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Hearing the voice of future generations: A laboratory experiment of "Demeny voting"

Yoshio Kamijo
School of Economics and Management, Kochi University of Technology
Research Center for Social Design Engineering, Kochi University of Technology

Yoichi Hizen
School of Economics and Management, Kochi University of Technology
Research Center for Social Design Engineering, Kochi University of Technology

Tatsuyoshi Saijo
Institute of Economic Research, Hitotsubashi University
Research Center for Social Design Engineering, Kochi University of Technology
Center for environmental Innovation Design for Sustinability, Osaka University

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School of Economics and Management
Research Center for Social Design Engineering
Kochi University of Technology

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Yoshio Kamijo, Yoichi Hizen, Tatsuyoshi Saijo
Kochi University of Technology

Abstract

We report the first experimental evidence on the effect of “Demeny voting,” wherein some people (e.g., parents) are given additional votes as proxy for the future generation (e.g., their children). In our experiment, three subjects are separated into the present and future generations, two of them regarded as the present generation. The present generation members are asked to determine the resource allocation between the present and future generations by majority voting. We compare voting behaviors and outcomes between ordinary majority voting (i.e., each of the two in the present generation has one vote) and Demeny voting (i.e., one of the two has two votes while the other has one vote). We obtain mixed evidence on whether the outcome of Demeny voting reflects the interest of the future generation. A remarkable finding is that half of the subjects who voted in favor of the future generation under ordinary voting reversed their decisions when they were given only one vote under Demeny voting; that is, they voted in favor of the present generation. This finding highlights the need, when planning to introduce Demeny voting, to consider the behaviors of not only people who are given additional votes but also those with only one vote. Finally, we compare voting behaviors between male and female subjects. We find that female subjects use their additional votes for the future generation more frequently than male subjects do, implying that women are less likely to abuse their proxy position than are men.

JEL classification: C91, D72, J13

Keywords: Aging Society, Demeny Voting, Laboratory Experiment,

Gender Difference, Vote Abuse

1. Introduction

Democratic countries with an aging population suffer a common political problem: an increase in the age of the median voter. That is, intergenerational resource allocation is biased in favor of older people, whereas family-friendly policies that may increase the birth rate of the country are given insufficient weight (Disney, 2007; McDonald and Budge, 2005; MacManus, 1995; Poterba, 1998; Preston, 1984). The demographer Paul Demeny mentioned a radical approach to deal with this problem in his seminal paper: a voting system reform such that all nations are enfranchised and parents vote as proxies for their children (Demeny, 1986). A typical argument against such a new voting system, called Demeny voting (Sanderson and Scherbov, 2007), is well summarized in the following remark made at the Lower House of Parliament in Germany: "[Parents] could abuse the delegated right to vote, and there could be a problem deciding which parent should exercise it" (Deutscher Bundestag, 2004: 9270; translated by the authors). Despite this criticism, Demeny voting has been debated in recent decades in European countries such as Germany, Hungary, and Austria as a potential electoral rule to enable the current generation to make future-friendly decisions and reduce intergenerational inequality. The discourse on this voting scheme has now spread to other countries, such as Japan (Aoki and Vaithianathan, 2009; Vaithianathan, Aoki, and Sbai, 2013) and Canada (Corak, 2013). Although Demeny voting has been increasingly considered in many developed countries, we have no experience of its actual working in any country at any period of time. Therefore, we do not have empirical evidence on what would likely happen under Demeny voting.[1]

In this study, we try to fill the gap between the increased interest in Demeny voting and the lack of empirical analysis by conducting a laboratory experiment. What we are concerned about is whether the interest of non-franchised people (i.e., children or people of the future) is reflected in the democratic decision by the franchised people

[1] However, Oguro, Shimasawa, Aoki, and Oshio (2012) use an overlapping generations (OLG) model, in a theoretical study on the efficacy of Demeny voting, to analyze the relationship between political voting blocs and the tax burden among different generations. They show that, under some conditions, Demeny voting decreases the tax burden of the working generation.

(i.e., parents or the present generation) under Demeny voting and, if not, what factors are responsible for the failure of this new voting system. Which parent should exercise the vote is also a relevant issue. Although Demeny originally suggested that each parent should have a half vote for one child, it is proposed that mothers should use it.[2] To shed light on this issue, we examine whether male and female subjects use proxy votes differently.

In our experiment, three subjects are separated into the present (two subjects) and future (the remaining one) generations. The two members of the present generation are asked to determine resource allocation between the present and future generations by majority voting. We compare voting behaviors and outcomes between ordinary majority voting (i.e., each of the two in the present generation has one vote) and Demeny voting (i.e., one of the two has two votes whereas the other has one vote). We try to answer the following three research questions: (a) Does the Demeny voting outcome reflect the interest of the future generation? (b) How do voting behaviors change in Demeny voting? (c) Does voting behavior differ between males and females?

From our experiment, we obtain mixed evidence about whether the result of Demeny voting reflects the interest of the future generation. That is, resource allocation is not significantly different between Demeny voting and ordinary majority voting. In contrast to this unclear result, we find a consistent pattern in the subjects' voting behavior between the two voting rules. An important finding is that about half of the subjects who consider the future generation in ordinary voting and are given only one vote in Demeny voting reverse their voting behaviors. That is, they vote in favor of the future generation under ordinary voting but in favor of the present generation under Demeny voting. In addition, we observe that about half of the subjects who vote in favor of the present generation under ordinary voting and are given two votes under Demeny voting use their proxy votes on behalf of the future generation. This can be a counterargument to the criticism that parents cannot act as their children's representatives because they might abuse their position. Finally, we find that female

[2] See *TheWashington Post* (http://www.washingtonpost.com/opinions/giving-children-the-right-to-vote/2012/10/18/a93bb514-1305-11e2-ba83-a7a396e6b2a7_story.html), *The New York Times* (http://www.nytimes.com/2013/03/08/world/americas/08iht-letter08.html?_r=0), and *The Guardian* (http://www.theguardian.com/world/2011/apr/17/hungary-mothers-get-extra-votes). These links were checked by authors on December 10, 2014.

subjects use their proxy votes for the future generation more frequently than male subjects do, implying that women are less likely to abuse their proxy position than are men.

The superiority of the simple majority rule over other voting rules has been shown, for example, by May (1952), Maskin (1995), and Dasgupta and Maskin (2008) on the basis of whether a rule satisfies some reasonable axioms. Demeny voting violates the anonymity axiom, that is, the "one person-one vote" principle, and thus can be regarded as a kind of plural voting system or weighted majority voting rule. Axiomatic characterizations of weighted majority voting rules are found, for example, in Fishburn (1973) and Nitzan and Parough (1981). However, these normative studies consider neither the problem of delegating voting rights to some voters nor the difficulty of hearing the voice of non-enfranchised people.

Some experimental studies of voting schemes focus on the interest of minority groups as reflected in voting outcome. Gerber, Morton, and Rietz (1998) and Kartal (2014) consider whether the preference of minority people would reflect in voting outcomes even if all voters are given equal voting rights. Gerber, Morton, and Rietz (1998) compare two cases where each voter has two votes, one where each voter is allowed to cast both votes for one candidate (i.e., *cumulative voting*) and the other where each voter is required to cast his/her two votes for two different candidates (i.e., *straight voting*). They theoretically and experimentally show that the minority candidate is more likely to win under cumulative voting than under straight voting. Kartal (2014) shows, by constructing a voting model with turnout decisions, that proportional representation improves minority representation in comparison with the majoritarian rule. The data of her laboratory experiment supported the theoretical prediction for a sufficiently large—but not a small—minority. Although these studies show that some voting rules, such as cumulative voting and proportional representation, reflect the preference of minority people to some extent, these rules cannot reflect the interest of a future generation with no voting rights.

Only has one experimental paper focused on plural voting where some groups have multiple votes but others do not. Dimdins, Montgomery, and Norell (2011) conducted a questionnaire experiment in which subjects were asked to rank-order five types of voting schemes, starting from the most appropriate to the least appropriate, in the context of a referendum regarding the construction of a new housing complex or

industrial park. Subjects favored voting schemes assigning more votes to groups with higher stakes. In contrast to their focus on the acceptability of plural voting, our focus is on how people vote if plural voting is adopted.

The rest of the paper is structured as follows. In the next section, we explain our experimental design. In Section 3, we report our experimental results. In Section 4, we summarize our results and discuss the significance and limitations of our results.

2. Design and procedure of experiment

2.1 General setup

A group of three subjects constitutes a society. Two of the three are members of the present generation, and the remaining one represents the future generation. Members of the present generation determine the resource allocation between the present and future generations, whereas the future generation representative does not have the right to participate in the resource allocation decision, but her payoff is determined by the present generation.

The members of the present generation are asked to choose one of the following three alternatives: Choice A (700, 300), Choice B (500, 500), and Choice C (300, 700), where the left number within parentheses is the amount of resource allocated to each of the two members in the present generation, whereas the right number is assigned to the future generation. The resource is measured in monetary units (Japanese yen). For instance, if Choice A is selected, each of the two members in the present generation obtains 700, whereas the future generation obtains 300. Choices A, B, and C are regarded as a present-oriented choice, fair choice, and future-friendly choice, respectively. We also call Choices B and C as future-consideration choices.

Notice that the total size of resources is different between the three choices; it is the largest for Choice A, and the smallest for Choice C. Thus, persons with not only self-regarding but also utilitarian preferences go for Choice A. Considering these facts, we test Demeny voting under the condition that the future-consideration choices B and C are less likely to be chosen.

2.2 Ordinary voting and Demeny voting

One of the three resource allocation choices is selected through majority voting by members of the present generation. In ordinary voting (OV), each member in

the present generation casts the only available vote for one of the three choices. Abstention is not allowed. The choice that obtains the largest number of votes wins, and resources are allocated accordingly. In case of a tie between choices, one of them is randomly selected as the winner.

Another type of voting system may pick up the voice of the future generation. In the second type of voting, called Demeny voting (DV), one of the two members in the present generation is given an additional vote. This vote represents the ballot of the person in the future generation, who cannot exercise it because of her immaturity or non-existence at the time of voting. Although the person who is given this additional vote is asked to use it for the future generation, he is not forced to do so and hence may use it as he likes. Since one of the two members in the present generation is given two votes whereas the other member has only one vote, DV is regarded as a majority voting system with asymmetric voting power between voters. The member who has one vote is called type-1 voter and the member who has two votes, type-2 voter.

We adopt a two-voter experimental setting to eliminate strategic considerations from the voting decision to the extent possible. Thus, voting behavior differences between OV and DV imply that subjects' voting outcome preferences are affected by the voting schemes. In fact, under the assumption of strict preferences over the set of three choices, the dominant OV strategy is for each member of the present generation to vote for his most favored choice.[3] The dominant DV strategy, for the type-2 voter, is to cast both votes for the most favored choice because it enables him to realize any outcome he likes. For the type-1 voter, voting for the most favored choice is uniquely optimal under the assumption that Choice C (the future-friendly choice) is the worst outcome for both types of voters and the type-2 voter does not cast one of his two votes for Choice C.[4]

2.3 Design of experiment

[3] Under the ordinary voting, each vote necessarily affects the outcome because there are only two voters, each with one vote. In other words, the pivot probability for each vote is always strictly positive. Therefore, the dominant strategy for each voter is to vote for the most favored alternative.

[4] Under Demeny voting, if the type-2 voter casts his two votes for one alternative, the type-1 voter cannot affect the outcome, and hence any voting behavior is weakly optimal for the type-1 voter. If the type-2 voter divides his two votes for Choices A and B and if the type-1 voter favors either Choice A or B most, then it is uniquely optimal for the type-1 voter to vote for his most favored alternative because he can realize his most favored outcome with certainty by voting for it.

Each subject participates in one session. Each session consists of two treatments where the subject makes a decision first under OV and then under DV. We neither disclosed the content of the second treatment during the course of the first treatment nor provided feedback on the first treatment until the second treatment finished. Thus, the interaction between the two treatments, such as the learning effect, is eliminated as much as possible. We adopt the within-subject design because we are interested in how the subjects' behaviors change between the two treatments.

To examine the robustness of the experimental results, we run another condition with a stake twice as large as in Section 2.1. In summary, our experiment has two conditions (low stake and high stake), each consisting of two treatments (OV and DV).

2.4 Procedure

We conducted two types of experiments, calibrating the stake size, at the laboratory (Experimental Social Design Lab) of Kochi University of Technology. The sessions of the first (low-stake) condition were held in January 2014. To check the robustness of the results of the first condition, the sessions of the second (high-stake) condition were held in August 2014.

All subjects were undergraduate students of Kochi University of Technology. Each subject participated in only one session; 57 subjects were recruited for the low-stake and 54 for the high-stake condition. Subjects were separated into groups of three in each session, and group members were fixed throughout the first and second (i.e., OV and DV) treatment. In total, 38 (=57*2/3) subjects for the low-stake condition and 36 (=54*2/3) for the high-stake were assigned to the present generation. In DV, half of the subjects in the present generation (i.e., type-1 voters) had one vote each and the other half (i.e., type-2 voters) had two votes. Note that the type of each member (i.e., type 1 or 2) of the present generation under DV was randomly determined prior to OV, but was informed to each subject after the OV treatment was completed. This procedure implies that the assignment of types 1 and 2 in DV is independent of the subjects' voting behaviors in OV.

At the beginning of each session, subjects were randomly assigned laboratory booths. These booths separated subjects in order to ensure that every individual made his or her decision anonymously and independently. Subjects were provided with

written instructions of the first treatment (i.e., OV). One of the experimenters read the instructions loudly. We used neutral wording in the instructions according to the common practice in experimental economics. That is, we avoided using words such as "fair," "pity," "election," "democracy," "Demeny voting," and so on, but we used a voting framework that naturally explains the treatments.

Subjects were randomly and anonymously assigned to groups of three by computer. Two subjects of each group were assigned to the present generation, and the remaining subject to the future generation. These roles were fixed between the two treatments in each session. Members of the present generation were asked to simultaneously vote for one of the three choices on their computer screens. After they completed their decisions under the first treatment, the instructions of the second treatment (i.e., DV) started. This means that there was no feedback of the results of the first treatment when subjects made decisions under the second treatment.

The instructions for the second treatment explained the use of the two votes as follows: "One of the participants in the present generation is given two votes in this treatment. If you are given two votes, please use the first vote for yourself, and the second vote on behalf of the future generation who cannot participate in the vote. You can determine how to cast your two votes as you like. There is no reward from the future generation for your voting as a proxy of the future generation." After the instructions, the members of the future generation saw their types (i.e., type 1 or type 2) on their computer screens, and made the voting decisions.

We used the z-Tree software (Fischbacher, 2007) to conduct the experiment. Each session took approximately 1 hour, on average, to complete. Subjects' earnings were based on the result of either the first or the second treatment, which was selected by computer-based lottery. The mean payment per subject was 1053 yen (= $10.32 evaluated at $1 = ¥102) for low-stake sessions and 1689 yen (= $16.56) for high-stake sessions. In addition to these variable fees, a fixed show-up fee of 500 yen (= $4.90) was also paid to each subject.

3 Results

3.1 The effect of Demeny voting

We first examine research question (a): "Does the Demeny voting outcome reflect the interest of the future generation?" Figure 1 shows the frequency of votes for

Choice A (present-oriented) under each combination of the stake condition (low or high) and the voting rule (OV or DV). From the figure, we find a paradoxical result for the low-stake condition; that is, the frequency of votes for choice A was higher in DV than in OV. On the other hand, in the high-stake condition, DV worked as desired although its effect was weak. Thus, the results provide mixed evidence regarding the effect of DV on the outcome.

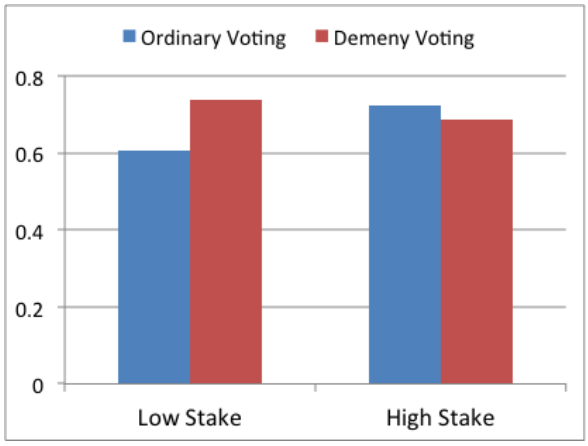


Figure 1 Vote Share for Choice A

However, the frequency of Choice A votes is not significantly different between OV and DV in either condition: $\chi^2(1) = 1.349$ and $P = 0.246$ for the low-stake condition; $\chi^2(1) = 0.141$ and $P = 0.707$ for the high-stake condition. Moreover, given a voting rule (i.e., OV or DV), the frequency of Choice A votes is not significantly different between the low-stake and high-stake conditions: $\chi^2(1) = 1.130$ and $P = 0.288$ for OV; $\chi^2(1) = 0.155$ and $P = 0.693$ for DV. In summary, whether or not DV favors the future generation is not certain. The finding in this subsection is summarized as follows.

Result 1: Regardless of the size of the stake, the vote share for Choice A (present-oriented decision) does not differ between OV and DV.

3.2 Voting behavior of type-1 voter

Next, we examine research question (b): "How do voting behaviors change in Demeny voting?" To investigate this question, we classify type-1 voters, according to their OV voting behavior, into the following two groups: "egoists," (the present-oriented

subjects who voted for Choice A in OV) and "altruists" (subjects with a future consideration who voted for Choice B or C in OV. These names have a rationale: voting for the most-favored choice is each voter's dominant strategy in OV, so voting behavior in OV can be regarded as representing each voter's true preference. Since the voting patterns of subjects are not different between the low-stake and high-stake conditions, we combine the data for these two conditions in what follows.[5]

		Egoist	Altruist	p value
A[a]		1	0.556	0.001[d]
BC[b]		0	0.444	
	Sum	1 (19)[c]	1 (18)	

Notes: a) "A" implies "vote for A." b) "BC" implies "vote for B or C." c) Within parentheses are the numbers of subjects classified in the respective categories. d) This p-value is obtained by Fisher's exact test to check for a voting pattern difference between egoists and altruists.

Table 1 Voting behavior of type-1 Demeny voters classified by voter group

Table 1 demonstrates the DV behaviors of type-1 egoists and altruists. Of the 37 subjects who were assigned the type-1 role in DV, 19 were classified as egoists and 18 as altruists. We find a clear difference in voting patterns between these two type-1 voter groups. That is, all egoists (19 of 19) voted for the present-oriented choice in DV, whereas about half of the altruists (10 of 18) shifted from future-consideration choices to the present-oriented choice in DV. This difference in DV behavior between egoists and altruists is statistically significant (Fisher's exact test, $P = 0.001$).

The voting behaviors of egoists are consistent between OV and DV. This implies that the egoists' preferences are not defined by the voting process, but only by the distributional outcomes. More specifically, the egoists' preferences are independent of the fact that another voter has two Demeny votes of which one is a proxy vote for the future generation.

In contrast to the egoists, the altruists are split into two groups according to their DV behaviors. About a half of the altruists continued to vote for future-considerations but, as mentioned above, the remaining half shifted from future-consideration choices to the present-oriented choice. The interpretation of these

[5] See the appendix for the analysis of the data separation between the two stake conditions.

altruist preference is defined by both distributional outcomes and voting schemes. The finding in this subsection is summarized as follows.

Result 2: (a) All type-1 egoists vote for Choice A (present-oriented choice) in DV.
(b) Half of type-1 altruists reverse their voting behaviors, i.e., they vote for Choice A, in DV.
(c) Type-1 altruists vote for Choice B or C (future-consideration choice) more frequently than type-1 egoists do.

3.3 Voting behavior of type-2 voters

Table 2 demonstrates the behaviors of type-2 voters, who are assigned two votes in DV. The numbers of egoists and altruists differ between type-2 (30 and 7, respectively) and type-1 (19 and 18, as in Table 1) voters. However, this is merely because of the random role assignment of types 1 and 2.

	Egoist	Altruist	p value
A+A[a]	0.533	0.143	
A+BC[b]	0.4	0.429	0.033[e]
BC+BC[c]	0.067	0.429	
Sum	1 (30)[d]	1 (7)	

Notes: a) "A+A" implies "two votes for A." b) "A+BC" implies "one vote for A and another vote for B or C." c) "BC+BC" implies "two votes for B and/or C." d) Within parentheses are the numbers of subjects in the respective categories. e) This p-value is obtained by Fisher's exact test to check for a voting pattern difference between egoists and altruists.

Table 2 Voting behavior of type-2 Demeny voters classified by voter group

The voting patterns of type-2 egoists and altruists are significantly different at the 5% level (Fisher's exact test, P = 0.033). About a half of the egoists (16 of 30) used two votes for themselves. The other half (14 of 30) used at least one vote for the future generation as suggested in the instructions. These egoists are regarded as naïve voters who use their additional votes as the authority suggests irrespective of their distributional outcome preferences. On the other hand, most of the altruists (6 of 7) used at least one vote for the future generation. The finding in this subsection is summarized as follows.

Result 3: (a) A half of type-2 egoists abuse their proxy votes, whereas the other half use them for the future generation.
(b) Type-2 altruists vote for Choice B or C (future-consideration choice) more frequently than type-2 egoists do.

3.4 Gender differences in voting behavior

In this subsection, we tackle research question (c): "Does voting behavior differ between males and females?" Empirical studies have found gender differences in voting behavior. For instance, Welch and Hibbing (1992) showed, using the data of U.S. presidential and House elections in 1980 and 1984, that women were more likely to consider the perceptions of the national economy in their voting decisions (i.e., sociotropic economic votes), whereas men often judged the administration's party on the basis of their family's finances (i.e., egocentric economic votes). The same result was obtained by Chaney, Alvarez, and Nagler (1998) with data of four U.S. presidential elections from 1980 to 1992. Laboratory experiments show that women have a strong tendency for egalitarian or fair preferences (e.g., Eckel and Grossman, 1998, and Andreoni and Vesterlund, 2001, within the framework of a dictator game), although Bolton and Katok (1995) found no evidence of gender differences. Croson and Gneezy (2009) conclude, from a comprehensive survey of laboratory studies on gender differences, that "the social preferences of women are more situationally specific than those of men; women are neither more nor less socially oriented, but their social preferences are more malleable" (p. 448). Therefore, which parent (mother or father) should be given the additional vote is a relevant question in the context of Demeny voting. This explains the importance of analyzing gender differences in voting behavior in our experiment.

We first compare the voting behaviors of male and female subjects in OV. In the high-stake condition, the ratio of altruists is 38.5% (5 of 13) for female and 21.7% (5 of 23) for male subjects. On the other hand, in the low-stake condition, the ratio is 36.8% (7 of 19) for females and 42.1% (8 of 19) for males. However, the difference between the male and female's voting pattern is not statistically significant in either condition: Fisher's exact test, $P=0.440$ in the low-stake condition and $P=1$ in the high-stake condition.

Next, we compare the DV patterns of egoists and altruists with respect to gender differences. Since these voting patterns are not very different between the two stake conditions, we combine the data for these two conditions. Table 3 divides the data by voting pattern (DV and OV), voter type (type 1 and type 2), voting behavior (A [egoists)] and BC [altruists]), and gender (male and female). Male and female voting patterns are different only for type-2 egoists. Male egoists abused their proxy votes (A+A) more frequently than did female egoists. The difference is statistically significant at the 5% level (Fisher's exact test, P =0.045). Even if we combine the type-2 egoist and altruist data, the vote abuse rate is higher for male (57%, i.e., 12 of 21) than female subjects (25%, i.e., 4 of 16). This difference is statistically significant at the 5% level (Fisher's exact test, P = 0.041). The finding in this subsection is summarized as follows.

Result 4: Female subjects use their proxy votes for the future generation more frequently than male subjects do.

	OV	DV		Male	Female	p value
Type 1	A	A[a]		1	1	1[g]
		BC[b]		0	0	
			Sum	1 (11)[f]	1 (8)	
	BC	A		0.6	0.5	1
		BC		0.4	0.5	
			Sum	1 (10)	1 (8)	
	OV	DV		Male	Female	p value
Type 2	A	A+A[c]		0.67	0.33	0.041
		A+BC[d]		0.22	0.67	
		BC+BC[e]		0.11	0	
			Sum	1 (18)	1 (12)	
	BC	A+A		0.33	0	1
		A+BC		0.33	0.5	
		BC+BC		0.33	0.5	
			Sum	1 (3)	1 (4)	

Notes: a) "A" implies "vote for A." b) "BC" implies "vote for B or C." c) "A+A" implies "two votes for A." d) "A+BC" implies "one vote for A and another vote for B or C." e) "BC+BC" implies "two votes for B and/or C." f) Within parentheses are the numbers of subjects in the respective categories. g) P-values are obtained by Fisher's exact test to check for a voting pattern difference between male and female subjects.

Table 3 Voting behaviors of male and female subjects

4 Discussion and conclusions

In this section, we summarize our findings in answer to our three research questions. We also discuss the implications and limitations of our findings.

For research question (a) (“Does the Demeny voting outcome reflect the interest of the future generation?), we found no positive effect from Demeny voting on the future generation (Result 1). This may be partly due to the random role assignment of types 1 (one vote) and 2 (two votes) under Demeny voting in our experiment. Since type-2 altruists, who voted with a future consideration in ordinary voting, are more likely to cast their proxy votes for the benefit of the future generation than are type-2 egoists, a necessary condition for Demeny voting to work as desired is that proxy votes are assigned to more altruistic than egoistic people. In our experiment, however, we did not control for this point because the role of each subject in Demeny voting was determined before the decision making in ordinary voting. However, although voting is actually introduced in some countries, the proxy votes are assigned to parents. A natural assumption is that parents are more likely to be altruists in the sense that they will use their proxy votes for their children, or the future generation. If this assumption is correct, real-life Demeny voting works more effectively than in our experimental setting. In other words, our result may underestimate the effect of Demeny voting because we did not factor in this parent-children relationship at the laboratory.

For research question (b) (“How do voting behaviors change in Demeny voting?”), we found that, as with type-1 voters, egoists consistently chose the present benefit in Demeny voting, whereas half of the altruists reversed their voting behaviors: they shifted from a future consideration in ordinary voting to a present-oriented choice in Demeny voting (Result 2). This implies that altruists’ preferences are affected by the voting procedure itself. As for type-2 voters, we observed that egoists abused their proxy votes more frequently than did the altruists, but half of the egoists used their proxy votes for the future generation (Result 3). This can be a counter-argument to the typical criticism against Demeny voting that parents cannot act merely as their children’s representatives but might abuse their position.

The answer to research question (c) (“Does voting behavior differ between males and females?”) is obtained from an investigation into how male and female subjects use their proxy votes. We observed that male subjects abused their proxy votes

more frequently than did female subjects (Result 4). This result indicates that women are more suitable as proxy voters. However, this point needs to be further investigated through variations in experimental conditions, especially with the recruitment of the general public as participants.

An unpredicted finding in our experiment is the reverse behavior of altruistic people who are given only one vote in Demeny voting. This indicates that if Demeny voting is used, people who do not have children, and thus have only one vote, may favor the present interest, rather than benefit the future generation. Although the external validity of our experiment is limited and our result cannot, on its own, directly apply to real voting systems, one needs to consider that giving a smaller number of votes to a particular group of people produces a negative effect on their voting behaviors.

The current study is not designed to detect the compelling reasons for the reverse behavior of altruists, which can be explained on the basis of strategic voting and/or the preference change. A strategic voting interpretation implies the incorporation by voters of voting rules' votes-to-outcome conversion system into their choices (Kedar, 2005). Since type-2 voters are given an additional vote on behalf of the future generation, the behavior of type-1 voters might become more present-oriented to balance the result close to a fair outcome. However, in our setting, where choice C is ignored, the dominant strategy of type-1 voters is to vote for their most-favored choice; thus, they do not have to change their voting behaviors between the two voting schemes. This point may be valid and can be tested if we consider a different experimental setting. Another interpretation of the reverse behavior of altruists is a crowding-out effect on the motivation for altruistic behavior (Frey and Oberhozler-Gee, 1997). As monetary incentives undermine intrinsic or internal motivations for some acts, giving only one vote under Demeny voting may weaken the internal motivation to vote in favor of the future generation. The second interpretation should be further investigated in future research.

<< References >>

Andreoni, James and Lise Vesterlund (2001), "Which is the fair sex? Gender differences in altruism," *The Quarterly Journal of Economics* 116: 293-312.

Aoki, Reiko and Rhema Vaithianathan (2009), "Is Demeny voting the answer to low

fertility in Japan?" Center of Intergenerational Studies, Hototsubashi University, Discussion Paper No. 435-2.

Bolton, Gary E. and Elena Katok (1995), "An experimental test for gender differences in beneficent behavior" *Economics Letters* 48: 287-292.

Chaney, Carole Kennedy, R. Michael Alvarez, and Jonathan Nagler (1998), "Explaining the Gender Gap in U.S. Presidential Elections, 1980-1992," *Political Research Quarterly* 51: 331-339.

Corak, Miles (2013), "Public policies for equality and social mobility in Canada," Background Paper of CANADA 2020.

Croson, Rachel and Uri Gneezy (2009), "Gender differences in preferences," *Journal of Economic Literature* 47(2): 448-474.

Dasgupta, Partha and Eric Maskin (2008), "On the robustness of majority rule," *Journal of the European Economic Association* 6(5): 949-973.

Demeny, Paul (1986), "Pronatalist polices in low-fertility countries: Patterns, performance, and prospects," *Population and Development Review* 12(supplement): 335-358.

Deutscher Bunderstag (2004). Stenografischer Bericht, 102 Sitzung. (Plenarprotokoll 15/102): 9270. Available at http://dip21.bundestag.de/dip21/btp/15/15102.pdf

Dimdins, Girts, Henry Montgomery, and Erik Norell (2011), "Egalitarian vs. proportional voting in various contexts: An experimental study," *Oñati Socio-Legal Series*, 1(5): Democracy in a Globalised World.

Disney, Richard (2007), "Population ageing and the size of the welfare state: Is there a puzzle to explain?" *European Journal of Political Economy* 23(2) 542-553.

Eckel, Catherine C. and Philip J. Grossman (1998), "Are women less selfish than man? Evidence from dictator experiments," *The Economic Journal* 108: 726-735.

Fischbacher, Urs (2007), "z-Tree: Zurich toolbox for ready-made economic experiments," *Experimental Economics* 10, 171-178.

Fishburn, Peter C. (1973), *The Theory of Social Choice*, Princeton University Press, Princeton, NJ.

Frey, Bruno and Felix Oberholzer-Gee (1997), "The cost of price incentives: An empirical analysis of motivation crowding-out," *The American Economic Review* 87(4): 746-755.

Gerber, Elisabeth R., Rebecca B. Morton, and Thomas A. Rietz (1998), "Minority

representation in multimember districts," *American Political Science Review* 92: 127-44.

Kartal, Melis (2014), "Laboratory elections with endogenous turnout: Proportional representation versus majoritarian Rule," forthcoming in *Experimental Economics*.

Kedar, Orit (2005), "When moderate voters prefer extreme parties: Policy balancing in parliamentary elections," *American Political Science Review* 99: 185-199.

MacManus, Susan (1995), "Taxing and spending: A generational perspective," *The Journal of Politics* 75(3): 607-629.

McDonald, Michael D. and Ian Budge (2005), *Elections, Parties, Democracy: Conferring the Median Mandate.* Oxford University Press, Oxford.

Maskin, Eric (1995), "Majority rule, social welfare functions, and game forms," Kaushik Basu, Prasanta K. Pattanaik, and Kotaro Suzumura, eds., *Choice, Welfare and Development*, Clarendon Press, Oxford: 100-109.

May, Kenneth O. (1952), "A set of independent necessary and sufficient conditions for simple majority decision," *Econometrica*, 20(4): 680-684.

Nitzan, Shmuel and Jacob Paroush (1981), "The characterization of decisive weighted majority rules," *Economics Letters* 7, 119-124.

Oguro, Kazumasa, Manabu Shimasawa, Reiko Aoki, and Takashi Oshio (2012), "Demographic change, intergenerational altruism, and fiscal policy - A political economy approach," *Studies in Applied Economics* 6: 1-15.

Poterba, James M. (1998), "Demographic change, intergenerational linkages, and public education," *The American Economic Review* 88(2): 315-320.

Preston, Samuel (1984), "Children and the elderly: Divergent paths for America's dependents," *Demography* 21(4): 435-457.

Sanderson and Scherbov (2007), "A near electoral majority of pensioners: Prospects and policies," *Population and Development Review* 33(3): 543-554.

Vaithianathan, Rhema, Reiko Aoki, and Erwan Sbai (2013), "Support for franchise extension for children: Evidence on Japanese attitude to Demeny voting" mimeo.

Welch, Susan and John Hibbing (1992), "Financial conditions, gender, and voting in American national elections," *The Journal of Politics* 52: 197-213.

Appendix

In this appendix, we deal with data for the two stake conditions (i.e., the low-stake and high-stake conditions) separately. As seen below, the voting behavior is not significantly different between the two conditions.

A.1. Behavior of type-1 voters in the low-stake and high-stake conditions

Figure A1 demonstrates the behaviors of type-1 voters who are given one Demeny vote. More specifically, this figure shows the numbers of egoists (who have voted for Choice A in OV) and altruists (who have voted for Choice B or C in OV) among type-1 voters in both low-stake and high-stake conditions, as well as their voting behaviors in DV. The proportions of egoists and altruists differ between the two stake conditions at a statistical significance level of 10%: $\chi^2(1) = 3.291$ and P = 0.070. In contrast, among the type-2 voters, the proportions of egoists and altruists (i.e., voting behaviors in OV) are not significantly different between the two stake conditions (Fisher's exact test, P=0.693). However, as mentioned in the main text, this difference is due to the random role assignment of types 1 and 2 before the OV decision is made. In fact, when type-1 and type-2 voter data are combined, the same test, shows that the proportions of egoists and altruists are insignificantly different between the two stake conditions: $\chi^2(1) = 0.6837$ and P = 0.4083.

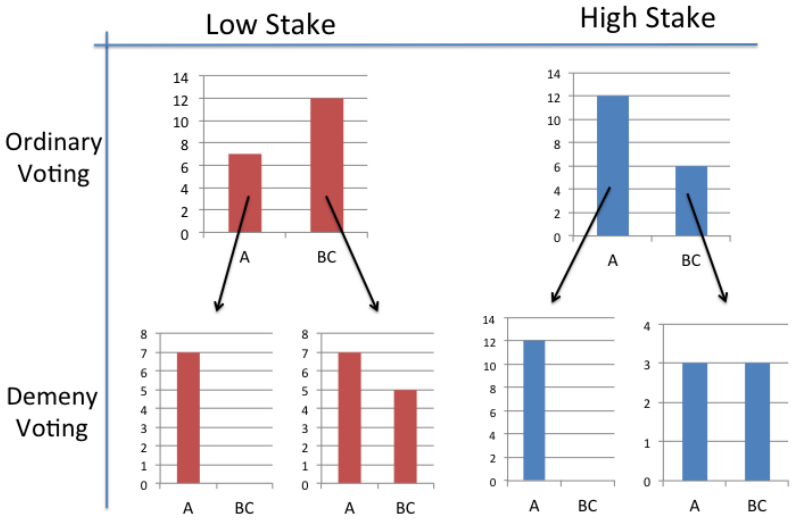


Figure A1 Behaviors of type-1 voters

Voting patterns of egoists and altruists are respectively consistent between the two stake conditions. The voting behaviors of egoists are consistent between OV and DV: all egoists (7 of 7 in the low-stake and 12 of 12 in the high-stake condition) vote for Choice A in DV. On the other hand, about half of the altruists (7 of 12 in the low-stake and 3 of 6 in the high-stake condition) shift from Choice B or C in OV to Choice A in DV. The voting behaviors of egoists and altruists in DV are statistically different at the 5% significance level in the high-stake condition (Fisher's exact test, P = 0.025), but not in the low-stake condition (Fisher's exact test, P = 0.106). Moreover, the voting patterns of egoists and altruists are respectively consistent between the two stake conditions (Fisher's exact test, P = 1 for egoists and P = 1 for altruists)

A.2. Behavior of type-2 voters

Figure A2 demonstrates the voting behaviors of type-2 voters, who have two votes in DV, under the low-stake and high-stake conditions.

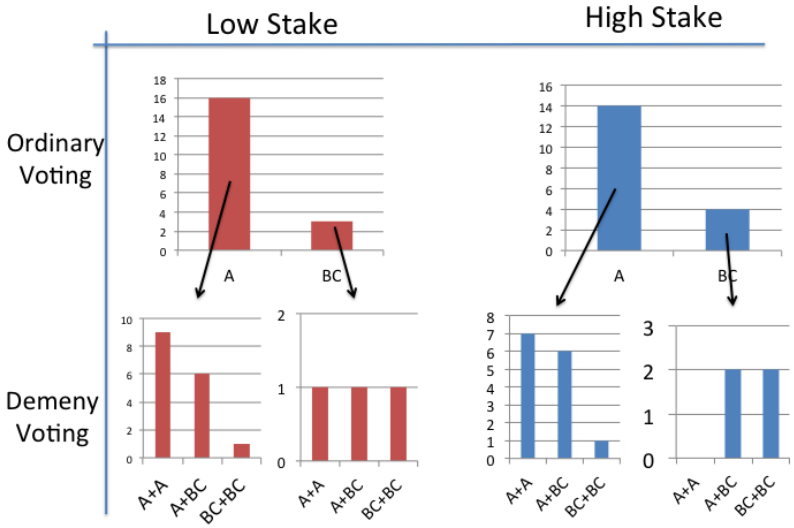


Figure A2 Behaviors of type-2 voters

As in the case of type-1 voters, voting patterns of egoists and altruists are respectively consistent between the two stake conditions (Fisher's exact test, P = 1 for egoists and P = 1 for altruists). About a half of the egoists (9 of 16 in the low-stake and 7 of 14 in the high-stake condition) cast both of their votes for Choice A, whereas another half of the egoists use one vote for themselves and the other vote for the future

generation as suggested in the instructions. Although the number of observations of altruists' voting behaviors is unfortunately quite small, their voting pattern is statistically different from that of the egoists in the high-stake condition at the 10% significance level (Fisher's exact test, $P = 0.458$ in the low-stake and $P = 0.087$ in the high-stake condition). Altruists give more weightage to the interest of the future generation.

*You may make notes on this instruction if necessary.

To participants

Thank you very much for your participation in this experiment today. Please refrain from talking until the end of the experiment. Please switch off your cellular phone. If you have any questions, please let experimenters or staffs know by raising your hand.

General information

In this experiment, participants are divided into groups of three.

Two of the three participants are given roles of "present generation," whereas the remaining one is given a role of "future generation." Participants are asked to make decisions on a resource allocation between the present generation and the future generation.

In the experiment, and even after the experiment, it will not be made public who are given the roles of the present generation and who is given the role of the future generation. Furthermore, your decisions will not be informed to any other participants.

The experiment consists of the first half (experiment 1) and the second half (experiment 2). Experiments 1 and 2 are independent of each other, and hence the outcome of the decisions in experiment 1 will not affect the contents of experiment 2. Please regard experiments 1 and 2 not to be related with each other when you make decisions.

Rewards from the experiment

According to the outcomes of decisions in experiments 1 and 2, your rewards are determined. Specifically, "your reward from experiment 1" and "your reward from experiment 2" are determined according to the outcomes of your decisions. After experiment 2, one of them is selected randomly by computer as your today's reward. The total amount of rewards you receive is this reward added by 500 yen as your participation fee.

Present generation and future generation

At the beginning of experiment 1, participants are divided randomly by computer into "the present generation" and "the future generation." You can find on your computer screen whether you are in the present generation or the future generation.

The roles of the present generation and the future generation will not change in experiment 2. That is, if your role in experiment 1 is the present generation, your role in experiment 2 will be also the present generation. The fixed role also applies to the case of the future generation.

Experiment 1

Decision making in experiment 1

In experiment 1, participants determine how to divide “1000 yen” between “the present generation” and “the future generation.”

The way to determine the division is “the vote by the present generation” among the following proposals:

Proposal 1 (700 yen to the present generation; 300 yen to the future generation);

Proposal 2 (500 yen to the present generation; 500 yen to the future generation);

Proposal 3 (300 yen to the present generation; 700 yen to the future generation).

1000 yen is divided according to the proposal which obtains the largest number of votes.

Notice on the vote

Each participant of the present generation has one vote. That is, he or she can vote for only one proposal. If a tie occurs, one of the tied proposals is selected randomly by computer.

Notice on the proposals

The amount of money in each proposal is given to each of the participants in each generation. For example, if proposal 1 is selected by vote, each participant of the present generation receives 700 yen, and each participant of the future generation receives 300 yen. This rule also applies to the other proposals.

Role of the future generation

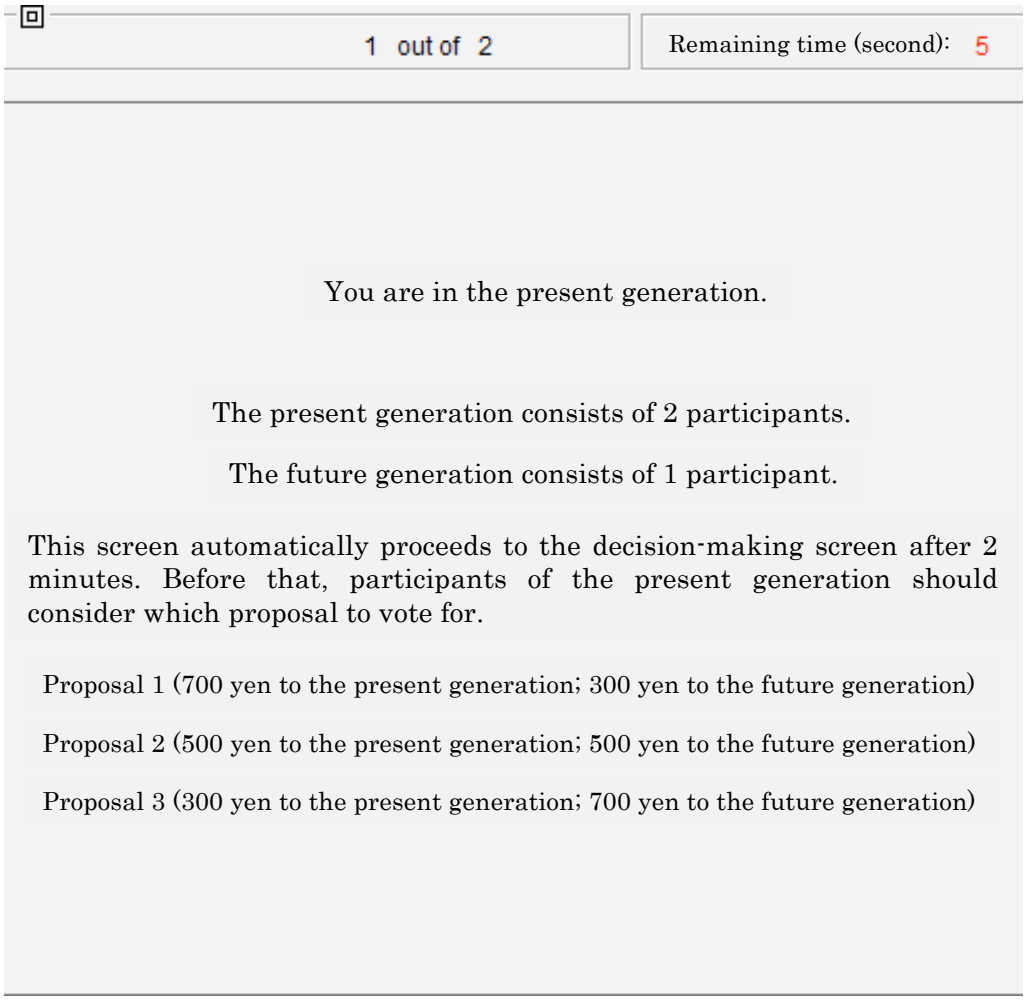
Participants who are given the roles of the future generation will not make decisions. Please wait for the decisions by the participants of the present generation.

Release of the voting outcome

The voting outcome in experiment 1 will not be released even after experiment 1. It will be released when your rewards are determined after experiment 2.

In the following pages, computer screens and operation procedures are explained.

Start screen



At the beginning, a screen such as the above appears.

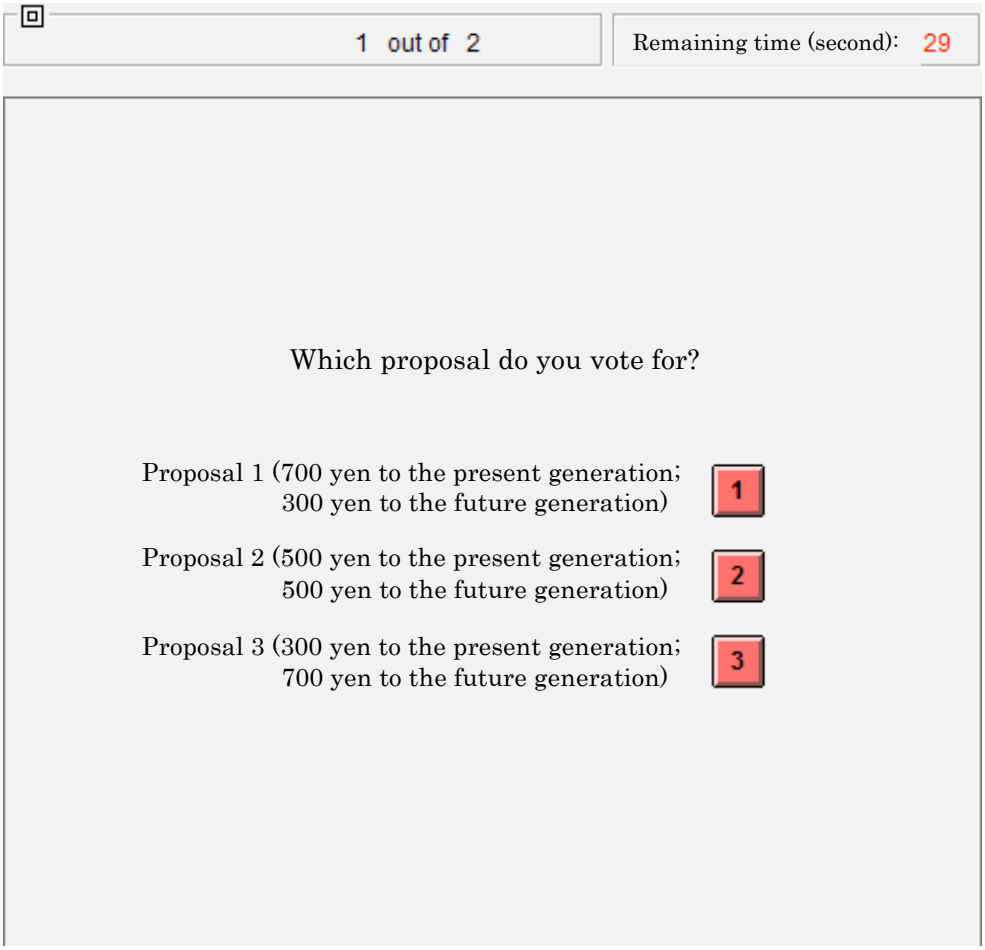
In this screen, you are informed whether you are in “the present generation” or “the future generation.”

There also appear the numbers of participants in “the present generation” and “the future generation.”

In this example, you are in “the present generation.”

In the upper right corner of the screen, the remaining time in second is shown. This screen automatically proceeds after “2 minutes.” Before that, participants who are given the roles of the present generation should consider which proposal to vote for.

Decision-making screen for “the present generation”



Decisions by the present generation are made on a screen such as the above.

Please click

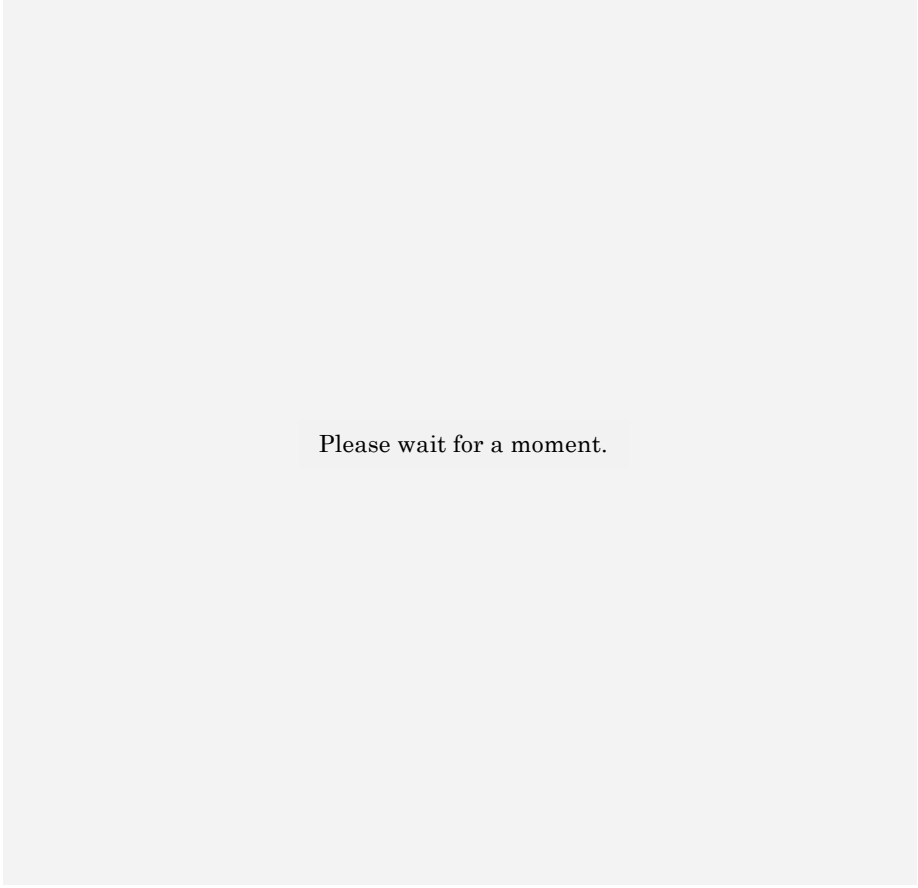
the button written “1” if you would like to vote for proposal 1;

the button written “2” if you would like to vote for proposal 2;

the button written “3” if you would like to vote for proposal 3.

Note that you cannot change your decision once you have made.

Wait screen



When you are waiting for the decision making of other participants or the operation of experimenters, the above screen appears. It takes at longest a few minutes, and so please wait.

After all the participants in “the present generation” finish their decision making, the explanation of experiment 2 starts promptly.

Experiment 2

Decision making in experiment 2

What participants do in experiment 2 is almost the same as experiment 1.

That is, participants determine how to divide “1000 yen” between “the present generation” and “the future generation.”

The way to determine the division is “the vote by the present generation” among the following proposals:

Proposal 1 (700 yen to the present generation; 300 yen to the future generation);

Proposal 2 (500 yen to the present generation; 500 yen to the future generation);

Proposal 3 (300 yen to the present generation; 700 yen to the future generation).

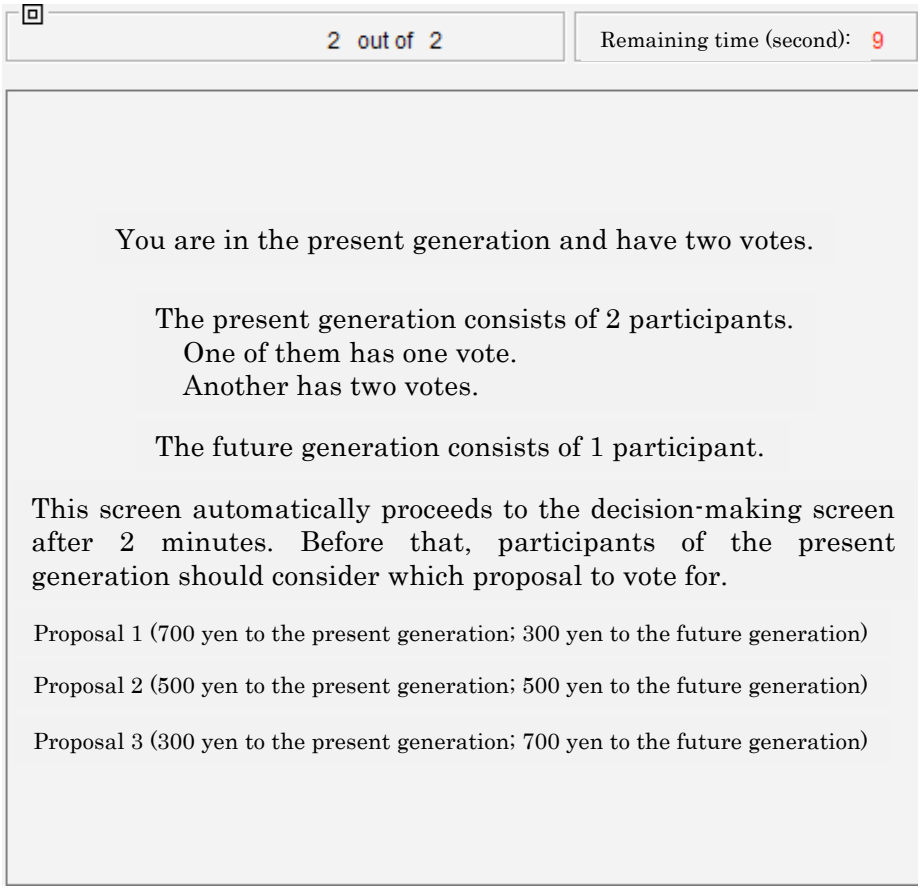
1000 yen is divided according to the proposal which obtains the largest number of votes.

Difference from experiment 1

Unlike experiment 1, one of the participants in the present generation is given two votes in experiment 2. If you are given two votes, please use the first vote for yourself, and the second vote on behalf of the future generation who cannot participate in the vote. You can determine how to cast your two votes as you like. There is no reward from the future generation for your voting as a proxy of the future generation.

In the following pages, computer screens and operation procedures are explained.

Start screen



At the beginning, a screen such as the above appears.

In this screen, you are informed whether you are in “the present generation” or “the future generation.”

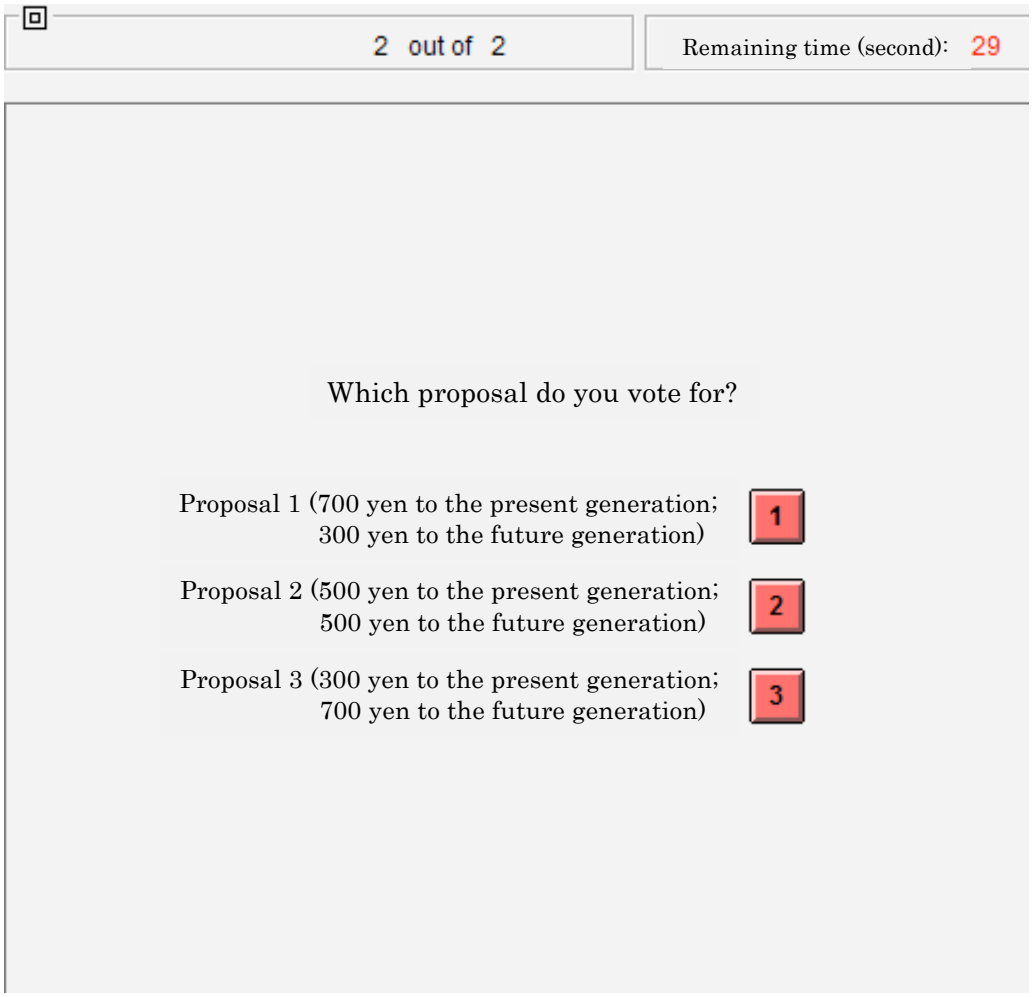
There also appear the numbers of participants in “the present generation” and “the future generation.”

You are also informed whether you have “one vote” or “two votes.”

In this example, you are in “the present generation” and have “two votes.”

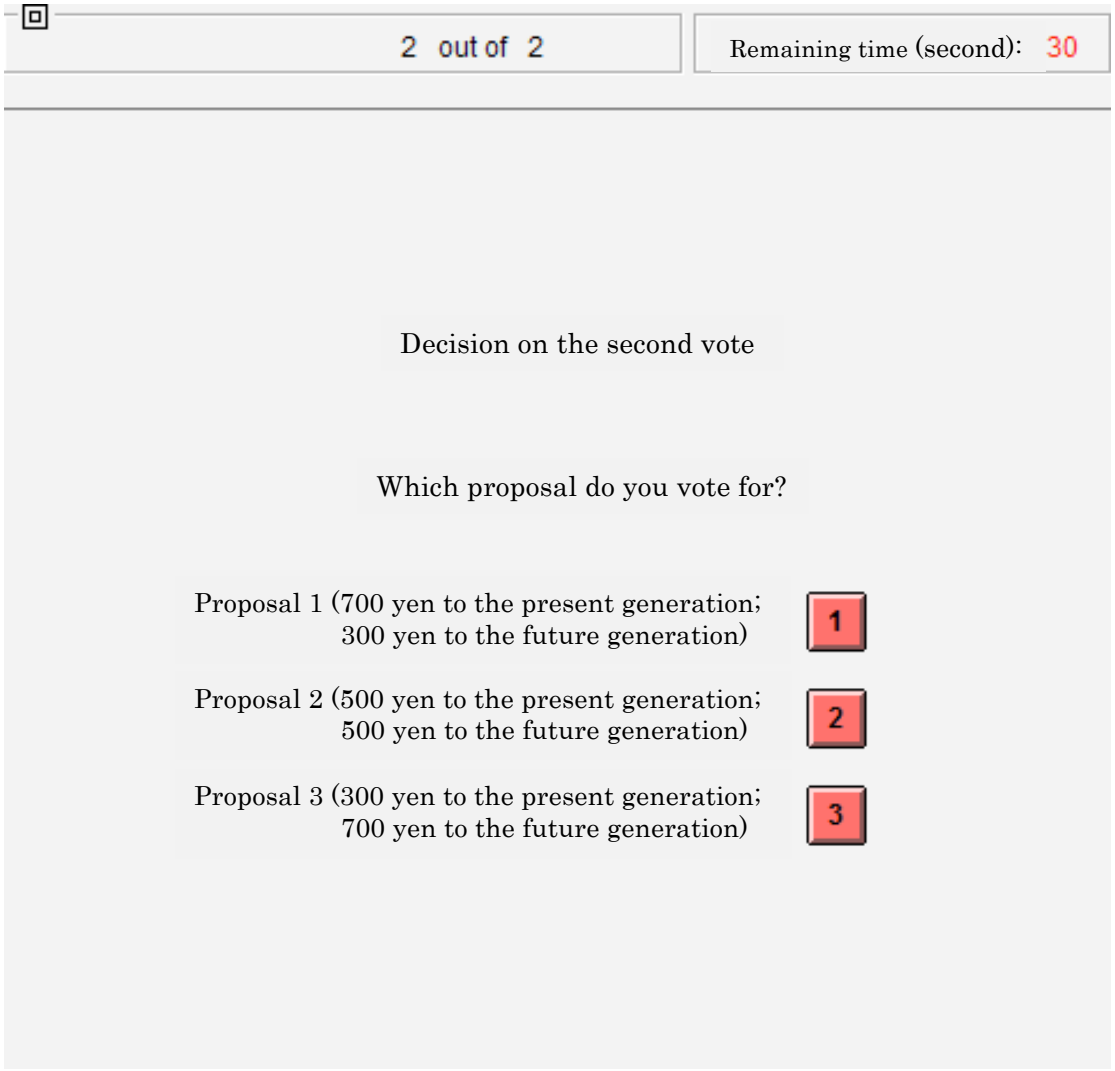
In the upper right corner of the screen, the remaining time in second is shown. This screen automatically proceeds after “2 minutes.” Before that, participants who are given the roles of the present generation should consider which proposal to vote for.

Decision-making screen 1 for “the present generation”



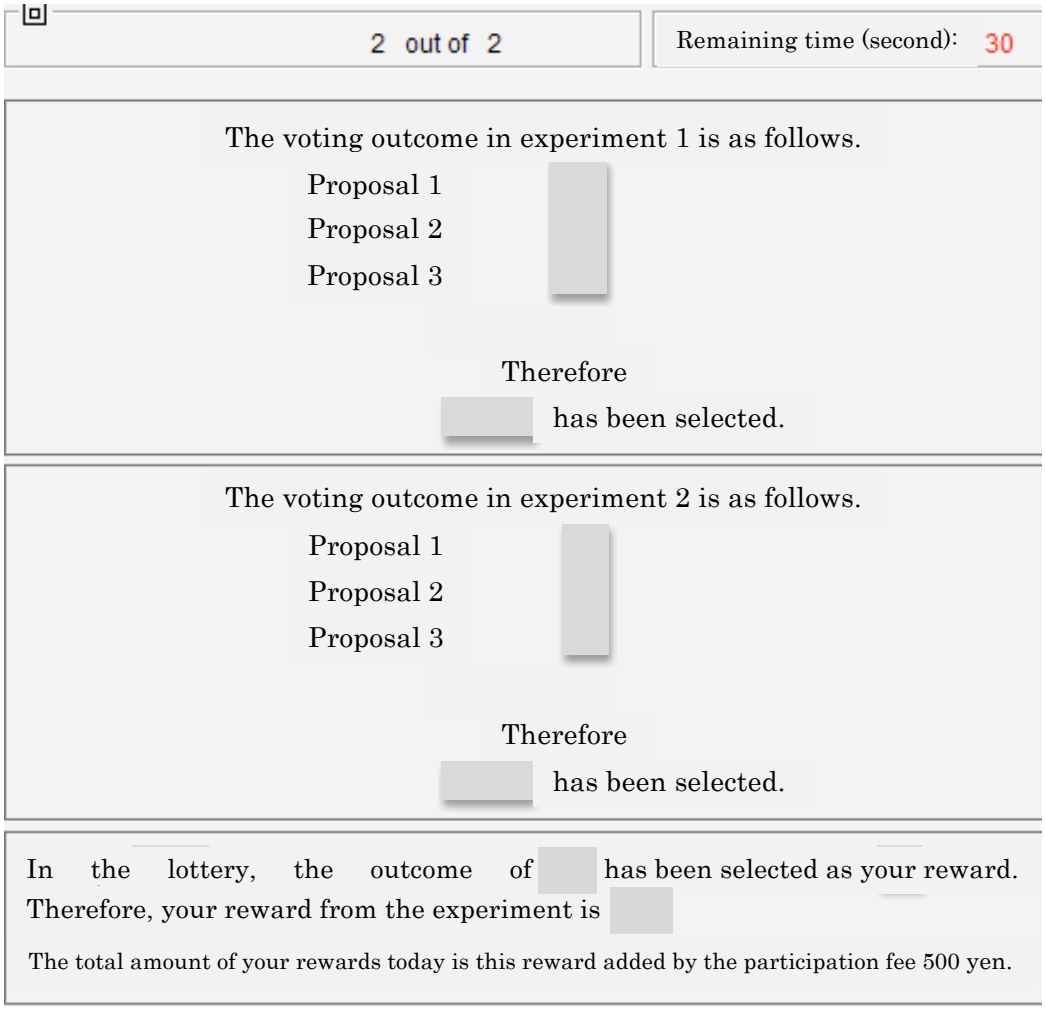
Decisions by the present generation are made on a screen such as the above. This screen is the same as the decision-making screen of experiment 1.

Decision-making screen 2 for "the present generation"



On a screen such as the above, the participant who is in the present generation and has two votes casts his or her second vote as the proxy of "the future generation." The way of decision making is the same as before.

Screen of the outcomes



After all the decisions in experiment 2 are completed, there appear the voting outcomes of experiments 1 and 2 such as the above. It is also informed which outcome has been selected by computer as your reward. The total amount of your rewards, including your participation fee 500 yen, is also shown.