Does Being Intergenerationally Accountable Resolve the Intergenerational Sustainability Dilemma?

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ABSTRACT We address whether intergenerational accountability (IA) is effective at maintaining intergenerational sustainability (IS) by conducting lab-in-the-field experiments of IS dilemma games. In a baseline treatment, a sequence of six generations, each composed of three members, was organized, and each generation chose whether to maintain IS (sustainable option) or maximize their payoff by imposing costs on future generations (unsustainable option) via deliberation. In IA, each generation was asked to provide reasons and advice to subsequent generations, along with the decision. Results indicate that IA induces generations to choose the sustainable option with positive reasons and advice, enhancing IS. (JEL Q56)

1. Introduction

Maintaining intergenerational sustainability (IS) is a challenge because of its unidirectional nature; the current generation affects future generations, but the opposite is not true. Therefore, the current generation must decide how to behave for the benefit of future generations. If the current generation chooses an action that is to their own benefit, the burden is passed to future generations and IS is compromised. We call such a situation the intergenerational sustainability dilemma (ISD) (Kamijo et al. 2017; Shahrier, Kotani, and Saijo 2017). Many problems are considered to have occurred because of ISD, such as climate change and government debt, threatening the sustainability of subsequent generations. Possible solutions to maintain IS have been discussed in relation to responsibility, justice, and equity (Padilla 2002; Garri 2010; Kverndokk, Naevdal, and Nostbakken 2014; Hoberg and Baumgartner 2017). However, contemporary economic and political institutions are not effective at maintaining IS because they fail to ensure an efficient allocation of resources, such as natural resources, public and environmental goods, and their intergenerational provisions (Buchanan and Stubblebine 1962; Krutilla 1967; Barry 1997; Milinski et al. 2006; Wolf 2008; Caney 2014, 2018; Hauser et al. 2014; Streeck et al. 2016).

Economic literature defines sustainability as a minimum condition to be satisfied; that is, maintaining the welfare of successive generations compared with the current generation (Hartwick 1977; Becker 1982; Dasgupta and Mitra 1983; Howarth 1991; Weitzman 1997). However, many social problems in contemporary societies violate the sustainability condition, where the current generation prioritizes their benefit by leaving burdens on future generations. For instance, outstanding debts of some OECD countries, such as Japan, the United States, France, and Italy, amount...
to 2.36, 1.3, 0.08, and 0.96 times their GDP, respectively, and Japan will take more than 100 years to pay its debt, even if it raises consumption tax from 10% (its current level as of 2018) to 40% (Hansen and Imrohoroglu 2016). Similarly, there is a serious threat of global climate change the current generation imposes on future generations. Coastal communities are predicted to suffer from a sea level rise by 2100 of up to 2 m, and it is reported that the rise is due to high greenhouse gas emission by the current generation (Bamber et al. 2019). The fundamental nature of the aforementioned sustainability problems can be considered ISD.

This article addresses a potential solution for ISD. We suggest a mechanism with accountability of reasons and advice as a one-way communication device from the current generation to subsequent generations to possibly improve IS; we call this “intergenerational accountability” (IA).\(^1\) We experimentally implement and evaluate IA in an ISD game (ISDG), where a sequence of generations is organized, and each generation chooses, within a 10-minute deliberation, to either maintain IS (sustainable option) or maximize their own generation’s payoff by irreversibly costing future generations (unsustainable option). We hypothesize that with IA, generations are likely to choose the sustainable option, giving positive reasons and advice to subsequent generations.

We conducted ISDG lab-in-the-field experiments in Nepal with three treatments: a baseline ISDG, an imaginary future generation (IFG), and IA. With the baseline ISDG treatment, a sequence of six generations was organized, and each generation chose either

\(^1\) The un incentivized communication, such as chat messages, cheap talks, and signaling, are studied intensively through laboratory experiments (Cason, Sheremata, and Zhang 2012, 2017; Cason and Mui 2015b; Crawford and Harris 2018). Following this line of research, we use un incentivized communication of reasons and advice as well as individual interviews to elicit subjects’ motives and belief behind the decision in a similar fashion with Blanco et al. (2010) and Armantier and Treich (2013). These features of our experiments shall be described in the details later. In addition, in this research, we consistently mention the term IA to refer to a (one-way) communication of reasons and advice, and the terms are interchangeably used throughout the manuscript.
rural people choose sustainable options more often than urban people, and IFG is not effective at enhancing IS. Overall, IS is found to be affected by individual social preferences and institutions.

Economics literature has sought to understand behaviors and performances of a group under various settings, such as communication (McCallum et al. 1985; Kameda and Davis 1990; Bornstein and Yaniv 1998; Charness and Sutter 2012; Kugler, Kausel, and Kocher 2012; Cooper and Kuhn 2016; Meub and Proeger 2017; Crawford and Harris 2018; Carbone, Georgalos, and Infante 2019; Vollstadt and Bohm 2019). In some specific situations, it is reported that communication does not necessarily enhance coordination and performances, influencing group members and groups in unexpected ways, such as in competitive coordination games (Bornstein, Gneezy, and Nagel 2002; Cason, Sheremeta, and Zhang 2012, 2017; Charness and Sutter 2012; Kugler, Kausel, and Kocher 2012; Keck, Diecidue, and Budescu 2014; Bradfield and Kagel 2015; Kagel and McGee 2016). Schotter and Sopher (2003, 2006, 2007), Chaudhuri, Graziano, and Maitra (2006), and Chaudhuri, Schotter, and Sopher (2009) use experimental games in which the current generation is incentivized to give advice to subsequent generations for their better choices, and the possibility of Pareto improvement mostly exists. Specifically, the current generation’s payoff depends on later generations’ actions (or performances) as if the relationship is overlapping, such as a parent-child relationship. In this type of experimental setting, Schotter and Sopher (2003, 2006, 2007), Chaudhuri, Graziano, and Maitra (2006), and Chaudhuri, Schotter, and Sopher (2009) focus on addressing the roles of social learning through advice over generations.

In ISD, our focus is on addressing sustainability for long-run relationships across generations as if they are nonoverlapping, and long-run sustainability problems are exemplified by the emergence of global climate change, various environmental problems, and government debt. In ISD situations, the current generation is considered to affect subsequent generations, but the opposite is not true where there is no possibility of Pareto improvement across generations (or all possible allocations are Pareto-efficient). That is, the current generation’s payoff does not depend on subsequent generations’ payoffs, but later generations’ payoffs depend on the current generation’s payoff. This is a unique feature in ISD, as it reflects environmental and resource sustainability problems over generations in the long run and is different from the experimental games in previous literature.

2. Experiments

ISDG

We explain the baseline ISDG following Kamijo et al. (2017) and Shahrier, Kotani, and Saijo (2017). In the ISDG, a nonoverlapping generational sequence is prepared with three members in a group called a generation, and each member participates only once. Each generation is asked to decide between an...
unsustainable option A and a sustainable option B through deliberation and how to split the share from the selected option within the generation. It is claimed that the ultimate goal of sustainability is to fairly ensure the well-being of people among the current and future generations; that is, intragenerational and intergenerational equalities at the same time (Dasgupta and Mira 1983; Howarth 1991; Weitzman 1997; Kverndokk, Naevdal, and Nostbakken 2014; Fochmann et al. 2018; Martinet, Campo, and Cairns 2022). Therefore, the ISDG is designed to mimic intragenerational and intergenerational decisions each generation must make for equalities in sustainability. With the design, the ISDG enables us to understand how individuals and groups sequentially behave toward sustainability in a single framework, building on some literature in individual and group decisions (McCallum et al. 1985; Bornstein and Yaniv 1998; Janssen, Anderies, and Cardenas 2011; Janssen et al. 2012).

The first generation starts an ISDG with \( X = 1,200 \) as a payoff for choosing A and a payoff \( (X - 300 = 1,200 - 300 = 900) \) for choosing B. After choosing between options A and B, the generation is asked to split the payoff associated with the option they choose among the generation members, which is considered their generation share. Each subject’s payoff is the sum of the individual generation share plus an initial individual endowment of 300. These numbers represent experimental points that a subject earns from the ISDG. Throughout the article, we consistently mention only the numbers for simplicity. Consequently, if members in a generation split the payoff equally among them, each member earns 400 by choosing A and 300 by choosing B as the individual generation share. Therefore, the total payoff of each subject in the generation choice of A is 700 (= 400 + 300), whereas the payoff is 600 (= 300 + 300) when choosing B.

The current generation’s decision affects subsequent generations such that later generations’ payoffs decline uniformly by 300 when the current generation chooses A. Suppose that the first generation chooses A. The second generation will face the game in which they can get 900 and 600 for choosing options A and B, respectively. However, if the first generation chooses B, the next generation can have the same decision environment as that of the first generation. When the first generation chooses B, the second generation plays a game in which they can get 1,200 and 900 for choosing options A and B, respectively. Following the same rule, the game continues for the rest of the subsequent two generations; that is between \( i \)th and \((i + 1)\)th generations. Therefore, B can be considered a “sustainable option,” whereas A is the choice that compromises IS and can be considered an “unsustainable option.”

In each session, the first generation starts and then proceeds to the second, third, . . . sixth generations in a sequence. Information regarding the previous generations’ decisions is provided to each of the second, third, . . . sixth generations just before they start deliberation. In ISDGs, the fifth and sixth generations may face the game in which options A and B are associated with the generation share of zero and/or a negative payoff if all previous generations keep choosing A. In the ISDG, we explain and ensure that an initial endowment is given to all subjects for covering their losses. This follows Mason et al. (2005), who argue some justification and procedures of preparing an initial endowment for subjects not to incur the losses via participating in experiments. In such a situation, generation members equally split their zero or negative generation share and recover by their initial individual endowments of 300. For instance, if all previous five generations in a sequence choose A, then the sixth generation faces the game in which options A and B are associated with generation shares of −300 and −600, respectively. If members in the sixth generation choose B, they receive the generation share of −600. In this case, each member would receive \(-200 = -600 \div 3\) from the generation share, ending up with the payoff of 100 = 300 − 200 by the initial endowment. Therefore, each subject’s payoff never becomes negative, even in the worst-case scenario.

Each generation deliberates to decide between options A and B and how to split the generation share within a 10-minute discussion. When decisions cannot be made in 10 minutes, the following rules apply: (1) if the generation share is positive, each member
receives an initial endowment of 300; (2) if the generation share is negative (e.g., –Z), each member equally splits –Z by 3 and receives the payment of –Z/3 plus an initial endowment of 300. In the experiments, all the generations reached decisions in 10 minutes across all the treatments. The subjects know that they are assigned to one generation in a sequence, but they are not informed of which generation is the last in the sequence. Note that we used more than six rooms in a session, depending on the days, locations, and number of subjects, and we prepared a separate room for each generation to keep anonymity among generations in a sequence (see Appendix Figure A2). This experimental environment is important to avoid a situation where subjects detect that they may be the last generation in the sequence. In this way, the end game effect is minimized. For further details of experimental procedures, refer to the Appendix.

A dominant strategy and a Nash equilibrium strategy in an ISDG are choosing A because it maximizes payoff, irrespective of how other generations choose in the past and will choose in the future in the same sequence. All allocations in an ISDG are Pareto-optimal because every allocation cannot be Pareto-improved by any other feasible allocation. However, there exists a unique allocation that leads to sustainability and maximizes the sum of payoffs for all the generations (i.e., social welfare). The socially desirable allocation will be the one achieved when every generation keeps choosing B, maintaining sustainability. Thus, in this article, a new mechanism called IA, as well as IFGs, are instituted as treatments to improve IS in an ISDG. The treatments are explained as follows.

**ISDG with IA**

In the IA treatment, generations were asked to choose between options A and B through a 10-minute deliberation, as in the baseline ISDG. With the IA treatment, during the deliberation, each generation was asked to provide reasons and advice for their decisions by writing on a sheet of paper, being accountable for subsequent generations. There were no penalties if current generations did not provide reasons and advice to later generations. The experimental instructions use a neutral phrasing of “please be accountable by providing reasons and advice for your decision during the deliberation.” We ensured that each generation’s reasons and advice were passed to later generations in the sequence. Each generation wrote the reasons and advice on a sheet of paper and handed it to research assistants. They were then asked to choose one concept from a list of seven that they consider the closest to their reasons and advice, as suggested by Timilsina et al. (2021a, 2021b). Generations that chose A or B can select one among concepts 1–5 or 6 and 7. In this way, they could not revise their decision and messages after seeing the list of concepts. Finally, we observed that generations in IA treatment provided reasons and advice to later generations, except one generation, which provided only the reasons to the decision without mentioning any advice.

We hypothesize that the IA treatment is effective at maintaining IS in the ISDG through one-way communication from the current generation to subsequent generations by being accountable; our idea is partly inspired by previous literature, such as Konow (2000), Schotter and Sopher (2003, 2006, 2007), Chaudhuri, Graziano, and Maitra (2006), and Chaudhuri, Schotter, and Sopher (2009). For the purpose of comparison with previous literature, such as Kamijo et al. (2017) and Shahrier, Kotani, and Saijo (2017), we include the IFG as an experimental method in our analysis.

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The accountability principle states that the scope of fair allocations varies in proportion to the relevant variables that people can influence (e.g., action-work effort), and the variables that cannot be influenced tend to be out of the scope (e.g., physical handicap by birth) (Konow 2000). “Reasons” and “advice” are two important elements of accountability as part of public and social communication for self-governance (Mulgan 2000; Wagner 2005). In this research, ISD represents sustainability problems, such as global climate change, with a long-run perspective of nonoverlapping generations. No previous literature has systematically examined how reasons and advice are effective at resolving sustainability problems under nonoverlapping generations, while some studies mention that offering reasons and advice to the public and responding to them may induce citizens to manifest their commitment to justice (Ortmann and Gigerenzer 1997; Rawls 1999; Schedler 1999; Hadfield and Macedo 2012; Kogelmann and Stich 2016; Caney 2018). Therefore, we hypothesize that reasons and advice in ISD function as part of institutions to enhance IS.
another treatment and evaluate which works better: IFG or IA.

**ISDG with IFG**

In the IFG treatment, generations were asked to choose between options A and B through a 10-minute deliberation as in the baseline ISDG; in addition, one member in a generation was randomly picked through a lottery and assigned as a representative for the IFG throughout deliberation and decision. In this process, the role of the IFG is automatically revealed to the entire group. The IFG person was asked to consider not only the current generation but also later generations for deliberating and deciding between options A and B without any coercive obligation. The remaining two members know that one member is asked to play the IFG role, and there are no extraeconomic benefits for the IFG person to represent future generations.

**Experimental Procedures**

We conducted an ISDG, a social value orientation (SVO) game, and individual interviews and questionnaires for sociodemographic information. Subjects participated in the experiments following this order.

**Study Areas, Recruitment, and Sample**

We conducted the experiments in the following regions of Nepal: Kathmandu, Lalitpur, Bhaktapur, and Pokhara (see Appendix Figure A1). A series of previous studies identified that people living in urban areas are not concerned about maintaining sustainability compared with those living in rural areas (see Shahrier, Kotani, and Saijo 2017; Timilsina, Kotani, and Kamijo 2017). As noted in Henrich et al. (2001), Fehr and Leibbrandt (2011), and Edwards (2011), the observations of any decision in economic experiments tend to reflect naturally occurring situations or vice versa. Thus, the results in this article are considered good approximations for urban residents’ behaviors in ISD. The selected regions are homogeneous in terms of culture, language, economy, and religion. The residents are usually ranked high in the human development index on the basis of the United Nations Development Programme (2014), and the population density is also high in these regions. For instance, Kathmandu has a population density of 4,416 people per square kilometer (Central Bureau of Statistics 2011b) and is the most crowded city in Nepal, with 24.3% of its total urban population. Kathmandu, Lalitpur, Bhaktapur, and Pokhara are centers for businesses and services, and we chose them for our experiments because of the claim that urban cities in the developing countries of Asia (e.g., Bangladesh, India, and Nepal) play a significant role in determining the future sustainability of the planet (Henderson et al. 2016; Wigginton et al. 2016).

The first author was the chief administrator for the experiments, hiring local staff and research assistants who supported some experimental procedures, such as recruiting subjects, assigning rooms, recording deliberations, and conducting questionnaires. To collect the sample of the urban population in these experiments, we selected the desired number of subjects from different occupational groups (banking, government, health, education, business, transportation, entertainment, and students) (Central Bureau of Statistics 2011b). We distributed invitation letters to government offices, local banks, colleges, and business entities, requesting people to participate in the experiments, and we placed pamphlets in open public spaces. We usually conducted experiments every weekend, considering respondents’ time schedules. Because there were sufficient incentives, the participation rate was 80%.

Table 1 presents the summary statistics of subjects’ sociodemographics, such as income, age, and education. All income earners in the urban areas are 25–44 years old and are mostly engaged in the service and nonagriculture sectors. According to the Central Bureau of Statistics (2011a), 80% of the urban population are high-income earners with an average yearly income of NPR 40,000. Table 1 summarizes subjects’ sociodemographic variables in a baseline ISDG, IFG, and IA.

We ran a Mann-Whitney test to check if there were any statistically significant differences in sociodemographic variables across treatments. The null hypothesis is that the
distributions of sociodemographic variables between the pairs of treatments (baseline ISDG vs. IFG, baseline ISDG vs. IA, and IFG vs. IA) are the same. We did not find a significant difference in the distributions of years of schooling, income, or number of prosocial members in a generation across treatments. However, we did find that the distributions of the number of male members in a generation were different and significant for baseline ISDG versus IFG ($Z = -2.94, p < 0.01$) and ISDG versus IA ($Z = -2.70, p < 0.01$). Overall, these summary statistics of sociodemographics, except for gender and age for some pairs of treatments, were not so different, and we believe that the samples in our experiments reflect the Nepalese urban population.

### Implementing an ISDG

The experiments were conducted at training halls of district health organizations and public seminar halls in the cities. On arrival at the locations, subjects were gathered in one hall, given experiment instructions, and asked to sign a written consent to participate in the study with their native language (Nepali).
Once everyone was present, the experiment instructions were distributed, and an experimenter (the first author) provided the subjects with a verbal explanation of the experiment rules. Each subject played only once as a member of a single generation that was randomly formed. We maintained anonymity across generations and confirmed that the subjects fully understood the rules. Several quizzes were administered to check subjects’ understanding of the game. We proceeded with the experiments after confirming that all subjects answered the quizzes correctly. Subjects were then asked to randomly pick from a bag a chip containing their generation ID and individual ID. Each subject then went to a specific room according to their IDs. The generations were separated into rooms based on their generation IDs, and research assistants helped us with these procedures. In this way, the subjects did not know who belonged to each generation (each subject only knew the members in the same generation as the subject). One session was administered to 18–24 subjects, with 6–8 generations in a day; a total of 19 sessions were conducted with 462 subjects (154 generations). Each generation was randomly assigned to the first, second . . . sixth generations as one sequence. When the number of subjects participating in a session was 21 or 24, we organized the seventh and even the eighth generations that were assigned as the first and the second in another sequence of generations (see Appendix Figure A2).

The research assistants distributed questionnaires, explained the experiment procedures to the subjects, and kept them engaged. In the ISDG, the first generation deliberated up to 10 minutes before deciding between options A and B and how to split the generation share. Research assistants recorded what subjects in each generation discussed during the deliberation via voice recorders. Once the generation made the decisions, research assistants confirmed them and asked subjects to move to a different room to ensure anonymity. After the first generation’s decision, we proceeded to the second generation and continued the experiments using the same procedures. The same routine was applied to the remaining generations. Decisions by the previous generations were given on a sheet of paper to the next generation, and each subject in a generation was asked to confirm which generation they belonged to in the sequence and the payoffs associated with options A and B before deliberation. Therefore, each generation could see the payoff structure as well as how many times options A and B were chosen by previous generations.

Overall, we prepared baseline ISDG, IFG, and IA treatments and conducted lab-in-the-field experiments with between-subject designs. With this information, each generation deliberated and decided between options A and B. Next, the generation discussed how to split the payoff among the members. There were a total of 26 sequences, with 10 sequences in baseline ISDG and 8 sequences in IFG and IA treatments. In this process, we observed that generations in all treatments split their payoff equally among members after making the decision. In the ISDG experiments, subjects were paid a maximum average of NPR 550 (US$5.50) and NPR 330 (US$3.30).5

Interviews

The individual interview was administered at the end of the experiments after subjects finished playing the ISDG and SVO games. The subjects did not know that they were going to be interviewed after participating in the games. We chose to do this to avoid “subjects behaving nicely” when they know there is an interview. For example, past studies reveal that subjects tend to become less selfish when anonymity toward the experimenter decreases (Cherry, Frykblom, and Shogren 2002). The individual interviews identified whether and why each subject changed their individual opinion to support A, B, or N (where N denotes that the subject is ambivalent or has no

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4The chip indicates the following type of information: “2017-11-G3-2,” where “2017-11” is the date of an experiment, “G3” is the third generation within G sequence, and “2” indicates the individual ID in the third generation. However, these explanations are not given to the subjects. The information is only used by the research assistants to manage the generations in a sequence during experiments.

5Nepal’s GDP per capita is approximately US$866 according to the economic survey report (Government of Nepal 2018).
ideas about the opinion to support) before and after deliberation in each treatment. Instituting the interviews showed us the cognitive processes for subjects to change or keep opinions in deliberation.

Qualitative behavioral research establishes that individual opinions and ideas are truthfully elicited by interviews after the incidences of interest (Brinkmann 2014). For instance, some subjects supported option A as their individual initial opinion before deliberation but ended up supporting option B as their individual final opinion after deliberation. In this case, the opinion change is coded as AB, where the first letter represents the initial support for A, and the second letter represents the final support for B. In the same manner, we identified and coded subjects’ opinion changes through individual interviews; the possible combinations of opinion changes are AA, AB, AN, BA, BB, BN, NA, NB, and NN. With this information about individual opinion changes, we can identify whether each generation has a unanimous opinion to support options A or B before and after deliberation. An alternative way to collect the same data is to incentivize or ask each subject to reveal their opinions to support A, B, or N in a timely manner (i.e., each subject is asked to reveal an individual initial opinion before deliberation and asked to reveal an individual final opinion after deliberation). However, this procedure does not reflect the process of real-world deliberative group decisions; it is also reported to induce subjects to have strong priming and anchoring effects that unnecessarily influence group deliberation and decisions (Kahneman, 2011; Kotani, Tanaka, and Managi 2014).

SVO Game and Questionnaire

An SVO is considered a good approximation of individual social preferences in relation to other people. The SVO framework assumes that people have different motivations and goals for evaluating resource allocations between oneself and others. In addition, SVOs are established to be stable for a long time (see Van Lange et al. 2007; Brosig-Koch et al. 2011; Carlsson, Johansson-Stenen, and Nam 2014; Sutter et al. 2018). Thus, an SVO helps us understand what types of people consider future generations while deciding in an ISDG. An SVO game with the slider method elicits decisions on six primary items from each subject and identifies the subject as either prosocial or proself (see Murphy, Ackermann, and Handgraaf 2011).6 We used the slider method because it is easy and intuitive for Nepalese subjects to understand, even with a limited level of education. As is done in psychological research, we simplified the four categories of social preferences into two categories of prosocial and proself types: “altruist” and “prosocial” types are categorized as prosocial subjects, while “individualistic” and “competitive” types are categorized as prosself (Murphy, Ackermann, and Handgraaf 2011).7 Respondents were informed that the units in this game were points, meaning that the more points they accumulated, the more real money they would earn.8 After the SVO game finished, subjects answered the questionnaires for their sociodemographic information. An exchange rate was applied to the points in the SVO game to determine the monetary reward.

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6 The decisions for this SVO game are made with complete privacy as subjects are instructed not to communicate with each other. Each decision maker (subject) and the other person in a pair will remain mutually anonymous, during and after the decisions are made. Such anonymity removes the potential influence of fear of reprisal, reciprocity, and reputation concern.

7 Appendix Figure A3 shows the six items on the slider measure that uses numbers to represent the outcomes for oneself and the other in a pair of persons where the other is unknown to the subject. Subjects are asked to make a choice among the nine options for each item. Each subject chooses an allocation by marking a line at the point that defines their most preferred distribution between oneself and the other. The mean allocation for oneself \( \bar{A}_{i} \) and the mean allocation for the other \( \bar{A}_{o} \) are computed from all six items (see Appendix Figure A3). Then, 50 is subtracted from \( \bar{A}_{i} \) and \( \bar{A}_{o} \) to shift the base of the resulting angle to the center of the circle (50, 50). The index of a subject’s SVO is given by \( \text{SVO} = \arctan((\bar{A}_{i}–50)/((\bar{A}_{o})–50) \). Depending on the values generated from the test, social preferences are categorized as follows: (1) altruist: SVO > 57.15°; (2) prosocial: 22.45° < SVO < 57.15°; (3) individualist: –12.04° < SVO < 22.45°; and (4) competitive: SVO < –12.04°.

8 To compute the payoffs, we collect the answer sheets from all subjects in a session and randomly make a pair. The payoff for each subject in the SVO game is the summation of points from six of their selections as “You” and six selections by the partner as “Other” in the pair. We explain the payoff calculation with the exchange rate for the real money to subjects before starting SVO game.
and subjects received a maximum average of NPR 150 (US$1.50) and NPR 100 (US$1.00). Finally, total payment from the experiment session for each subject was calculated as a summation of the participation fee and their earnings from the ISDG and SVO game where each subject received on average NPR 100, NPR 330, and NPR 100.

3. Results

A total of 154 generations participated in our experiments, with 59 generations in baseline ISDG, 47 generations in IFG treatment, and 48 generations in IA treatment. First, we present the summary statistics of the generation decisions over baseline ISD, IFG, and IA treatments. Then we analyze the effects of IFG and IA on generation choices in ISDG.

Table 2 shows the frequencies (percentages) of sustainable generation choice B and unsustainable generation choice A in baseline ISDG, IFG, and IA. Approximately 64.41%, 70.22%, and 85.42% of generations chose B in baseline ISDG, IFG, and IA, respectively, suggesting that generations are more likely to choose sustainable choice B in IA than in baseline ISDG and IFG. To confirm whether the overall distributions of generation choices A and B are independent of the treatments, pair-wise chi-squared tests were performed by taking the following pairs: baseline ISDG versus IFG, baseline ISDG versus IA, and IFG versus IA. A null hypothesis is that the distributions of generation choices A and B are the same for a pair of treatments. Our results reject the null hypothesis for baseline ISDG versus IA ($\chi^2 = 6.05, p = 0.014$) and IFG versus IA ($\chi^2 = 3.19, p = 0.07$) at the significance level of 5% and 10%. However, the test fails to reject the hypothesis for baseline ISDG versus IFG. These results confirm that in IA more generations choose sustainable choice B than any other treatment.

In baseline ISDG, IFG, and IA treatments, nine, seven, and eight sequences have a complete set of six generations, respectively. The percentages of generation choice B are calculated by the generational order in sequences and are plotted in Figure 1. The percentages vary from 50% to 100%, corroborating that the first and second generations chose 100% B in IA but 70% and 75% in baseline ISDG and IFG, respectively. Pooling only the one-generation data makes a sample size very small, and it is not appropriate to conduct statistical analyses with the very low frequency (Agresti 2003; Campbell 2007). Therefore, some additional statistical analyses, such as pair-wise chi-squared tests, cannot be conducted to establish this result.

We cannot complete these sequences with six generations due to time and budget limitations. This is not problematic, because subjects in such sequences do not know that there the sixth generation does not exist, as we explained earlier.

Table 2

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<tr>
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<th>A</th>
<th>B</th>
<th>Overall</th>
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<tbody>
<tr>
<td>Baseline ISDG</td>
<td>21 (35.59%)</td>
<td>38 (64.41%)</td>
<td>59 (100%)</td>
</tr>
<tr>
<td>IFG</td>
<td>14 (29.78%)</td>
<td>33 (70.22%)</td>
<td>47 (100%)</td>
</tr>
<tr>
<td>IA</td>
<td>7 (14.58%)</td>
<td>41 (85.42%)</td>
<td>48 (100%)</td>
</tr>
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Note: IA, intergenerational accountability; IF, imaginary future generation; ISDG, intergenerational sustainability game.

Figure 1

Trends for Percentages of Generation Choice B over the Orders in Sequences across the Baseline and Treatments Discussed: Intergenerational Sustainability Dilemma Game, Imaginary Future Generation, and Intergenerational Accountability
statistically. Instead, Figure 1 presents sufficient evidence that the percentages of choice B at the sixth generation in IA are consistently high (i.e., around 75% than those in basic ISDG and IFG with close to 50% and 60%, respectively). Overall, Figure 1 suggests that IA induces generations to consistently choose B and prevents them from choosing A, even in later generations within sequences.

Some behaviors are observed to change from the third and later generations under IA in Figure 1. The percentage(s) of the third generations’ (later generations’) choice B drop (fluctuate), whereas those of the first and second ones are 100%. We consider that the third and/or later generations may feel less pressure to be sustainable or feel less guilty, implicitly realizing that sustainability will not be crucially damaged by choice A. This will be evident when all of the previous generations (in particular, the first and second ones) choose B. It should be noted that each generation did not know the end of ISDG in a sequence, and the members may have been guessing it. This type of behavioral change can be explained by moral licensing or rebound effects; that is, good deeds by one person in a group (at one point in time) give the freedom of behaving badly or unethically to other people in the group (the same person at another later point in time) (Bénabou and Tirole 2006; Gneezy, Imas, and Madarasz 2014; Dutschke et al. 2018; List and Momeni 2021). It is also argued in relation to commitment and progress toward a goal. Suppose that my goal is to reduce my body weight by 5 kg within a few months. At initial stages, a commitment motive drives me to make a lot of effort for the reduction goal. However, effort at later stages is expected to increase or decrease, depending on the progress toward the goal (Dutschke et al. 2018). For example, I am likely to relax my rules on eating sweet foods along with some justifiable reason, such as “I should reward myself,” when progress has been made, such as losing 4 kg. Therefore, we conjecture that later generations would be likely to fall into unethical behavior toward sustainability in an ISDG due to moral licensing or rebound effects, when they observe the progress made by early generations in the same sequence.

To check the robustness of our findings, we applied nonparametric statistical tests accommodating possible serial correlations among generation decisions in a sequence. To this end, we clustered generation decisions at a sequence level. There is a total of 26 sequences: 10 in baseline ISDG, 8 in IFG, and 8 in IA. We calculated the percentage for generations in a sequence to choose B as one observation, running the Mann-Whitney test to examine the null hypothesis that the distributions of the percentages between the two treatments are the same. In this way, observations are taken to be independent, and the tests should be able to clarify some distributional differences of percentages for generations per sequence to choose B between the two treatments. The results for baseline ISDG versus IFG (Z=0.51, p=0.61), baseline ISDG versus IA (Z=2.31, p<0.05), and IFG versus IA (Z=1.46, p=0.14) demonstrate that the distributions of percentages for generations per sequence to choose B are different and significant at 5% only for the pair of baseline ISDG versus IA. However, the test result for the pair of IFG versus IA suggests that the p-value of 14% is close to 10% significance, implying that IA considerably induces generations for choice B, even when compared with IFG. Overall, the results suggest that generations in IA appear to choose the sustainable choice B more often than in the baseline ISDG and IFG treatment.

Table 1 reports summary statistics for the number of prosocial members per generation across treatments. The prosociality was elicited from each subject’s responses to six primary items in the SVO game. The Mann-Whitney test was used to examine the null hypothesis that the distributions of the number of prosocial members in a generation between the pairs of treatments (baseline ISDG vs. IFG, baseline ISDG vs. IA, and IFG vs. IA) are the same. The results are insignificant for all the pairs, such as baseline ISDG versus IFG (Z=-0.16, p=0.87), baseline ISDG versus IA (Z=0.67, p=0.50), and IFG versus IA (Z=0.70, p=0.48). Thus, the number of prosocial members in a generation across the treatments is not different from one another.

Table 3 demonstrates the proportions of generation choice B with respect to the number
of prosocial members per generation in each treatment, showing that the percentages of generation choice B tend to increase in the number of prosocial members per generation in each treatment. This result is consistent with the literature in that prosocial people play an important role in cooperation to sustain common pool resources or public goods (Shahrier, Kotani, and Kakinaka 2016; Shahrier, Kotani, and Saijo 2017). Here we must admit some possibility that the deliberation process for generation decisions in the ISDG influences individual prosociality elicited through the SVO game, and it would undermine some interpretations for the results in Table 3. However, the SVOs are reported to be stable characteristics in the long run without having the change by some incidents and as such are consistent with the results of the Mann–Whitney tests (Van Lange 1999; Perugini and Gallucci 2001; Van Lange et al. 2007; Brosig-Koch et al. 2011; Carlsson, Johansson-Stenman, and Nam 2014; Cavazza, Guidetti, and Pagliaro 2014; Sutter et al. 2018). Therefore, we believe the main results will not change much, even with the caveat.

Table 3 shows that 37.50%, 66.66%, and 60.00% of generation choice B in baseline ISDG, IFG, and IA, respectively, when three members in a generation consist of only pro-self subjects (or zero prosocials). There might be several explanations for this result. Nepalese urban culture can be considered less competitive than other countries, and urban Nepalese people choose sustainable choice B more often than do urban Bangladesh people, controlling for SVO (Shahrier, Kotani, and Saijo 2017). Shahrier, Kotani, and Saijo (2017) claim that in “competitive” countries, such as Bangladesh, urban residents face harsh competition in daily activities (e.g., business, transportation, education) because of its very high population density and improper management of public infrastructure. They also argue that urban Bangladesh people may neither consider subsequent generations nor choose the sustainable choice B in an ISDG. On the contrary, urban areas (i.e., Kathmandu in Nepal) do not impose competitive environments on people, and family and neighbors provide fundamental and close support in daily life. A succession to subsequent generations in families and neighbors (i.e., in-group succession and reciprocity culture) still plays the most important roles in sustaining businesses and activities for urban Nepalese life.10 When there are one prosocial and two pro-self members in a generation, 50.00%, 72.00%, and 88.88% of the generation choose B in baseline ISDG, IFG, and IA, respectively. These findings imply that a generation usually chooses A in baseline ISDG when most of the members are pro-self. However, in IFG and IA, a generation is likely to choose B, even in the same situation, suggesting that IFG and IA may be effective at inducing generations to choose B. When a generation contains two or three prosocial members, most generations choose B, irrespective of IFG and IA treatments.

Table 3: Distributions of Generation Choice B with Respect to the Number of Prosocial Members per Generation in Each Treatment

<table>
<thead>
<tr>
<th>No. Prosocial Members in One Generation</th>
<th>Percentage of Choice B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline ISDG</td>
</tr>
<tr>
<td>0</td>
<td>37.50% (3/8)</td>
</tr>
<tr>
<td>1</td>
<td>50.00% (10/20)</td>
</tr>
<tr>
<td>2</td>
<td>79.31% (23/29)</td>
</tr>
<tr>
<td>3</td>
<td>100.00% (2/2)</td>
</tr>
<tr>
<td>Total</td>
<td>64.4% (38/59)</td>
</tr>
</tbody>
</table>

Note: IA, intergenerational accountability; IFG, imaginary future generation; ISDG, intergenerational sustainability dilemma game.

10We argue that such cultures may even shape urban people’s preferences (other than their social preferences) and behaviors, inducing the subjects to choose sustainable choice B in ISDG. This argument is in line with literature that claim “daily-life practices and culture shape people’s preferences” (Tomassello et al. 2005; Leibbrandt, Gneezy, and List 2013; Shahrier, Kotani, and Kakinaka 2016; Timilsina, Kotani, and Kamijo 2017; Hernuryadin, Kotani, and Saijo 2020).
Regression Analysis

To statistically characterize the effects of treatments, we ran several models of probit regression by taking generation choice B as a dependent dummy variable that takes the value of one when the generation chooses it, otherwise zero. Along with some independent variables, we estimated the models by clustering the standard errors at the sequence level (Angrist and Pischke 2008). The independent variables include the treatment dummies (IFG and IA), a number of prosocial members in a generation (i.e., characterized by SVO), the percentage of choosing B in history, gender (number of males in a generation), average age, and average education. Because the decisions were taken at the generational level, we took an average or a summation of independent variables by generations for the analyses (see the definitions of independent variables in the notes to Table 4). We focus on reporting the marginal effects of the treatment dummies and other independent variables from models 1–4 (see Table 4). The marginal effects of the treatment dummies can be considered causal as a result of their random assignments (Angrist and Pischke 2008). In model 1, we present the marginal effects of the treatment dummies. In model 3, we add a number of prosocial individuals in a generation. Finally, in model 4, we add other sociodemographic variables for a robustness check. 11

11The additional models are also estimated by controlling for sociodemographic variables at generational level (such as gender, age, and years of schooling), the percentages of generation choice B in sequence history (or the value of X each generation faced), previous generation’s decision, the
Table 4 presents the marginal effects of independent variables on generation choice B in probit regressions. Models 1, 2, 3, and 4 consistently show that the IA dummy is economically and statistically significant, affecting the likelihood for generations to choose B. However, the IFG dummy in all models is identified as insignificant. Model 4 in Table 4 shows that if the number of prosocial members per generation increases by one, a generation is likely to choose B by 8.2 percentage points, holding all other factors fixed. Model 4 reveals a significant IA treatment effect on the probability for generations to choose B, suggesting that generations in IA are likely to choose B by 23.4 percentage points compared with those in baseline ISDG, holding all other factors fixed. Overall, the results indicate that the IA dummy is a key determinant for maintaining IS. In particular, IA is identified to be effective for inducing subjects to choose B more frequently than any IFG treatment.

Some readers may wonder that subjects are primed to think about subsequent generations, and there may be an observer effect or an experimenter demand effect, especially in IFG and IA. The fundamental experimental design is the same in baseline ISDG, IFG, and IA in that each generation is neither observed nor required to reveal individual identities to other generations for deliberation and decision. In other words, no one is an observer for anyone in every treatment, and thus there should not be an observer effect in our experiments. Next, IA asks each generation to write reasons and advice using a neutral terminology without implying which decision is good or bad, whereas IFG directly asks one member in a generation to be a representative of future generations, which is known by other members in the same generation. In that sense, IFG is more explicit about an experimenter’s demand and should be more likely to suffer from the effect than IA. That is, if IA suffers from an experimenter demand effect, so does IFG. However, IFG (IA) is identified to be ineffective (effective), implying that an experimenter demand effect is not a concern.

### Interview Analysis

To identify the mechanism behind the average treatment effects described in the previous section, we used data from the individual interviews conducted after the generation decisions were made. Following past literature, this interview procedure was structured as a within-subject design to investigate the patterns of the shift in individual opinions to have supported options A or B or to have been ambivalent (no ideas) (coded as N) as their individual initial opinion and individual final opinion (Opdenakker 2006; Cardenas and Carpenter 2008; Charness, Gneezy, and Kuhn 2012; Falk et al. 2018). As mentioned, the interviews enabled us to trace the changes in each subject’s initial opinion and final opinion to have supported A, B, and/or to be N before and after deliberation. When there were no changes between the initial and the final opinions, these situations were coded as AA, BB, or NN, where the first (second) letter represents the initial (final) opinion to have supported A, B, or N before (after) deliberation. The other combinations of letters represent situations where a subject changed the individual opinion over the course of the deliberation. For instance, AB describes a situation where the subject initially supported A before deliberation but changed their final opinion to support B after deliberation.

Table 5 shows that the proportions of subjects with BB (AA) are 55.93% (16.95%), 56.02% (21.28%), and 72.22% (11.11%) in baseline ISDG, IFG, and IA, respectively. The results suggest that the individual opinions BB (AA) are more (less) dominant in IA than with other treatments. Furthermore, there is a higher (lower) proportion of subjects with AB (BA) in IA than with other treatments. The deliberation alone does not favorably affect number of subjects in a generation with an initial opinion A, and the interaction with IFG and IA treatment dummies (see different models in the Appendix). We confirm that the results qualitatively remain the same as those in base models 1, 2, 3, and 4, irrespective of the various model specifications we tried for the robustness check.

12The IFG dummy is not significant, and it implies that IFG effectiveness is not established in the fields with a subject pool of general people in Nepal. This result is consistent with the findings of Shahrier, Kotani, and Saijo (2017). Refer to Tsuji and Shen (2021) for an extensive review of methodological decision-making processes in intergenerational social dilemma mediation regarding IFG and other treatment.
individual opinions to change for supporting B in baseline ISDG and IFG compared with IA. These results confirm that most subjects in IA consistently have individual initial and final opinions of BB. In contrast, approximately half of the subjects in baseline ISDG and IFG exhibit variation in their opinions other than BB. Therefore, IA can be interpreted to be a social device that induces self-consistency between initial and final opinions for sustainability in ISDG compared with baseline ISDG and IFG.

To statistically confirm the variation in individual initial and final opinions, we applied the coefficient of “unalikeability” as a concept of variability for an unordered categorical variable (Gordon 1986; Kader and Perry 2007; Frankfort-Nachmias and Leon-Guerrero 2017). We have identified that the coefficients of unalikeability in individual initial (final) opinions are 0.46 (0.52), 0.43 (0.51), and 0.32 (0.32) for baseline ISDG, IFG, and IA, respectively, confirming that subjects with IA have less variation in individual initial and final opinions, leading subjects to support choice B at the individual level. The analysis suggests that IA appears to trigger members in a generation to think about later generations before and after deliberation by providing reasons and advice, inducing themselves to consistently support B as an individual opinion. It is in line with past literature, which claims that asking people the reasoning behind their action makes them logically consistent (Elster and Rendall 2008).

Recall that each generation wrote their reasons and advice to subsequent generations in IA, and then they were asked to choose one concept from the list of seven that they considered the closest to their reasons and advice. Table 6 summarizes the occurrence frequencies of the reasons and advice, based on the seven concepts suggested by Timilsina et al. (2021a, 2021b) (see Table 6 for the concepts of the reasons and advice). First, “maximization of the sum of all generations’ benefits” has been identified as the most frequent concept that appeared as reasons and advice in IA, which could be considered more relevant to justifying or advising choice B. Likewise, the second, third, and fourth frequent concepts that appear as reasons and advice in IA are “hope to avoid future generations’ disadvantages,” “expectation that goodwill will succeed with choosing B,” and “willingness to terminate the chain of bad will,” respectively, which could also be considered more relevant to advising B to subsequent generations. However, we observe only two concepts

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Table 5

<table>
<thead>
<tr>
<th>Individual Opinion</th>
<th>Baseline ISDG</th>
<th>IFG</th>
<th>IA</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>30 (16.95%)</td>
<td>30 (21.28%)</td>
<td>16 (11.11%)</td>
</tr>
<tr>
<td>AB</td>
<td>12 (6.78%)</td>
<td>5 (3.54%)</td>
<td>12 (8.33%)</td>
</tr>
<tr>
<td>AN</td>
<td>9 (5.08%)</td>
<td>3 (2.13%)</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>BB</td>
<td>99 (55.93%)</td>
<td>79 (56.02%)</td>
<td>104 (72.22%)</td>
</tr>
<tr>
<td>BA</td>
<td>11 (6.21%)</td>
<td>16 (11.35%)</td>
<td>6 (4.17%)</td>
</tr>
<tr>
<td>BN</td>
<td>9 (5.08%)</td>
<td>4 (2.84%)</td>
<td>5 (3.47%)</td>
</tr>
<tr>
<td>NN</td>
<td>2 (1.13%)</td>
<td>0 (0.00%)</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>NA</td>
<td>3 (1.69%)</td>
<td>1 (0.71%)</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>NB</td>
<td>2 (1.13%)</td>
<td>3 (2.13%)</td>
<td>1 (0.70%)</td>
</tr>
<tr>
<td>Total</td>
<td>177 (100.00%)</td>
<td>141 (100.00%)</td>
<td>144 (100.00%)</td>
</tr>
</tbody>
</table>

Note: The unit of observations is a count of subjects who stated their individual opinions in the interviews before and after deliberation corresponding to the one among AA, AB, AN, BB, BA, BN, NN, NA, and NB. IA, intergenerational accountability; IF, imaginary future generation; ISDG, intergenerational sustainability game.

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13The coefficient of unalikeability measures how much the observations of a categorical variable differ from one another in the same treatment group. It is a scale from zero to one, and higher the value means, the less alike the observations are in the group. For example, the “unalikeability,” $u$, for the observations of the three categories is computed by the equation of $u=1-p_A^2-p_B^2-p_N^2$ where $P_A$, $P_B$, and $P_N$ are the proportions of A, B, and N observations in the categories of A, B, and N, respectively.
relevant to justifying and advising A in IA: “maximization of the current generation’s benefits by choosing A” and “non-negligible costs of considering future generations by choosing A.” The total occurrence frequency of these two concepts in IA is just six. IA induces current generations to give positive reasons and advice for a sustainable choice to subsequent generations in the same sequence. In summary, IA is considered to function as a successful social device, as if it is a sequential writing for one book by different generations to maintain IS.

### 4. Discussion and Conclusion

Our research addresses ISD and examines the potential solution of how to maintain IS by conducting lab-in-the-field experiments of ISDGs in Nepal. The three treatments of baseline ISDG, IFG, and IA were prepared and implemented to see whether IFG and IA work for IS. Our results demonstrate that the generations in IA choose a sustainable choice more often than those in baseline ISDG and IFG, giving positive reasons and advice for sustainable choice to later generations.

Brain scientists, social psychologists, and anthropologists have established that social learning through observations and communication enhances sympathy and decreases social distance for out-group members (Ep-ley and Caruso 2004; Laland 2004; Gilbert and Wilson 2007; Behrens et al. 2008; Smith 2010; Heyes 2012; Hein et al. 2016). Consistent with the literature, a one-way communication of reasons and advice to subsequent generations (out-group members) in IA is identified to function as a social device that decreases social distance over generations and transfers a common image, such as a process of sequentially writing each chapter for one book by different generations to maintain IS (Sacco, Vanin, and Zamagni 2006). In this sense, IA in ISD is considered to raise sympathy and solidarity beyond self-interest motives across generations through the one-way

<table>
<thead>
<tr>
<th>Table 6</th>
<th>List of Reasons and Advice Provided to Each Generation after the Decision between Options A and B in IA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
<td><strong>No.</strong></td>
</tr>
<tr>
<td>Reasons for choosing option B (sustainable option)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Reasons for choosing option A (unsustainable option)</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

**Note:** One generation that chose option A did not put any check marks in the list we provided. Therefore, one observation of the frequencies in the reasons for choosing A is missing. IA, Intergenerational Accountability.
communication channel from the current generation to later ones, leading generations’ decisions toward a common image for IS (Bohnet and Frey 1999; Haidt 2004; Elster and Rendall 2008; Chen et al. 2019).

Previous studies find that advice and communication are effective at solving some classes of allocation and public goods problems of overlapping generations, such as in a parent-child relationship or in intergenerational resource sharing (see Ostrom 1990; Ostrom, Fung Lam, and Lee 1994; Schotter and Sopher 2003, 2006, 2007; Chaudhuri, Graziano, and Maitra 2006; Mantilla 2015a, 2015b). To the best of our knowledge, this is the first study to establish that a one-way communication, such as IA, is effective at solving nonoverlapping generational problems of sustainability in a long-run perspective. The possible reasons and mechanisms for the IA result may be relevant to some economic literature. For example, generations have opted for fair allocation by underlying the accountability principle, as theorized by Konow (2000). IA can also be considered a possible device that triggers the current generation to feel a “warm glow,” to avoid “guilt aversion,” or to have an “image motivation” of wanting to be seen as good humans by future generations by the act of doing good or sending signals to subsequent ones (Andreoni 1993; Bardsley and Sugden 2006; Sacco, Vanin, and Zamagni 2006; Crumpler and Grossman 2008; Ariely, Bracha, and Meier 2009; Andreoni and Rao 2011; Koukoumelis, Levati, and Weisser 2012; Andreoni, Rao, and Trachtman 2017; Shahen, Kotani, and Saijo 2021).

The IA result is also in line with past studies of “conditional cooperators” in public goods games (Fischbacher, Gächter, and Fehr 2001; Hauser et al. 2014). IA is interpreted as a one-way channel through which each generation is induced to be a cooperator by observing previous generations’ choices, reasons, and advice and leaving their own reasons and advice for the future as a “cooperation” initiator that induces subsequent generations to be conditional cooperators.14

Underrepresentation of future generations is considered a fundamental problem for IS, where future generations cannot participate in the current decision-making process because they are yet to be born (Kamijo et al. 2017; Shahrier, Kotani, and Saijo 2017; Shahen, Kotani, and Saijo 2021; Timilsina et al. 2021a). Thus, to guarantee the early representation, we also introduce IFG, where one person per generation is assigned as an agent for future generations to negotiate and decide with the other members. However, we do not find the effectiveness of IFG in the fields with a subject pool of general people, and these results are consistent with Shahrier, Kotani, and Saijo (2017). The underlying reasons behind these results might be that in IFG, only one person is asked to take the perspective of future generations, and it is not concrete enough to let the person imagine and incorporate future preferences for sustainability. Therefore, we introduce a new treatment with an “intergenerational” linkage and “accountability” (IA). The rationale of IA is to explicitly introduce an opportunity for the current generation to make a (one-way) communication of reasons and advice for future generations. Accountability can be applied to any real-life decisions in daily practices (e.g., buying biodegradable or plastic products, using environmentally friendly or fossil-fuel transportation, adopting renewable energies). These choices shall unidirectionally affect future generations. The prosocial tasks have clear implications that allow to signal own personal traits even when the decisions are made in private (Ariely, Bracha, and Meier 2009). In this regard, IA strengthens the intergenerational linkage by making a one-way communication with future generations. Thus, the proper working mechanism of IA may be connected to people’s self-image concerns for sustainability, triggering people to have some moral commitment for future generations. That is, being accountable is known to signify fairness and/or justice concerns in people’s judgments and decisions (Ariely, Bracha, and Meier 2009; Khalil and Felstovitch 2018). Thus, our research is considered to experimentally demonstrate that accountability leads people to have such fairness and justice concerns, resolving the

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14See Appendix Table A for extensive examples of messages given by the current generation to the subsequent ones in IA treatment.
underrepresentation problem of future generations for sustainability.

A simple possible application of IA to the real world is introducing and institutionalizing a public responsibility of writing, recording, and leaving reasons and advice. The current generation can provide reasons and advice through IA in deciding important policies to subsequent generations over intergenerational problems at community, city, and national levels. Such intergenerational problems span cultural, environmental, financial, and resource-sustainability problems. We believe that institutionalizing IA in public policies for intergenerational problems is not too difficult (Ortmann and Gigerenzer 1997; Rawls 1999; Schedler 1999; Chen et al. 2019). Thus far, few countries and organizations have introduced an IA institution, such as mini-public and local assemblies. For instance, Wales practices public accountability for future generations’ well-being (Knebel 2023). To fully resolve ISD in the real world, it will be necessary to institutionalize IA in practice and further study how a cooperation initiator and a conditional cooperator think and behave along with reasons and advice for the decision in ISD. By doing so, we untangle the detailed mechanism and hands-on experiences of how and why IA can be effective in relation to socioeconomic and psychological factors. Such a combination of practices and research will be necessary to lead to better procedures for IA mechanisms for people to behave toward IS.

Finally, we note some limitations and future avenues of research. The results of this study are mainly from observed behavioral data. The qualitative data from the transcribed interviews and details of deliberative processes by asking subjects about the corresponding reasons for their opinions, such as why they change their minds and whether there is influence from other members during deliberation, are not fully examined. As one possible future area of research, we could examine whether generation members look for unanimity or identify a leader per generation following qualitative deliberative analysis (see Krippendorff 2003; Vaismoradi, Bondas, and Turunen 2013; Brinkmann 2014; Corbin and Strauss 2014; Cason and Mui 2015a). The current study neither compares individuals and groups (generations) regarding how they are similar and different in making decisions under ISD nor fully untangles the learning effect of IA with the number of messages an agent receives from past generations. By doing such future research for individuals versus groups or the learning effect, we will be able to further identify the precise mechanism of IA effectiveness at individual and group levels. Even with these caveats, we believe that this study is an important first step in resolving ISD problems, and we hope that other studies will suggest something new to enhance IS.

Acknowledgments

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