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Asymmetry and Incomplete Information in an Experimental Volunteer's Dilemma

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Abstract: The Volunteer's Dilemma is a provision point version of the classic public goods game where, once the level is obtained, all n players enjoy the benefit of the public good. Each member faces a binary set of options including a costly decision to volunteer and a costless no volunteer choice. The volunteer's dilemma is a unique version in that only one volunteer is needed to supply the public good. Typical examples of the volunteer's dilemma range from helping potential victims of violent crime to political vetoes, where volunteering comes at a real cost, monetary or otherwise.

Following prior studies, the situation is modeled as n members of a group receiving a monetary payoff of V if at least one player volunteers at a cost of C. In the event of a no-volunteer outcome, members receive a lower payoff of L. Since V >L, the preferred outcome for any player is to not volunteer while at least one other group member volunteers. However, it is assumed that C<V–L, which makes volunteering at cost C better than a no-volunteer outcome for every individual player. The trade-off between costly volunteering and the benefit to free-riding while possibly receiving L is the dilemma. Our experimental design features 10 sessions testing cost asymmetry in the volunteer's dilemma, with complete and incomplete information, across group sizes of N = 2 and N = 6, funded by the Russell Sage Foundation.

Prior studies (e.g. Diekmann, 1985) have produced theoretical predictions and tested staged field experiments (Darley and Latane, 1968), while the experimental literature remains undeveloped. Most recently, Goeree et.al. (2005) explored the relationship between group size and volunteering, where the Nash equilibrium predicts the probability of volunteering to be a decreasing function of group size, while the probability of a no-volunteer outcome is increasing in the number of players. Testing group sizes N=2, 3, 6, 9, and 12, the authors find evidence to support the former hypothesis but not the latter.

Our study tests a variation of the volunteer's dilemma where the cost to volunteer is not symmetric across members of a group. Diekmann (1993) gives an example of three bystanders observing a victim in danger of drowning. If only one of the bystanders is able to swim, such that $C_k<C_i$, it seems apparent that the bystander who can swim should save the victim. However the Nash solution implies that the non-swimmers are expected to save the victim.

We find that increasing the cost to volunteer significantly decreases the rate of volunteering. We are also able to show that the rate of volunteering is positively correlated with other group members' costs, which suggests that people tend to take their turn volunteering when their cost to volunteer is relatively low.

Keywords: *Volunteer's dilemma, Experimental economics, Behavioral economics*

1. INTRODUCTION

Classical economic theory predicts that individuals will always act in their own narrow self-interest. In reality, individuals often consider the interest of others when making decisions. For example, individuals often decide to volunteer to help others even when doing so involves a costly action. The economics literature has tested hypotheses about other-regarding behavior in a controlled environment using experimental methods, with one such example being the classic public goods game. In this game, any individual achieves their highest payoff by not contributing to the public good, but the group as a whole does better by everyone contributing. This study examines a variation of the basic public goods game in order to gain insights into how people make decisions regarding volunteering.

Volunteering is an incredibly relevant component of society. It specifically addresses the rationale for one person helping another, while in doing so the volunteer improves the status of every member of society, either directly or indirectly. Being able to identify the different incentives behind volunteering and how to manipulate these incentives allows for the opportunity to induce an increase in the rate of volunteering, thereby increasing social welfare and improving society overall.

The volunteer's dilemma (hereafter VOD) is a provision point version of the public goods game where, once the level is obtained, all n players enjoy the benefit of the public good. Each member faces a binary set of options that includes a costly decision to volunteer and a costless no volunteer choice. The VOD is a unique voluntary contributions game in that only one volunteer is needed to supply the public good. Additional volunteers have no impact on the level of public good provided or, traditionally, the cost to volunteering.

Following prior studies of the VOD (see e.g. Goeree, Holt, and Moore, 2005), the situation is modeled as n members of a group receiving a monetary payoff of V if at least one player volunteers at a cost of C. In the event of a no-volunteer outcome, members receive a lower payoff of L. Since $V > L$, any player's optimal outcome is for at least one other member of the group to volunteer while she does not. However, it is assumed that $C < V - L$, which makes volunteering at cost C better than a no-volunteer outcome for every individual player. The dilemma comes from the incentive for each individual to wait for someone else to volunteer to avoid the associated cost.

This study goes beyond this basic environment to test variations of the VOD where the cost to volunteer is not symmetric across members of a group and where others' costs are known imperfectly. Diekmann (1993) gives an example of three bystanders observing a victim in danger of drowning. If only one of the bystanders is able to swim, such that $C_k < C_i$, it seems apparent that the bystander who can swim should save the victim. However, the solution implied by standard economic theory, shown in Diekmann and also in Weesie (1993), indicates that the non-swimmers are expected to jump in the water to save the victim.

In addition to examining cost asymmetry, our experiment also considered the role of imperfect information in the volunteer's dilemma. Continuing the above drowning victim example, this element addresses the uncertainty the bystanders face regarding each other's swimming abilities. If the group utility would be best off with the strongest swimmer volunteering, how is this determined in the face of uncertainty? The theory, explored in Weesie (1994), suggests that the individual likelihood to volunteer may actually increase with uncertainty, provided the group size is sufficiently large ($N > 2$), and incomplete information will foster, rather than hamper, efficiency. Weesie also finds that uncertainty may stifle the production of public goods in small groups. The results of our incomplete information treatments appear in Healy and Pate (2009).

Our experimental findings confirm the primary hypothesis that an increase in the cost to volunteering reduces the likelihood of an individual to volunteer. Furthermore, the rate of volunteering is positively correlated with the other group members' costs,

2. RELATED LITERATURE

Prior studies of the volunteer's dilemma have produced theoretical predictions (e.g. Diekmann, 1985) and social psychology research has tested staged field experiments (Darley and Latane, 1968), while the experimental literature remains open to further examination. Recently, Goeree et al. (2005) explored the relationship between group size and volunteering, where the Nash equilibrium predicts the probability of volunteering to be a decreasing function of group size and that the probability of a no-volunteer outcome is

increasing in the number of players. Testing group sizes N = 2, 3, 6, 9, and 12 experimentally, the authors find evidence to support the former hypothesis but not the latter. Other experimental studies include Diekmann's (1993) basic survey examining different levels of volunteer costs and Weesie and Franzen's (1998) mailed questionnaire looking at the effect of cost sharing on the probability of volunteering. Overall, this area of literature is heavily based in theoretical studies, creating ample opportunities for experimental testing.

3. EXPERIMENTAL DATA

This experiment was conducted at Loyola Marymount University with 144 undergraduate students. The design featured 10 experimental sessions testing cost asymmetry in the volunteer's dilemma, with complete and incomplete information, across group sizes of N = 2 and N = 6.

The following table describes the experimental design.

Table 1: Design

Experimental Condition	Group Size	Cost to Volunteer (C)	Information Treatment	Number of Subjects per Session	Number of Sessions
A	2	0.20/0.60	Complete	12	3
B	6	0.20/0.20/0.20 0.60/0.60/0.60	Complete	18	2
C	2	0.20/0.60	Incomplete	12	3
D	6	0.20/0.20/0.20 0.60/0.60/0.60	Incomplete	18	2

Following Goeree et al. (2005), the experimental values for V and L were \$1.00 and \$0.20, respectively. The set of possible volunteer costs varied with group size. For all sessions, each subject's cost was either \$0.20 or \$0.60 with probability p = 0.5. In the complete information treatment, subjects knew their cost and the costs drawn for other group members, although not which member had what cost. In the incomplete information treatment, the subjects knew their cost and the range of costs, though not what cost values had been drawn.

All sessions lasted 24 periods, using neutral terminology to avoid bias, using the term "invest" rather than "volunteer." The groups were randomly re-matched in every period and all subjects' identities remained anonymous to prevent reputation building. The experiment lasted approximately 45 minutes, with subjects earning approximately \$20 on average.

4. RESULTS

4.1 Overview

The experimental data support two primary results. First, subjects were significantly more likely to volunteer when the costs to volunteering were low (c = \$0.20). Next, subjects were more likely to volunteer when the other group members faced a high cost (c = \$0.60). Together this evidence suggests that people attempt to volunteer efficiently, that is, they volunteer when most necessary to ensure the public good is provided.

4.2 Symmetric Costs

Table 2 shows the rate of volunteering under each of the experimental treatments. Over both group sizes and levels of information, we find an average volunteer rate of 42%. However, considering the volunteer rates by treatment category provides a clearer picture of the subjects' behavior. Comparing the second row (with a low cost draw, V% when c = \$0.20) to the third row (with a high cost draw, V% when c = \$0.60), subjects are significantly more likely to volunteer when they face a low cost regardless of group size and

information structure. Overall, subjects with a low cost volunteered 62.2% of the time versus when they faced a high cost, when this rate fell to 21.7%.

Table 2: Summary Results

	Full Information			All (including Incomplete Information sessions)		
Group Size	2	6	All	2	6	All
Volunteer Percentage	48.3	26.6	37.5	52.8	31.1	41.9
V% when C=\$0.20	71.0	39.6	55.3	74.6	49.9	62.2
V% when C=\$0.60	25.9	13.7	19.8	31.1	12.4	21.7
V% when C_i=\$0.20 C_{-i}=\$0.20	51.4	25.9	38.7	65.7	45.4	55.6
V% when C_i=\$0.60 C_{-i}=\$0.60	37.0	20.8	28.9	35.7	15.5	25.6
V% when C_i=\$0.20 C_{-i}=\$0.60	91.9	53.2	72.6	84.2	54.4	69.3
V% when C_i=\$0.60 C_{-i}=\$0.20	15.7	6.5	11.1	26.8	9.3	18.1

Table 2 further partitions the results into four distinct circumstances; when all subjects in a group face a cost of \$0.20, when all subjects in a group face a cost of \$0.60, when the subject has a cost of \$0.20 and at least one other group members has a cost of \$0.60, and when the subject has a cost of \$0.60 and at least one other group member has a cost of \$0.20.

First considering the cases with symmetric costs, the volunteer rate falls from 55.6% when c = \$0.20 to 25.6% when c = \$0.60. Since the payoffs are designed such that any participant would prefer to volunteer rather than to have a no-volunteer outcome, it appears that subjects may be attempting to share the responsibility of volunteering when costs are low, volunteering about half of the time when n = 2 and around 25% of the time when n = 6. In contrast, when the cost to volunteer is high for everyone, the volunteer rate falls to around 25%. However, looking deeper into this figure, we find that this is primarily driven by groups with 6 members and that the average volunteer rate when n = 2 is approximately 36%. These findings confirm the main hypothesis that an increase in the cost to volunteering reduces the likelihood of an individual to volunteer.

4.3 Asymmetric Costs

The asymmetric cost treatments tell another story. Focusing on the bottom two rows, both the highest and lowest volunteer rates overall are realized, exactly where they are expected. When n = 2 and one subject faces a low cost while the other group member faces a high cost, the low cost subject volunteers around 92% of the time. Although this rate falls to 53% when n = 6, this is still a high volunteer rate given that, with a group of 6, at least two other group members also have a low cost. In sharp contrast is the last row, which reports the volunteer rate when the subject faces a high cost and at least one other group member faces a cost of \$0.60. In this case, the volunteer rate falls to 15.7% when n = 2 and hits its lowest value when n = 6, at a rate of 6.5%.

Combined, the asymmetric treatments demonstrate that a subject's relative cost to volunteer, as compared to their other group members, is also important. We find that the rate of volunteering is positively correlated with other group members' costs, which suggests that people tend to take their turn volunteering when their cost to volunteer is relatively low. In more general terms, this means that people are more likely to volunteer when their cost is low, or when they know that other potential volunteers face a higher cost.

To confirm the significance of our findings we ran multiple regressions, with the results appearing in Table 3. Each column represents an independent regression with the dependent variable in the first row of the table. The first column tests the impact of group size, information, and cost on the rate of volunteering. The focus of the remaining columns (2-7) is narrowed to examine each treatment specification in greater detail. All of the regressions controlling for a subject's major, experience with paid experiments, and the number of completed semesters in college.

Table 3: Regression Results[a]

	Volunteer Percentage (V%)	V% when c = \$0.20	V% when c = \$0.60	V% when c_i = \$0.20 c_{-i} = \$0.20	V% when c_i = \$0.60 c_{-i} = \$0.60	V% when c_i = \$0.20 c_{-i} = \$0.60	V% when c_i = \$0.60 c_{-i} = \$0.20
Group Size (=1 if N=6)	-0.16*** (0.04))	-0.238*** (0.08)	-0.28*** (0.69)	-0.15 (0.10)	-0.27*** (0.94)	-0.32*** (0.10)	-0.28*** (0.79)
Information (=1 if Full)	-0.10* (0.05)	-0.094 (0.09)	-0.17** (0.76)	-0.33*** (0.11)	-0.46 (0.10)	0.13 (0.11)	-0.28*** (0.87)
Cost to Volunteer (=1 if High)	-0.42*** (0.02)						
R-squared	0.419	0.344	0.358	0.406	0.268	0.335	0.362

[a]Robust standard errors are in parenthesis; ***, **, and * denote significance at 1%, 5%, and 10%, respectively.

The first column indicates that, overall, increasing the group size from 2 to 6, increasing the amount of information, or increasing the cost to volunteer decreases the rate of volunteering. Each of these coefficients is significant and together they confirm the summary results from Table 2.

Examining the different treatments further, we find that group size is relevant in all cases except when all group members face a low cost. The relative impact of group size on the volunteer rate is similar under both low and high cost scenarios. Also, the amount of information provided to subjects impacts the volunteer rate only when it is known that another group member faces a low cost.

5. CONCLUSION

While theorists have investigated how people should behave in the Volunteer's Dilemma, only recently have social scientists started to use experimental techniques to investigate how people really behave in a carefully controlled environment. We contribute to the literature by examining how the cost to volunteer, along with cost asymmetry, affect the willingness of people to volunteer to provide a public good for their group.

We find that increasing the cost to volunteer significantly decreases the rate of volunteering. We are also able to show that the rate of volunteering is positively correlated with other group members' costs. Together, this means that people are more likely to volunteer when their cost is low, or when they know that other potential volunteers face a higher cost.

In the context of earlier examples, these results suggest that if someone is drowning and there are two people nearby, then the person who is a better swimmer should jump in to rescue the victim. Notice that this does not necessarily mean that the volunteer must be a good swimmer, but rather that this person is a better swimmer than the other potential volunteer.

These results contribute to the development of accurate models of behavior and to our understanding of the reasons why people choose to volunteer when that action entails a personal cost. If increasing the rate of volunteering would increase social welfare, then understanding the motives behind volunteering allows for the opportunity to manipulate these incentives to improve society.

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