Sustain Sci
DOI 10.1007/s11625-016-0419-8

ORIGINAL ARTICLE

Negotiating with the future: incorporating imaginary future generations into negotiations

Yoshio Kamijo[1,2] · **Asuka Komiya**[3] · **Nobuhiro Mifune**[1,2] · **Tatsuyoshi Saijo**[1,2,4,5,6]

Received: 13 May 2016 / Accepted: 14 December 2016

Abstract People to be born in the future have no direct influence on current affairs. Given the disconnect between people who are currently living and those who will inherit the planet left for them, individuals who are currently alive tend to be more oriented toward the present, posing a fundamental problem related to sustainability. In this study, we propose a new framework for reconciling the disconnect between the present and the future whereby some individuals in the current generation serve as an imaginary future generation that negotiates with individuals in the real-world present. Through a laboratory-controlled intergenerational sustainability dilemma game (ISDG), we show how the presence of negotiators for a future generation increases the benefits of future generations. More specifically, we found that when faced with members of an imaginary future generation, 60% of participants selected an option that promoted sustainability. In contrast, when the imaginary future generation was not salient, only 28% of participants chose the sustainable option.

Handled by Eiji Hosoda, Keio University, Japan.

✉ Yoshio Kamijo
yoshio.kamijo@gmail.com

[1] School of Economics and Management, Kochi University of Technology, 2-22 Eikokuji-Cho, Kochi-Shi, Kochi-Ken 780-8515, Japan

[2] Research Center for Future Design, Kochi University of Technology, Kochi-Shi, Japan

[3] School of Integrated Arts and Sciences, Hiroshima University, Higashihiroshima, Japan

[4] Institute of Economic Research, Hitotsubashi University, Tokyo, Japan

[5] Research Institute for Humanity and Nature, Kyoto, Japan

[6] Urban Institute, Kyushu University, Fukuoka, Japan

Keywords Intergenerational sustainability dilemma game · Imaginary future generation · Negotiation

Introduction

One obvious, but important fact is that people to be born in the future are not present today. Although this fact is clear to the point of being redundant, it is of critical importance when considering its implications for the sustainability of communities, nations, and the world as a whole. When individuals discuss important issues, including pension reform, energy policy, or environmental protection—all of which affect future generations—individuals in those generations are (by nature) excluded from those discussions. This is problematic when agreements struck by individuals in the present are biased to present circumstances; this represents one of the fundamental problems facing issues related to sustainability (Saijo 2015).

To make a path towards sustainability, it is important to understand the global, social, and human systems that support it, as well as the linkages between them (Komiyama and Takeuchi 2006). Experimental studies are useful for gathering data on issues that influence the three systems across generations, as collection of reliable data over a long period is difficult due to changes in the social, political, and economic environments.

Compared to resource management within a single generation, the problem of inter multiple distinct generations differs intrinsically in the existence of a time lag (Grolleau et al. 2016) due to the longer time span, in the composition of society (Chaudohuri et al. 2006) and, thus, in the one-direction consequences of the interaction of their decision (i.e., the past generation affects the situation of the current and future generation, and not vice versa) (Fisher

Published online: 30 December 2016

et al. 2004; Hauser et al. 2014; Sherstyuk et al. 2016). As the future generation is not in the present, communication (Carpenter 2000; Hackett et al. 1994) and sanctions (Fehr and Gachter 2000; Ostrom et al. 1992; Yamagishi 1986) that are well-known from the literature on experimental economics to work as a resolution to the common pool resource, are difficult to implement to the resource allocation problem across generations.

The number of the studies that explore the mechanisms to enhance the sustainability of a resource across multiple generations is limited. Previous studies experimentally investigate how the sustainability of a common pool resource across generations is affected by the growth rate of the resource (Fisher et al. 2004), the degree of altruistic preference for future generations (Sherstyuk et al. 2016), and the democratic process (Hauser et al. 2014). In particular, Hauser et al. (2014) found that, when group members vote for the extraction level of resources and the median vote is extracted by all members, democratic decisions greatly reduce the probability of resource depletion. Hauser et al. (2014) noted, however, that this relationship only holds if all members within a given generation join this institution. That is, if some members of a generation are not required to adhere to a decision that was democratically taken, the democratic rule's effectiveness in preventing resource depletion is mitigated.

Independent of Hauser et al. (2014) work, there exists another limitation of democratically selected choices that exclude future generations from the political process. When there are conflicts of interest between individuals in the present and individuals in the future, the decisions made by the former generation (and the degree to which they benefit the latter) are strongly contingent on the degree of their altruism. Although Hauser et al. (2014) argued that "voting can allow a majority of pro-social individuals to override a purely selfish minority" (p. 222), some studies have shown that the likelihood of this occurrence depends on specific situations (Croson and Gneezy 2009; Gintis 2014; Kamijo et al. 2015; Paxton and Glanville 2015). The possibility of an individual to make prosocial decisions that benefit future generations is uncertain at best. This uncertainty highlights the need for an instrument that prevents the traditional democratic process from passing the debts (financial and otherwise) of current generations to future generations. In other words, we need some device to enable the current generation to also consider the welfare of the future generations when dealing with issues that may have a long-term impact and thus affect the population of the future generation.

To this end, we propose a new mechanism that allows members of the current generation to virtually communicate and negotiate with members of future generations. In this communicative mechanism, an individual from the present generation (referred to as an imaginary future generation) interacts and negotiates with others as if he/she were doing so on behalf of a future generation.[1] The imaginary future generation plays the role of the negotiator on behalf of the future generation, the communicator who informs the present people of what the future generation would think about, and the observer with future views. Through communication and negotiations with the imaginary future generation, the present people are expected to gain significant knowledge of what may benefit the future and their decisions are expected to reflect such awareness.

In this paper, we examine this framework in a laboratory setting to determine how well it reconciles the conflict of interest between present and future generations. More specifically, we examine how the forced salience of an imaginary future generation during negotiations improves benefits for that generation through an intergenerational resource allocation problem. We expect the imaginary future generation to contribute to the benefit of the future and to the total welfare of the present and the successive generations.

To test this framework, we newly develop a simple distribution task that captures the nature of the dilemma regarding sustainability. In the intergenerational sustainability dilemma game (ISDG), players adopt one of two sides. On one side, participants advocate positions that are beneficial to the present generation, exclusively maximizing the benefits of the current generation. On the other side, players advocate positions that are beneficial to future generations, supporting the principle of utilitarianism (providing the greatest happiness of the greatest number of people), the maximin principle (providing the greatest benefit of the least-advantaged members of society), and the notion of sustainable development (World Commission on Environment and Development 1987). Each generation faces the tension between outcomes that maximize profits versus those that adhere to sound ethical standards.

For the purposes of our analysis, we introduced two conditions for the ISDG. In the treatment condition, one of the members in the present generation is assigned with the role of an imaginary future generation, who acts on behalf of future generations. Thus, in the treatment condition, negotiations take place with the "presence" of such negotiator. In contrast, in the control condition, the present people discuss without an individual who speaks for future generations.

[1] The idea of an imaginary future generation first appeared in Saijo (2015). The author proposed a way of transforming our society towards sustainability, and the key concept of his approach is the imaginary future generation. In addition to this laboratory experiment, our research team examines the idea through some practice exercises, as the citizen participation in local districts of Japan. A detailed explanation can be found in "Discussion".

Our analyses produced three notable findings. First, comparison of the two conditions shows that players choose a sustainable option in the treatment condition (60% of the time) to a significantly higher degree than the control condition (28% of the time). Second, this increase is associated with the increase of the statements for a sustainable option in the discussion of the treatment condition. The imaginary future generations, as well as other members (i.e., not-imaginary-future-generation members) in the treatment condition, produced more positive statements on a sustainable option than participants in the control condition. Third, our analyses demonstrate that this treatment works especially in situations characterized by fewer prosocial players. Indeed, the number of prosocial players in a negotiation significantly increases the likelihood that the players will choose a sustainable option in the control condition. However, even when there are less prosocial players, introducing an imaginary future generation enhances the likelihood at the same level as when all members are prosocial.

We discuss these results, and other issues surrounding them, in greater detail in the subsequent sections. In "Experimental design and procedure", we explain the nature of the ISDG and describe the experimental design and procedures we followed. We report the results of our experiment in "Results" and offer some concluding remarks in "Discussion".

Experimental design and procedure

Intergenerational sustainability dilemma game

We first describe in detail the intergenerational sustainability dilemma game (ISDG). In this game, a chain (which represents a "society") consists of five distinct generations, each of which comprises of three participants.[2] Three participants in one generation are required to choose between Option A and Option B (Fig. 1). These options entail the pie (i.e., money) for the generation and, thus, each generation has to discuss and decide how to redistribute it among themselves, in addition to the choice from Options A and B.

An essential feature of the ISDG is that the choice of the current generation affects the size of the next generation's pie (Fig. 1). Option A brings a larger benefit to the current generation, but it is detrimental to the benefit of the next generation. This is interpreted as exploiting the future generations or refraining from investing in the future. In contrast, Option B brings less benefit to the current generation, but preserves the size of the pie as it is. Therefore, Option B is a sustainable choice. For example, as shown in the last column on the left of Fig. 1, the first generation chooses between obtaining 3600 JPY (Option A) and 2700 JPY (Option B). When the first generation chooses Option A, the second generation's pie decreases in size by 900 JPY; they have to choose between 2700 JPY (Option A) or 1800 JPY (Option B). In contrast, when the first generation chooses Option B, the size of the second generation's pie is not affected (i.e., 3600 JPY vs. 2700 JPY). In a similar way, the choice of the second generation affects the size of the third generation's pie and so on (see Fig. 1).[3] Thus, all generations obtain 2700 JPY when they continue to choose Option B, but their pies shrink gradually (3600 for the first generation, 2700 for the second, 1800 for the third, etc.) if they continue to choose Option A.

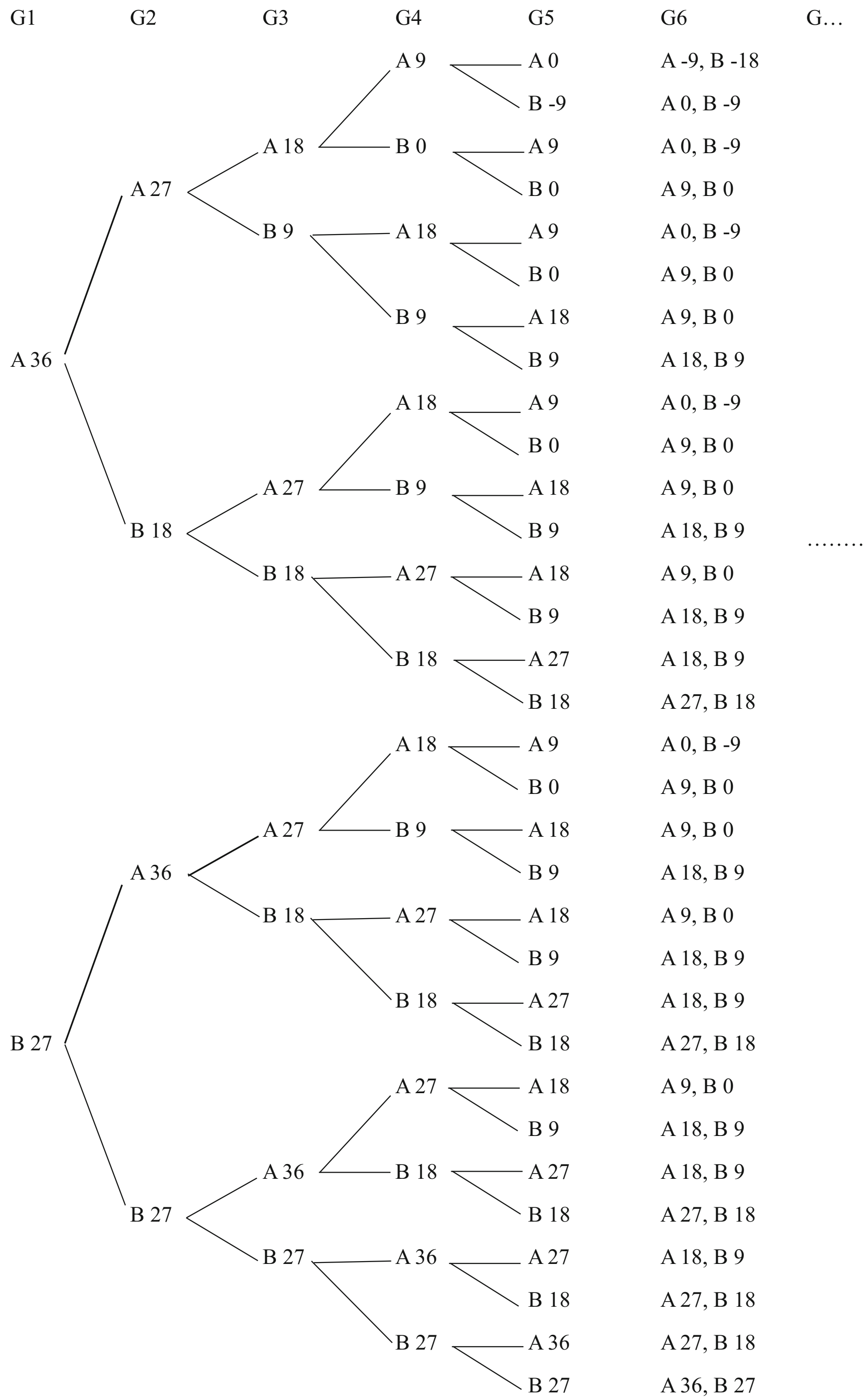
While the equality, utilitarian, and maximin principles suggest that all generations should choose Option B, the self-interested choice of each generation is Option A. Thus, there is a conflict between the intergenerational rationality and the single-generational rationality, like in the well-known prisoner dilemma, where the collective rationality conflicts with the individual rationality. However, the ISDG game differs from the prisoner dilemma on a number of key aspects. First, in the ISGD game, the payoff for people in a given generation is fixed as a function of their own decision; the decisions of future generations do not influence the payoff obtained by the original generation. Consequently, direct reciprocal behavior of between present and future generations is impossible; choosing the sustainable choice cannot be explained by reciprocal altruism (Trivers 1971). Second, each generation can only select Option A or B one time, and are therefore unable to exert influence the decisions of future generations beyond their one selection. Consider that even if the current generation chooses Option B, there is no guarantee that the next generation will also choose Option B, nor is there any way for the current generation to intervene in the next generation's decision-making process.

There are a few studies that experimentally investigate the sustainability of a resource across generations. Fisher et al. (2004), Hauser et al. (2014) and Sherstyuk et al. (2016) (henceforth, FHS) carried on an experiment of dynamic games across generations, where members of a generation individually deicide their level of consumption of the inter-generational resource. In the FHS models, the

[2] In our experiment, there was a sixth generation, who only receives benefits following the decisions of the fifth generation.

[3] We chose the reward sizes so that the total participation fee of participants should not deviate from the standard participation fee of experiments in Kochi University of Technology. Moreover, the cost of choosing a sustainable option is 900 JPY for a generation (i.e., 300 JPY for each generation member on average), which would be enough high for about 70% of participants to choose Option A when there is no additional mechanism to support the sustainable option.

Fig. 1 Payoffs for each generation



larger the consumption of the resource by the members of some generation, the greater their benefit and the worse the situation of the subsequent generations. Thus, similar to the ISDG, past generations unilaterally affect the situation of future generations.

The ISDG has two specific features compared to the FHS models. First, the experimental task the participants work on is simple enough to eliminate the possibility of mistakes or misunderstanding of the participants. In particular, in the ISDG, the participants face a binary choice problem between the sustainable and the self-interested options, while the FHS considers a rather complex dynamic problem with multiple choices, wherein a certain level of cognitive ability is required to understand what the best options are with regard to self interest and total welfare. Second, while people in the same generation should discuss and take a decision as a group in the ISDG, participants in the same generation take individual decisions separately in the FHS, and the combination of their choices determine their own payoff, as well as the situation of the next generation (i.e., how much resources remain in the future). Therefore, participants in the FHS choose considering not only the choices of the future people, but also the choices of others in the same generation. In particular, the over-consumption or the free-riding behavior of members of the same generation becomes important for the sake of sustainability. In contrast, eliminating the effect of intra-generational conflict, the ISDG directly considers the problem of intergenerational resource allocation and focuses on the moral dilemma of the current people between self-interest and sustainability.

Introducing an imaginary future generation

The difficulty associated with a generation's selection of Option B derives from the inability of future generations to communicate and negotiate with the current generation. The absence of voices from future generations makes it impossible for the current generation to consider their hopes and preferences.

We, thus, suggest introducing a person who acts on behalf of people of the future generation into negotiations (i.e., the imaginary future generation). The imaginary future generation communicates and negotiates with individuals in the current generation, on behalf of the future generation. Note that, because the imaginary future generation is a part of the current generation, their delegate receives the benefit based on the decision of the current generation.

As already mentioned, in the present study, there are two conditions: the treatment and the control condition. In both conditions, three participants made a choice through discussion between Option A and Option B. In the treatment condition, one of the members was told to negotiate with other members as a representative of the later generations, whereas there was no imaginary future generation in the control condition. It is also explained that the payoff of the imaginary future generation is determined by the choice of the current three participants, including this person, and how they allocate the amount of money from their choice among the three. Comparing these conditions, we investigated whether the presence of the imaginary future generation helps people make sustainable choices in the context of an ISDG.

Experimental procedure

Subjects

We performed this experiment in two waves, respectively, occurring in February and June of 2014. We recruited subjects from a subject pool based at Kochi University of Technology in Japan. In total, we recruited 210 graduate and undergraduate students (90 in February and 120 in June) to participate in the study.

The data from five generations from twelve chains ($N = 180$, 55 women, 125 men; mean age = 19.47) were submitted to the analyses reported below. The other 30 participants were assigned to the sixth generations, who only received benefits following the decisions of the former generations. Five chains were assigned to the control condition, whereas seven chains were assigned to the treatment condition.

Procedure

Upon arriving at the reception desk, they drew a card that indicated which chain and generation they belonged, as well as their identification numbers (i.e., 1, 2, and 3 in the control condition or 3α in the treatment condition).[4] They then were introduced to separate rooms, depending on whether they were in the treatment or control conditions. In each room, a member of the research team distributed instructions and explained the experimental procedures to participants (see Appendix for the specific instructions). Specifically, participants were told that each generation would make a decision between Option A and Option B and would receive a reward based on their choice. They knew all branches of the game tree (i.e., they saw Fig. 1), but did not know the total number of generations involved in the game. In the treatment condition, participants were also told that one of the three participants (i.e., the person who drew a card indicating 3α) should discuss with other members on behalf of later generations. In the instruction, the role of α participant is explained as follows: "Subject α will negotiate with the other two members of the subgroup, not on behalf of him/herself, but on behalf of the people in the subgroups who follow the current subgroup. However, the reward of Subject α will be determined by how the subgroup allocates its money". The instructions did not refer to the context of the intergenerational resource allocation problem and did not allude to salient research objectives. For instance, rather than use the word "chain" and "generation" in the instructions, we instead used the word "group" and "subgroup". After receiving the instructions, the first generations were led to small rooms

[4] α has no special meaning in Japan, and is considered to be neutral.

with respect to each chain, where they engaged in discussions. After arriving at their decisions, participants moved to another room to complete a questionnaire that measured social value orientation (Van Lange et al. 1997) and demographics (e.g., sex and age). Participants then received their payouts and were dismissed. The procedure was repeated five times.

Each generation in a chain used the same discussion room, in order. In each discussion room, there was a research assistant, who handled the flow of subjects (i.e., letting subjects who finished the decision move out and inviting the next participants) and followed the group discussion. The discussion was carried on orally and recorded through a voice recorder. The discussion was required to finish within 10 min; otherwise, the generation's reward regarding this task would be zero. In the treatment condition, at the beginning of the discussion, subject α (an imaginary future generation) had to inform the other two members that he/she drew the α card.

The group decisions were all written on a whiteboard.[5] Therefore, subjects were aware of the former generations' decisions. For example, members of the third generation could see the choices of the first and the second generations in the same chain, like "B, B." Each generation could not face and communicate with the former generation, as they came into the discussion room only after the former generation moved out. Also, they could not know the decisions of the other chains.

On average, the experiment took approximately 90 min. Since subjects were dismissed right after receiving the payout, the subjects assigned to the first generation were dismissed in 30–40 min, whereas those assigned to the fifth or sixth generation were dismissed in 90 min. For their participation, all subjects received a flat rate of 900 JPY, plus additional money as they decided in the ISDG.

Coding

To explore whether and the degree to which the presence of an imaginary future generation influenced the decision-making process, we transcribed all recordings of the negotiations. In total, participants produced 3034 statements.[6] We employed three coding types. The coding schema is shown in Table 1. Specifically, the coding took into account whether a statement was in support of or against Option A or Option B, neutral between the two, or about payout or not (Coding 1), whether each participant's final, pre-decision opinion was in support of Option A or Option B (Coding 2), and how the generation's decision was taken (Coding 3). For each statement (Coding 1), each individual (Coding 2), or each generation (Coding 3), two trained assistants applied a code. When these two coders disagreed on or missed the code to be assigned, one of authors made the determination.

Results

The influence of imaginary future generations on a generation's decisions in the ISDG

We first explored the main research objective of this study. Specifically, we tested whether the introduction of an imaginary future generation into negotiations affected a generation's likelihood of selecting a more sustainable option (Option B). Each generation's decision by each chain is shown in Table 2.

First, a Chi-square test reveals that the presence of an imaginary future generation significantly influenced the choice of the ISDG (χ^2 [1] = 6.00, p = .019). Whereas the majority of the generations in the control condition chose Option A (72%, 18 of 25) compared to Option B (28%, 7 of 25; z = −2.00, p = .046), those in the treatment condition were as likely to choose Option B (60%, 21 of 35) as Option A (40%, 14 of 35; z = 1.00, p = .31).

Next, we conducted a hierarchical regression analysis to examine the effects of contextual factors, such as the position in the chain and the size of pies. First, we regressed the generation's choice (Option A = 1, Option B = 0) on the condition (treatment condition = 1, control condition = 0; Table 3, Model 1). A Wald test revealed that the 95% confidence interval ($CI_{95\%}$) surrounding the mean did not contain zero (χ^2 [1] = 5.74, p = .017). As the next step, we added contextual factors to the model (Table 3, Model 2). The results showed that the significant $CI_{95\%}$ persisted (χ^2 [1] = 5.23, p = .022), suggesting that the effect of a future generation's presence in negotiations on the decision outcome was not moderated by the position in the chain or by the size of their potential payout.

Result 1: The presence of an imaginary future generation promoted a generation's sustainable choice in the context of the ISDG.

The influence of imaginary future generations on individual decisions in the ISDG

Individual choices

Next, based on Coding 2 (Table 1), we examined how introducing an imaginary future generation influences

[5] Later participants could only access to the group decision. They could not know individual decisions of the former generations.

[6] We defined a statement in terms of a speaking turn. We excluded conversations that took place between experimenters and subjects to clarify the procedures of the experiment.

Table 1 Coding schema

Coding	Coding schema	Proportions of all (%)	Inter-coder reliability	
			Agreement ratio (%)	Cohen's kappa (κ)
Coding 1[a]	In support of Option A	19.3	90.9	.71
	In support of Option B	17.8	91.3	.71
"The statement was…"	Against of Option A	4.7	94.6	.42
	Against of Option B	2.0	97.9	.45
	Neutral	45.0	78.5	.57
	Discussion about how to share	13.4	93.1	.71
Coding 2[b]	Participant's pre-decision opinion was in support of Option A	54.3	98.3	.97
Coding 3	A unanimous agreement without an opposing opinion	56.7	66.7	.42
"The group decision was made by…"	Using a decision-making device (e.g., majority voting, or a random-outcome mechanism like paper–rock–scissors)	13.3		
	Reaching a consensus through discussion, though there is a conflict of opinion	26.7		
	Miscellaneous/other methods[c]	3.3		

[a] A statement was defined by a speaking turn. This indicates that a statement can be classified into more than one category. Therefore, we treated types of statement as six independent categories, rather than mutually exclusive options of a single category. The percentages of types of statements did not sum up to 100%

[b] Five subjects' final opinions could not be coded, as they did not express their opinion before the group's decision was made final

[c] Two groups (3.3%) were rather unorthodox; they used a game of rock-paper-scissors to take their decisions, despite the absence of conflict among the group's members

Table 2 Raw data

Control						Treatment					
Chain	G1	G2	G3	G4	G5	Chain	G1	G2	G3	G4	G5
1	A	A	A	A	A	6	B	B	B	B	B
2	A	A	A	A	B	7	B	B	B	B	A
3	A	A	A	A	B	8	B	B	A	A	B
4	A	A	B	B	A	9	B	A	B	B	A
5	B	B	A	A	B	10	B	A	A	B	A
						11	A	B	B	A	A
						12	A	B	A	B	A

individual choices. When comparing individual opinions on the different types of subjects (i.e., subjects in the control condition, non-α participants in the treatment condition, and α [imaginary future generations] in the treatment condition), preferences for Option A differed significantly (χ^2 [2] $= 18.87$, $p < .001$). Not surprisingly, most of the α participants (69.7%; 23 of 33) selected Option B rather than Option A ($z = -2.263$, $p = .024$), whereas the majority (72.0%; 54 of 75) of the subjects in the control condition preferred Option A to Option B ($z = 3.811$, $p < .001$). Interestingly, non-α participants in the treatment condition were relatively split ($z = -0.611$, $p = .54$); 46.3% (31 of 67) voiced a final opinion in preference for Option A, and 53.7% (36 of 67) were in support of Option B.

The distribution of the individual positions within a generation is shown in Table 4. As shown, the majority of the generations in the control condition (72%) unanimously preferred Option A. In the treatment condition, in contrast, over half of the generations showed at least two people who preferred Option B. This means that there was a person who had a preference for Option B, other than the imaginary future generation, in the treatment condition.

Result 2: Introducing an imaginary future generation also facilitated a sustainable choice at the individual level.

Statements in the discussion

Did we facilitate a sustainable choice by introducing an imaginary future generation? To explore this point, we analyzed the statements of the discussion. The proportions of each type of statements over all statements across different types of participants are reported in Table 5. Not surprisingly, the α participants produced the largest number of statements in favor of Option B. Interestingly, it was followed by non-α participants in the treatment condition, and by subjects in the control condition (see Table 5). This rank order was reversed in terms of the proportion of statements in favor of Option A. That is, the presence of imaginary future generations promoted positive statements towards Option B of α participants, as well as of non-α participants.

Table 3 Log-linear regression models of group decisions

Explanatory variables	Model 1				Model 2			
	Coef. (SE)	z	p	$CI_{95\%}$	Coef. (SE)	z	p	$CI_{95\%}$
Intercept	0.94 (0.45)	2.12	.034	(0.07, 1.82)	−0.20 (1.66)	0.12	.904	(−3.45, 3.05)
Condition (0 = control, 1 = treatment)	−1.35 (0.56)	−2.40	.017	(−2.45, −0.25)	−1.59 (0.69)	−2.30	.022	(−2.95, −0.23)
Generation no.	–	–		–	0.20 (0.28)	0.70	.481	(−0.35, 0.74)
Payoff for A	–	–		–	0.0003 (0.0004)	0.62	.538	(−0.001, 0.001)
Pseudo R^2	.0742				.0806			
AIC	80.76				84.23			
LR χ^2	6.15				6.68			
Prob $>\chi^2$	.013				.083			
Log-likelihood value	−38.38				−38.11			

Table 4 Proportion of generations that chose Option B, based on the final position of their members ($N = 57$)

Condition	Members who took the position of Option B				χ^2 (3)	p
	None	1 person	2 people	3 people (all)		
Control	18 (72.00%)	0 (0.00%)	0 (0.00%)	7 (28.00%)	12.86	.005
Treatment	9 (28.13%)	5 (15.63%)	2 (6.25%)	16 (50.00%)		

Table 5 Proportion of statements in support of Option A or Option B by condition

Statements	Control	Treatment		χ^2 (2)	p
		Non-α	α		
Supportive statements for Option A	270 (27.55%)	247 (18.04%)	68 (9.94%)	82.78	<.001
Supportive statements for Option B	142 (14.49%)	234 (17.08%)	163 (23.83%)	24.86	<.001
Total statements (denominator)	980	1370	684	–	–

Result 3: Introducing an imaginary future generation increased the number of positive utterances towards a sustainable choice.

Finally, we calculated the correlation coefficients relating the generation's choice (Option A = 1, Option B = 0) to: (1) the number of members who supported A in the generation, and (2) the ratios of statements which were supportive of Option A to Option B in the generation (see Table 6). These correlations were statistically significant, suggesting that the indicators outlined above were the driving factors behind the generation's decisions.

Result 4: There were significant correlations across statements in the discussions, individual decisions, and generation's decisions.

In sum, the results suggest that introducing an imaginary future generation facilitates people to talk about and choose Option B at the individual level, and, thus, Option B was more likely to be chosen as a generation's decision in the treatment condition.

Did the presence of an imaginary future generation influence decision-making processes?

For this part of the analysis, we reported how the introduction of an imaginary future generation influenced the style of the group decision-making (i.e., the discussion rules and times). Because there have been few behavioral experiments using the ISDG, we believed it is also important to describe how a discussion proceeds.

Decision rules. Introducing a representative of the future did not significantly influence the type of decision rule the groups adopted, but a slightly greater number of treatment groups used a decision rule than control groups (Table 7). This result was consistent with our findings related to individual choice, which showed greater disagreement among treatment groups relative to control groups.

Discussion time. Across all conditions and groups, subjects spent nearly five minutes engaging in discussion ($M = 292.71$ s, $SD = 171.68$ s). As with the other

Table 6 Correlation matrix ($N = 57$)

	Statements for B	No. members for A	Chose Option A
Ratio of statements for A in each group	−.682**	.775**	.779**
Ratio of statements for B in each group	–	−.782**	−.725**
Number of members who ultimately endorsed A	–	–	.949**
Chose Option A (A = 1, B = 0)	–	–	–

** $p < .001$

Table 7 Proportion of groups that adopted decision rules of various types ($N = 60$)

Condition	Decision rule				χ^2 (3)	p
	Unanimity	Decision device	Consensus	Other		
Control ($N = 25$)	18 (72.00%)	1 (4.00%)	6 (24.00%)	0 (0.00%)	6.12	.011
Treatment ($N = 35$)	16 (45.71%)	7 (20.00%)	10 (28.57%)	2 (5.71%)		

Table 8 Ratio of groups choosing Option B

Condition	Number of prosocial people			
	None	1 person	2 people	3 people
Treatment	–	80.0% (4 of 5)	56.3% (9 of 16)	57.1% (8 of 14)
Control	0.0% (0 of 1)	0.0% (0 of 2)	0.0% (0 of 6)	43.8% (7 of 16)

moderators, however, discussion time was dependent on the condition. The generations in the treatment condition ($M = 351.23$ s, $SD = 158.60$ s) tended to discuss longer than the generations in the control condition ($M_{ctl} = 210.80$ s, $SD_{ctl} = 157.60$). This difference was significant (t [58] = 3.39, $p = .001$, $d = 0.88$). This result was unsurprising given the high level of disagreement among individuals in the treatment groups. That level of disagreement takes a longer amount of time to sort through.

Results 5: Introducing an imaginary future generation did not significantly change the methods of achieving agreement (However, simply because it increases the number of individuals who are supportive of Option B, there were more conflicts in the treatment condition than in the control condition and, then, it took longer to reach an agreement).

The moderating effect of prosociality

We finally explored whether and how prosociality, that is, the orientation "to maximize outcomes for both themselves and others (cooperation) and to minimize differences between outcomes for themselves and others (equality) (Van Lange et al. 1997, p. 733)", moderates the effect between the treatment condition and the groups' decision-making. Prosocial people—who tend to have a general concern for the outcomes of others—would be also generous with future generations. Thus, if there are many prosocial individuals in a generation, the generation would be more likely to choose Option B, regardless of whether there is an imaginary future generation or not. In other words, prosocial people might be less sensitive to the presence of the imaginary future generation than non-prosocial people. The results of our analyses supported this hypothesis. The makeups of the generations that selected Option B (in terms of prosocial members relative to other members) are outlined in Table 8. When none or only some (i.e., one or two) in a generation were prosocial ($n = 30$), the generations in the treatment condition were more likely to choose Option B than those in the control condition (Fisher's exact test, $p = .003$). In contrast, when all members of the generation were prosocial ($n = 30$), regardless of the conditions, almost half of the generations chose Option B (Fisher's exact test, $p = .72$).[7] Moreover, in the treatment condition, the number of prosocial players in a generation did not predict whether the group selected Option B (Fisher's exact test, $p = .07$). However, in the control condition, groups only comprising prosocial individuals selected Option B significantly more than Option A (Fisher's exact test, $p = .02$). These results suggest that the inclusion of a member of an imaginary future makes individuals choose a sustainable alternative, especially when there are no or less prosocial individuals.

[7] We did not conduct a logistic regression analysis entering the interaction term of the number of prosocial people and conditions here because this dataset has a problem of quasi-complete separation due to the small sample size. Therefore, a logistic regression model fails to converge and the parameters in the model could not be estimated.

Result 6: When all members of the generation were prosocial, the generation was as likely to choose a sustainable option in the treatment condition as in the control condition in the ISDG. However, when there were less prosocial individuals, the existence of an imaginary future generation induced people to choose a sustainable option.

Discussion

Without accounting for the voices of individuals from distant future generations, it is impossible to move towards a sustainable society. To address this difficulty, we propose a new approach through which some individuals from the current generation serve as representatives for future generations (called an imaginary future generation) during negotiations. In this study, we have empirically explored how this approach works in the laboratory with respect to resource allocation. Our analyses revealed that when members of an imaginary future generation are present during negotiations, groups tend to select more sustainable options.

This is the first study to show that introducing an imaginary future generation helps people achieve a sustainable society. In previous studies, the median voter rule is the only mechanism that is investigated as a means to enhance sustainability (Hauser et al. 2014), and it is a clear limitation, as it relies strongly on the altruistic preference of the current people for the future. On the other hand, in the present study, we explore an alternative mechanism that focuses on and solves the fundamental problem of the intergenerational issue, i.e., the absence of the future generation in negotiations in the present. We found that the presence of an imaginary future generation makes people choose a sustainable option.

Moreover, contents analyses of discussions showed that the α participants (i.e., participants who were assigned to the imaginary future generation) served as effective proxies for these imagined generations. Relative to those from the current generation in the treatment condition, as well as those in the control condition, α participants tended to: (1) be more supportive of sustainable options, and (2) maintain their preferences for sustainable options at the end of the discussion. Interestingly, this tendency also encourages other people in the treatment condition to foster positive attitudes towards a sustainable option. Taken together, these results suggest that the presence of an imaginary future generation provokes lively arguments and negotiations between the current and the future generations.

We found that the introduction of an imaginary future generation works especially when there are less prosocial people. Prosociality and altruism have long-been known to contribute to cooperation in prisoners' dilemmas (McClintock and Liebrand 1988; Van Lange 1992). In the control condition in this study, only groups comprised of three prosocial people selected the sustainable option. In contrast, in the treatment condition, participants tended to choose the sustainable option regardless of the number of prosocial members in the group. We believe that the pursuit of a sustainable society cannot be exclusively reliant on the prosociality of a generation's members. Introducing an imaginary future generation is one of the options to create a sustainable society.

Our finding that the group becomes more altruistic in presence of an imaginary future generation should be emphasized in the literature on group decision in experimental economics and social psychology. The literature concludes that a group shows a stronger self-interested preference than an individual (Charness and Sutter 2012). The reason of this tendency is a mixture of several factors, such as in-group favoritism and group discussion process (Wildschut and Insko 2007). It is also suggested that the future payoff is further threatened by the self-interested bias of the group decision and this is also the source of the present bias of our society. Our experiment shows that, even under a group decision that is biased towards self-interest, the introduction of imaginary future generations works to enhance the future profit and sustainability.

Even though we found that a positive effect on the sustainability of the treatment condition, there were some limitations in the present study. First, we found that, when people were designated to the imaginary future generation, many actively supported the sustainable option and served as proxies for other generations, even without a monetary incentive. However, this result might depend on the fact that we used Japanese university students as participants and professors as instructors. Thus, the norm-sensitive environment of the Japanese society may become a strong pressure for α participants to behave as "experimenter demands," and the effect of the treatment condition might be overestimated. Future research in this domain would benefit from replication studies conducted in other societies, where there is a weak norm and hierarchical relationship, like Australia (Gelfand et al. 2011).

Second, in our experiment, participants could see "the future generation" in the waiting room, unlike in the real life. In a sense, our manipulation fails to realize an intergenerational feature where people in different generations never meet, communicate, and negotiate with each other, although participants neither had a chance to talk to each other, nor knew the generation and the chain numbers of other participants. We adopted this setting so that the participants could recognize that the successive generation actually exists, but, at the same time, it is possible that this setting affects their decision. For example, it might lessen the feeling of time discrepancy, which should exist in intergenerational problems. In addition, the lack of time dimension might influence psychological processes, such as time discounting. For example, Yi et al. (2011) showed that adding a delay to the receipt of outcomes decreases self-interests and increases altruism. Future research should address this issue by designing experiments with delayed rewards.

Third, the three-person group may be sensitive to the adjustment of one person to the imaginary future generation. Although it is easily predicted that the efficacy of the imaginary future generation on the sustainable choice strongly depends on the ratio of α participants to the group size, it is useful to identify the boundary condition of the efficacy of the imaginary future generation. Moreover, other experimental parameters, such as the decision rule of each generation and the size of the stake, were arbitrarily determined. Future studies in various laboratory settings could confirm the robustness of the current findings.

Related to the second and third points, we have to consider how our experimental findings can be applied to the actual people's behaviors. The real-world is totally different from the laboratory environment in several aspects, such as the biased subject pool, the size and kinds of incentives, anonymity among people, and the choice set that people select (Levitt and List 2007). Field experiments can help check the external validity of our findings in the laboratory and make a bridge between the laboratory and the real environment (Falk and Heckman 2009). Thus, by using the general public as participants, future studies should investigate how the imaginary future generation works on group decisions and how the people assigned to the imaginary future generation behave and interact with other participants.

Accordingly, under the encouragement of our success of the laboratory experiment, our research team currently collaborates with local districts in Japan and attempts to institutionalize our approach into citizen participation. In particular, we assign a group of people to the imaginary future generation and others to the current generation and ask them to build a future vision of the district through discussion between the two parties.[8] This is one example of how we institutionalize and utilize the idea of an imaginary future generation into the decision-making of our society, and we expect that the number and the variety of the applications will increase in the near future.

Acknowledgements This work was supported by the Japan Society for the Promotion of Science (Grant-in-Aid for Scientific Research [B] 26285047 for YK, and Grant-in-Aid for Scientific Research [A] 24243028 and Grant-in-Aid for Challenging Exploratory Research 16K13354 for TS).

[8] For a detail of this pioneering attempt, see Hara et al. (2015) and Hara (2016).

References

Carpenter JP (2000) Negotiation in the commons: incorporating field and experimental evidence into a theory of local collective action. J Inst Theor Econ 156:661–683

Charness G, Sutter M (2012) Groups make better self-interested decisions. J Econ Perspect 26:157–176

Chaudohuri A, Graziano S, Maitra P (2006) Social learning and norms in a public goods experiment with inter-generational advice. Rev Econ Stud 73:357–380

Croson R, Gneezy U (2009) Gender differences in preferences. J Econ Lit 47:448–474

Falk A, Heckman JJ (2009) Lab experiments are a major source of knowledge in the social sciences. Science 326(5952):535–538

Fehr E, Gachter S (2000) Fairness and retaliation: The economics of reciprocity. J Econ Perspect 14:159–181

Fisher M-E, Irlenbusch B, Sadrieh A (2004) An intergenerational common pool resource experiment. J Environ Econ Manag 48:811–836. doi:10.1016/j.jeem.2003.12.002

Gelfand MJ et al (2011) Differences between tight and loose cultures: A 33-nation study. Science 332:1100–1104

Gintis H (2014) The bounds of reason: Game theory and the unification of the behavioral sciences. Princeton University Press, Princeton

Grolleau G, Sutan A, Vranceanu R (2016) Do people contribute more to intra-temporal or inter-temporal public goods? Res Econ 70:186–195

Hackett S, Schlager E, Walker J (1994) The role of communication in resolving commons dilemmas: experimental evidence with heterogeneous appropriators. J Environ Econ Manag 27:99–126. doi:10.1006/jeem.1994.1029

Hara K (2016) Participatory future design in pursuit of sustainability. Des Eng 51:22–28

Hara K, Yoshioka T, Kuroda M, Kurimoto S, Saijo T (2015) Participatory deliberation for future design by creating imaginary future generations - Evidence from an experimental workshop in Yahaba Town, Iwate, Japan. Proceedings of EcoDesign 2015 International Symposium, Tokyo, pp 72–74

Hauser OP, Rand DG, Peysakhovich A, Nowak MA (2014) Cooperating with the future. Nature 511(7508):220–223

Kamijo Y, Hizen Y, Saijo T (2015) Hearing the voice of future generations: A laboratory experiment of "Demeny voting". Kochi University of Technology, Social Design Engineering Series 2015–8

Komiyama H, Takeuchi K (2006) Sustainability science: Building a new discipline. Sustain Sci 1:1–6. doi:10.1007/s11625-006-0007-4

Levitt SD, List JA (2007) What do laboratory experiments measuring social preferences reveal about real world? J Econ Perspect 21(2):153–174

McClintock CG, Liebrand WBG (1988) Role of interdependence structure, individual value orientation, and another's strategy in social decision making: A transformational analysis. J Pers Soc Psychol 55(3):396–409. doi:10.1037/0022-3514.55.3.396

Ostrom E, Walker JM, Gardner R (1992) Covenants with and without a Sword: Self-governance Is Possible. Am Polit Sci Rev 86:404–417. doi:10.2307/1964229

Paxton P, Glanville JL (2015) Is trust rigid or malleable? A laboratory experiment. Soc Psychol Q 78:194–204. doi:10.1177/0190272515582177

Saijo T (2015) Future design: Concept for a ministry of the future. Kochi University of Technology, Social Design Engineering Series 2015–14

Sherstyuk K, Tarui N, Ravago MV, Saijo T (2016) Intergenerational games with dynamic externalities and climate change experiments. J Assoc Environ Res Econ 3:247–281

Trivers RL (1971) The evolution of reciprocal altruism. Q Rev Biol 46(1):35–57

Van Lange PAM (1992) Confidence in expectations: A test of the triangle hypothesis. Eur J Pers 6(5):371–379

Van Lange PAM, Otten W, De Bruin EMN, Joireman JA (1997) Development of pro-social, individualistic, and competitive orientations: theory and preliminary evidence. J Pers Soc Psychol 73(4):733–746. doi:10.1037/0022-3514.73.4.733

Wildschut T, Insko CA (2007) Explanations of interindividual–intergroup discontinuity: A review of the evidence. Eur Rev Soc Psychol 18:175–211

World Commission on Environment and Development (1987) Our common future. Oxford University Press, New York

Yamagishi T (1986) The provision of a sanctioning system as a public good. J Pers Soc Psychol 51(1):110–116. doi:10.1037/0022-3514.51.1.110

Yi R, Charlton S, Porter C, Carter AE, Bickel WK (2011) Future altruism: Social discounting of delayed rewards. Behav Process 86(1):160–163