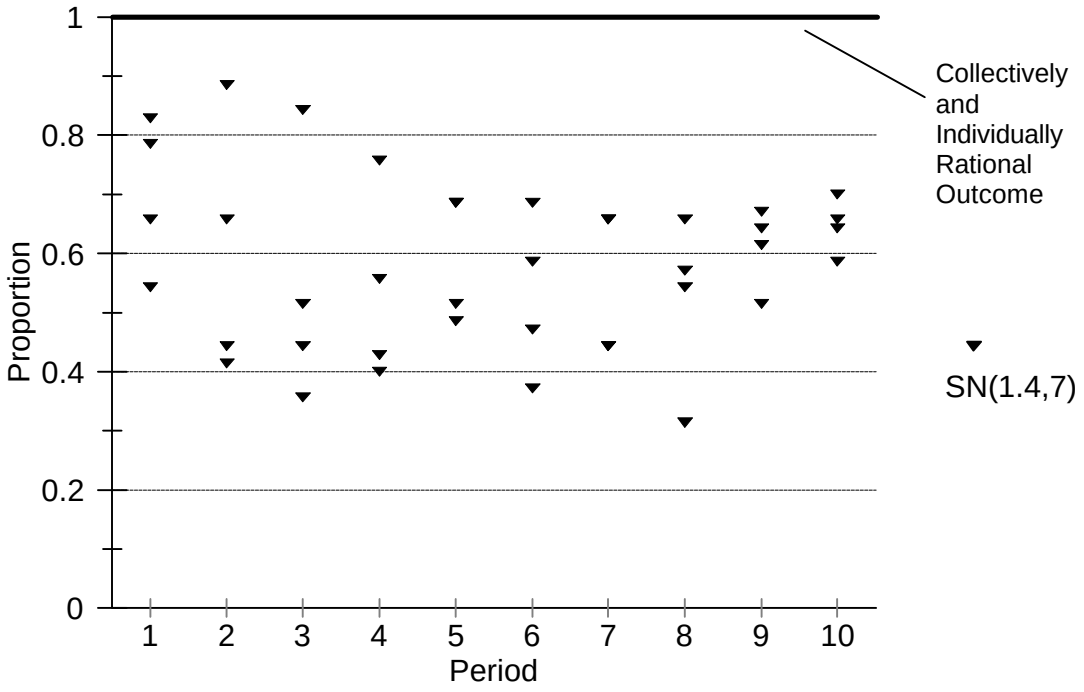

Figure 2 Proportion of Optimal Contribution Made by Four Different Groups of Subjects Across Ten Decision Rounds When the Individual Return to the Group Activity Exceeds the Individual Return to the Private Activity (SN indicates the sessions are from Saijo and Nakamura (1995) and the marginal per capita return to the group activity is 1.4 and there are 7 people in the group)

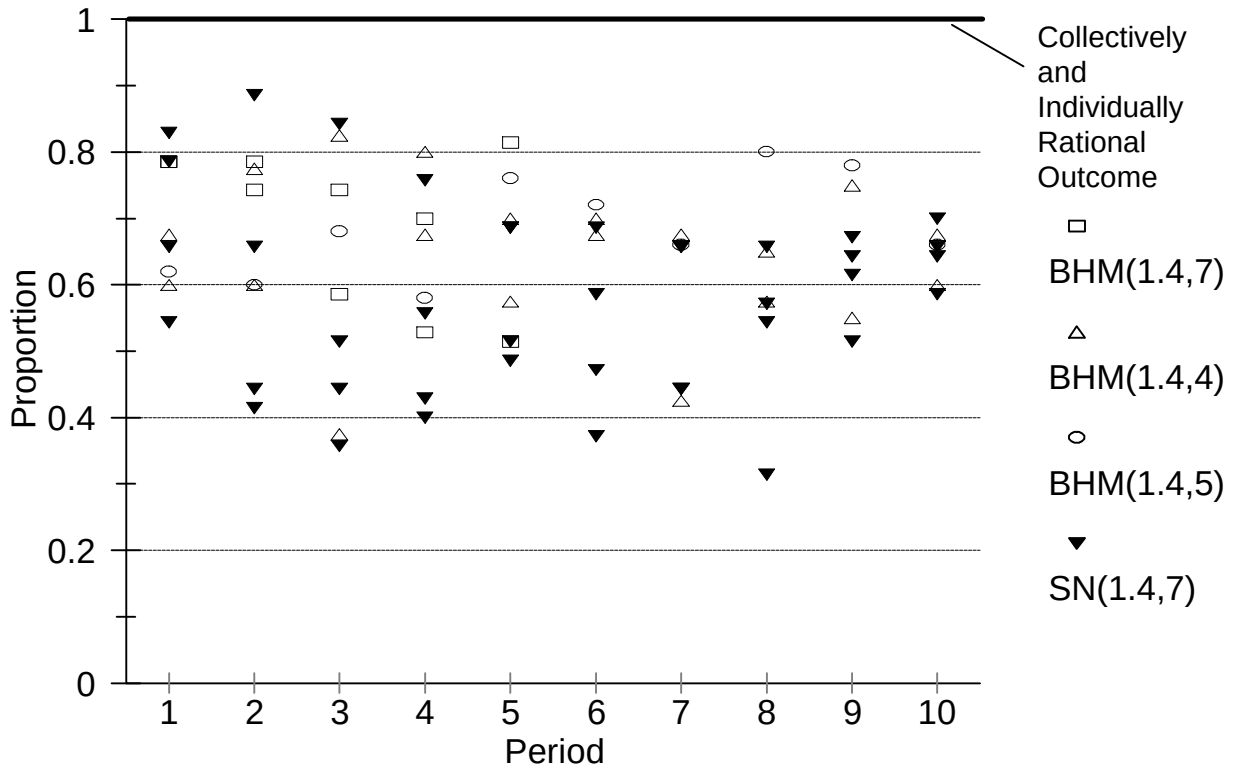

Figure 3 Proportion of Optimal Contribution Made by Eleven Different Groups of Subjects Across Ten Decision Rounds When the Individual Return to the Group Activity Exceeds the Individual Return to the Private Activity (SN and BHM identify sessions from Saijo and Nakamura (1995) and the new sessions reported here respectively; the first number in the parentheses is the marginal per capita return to the group activity and the second number in the parentheses is the number of subjects in a group)