Citizens' Juries and Public Goods*

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Abstract

A citizens' jury is a small group of individuals acting on behalf of society, convened to deliberate over social issues and recommend or assess government policies. While citizens' juries have been employed in many situations, there is no consensus on how to interpret the values implied by their decisions. In a controlled economic experiment we find that, given the authority to collect and allocate funds on behalf of society to provide a public good, citizens' juries: a) choose more efficient outcomes than the population they represent, b) are more "rational" than the average juror in terms of looking out for their own self-interest, and c) are concerned about equality, but only after maximizing personal gain.

1. Introduction

Citizens' juries offer a non-market alternative for allocating scarce resources in the presence of a public good. A citizens' jury is somewhat analogous with a trial jury; it is a small group of representatives acting on behalf of society, but instead of deciding the verdict in a legal matter, a citizens' jury is convened to deliberate over social issues and recommend or assess government policies (Brown, et al 1995, Howarth and Wilson 2006,

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Kenyon and Nevin 2001, Sagoff 1998, and Wilson and Howarth 2002). For example, juries have been used to: help electric companies choose an appropriate mix of renewable and nonrenewable resources and conservation efforts in Texas; appraise the decision whether or not to adopt the Euro currency in Denmark; rank alternative infrastructure projects in Wenling City, China; evaluate wetland restoration projects in the Tillamook Bay estuary, Oregon; assess national park management in Australia; and investigate options for implementing the European Water Framework Directive on the Cidacos River in Navarra, Spain.[1]

These types of decisions have traditionally been made by professional policy makers or politicians who are susceptible to corruption or disproportionate influence from special interests. In a representative government like the United States', many policy makers are held accountable through periodic elections, but some authors have argued that citizens' juries offer an alternative more in line with Locke's democratic concept of governance by, for, and with the consent of the governed (DeLeon 1997, Howarth and Wilson 2006, Sagoff 1998.)

While the feasibility of using citizens' juries to assess public policy has been demonstrated, there is no consensus on how to interpret the values implied by their decisions (Alvarez-Farizo and Hanley 2006, Kenyon and Nevin 2001). Competitive markets are thought to be inefficient at providing goods that are jointly consumed by an entire population because individually, each citizen/taxpayer has an incentive to withhold voluntary contributions to the public good and free-ride on the generosity of others (Hardin 1968, Samuelson 1954). The more free-riders there are, the less public good that is supplied and the less efficient the outcome. If a citizens' jury were given the authority to collect and allocate funds on behalf of society to provide a public good, would they choose a more efficient outcome? A more fair outcome? The fear of giving "oligarchical" power to a small group is, of course, that they would take advantage of their position and impose their personal preferences on the rest of society. Would the members of a citizens' jury collude to make themselves better off at the expense of everyone else?

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[1]For more examples, see Fishkin, J. S. (2006). "The nation in a room: turning public opinion in to policy," *Boston Review*, March/April

In many situations it is impossible to answer these questions because the efficient level of public goods provision is unknown and there is no consensus on how to measure “fairness.” We develop in the following section a controlled economic experiment in which *citizens’ juries* deliberate over the payoffs of a larger population in a variation of the classic *public goods game*. Asking a subsample of the participants in a public goods game to discuss and decide by mutual agreement, the level of public contributions, and therefore the distribution of outcomes, for all participants, on behalf of all participants, represents a parallel situation to that facing a real citizens’ jury, but without the moral, political and scientific confusion often associated with specific public goods like clean air and water, military defense, education, and public health and safety.

The mock juries’ decisions are summarized in terms of economic efficiency and various measures of fairness founded in moral philosophy, political economics and cooperative game theory. The results of the experiment are discussed in detail below, but some general conclusions that can be drawn are: a) citizens’ juries, as a group, are more “rational” than the average juror in terms of looking out for their own self-interest; b) they choose more efficient outcomes than the population they represent; c) juries are concerned about equality, but only after maximizing personal gain; and d) jurors may be willing to sacrifice some efficiency to ensure fairness.

2. A Citizens’ Jury Game

In a voluntary-contributions-public-goods game with no communication, each participant receives an endowment that must be divided between private and public accounts. The private account is like a saving account and the return is usually one for one. Contributions to the public account are increased by a public goods multiplier, but divided among all participants (an abstract, pure public good).[2] Non-cooperative game theory predicts that expected utility maximizing individuals will not contribute to the public good at all, but free-ride on the contributions of others. This leads to a less than efficient outcome because the combined social payoffs are highest when all players contribute their entire endowment to the public account, receiving the full benefit of the

[2] Some real-world public-goods that rely on voluntary contributions include public libraries, volunteer fire departments, and charities. Competitive markets also rely on voluntary exchange.

public goods multiplier. Historical research indicates that participants in the public goods game with no communication neither completely free-ride nor choose the efficient, full-contribution strategy on average, but contribute about half of their endowment in the first round and decrease their contributions thereafter, decreasing social payoffs (Davis and Holt, 1994, Ledyard, 1995, and Zelmer, 2006).

The incentive to free-ride can be lessened by introducing a minimum public contributions threshold, or provision point mechanism (PPM), with full refunds if the PPM requirement is not met. With the PPM participants only receive the benefit of the public goods multiplier if their contributions add up to at least some minimum requirement. With the full refund rule, all public contributions are returned to players if the PPM is not met, but contributions in excess of the PPM are not refunded. Any combination of public contributions that exactly sum to the PPM threshold is economically efficient, maximizing social payoffs. To achieve one of these outcomes, though, players must solve a two-part coordination problem. The decision to provide the public good is a dichotomous choice – positive if the PPM requirement is met, negative otherwise. If the good is provided, players must also determine the distribution of contributions. As long as the PPM is met, each individual still has an incentive to "cheap-ride" (Isaac and Walker 1989). That is each player is better off if they contribute less to the public good than the other players because everyone enjoys the public good equally, regardless of who pays for it. Some experiments seem to support the theory that introducing a PPM increases contributions and adding a refund further enforces this trend (Isaac and Walker 1989, Messer, et al. 2007), but the cumulative evidence shows mixed results (Marks, et al. 2006). Assigning heterogeneous endowments to participants introduces an income distribution component to the game that seems to reinforce the incentive to cheap-ride (Zelmer 2006).

In each trial of our Citizens Jury experiment 20 individuals participate in three rounds of a public goods game with a PPM and full refund of contributions if the threshold is not met, and heterogeneous endowments. The first two rounds are conducted in a non-cooperative setting – the payoffs for each round are decided by the private allocation decisions of each individual participant without communication or discussion. At the end of the two initial rounds, participants are separated into four smaller groups, five people in each, and asked to deliberate over the outcome of a third and final round of the public goods game - each of the *mock juries* is instructed to choose, by mutual agreement, the contribution level for each individual in the entire population (themselves and everyone else as well).

At the beginning of each round, half of the participants (10) are endowed with 8 tokens and the other half are given 10 tokens. Players are instructed to distribute their entire endowment between a private savings account and a group account that provides a total of 240 tokens to be divided among everyone if at least 60 tokens are contributed to the group account. If the PPM requirement is met, each individual receives their share of the public account (240/20=12 tokens) plus whatever tokens remain in their private accounts. If fewer than 60 tokens are contributed all tokens are returned to the private accounts and each player gets to keep his or her endowment in tokens. At the end of the experiment tokens are remitted at a rate of $0.50 each (see Appendix).

The Pareto Efficient outcome in each round of the experiment maximizes total social payoffs, which are the sum of individual payoffs, X_i,

$$\sum X_i = \begin{Bmatrix} \sum Y_i & if \sum g_i < 60 \\ \sum (Y_i - g_i) + G & if \sum g_i \geq 60 \end{Bmatrix} \tag{1}$$

where $Y_i = \{8,10\}$ is individual *i*'s endowment, $i = 1\{,2,3,...,n\}$, $n = 20$ is the population size, $g_i = Y_i - x_i$ is individual *i*'s contribution to the public good, which is equal the endowment minus whatever is kept in the private account, x_i, and $G = 240$ is the value of the public good. Table 1 shows how the social payoffs in each round depend on the total public contributions of every player.

If the PPM threshold of 60 tokens is not met, all 20 participants keep their original endowments in tokens for an aggregate social payoff of ((10*8)+(10*10)=180) tokens. Any combination of contributions to the public good that exactly sum to 60 tokens triggers the public goods multiplier and players earn a 240 token bonus to be shared by all. The total payoffs for any of these outcomes are socially efficient with a total return of (240+(180-60)=360) tokens. Over contribution to the public good is penalized token for token because contributions in excess of the 60 token minimum are not refunded. If all 180 tokens are contributed to the public good the public good of 240 tokens is received, but no tokens remain in players' private accounts.

Table 1: Social Payoffs

Total Public Contribution	Social Payoffs
< 60	180
60	**360**
80	340
100	320
120	300
140	280
160	260
180	240

The non-cooperative, Nash Equilibrium for each round maximizes individual payoffs,

$$X_i = \begin{cases} Y_i & if \sum g_i < 60 \\ \frac{G}{n} + (Y_i - g_i) & if \sum g_i \geq 60 \end{cases} \tag{2}$$

Note that there is not a strong incentive to free-ride because $Y_i < \frac{G}{n} + (Y_i - g_i)$ no matter what g_i is, but $\frac{\partial X_i}{\partial g_i} < 1$ when $\sum g_i \geq 60$, so there is an incentive to cheap-ride. Tables 2 and 3 show how the payoffs for participants originally endowed with 10 and 8 tokens, respectively, depend on the total contributions of all other players. An individual's contributions are only relevant over a limited range of outcomes. If the sum of all other players' contributions is less than 50 (52), even if a player with 10 (8) tokens contributed everything to the public account the 60 token PPM would not be reached and all tokens returned to each player.

The payoffs along the diagonal, shown in boldface type, illustrate the tipping point at which an individual's contribution become decisive. In each of these outcomes total public contributions are exactly 60 tokens and each individual receives his or her share of the public good, 12 tokens, plus whatever tokens remain in the private account. As noted above, these are all socially efficient outcomes, but they are also weak Nash Equilibria because no individual has an incentive to unilaterally change their contribution beginning from any of these outcomes. A lower contribution would result in not satisfying the PPM and a larger contribution would leave fewer tokens in the private account.

Table 2: Individual Payoffs (endowment = 10)

Sum of Others Contributions	Individual Contribution to Public Good										
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
< 50	10	10	10	10	10	10	10	10	10	10	10
50	10	10	10	10	10	10	10	10	10	10	**12**
51	10	10	10	10	10	10	10	10	10	**13**	12
52	10	10	10	10	10	10	10	10	**14**	13	12
53	10	10	10	10	10	10	10	**15**	14	13	12
54	10	10	10	10	10	10	**16**	15	14	13	12
55	10	10	10	10	10	**17**	16	15	14	13	12
56	10	10	10	10	**18**	17	16	15	14	13	12
57	10	10	10	**19**	18	17	16	15	14	13	12
58	10	10	**20**	19	18	17	16	15	14	13	12
59	10	**21**	20	19	18	17	16	15	14	13	12
> 59	**22**	21	20	19	18	17	16	15	14	13	12

Table 3: Individual Payoffs (endowment = 8)

Sum of Others Contributions	Individual Contribution to Public Good								
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
< 52	8	8	8	8	8	8	8	8	8
52	8	8	8	8	8	8	8	8	**12**
53	8	8	8	8	8	8	8	**13**	12
54	8	8	8	8	8	8	**14**	13	12
55	8	8	8	8	8	**15**	14	13	12
56	8	8	8	8	**16**	15	14	13	12
57	8	8	8	**17**	16	15	14	13	12
58	8	8	**18**	17	16	15	14	13	12
59	8	**19**	18	17	16	15	14	13	12
> 59	**20**	19	18	17	16	15	14	13	12

If the 60 token PPM is to be satisfied, players must coordinate the distribution of contributions. For example, beginning in the bottom right hand corner of either individual payoff table, when an individual contributes all of his or her tokens to the public account and the PPM threshold is surpassed that person receives 12 tokens. Moving one cell to the left, however, notice that the individual is even better off if they contribute less to the public account, keeping more in their own private account. In fact, no matter what the sum of other players' contributions is there is always an incentive to "cheap-ride". As long as everybody else contributes enough, the less an individual gives to the public good, the higher their final payoff. In the extreme, the payoffs in the bottom left corner of the payoff tables show that the highest individual payoffs are achieved when all other players contribute enough to supply the public good, but the individual completely free-rides, contributing nothing.

Because payoffs in the experiment are jointly determined, participants may not only care about their own earnings, but everyone else's as well. Social preferences may reflect participants' feelings about fairness, justice, and altruism, or envy and revenge. If a person's feelings towards others are paternalistic, they may choose to over-contribute to the public account in order to ensure that the public good is supplied (McConnell 1997).

Another simple solution that achieves Pareto Efficiency is for all 20 players to contribute 3 tokens apiece. The 60 token PPM is exactly met so every player receives 12 tokens from the public good, but players who started out with more tokens also end up with more; players endowed with 10 tokens receive a final payoff of 19 and players endowed with 8 tokens get only 17. Depending on how participants view issues of fairness and justice, this outcome may or may not be acceptable. The moral philosopher John Rawls, for example, argued that if people could see the world from behind a "veil of ignorance", not knowing whether they are going to be one of the relatively well-off or less-fortunate members of the population, they would choose to improve the welfare of the least-fortunate, just in case (Rawls 1971). In terms of the Citizens' Jury game, these social preferences are described by the objective function,

$$\max\{\min(X_i)\} \tag{3}$$

With repetition, this *maximin* strategy can be interpreted as leading to a perfectly equal outcome. Wealth is continually redistributed from the wealthiest to the poorest until there is no more inequality.[3]

One example in our experiment that results in equal outcomes is when all players contribute their entire endowment to the public account. In this case everyone receives 12 tokens from the public account but no tokens remain in any private accounts. Even though this is not an efficient outcome, it is a Pareto improvement over the original

[3] Rawls' theory was developed in terms of, "access to primary goods," but is often interpreted in terms of total income, wealth, or utility.

endowments (because each player is better off) and might be viewed as more fair (because it results in equal payoffs). There is no need to sacrifice efficiency to achieve Rawlsian justice in this game, though. If the 10 players originally endowed with 10 tokens contribute 4 tokens each and the 10 players originally endowed with 8 tokens contribute only 2 tokens each, the 60 token PPM is exactly met, resulting in a socially efficient outcome, and payoffs are 18 tokens per player, regardless of initial endowment.

Philosopher Robert Nozick, in contrast, argues that fairness should not necessarily be measured in terms of outcomes, but in terms of opportunities (Nozick 1974). As long as everyone is allowed to compete under the same rules, unequal outcomes can still be fair as long as everyone's rewards are in proportion to their contributions. If participants in our experiment don't feel any responsibility to correct the initial uneven distribution of endowments, the 3 token, equal contributions solution might be considered fair; each player's reward, the 12 token return from the public good, is proportionate to their 3 token contribution. This fair-process outcome is the solution to the social welfare function,

$$\max\left\{\min\left(\frac{X_i - Y_i}{g_i}\right)\right\} \tag{4}$$

Table 4 describes the different strategies available to participants depending on whether they make their decisions based on private or social preferences. If individuals make decisions based on their private preferences they should either choose to cheap-ride, contributing less than their fair share to the public good, or completely free-ride, contributing nothing. If they express paternalistic altruism they will over-contribute, and if they reference their social preferences they might choose a level of contributions consistent with either a fair-outcome or fair-process result.

Table 4: Strategies for Choosing the level of Public Contributions

	Public Contributions	
Strategy	**$Y_i = 8$**	**$Y_i = 10$**
Over-Contribute	>3	>4
Fair-Outcome	2	4
Fair-Process	3	3
Cheap-Ride	1	1 or 2
Free-Ride	0	0

3. The Non-cooperative Game

On December 4, 2007, we conducted two trials of the Citizens' Jury Experiment. In each trial 20 individuals participated in three rounds of the public goods game described above. Participants were recruited over a two week period on the University of New Mexico campus from undergraduate classes in the college of liberal arts.[4] Students were told that they would have the opportunity to earn between $12 and $33 for participating, but the exact amount earned would depend on decisions made during the experiment.

The experiments began with participants reading along as the instructions for the game were read aloud (see Appendix). The rules of the game were explained and two examples were presented to illustrate how payoffs in the experiment are determined. Then the first two rounds of the experiment were conducted with no communication and payoffs were determined by the private decisions of each participant. Participants' public contributions for these two rounds are summarized in Table 5.

Table 5: Summary of Public Contributions with No Communication

	Trial 1		Trial 2 *	
Strategy	**Round 1**	**Round 2**	**Round 1**	**Round 2**
Over-Contribute	35%	30%	35%	30%
Fair-Outcome	30%	25%	30%	25%
Fair-Process	25%	15%	20%	30%
Cheap-Ride	10%	15%	0%	5%
Free-Ride	0%	15%	15%	10%
Total Contributions	74	60	71	65
Avg. Contributions	3.70	3.00	3.55	3.25
Earnings Dispersion Ratio	0.86	0.72	0.72	0.76

* Trial 2 was conducted with 19 participants, but payoffs were determined as if there were 20 – the average public contribution in each round being attributed to the missing player.

In both trials, participants contributed at least the 60 token minimum PPM in each of the first two rounds. In every round of non-cooperative play, over-contribution was the most common strategy, followed by the fair-outcome contribution strategy. Also, in both trials, total contributions decreased from the first round to the second. In the first trial, 85% of participants changed their decision between the first and second rounds and

[4] Recruitment fliers were handed out in undergraduate geography, biology, history, chemistry, and economics classes.

75% of those decreased their contribution. There was less over-contribution in the first round of the second trial than in the first, but 7 of the 15 players who changed their decisions between rounds chose to contribute less. Participants only achieved Pareto Efficiency once, in the second round of the first trial, but this outcome was highly unequal, with nearly a third of all participants either cheap- or free-riding. Only one participant consistently chose the non-cooperative Nash Equilibrium of zero contributions in both of the first two rounds.

Despite all of the free-riding and over-contribution, nearly half of all participants contributed a *fair* amount to the public food in every round (in either the outcome or process sense). Contributions consistent with a fair-outcome result were more common, but also decreased in the second round of both trials. The variation in strategies followed both between players and between rounds led to a wide distribution of payoffs. The minimum payoff in each round was 14 and the maximum was 22. The earnings dispersion ratio, or the average payoffs among the bottom quintile of earners compared with the top quintile, was an average 0.765. With a fair-outcome result the ratio would be 1.0; with a fair-process result it would be 0.895. The initial endowments' dispersion ratio is 0.80.

In summary, without communication participants in the two trials of the Citizens' Jury experiment were unable to coordinate a fair and efficient outcome. Given the authority, would a jury choose differently? To find out we divided the 20 participants in each trial into four groups with five people in each and asked them to deliberate over contributions and outcomes for the third and final round of the Citizens' Jury experiment. Instead of each individual deciding how much to allocate to the public good, each of the eight *mock juries* decided on their behalf.

4. Bargaining

There are two well-known economic theories that predict how individuals might negotiate over outcomes in similar situations. The Coase Theorem predicts that two, expected utility maximizing individuals with perfect information, equal bargaining power and zero transaction costs will negotiate a Pareto Optimal (efficient) solution to an externality problem (an externality is like a negative public good), regardless of which individual is awarded the initial property rights (that is, regardless of the initial distribution of resources). The Coase Theorem has been experimentally demonstrated to yield accurate predictions when all conditions are met, but does not do as well otherwise (Hoffman and Spitzer, 1982).

Increasing the number of individuals involved in bargaining situations also increases transaction costs and decreases the chances of all participants reaching a consensus. It is also unlikely that all participants will have equal bargaining power. Research in social psychology shows that group discussions can be affected by the preconceived social status differentials of participants (Stasser 1995), pre-existing personal preferences and biases, and the tendency to focus on shared information (Stasser 1985, Schittekatte 1996). The Coase Theorem also depends on the assumption that property rights can be assigned, but that is precisely the problem society faces with a pure public good that is equally shared by all.

The Nash Solution from cooperative game theory also predicts that two individuals will negotiate an efficient allocation of resources, as long as it results in a fair-outcome distribution. When achieving a fair distribution requires sacrificing efficiency, however, the Nash Solution predicts that individuals will negotiate a compromise resulting in less than complete fairness and less than complete efficiency (Nash 1950). Experiments in bilateral bargaining have shown that participants are likely to choose the Nash solution when a fair and efficient outcome can be reached, but if efficiency must be sacrificed to achieve fairness, rather than making a compromise, they are more likely to choose the fair-outcome result (Nydegger and Owen 1975). While tests of the Nash Solution are framed in the two-player, private-good context, previous research also shows that allowing participants in a multi-player, voluntary contributions public goods game to communicate with one another increases contributions to the public account, but does not necessarily result in an efficient level of contributions (Zelmer, 2003).

The social welfare function that describes the Nash Solution is,

$$\max\left\{\prod X_i\right\} \tag{5}$$

Because there is an outcome available that is both efficient and fair in the Citizens' Jury game, solving Equation 5 results in an outcome that also maximizes Equation 1 and simultaneously satisfies Equation 3. The Nash Solution in the Citizens' Jury game is the same fair-outcome solution described above, with high-endowment players contributing 4 tokens to the public good and low-endowment players contributing 2 tokens each. The difference, between the two interpretations is that while Rawls envisioned citizens acting out of empathy towards others, Nash saw his solution as a practical result of compromise between self-interested parties involved in negotiations. In the Citizens' Jury experiment, though, the incentive to compromise is diminished because only a fraction of all interested parties are involved in deliberation.

Regardless of the motivation, however, it seems likely that a jury would choose an efficient outcome in the game, but would jurors take advantage of their authority and enrich themselves at everyone else's expense? This is the assumption behind political economics models of government corruption and is described by the objective,

$$\max\left\{\sum X_j\right\} \tag{6}$$

Where $j = \{1,2,3,4,5\}$ represents only the individual's with decision making power. If jurors choose to collude in the Citizens' Jury experiment, they could choose an outcome where none of the jurors make any contribution to the public good them selves, but free-ride on the rest of the population, collecting the 60 token PPM from the remaining 15 participants.

5. The Juries' Decisions

In each trial of the Citizens' Jury Experiment, payoffs for the third and final round of the public goods game are decided by a jury. Participants are separated into four sub-groups and told to deliberate over the outcome of the game; choosing how many tokens to collect for the public good and from which players. After all four citizens' juries have reached their decisions, one of them is chosen at random to be implemented, so each jury has the incentive to treat their decision as if it is binding.

Of the eight juries conducted, only two of them decided to contribute any tokens to the public good themselves (one from each trial). One of these two chose the efficient and fair-outcome Nash Solution, and the other chose the efficient and fair-process, equal contribution result. The remaining six juries each colluded to free-ride off of the coerced contributions of non-jurors.

Having secured their own fortunes, however, each of the six free-riding juries showed concern for the distribution of payoffs among other players; all six required non-jurors originally endowed with more tokens to make higher contributions. Three of the juries were even willing to sacrifice some efficiency to increase equality. (Note that whether or not the outcome is efficient doesn't affect jurors' private payoffs as long as the PPM threshold is reached). One of these three resulted in equal payoffs for all non-jurors, one resulted in high-endowment players receiving payoffs only one token greater than low-endowment players, and the final one was the opposite, with low-endowment players receiving a one-token bonus over high-endowment players.

Table 6: Summary of Jury Decisions

Trial	Jury	Efficient	Free-Ride	Redistribution	Retaliation
1	1	Y	Y	Y	Y
	2	Y	N	Y	N
	3	N	Y	Y	N
	4	Y	Y	Y	N
2	1	N	Y	Y	N
	2	Y	Y	Y	Y
	3	Y	N	N	N
	4	N	Y	Y	Y

The remaining three free-riding juries chose Pareto Efficient outcomes. Two of these can be describes as retaliatory. These juries, each one consisting of all low-endowment players, included their fellow low-endowment players in the free-riding and required each of the 10 high-endowment players to contribute the full PPM – six tokens apiece. The result of this strategy is that all low-endowment players receive payoffs that are four tokens greater than high-endowment players.[5] The other free-riding jury that chose an efficient level of contributions resulted in half of the non-juror-low-endowment players receiving the same payoffs as the non-juror-high-endowment players and the other half receiving one token less. It seems that they were willing to sacrifice some equity in order to achieve efficiency. The juries' decisions are summarized in Table 6.

[5] This could be interpreted as a just outcome because it redresses institutional inequity in the previous, non-cooperative rounds.

6. Conclusion

The Citizens’ Jury experiment provides a useful framework for beginning to understand deliberative methods. Even in the controlled experimental setting, though, the decisions reached by citizens’ juries concerning the allocation of public goods are varied and unpredictable; only two of the mock juries’ decisions were the same. Despite the inconsistencies, we can draw some general conclusions about citizens’ juries from the experiment. Seventy-five percent of the juries chose to completely free-ride on the public-good, suggesting citizens’ juries may be just as susceptible to corruption as elected officials or private stakeholders. Only five of the eight juries chose Pareto efficient outcomes, but seven chose outcomes at least as efficient as either of the non-cooperative rounds, and all but one chose to redistribute wealth to low-endowment players. Rather than promoting either private or social preferences, then, it seems that deliberation encourages lexicographical preferences – juries are concerned about social efficiency and justice, but only after maximizing personal gain.

This combination of economic rationality and social morals may be particularly conducive to aggregation. Traditional methods of non-market valuation such as stated- or revealed-preferences rely on the assumptions of economic rationality and aggregation of private, individual values, but critics of these methods point out that when public goods are involved social values may be more relevant. Whereas traditional methods assume that the individual asks herself, “What is best for me?” when evaluating the situation, a jury member might ask, “What is best for everybody?” (Sagoff 1998). Our experimental results suggest that the decisions reached by citizens’ juries reflect both social and private values. If we take the average of all eight juries’ contribution decision for each player in the citizens’ jury experiment (rounded to the nearest whole token) we get the Nash solution, an efficient and fair-outcome result.

To really understand the choices that citizens’ juries make will require more research. There are two lines of work to follow-up with further research; experimental and applied. First, future investigation of citizens’ juries should tests the sensitivity of outcomes to control variables. In our experiments the population size, jury size, public goods multiplier, PPM threshold, endowment size and distribution, and number of rounds are all held constant. Changing any of these variables will either expand or contract the options available to citizens' juries.

Second, while these experiments are useful for investigating how juries would allocate an abstract, pure public good, real world issues can be more complicated. Most pubic goods are neither entirely non-excludable nor completely non- rival, but lie somewhere along the spectrum between purely private and purely public. Also, attitudes towards real world public goods are often influenced by public discourse and framing. Even the simple act of naming the public goods in our experiment might influence juries' behavior.

Outside of the experimental setting, however, the decisions that citizens' juries reach are harder to assess because the "true" value of public goods is unknown. Nearly all of the economic research on using Citizens' Juries has been focused on comparing the jury method with traditional, survey-based, stated preference methods. Participants are initially presented with a typical contingent valuation or choice experiment survey instrument to provide information and solicit pre-existing, private willingness to pay estimates. Juries, consisting of multiple sub-groups of the survey population, are then convened to deliberate over the same issues. Theoretically, the deliberation process reinforces the educational part of the survey instrument, allowing jurors more time to digest the information provided, request addition information or clarification, and share with each other private information. All of this, it is argued, may help individuals better form their own private preferences for the particular public good under consideration, and might also encourage "social" preferences.

After deliberations, individuals are re-surveyed privately and then the multiple juries are asked to answer choice questions parallel to those included in the survey, either by mutual agreement or majority rule. This framework allows for three comparisons, pre-deliberation vs. post-deliberation individual values, pre-deliberation private values vs. the consensus jury values, and post-deliberation private values vs. the consensus jury values. Not surprisingly, researches have found that deliberation affects both preferences and values, but it is still not apparent how to interpret these changes. In order to make the comparisons, the researches must aggregate the juries' decisions somehow, and in the works that I have reviewed, the way they do this is to treat each choice as if it were an individual's and using the observations to estimate a random utility function. It is not clear, however, that this is a theoretically appropriate method.

Our experimental results suggest that aggregating multiple juries' deliberative choices might be more fair and more efficient that relying on any one jury's decision. This approach takes advantage of the benefits of both the survey and jury approach to valuing public goods.

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Appendix

Instructions (Part 1)

You are about to participate in an economics experiment. Your earnings will be determined by the decisions you and everyone else make during the experiment.

The experiment will be conducted in two parts. You are not allowed to talk during this part of the experiment. If you do, you will be asked to leave, and you will not get paid. You are free to end your participation in the experiment at any time, but will have to forfeit payment. If you have a question, do not ask it out loud. Raise your hand and one of us will come to help you.

This part of the experiment will consist of 2 periods. At the beginning of each period, you and every other member of the group will be endowed with either 8 or 10 tokens.

You will be asked to allocate all of your tokens between two accounts**.**

- Your **Private Account** acts as a savings account. Any token you put into your Private Account will remain your own.
- The **Public Account** works differently. There is only *one* Public Account for everyone. If at least a total of 60 tokens are allocated to the Public Account, then the group will receive a bonus payment. This payment will be 240 tokens for the whole group.

If the group successfully allocates the required number of tokens, regardless of who is responsible for putting tokens in the Public Account, the 240 token bonus will be *divided equally*. Your earnings for the period would be composed of the 12 tokens you received from the Public Account plus any tokens from your Private Account.

If the group fails to allocate the minimum number of tokens to the Public Account, then there will be no bonus. Any token you allocated to the Public Account is not lost – it will simply be put back into your Private Account, meaning that all of your tokens would be allocated to your Private Account.

Each period proceeds as follows:
You will be asked to indicate your allocation choices on the **Reporting Sheets** supplied and on your **Record Sheet**. I will collect your Reporting Sheets and add up the contributions to the Public Account. I will report this back to you by announcing the total and putting it on the chalkboard. At this point you will be able to calculate your earnings for the period on your Record Sheet and the second period will then begin.

We will now go through two sample periods for a typical player with 10 tokens. Please follow along on the Sample Record Sheet and Sample Reporting Sheets to see how information was entered into the different columns. (Period Number **Ex 1**, and **Ex 2**)

Example 1:
Suppose that in the first period you allocated 7 tokens to the Private Account and 3 to the Public Account. (Find this information on your Record Sheet. Notice that the two allocations add up to the total endowment. If your initial endowment was 8 tokens, your allocations should add up to 8 in each period.) Now suppose that after collecting everyone's Reporting Sheets, a total of 56 tokens were contributed to the Public Account by the whole group. Because the group did not meet the 60 token requirement, no one would receive a bonus. The 3 tokens you allocated to the Public Account are not lost, they simply get moved to your Private Account. At this point all 10 tokens would be in your Private Account and your earnings for the period would be 10 tokens.

Example 2:
Suppose that in the second period you allocated 6 tokens to the Private Account and 4 to the Public Account. Assume the total allocation to the Public Account is 90 tokens. At this point, you and every one else would receive a bonus, regardless of who put how many tokens into the Public Account. You would then earn your share of the Public Account, 12 tokens. You would also get to keep the 6 tokens remaining in your Private Account. Your total earnings for the period would be 18 tokens.

It is important that you remain silent during this part of the experiment. If you sigh, exclaim out loud, or make any attempts to communicate with other subjects the experiment will be terminated. If you have questions at any time, please raise your hand and one of us will come to your desk.

At this point please find your Reporting Sheets and your Record Sheet. Fill out your allocation choices for **Period 1** *only*, remembering to allocate your entire endowment. When you are finished, please turn the forms face down and make your Reporting Sheet available for one of us to collect.

Sample Record Sheet

ID#: ___XX___ **Group#: ___XX___**

Period Number	Endowment	Private Account	Public Account	Total Public Contributions	Private Account Tokens	Public Account Tokens	Total Period Tokens
Ex 1	**10**	7	3	56	10	0	10
Ex2	**10**	6	4	90	6	12	18
						Total Part 1 Earnings:	28

Sample Reporting Sheets

ID #: __XX__

Period #: ______1______

Private Account: ______7______

Public Account: ______3______

ID #: __XX__

Period #: _____2______

Private Account: ______6______

Public Account: ______4______

Record Sheet

ID#: __________ **Group#: _________**

Period Number	Endowment	Private Account	Public Account	Total Public Contributions	Private Account Tokens	Public Account Tokens	Total Period Tokens
1	8						
2	8						
						Total Part 1 Earnings:	

ID#: __________ **Group#: _________**

Period Number	Endowment	Private Account	Public Account	Total Public Contributions	Private Account Tokens	Public Account Tokens	Total Period Tokens
1	10						
2	10						
						Total Part 1 Earnings:	

Reporting Sheets

ID #: ___________

Period #: ___________

Private Account: ___________

Public Account: ___________

ID #: ___________

Period #: ___________

Private Account: ___________

Public Account: ___________

Instructions (Part 2)

During this part of the experiment you will split up into smaller groups in order to discuss the exercise conducted in Part 1. Each group will consist of 5 people. The five of you will decide on behalf of all 20 participants how each individual should allocate his/her tokens in a third and final period of the allocation problem described in Part 1. At the end of this part of the experiment one of the groups' decisions will be chosen at random to be implemented and the tokens earned in Part 2 will be added to those earned in part 1.

Each group will have a maximum of 20 minutes to deliberate. The groups' allocation decision will be indicated by filling out an **Allocation Table**. The table shows everyone's endowments for the third period. As a group, you must decide how to allocate these endowments between individuals' *Private* and *Public Accounts*. Your decision will determine the *Total Public Contributions* for this period, and therefore each individual's *Total Earnings*. Each group must fill out only one Allocation Table that represents the final decision of the whole group.

Deliberations will be tape recorded and participants are expected to act in a civilized manner. Absolutely no threats, derogatory language, side-payments or bribes are acceptable. Be patient with your fellow group members and allow everyone an opportunity to participate.

After 20 minutes we will collect the Allocation Tables from each group and choose one of them at random to be implemented. The number of tokens indicated in the Total Earnings column of the chosen Allocation Table will be added to your Part 1 Earnings. Raise your hands if you have any questions and one of us will come to help you.

At this point please move to the table labeled with your **Group #** (found in the upper right hand corner of your Record Sheet). When your group is finished, please raise your hand and one of us will come to collect your Allocation Table. Once all groups are finished we will choose which one will be implemented.

Allocation Table – Group ________

ID Number	Endowment	Private Account	Public Account	Total Public Contributions	Private Account Earnings	Public Account Earnings	Total Part 2 Earnings
A	10						
B	8						
C	10						
D	8						
E	10						
F	8						
G	10						
H	8						
I	10						
J	8						
K	10						
L	8						
M	10						
N	8						
O	10						
P	8						
Q	10						
R	8						
S	10						
T	8						
Total Public Contributions:							