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Future Design: Bequeathing Sustainable Natural Environments and Sustainable Societies to Future Generations

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Abstract

“Future Design” poses the following question: what types of social systems are necessary if we are to leave future generations sustainable natural environments and sustainable societies. One such method is using an “imaginary future generation,” and I overview the theoretical background of this method, the results of relevant laboratory and field experiments, and the nature of relevant practical applications in cooperation with several local governments.

Keywords: Future design, imaginary future generation, futurability, intergenerational sustainability dilemma, time inconsistency problem

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1. What is it that have we done?

Steffen et al. (2015b) demonstrated that the indicators of human activity, such as population, real GDP, use of fossil fuels and fertilizers, and the number of automobiles, have expanded at an accelerating pace since the Industrial Revolution, especially in the second half of the 20th century. There has also been an accelerating pace of change in indicators of the impact of such human activity on the global environment, for example, concentration of carbon dioxide, nitroxide and methane in the atmosphere, the volume of nitrogen influx into the oceans, and the scale of reduction in tropical forests. These twin trends are known as the Great Acceleration.

Meanwhile, planetary boundary research by Rockström et al. (2009) identifies nine domains that are essential to the maintenance of the comparatively stable Holocene environment that has been in place for more than 10,000 years and proposes acceptable levels for these planetary boundaries. According to these researchers, it has been demonstrated that such acceptable levels have already been breached for climate change, biodiversity, land system change (the proportion of forest lost), and the cycles of biochemical substances such as nitrogen and phosphorus¹.

As a result, Crutzen and Stoermer (2000) and Crutzen (2002) propose that the Holocene age has already ended and that human beings have changed the Earth System to create a new geological age, the Anthropocene². In any case, to the extent that human activity has indeed changed the Earth System, this planetary boundary research can be seen, as it were, an evaluation of natural sciences since the Industrial Revolution.

Next, let us look at the relationship between a country's Human Development Index (HDI) and its per-capita Ecological Footprint (EF).³ The main components of a country's HDI, which shows its "well-being," are its average life expectancy, the level of its education, and its per-capita income. On the other hand, EF is an indicator of "sustainability" and shows whether that country is living within its share of global means. HDI and EF are low for developing countries and high for developed countries. For almost all countries, movement is from low HDI and low EF to high HDI and high EF. The aim should be to

¹ For example, the concentration of carbon dioxide in the atmosphere should not be higher than 350ppmv, and change in radiative forcing compared to before the Industrial Revolution should not be higher than 1Wm⁻². Both these indicators are already above these levels, increasing the risk of irreversible climate change, such as depletion of polar ice caps, acceleration in the rise of ocean levels, and sudden change in the forestry and agricultural system (Rockström et al., 2009, p.473). Steffen et al. (2015a) mention not only the scientific judgments but also the necessity of taking account of the time needed for society to react to early warning signs.

² However, there are various viewpoints on when this new age began, as summarized by Monastersky (2015).

³ For the relationship between the two indicators, for various countries since 1980, please see <https://www.footprintnetwork.org/our-work/sustainable-development/>.

have a low EF and a high HDI; however, almost no countries are heading in that direction. The relationship between the two links scientific evaluation and social evaluation, and when combined with evaluation related to planetary boundaries, it must be said that we are threatening our own continued existence.

Meanwhile, major countries have huge levels of outstanding debt. According to the IMF's World Economic Outlook Database (April 2018), outstanding debt in Japan is equivalent to 2.36 times GDP, and that in Italy, the US and France, 1.3 times, 1.08 times and 0.96 times, respectively⁴. The current generation is maintaining its wealth by using up the resources of future generations. In the case of Japan, it has been calculated that if consumption tax was raised to around 38%, from 8%, for the next 100 years to pay off the debt, this would still account for only around 60% of the outstanding debt balance (Hansen and Imrohoroğlu, 2016; Kobayashi, 2018b). Would any generation implement such a measure without complaint?

2. Why is the situation like this and what will happen next?

Maggio and Cacciola (2012) and Mohr et al. (2015) are among the researchers who have estimated peak production volume for oil, coal, and natural gas. Such studies can be interpreted as showing the past, present, and future of fossil fuels. According to Maggio and Cacciola (2012), in the "first half" of the 21st century, human beings seem set to burn around 1.7 times the volume of coal that was burnt in the 20th century. The same figure for oil is around 1.5 times and for natural gas around 3 times. In other words, it is clear that the 20th century was a "run-up" period for fossil fuel, while this century will be its "golden" period.

Therefore, to find an answer to why humans continue to burn fossil fuel, we would like to reconsider the fundamental characteristics of human beings. According to Sapolsky (2012), human beings apparently possess three traits; the first is "contrast." Our five senses do not react to absolute volume but to change in volume. When there is a sudden loud noise or shadow, that change may constitute a risk to ourselves, and we naturally react (by default) to increase the chances of our own survival. For example, we react more to change in volume, that is, to its differential value, than to absolute volume. In other words, human beings react when external factors change. If we consider that owing to change in the parameters (external factors) within the objective function, the variable that maximizes the objective function also ought to shift, it is safe to say that contrast expresses the optimality principle of humans. Of course, "contrast" does not stop with a person's five senses. The

⁴ See the Japanese Ministry of Finance's international comparison of outstanding debt on https://www.mof.go.jp/tax_policy/summary/condition/007.pdf.

human brain is said to react keenly to a position relative to other people. To survive in a group of people being chased by a lion, a running pace of a person would not need to be fast in absolute terms, merely fast enough to stop the person from being last.

The second human trait is “sociality.” Human beings do not possess the physical abilities of other creatures. A human cannot run as fast as a dog, let alone a horse, and our sense of smell and our eyesight is not very keen. For human beings to have adapted better than other mammals, and indeed, to have thrived, requires a deep understanding of our relationship with other people. For example, there is no way that a single human could hunt big animals. However, by cooperating with multiple agents, human beings eventually reached the top of the food chain. However, in sociality, certain education and experience is necessary; it is not possible to obtain these things immediately.

The third trait is “impulse.” It is not easy to resist eating something tasty in front of you. The dopamine reward pathways in the human brain light up on brain-imaging tests when we go for the impulsive immediate reward (Sapolsky, 2012). In short, to increase the likelihood of our own survival, the best thing to do when food was available was to eat it.

I would like to add a fourth human trait, namely “optimism.” The difference between the result that a human being expects and the actual outcome has an optimism bias. According to Sharot (2011), around 80% of people have an optimism bias. In other words, people think that good things, rather than bad things, will happen to them in the future.

There is hardly any research that goes right back to these human traits and examines their relationship with social systems. However, it is natural to consider that human traits are the basis for the construction of markets and democracy, which form the basic framework of our society. First, let us consider markets. Although the market is an “extremely good device for realizing the short-term desires of people,” it does not “allocate resources in a way that takes account of future generations.” Future generations cannot participate in today’s markets. Meanwhile, democracy is also a “device that profits people who are currently living” and it does not “incorporate future generations.” If a person proposes a policy that enriches people after a hundred years in an election, this person would not be chosen by the current generation.⁵

Dunbar’s Number is the maximum number of people with whom a human being is cognitively able to maintain stable social relationships, and he puts it at around 150 (Dunbar 1992). It would not be wrong to say that markets and democracy are devices that preserve some kind of sociality when that number is exceeded. They are also places where a person who has the optimality principle, i.e., contrast, can demonstrate both impulse and optimism.

⁵ For details, see Saijo (2015).

There is yet no definitive judgment on the Industrial Revolution; however, some researchers opine that it allowed the transformation from reliance on organic energy to reliance on fossil fuel energy⁶. According to Allen (2009), the Black Death reduced the population of the UK in the middle of the 14th century, giving rise to high wages in the country. Europe in the early modern era, in particular the UK, experienced a rise in the price of wood due to urbanization, and energy substitution occurred in favor of coal, which happened to be locally abundant and cheap. To fulfill the demand for coal required pumping out the subterranean water accumulating in the coalmines and steam engines worked the water pumps in place of expensive labor.

Various innovations continued throughout the Industrial Revolution, and large volumes of cheap and seemingly limitless fossil fuels were used. These factors are likely to have strengthened the human traits of contrast, impulse, and optimism, while weakening the human trait of sociality. The human traits that were transformed, in turn transformed the market, democracy and innovation. This is likely to have created a society blindly focused on growth despite such focus leading to the various “future failures” mentioned above.

3. Is transformation in favor of a sustainable society possible?

Future Earth was established in 2012 as an international research platform to create knowledge and action intended to accelerate radical innovation in favor of a sustainable society, becoming active by 2015.⁷ One of the basic concepts of Future Earth is transdisciplinary research. Stakeholders and scientists co-design research projects based on a framework, co-produce knowledge, and co-deliver results. However, both stakeholders and scientists are part of the current generation, and despite a win-win outcome in following their own incentives, future generations may still lose. In other words, the future generation should be included as stakeholders, and the target for change should be the thinking and behavior of the current generation.

From this viewpoint, “future design” emerged in 2012, with the aim of creating human “futurability.”⁸ A person exhibits *futurability* when this person experiences an increase in happiness as a result of deciding and acting to forego current benefits as long as it enriches future generations. Future design is the praxis of creating futurability through designing social systems. It is fundamentally a question of whether the willingness of a parent to eat less to give more to their children can extend to a future generation, which is not related by

⁶ See Allen (2009), Pomeranz (2009), and Hasegawa (2012).

⁷ See <http://www.futureearth.org/> and van der Hel (2016) and Salmon et al. (2017).

⁸ In fact, future design researchers were not aware of the existence of Future Earth until around 2015. See Saijo (2015).

blood. This set-up is against the background of stubborn concern regarding the concept of developing sustainability (fulfilling the needs of the current generation without detracting from the needs of the future generation) in *Our Common Future*, written by the Brundtland Commission. For example, in resolving the aforementioned outstanding debt, it is not possible to reduce the burden of the future generation without cost to the current generation.

There are two basic concepts in the future design research framework: “how humans think” and “social mechanisms.” In social sciences in the past, both “how humans think” and “social mechanisms” were immutable conditions, and the approach of research was to investigate what would happen in relation to various issues. Taking consequential impartiality and efficiency as social aims, while assuming no change in human thought processes or tastes, the position of mechanism design from the late 20th century has taken account of the design of social mechanisms needed to achieve those aims. However, this approach ignores the viewpoint of changing the way that people think. The nudge method is a behavioral economics method in which there is no transformation of social mechanisms, and alteration of behavior is encouraged rather than change in ways of thinking. However, although the nudge method is likely to be successful in, for example, reducing greenhouse gases by a few percent, it is unlikely to reduce them to close to zero. Although Future Earth is calling for transformation in social systems, it seems that it in markets and democracy is not part of the picture. Future design research aims to realize sustainable societies by designing “social mechanisms” that change the very “way that humans think.”

Of course, even if we assume that humans have “futurability,” it is not easy to activate this property. Is it possible that new social mechanisms will be constructed, sociality weakened in the name of the market and democracy strengthened, and that contrast, impulse, and optimism will be weakened? I summarize the future design research over the last year or two here.

4. Future design experiments

Let us summarize the experimental research of Kamijo et al. (2017), which was the starting point of future design research. Three-person groups representing different generations were asked to choose between Option A and Option B. Both options entailed a monetary sum for the generation, and the three people would decide how to distribute it among themselves. Discussion time was limited to a maximum of 10 minutes. The first generation (G1) chose between A (\$36) and B (\$27) to be distributed between the three of them. If they chose Option A with the higher sum, Options A and B for the next generation would be reduced by \$9. However, if they chose Option B with the lower sum, Option A

and Option B for the next generation would be unchanged. Table 1a shows the payoffs until the third generation. For example, if G1 chooses Option A, G1 gets \$36 and then G2 faces a choice of Option A (\$27) and Option B (\$18). If G2 chooses Option B, they get \$18 and G3 also faces the choice of Option A (\$27) and Option B (\$18). Unlike in the static prisoner's dilemma game, if the current generation chooses selfishly, it puts a burden on the next and subsequent generations, and Kamijo et al. (2017) dubbed the game the Intergenerational Sustainability Dilemma Game (ISDG).⁹

Table 1. Kamijo et al. (2017) - Payoff table and results

G1	G2	G3	...
		A 18	
	A 27		
		B 9	
A 36			
		A 27	
	B 18		
		B 18	
		A 27	
	A 36		
		B 18	
B 27			
		A 36	
	B 27		
		B 27	

G1	G2	G3	G4	G5
A	A	A	A	A
A	A	A	A	B
A	A	A	A	B
A	A	B	B	A
B	B	A	A	B

G1	G2	G3	G4	G5
B	B	B	B	B
B	B	B	B	A
B	B	A	A	B
B	A	B	B	A
B	A	A	B	A
A	B	B	A	A
A	B	A	B	A

In the experiment, a table of the gains until the sixth generation was distributed. Each generation understood that the following generations existed. The participants were paid according to the decisions that had been made. The participants were 210 undergraduate and graduate students at the Kochi University of Technology, and almost all groups chose to distribute the money equitably.

If a human activates his or her contrast trait (the principle of optimality), Option A would automatically be chosen. However, one person from the three was chosen and asked to negotiate with the other two, not for their own sake, but as a representative of the

⁹ To show the effect of deliberation alone within an ISDG framework, Timilsina et al. (2017) carried out a field study in urban and rural settings in Nepal, in which, when there was discussion between three people, they were asked to choose an option before and after the discussion. The results showed that the deliberation had hardly any impact.

groups down the chain. However, the money received by the participant was in line with the decision made by all three. These participants were called the imaginary future persons.

Table 1b shows the results of the ISDG when there was no imaginary future person. For example, in the first row, all generations chose Option A. Note that the actual experiment continued until the sixth or seventh generation. This was because the final generation would be aware that there were no participants after them and choose Option A for sure. Seven groups out of 25 chose Option B, with the ratio of selection of the sustainable Option B at 28%. Table 1c shows the results when there was an imaginary future person. In this case, 21 groups out of 35 chose Option B, a 60% selection ratio.¹⁰

After the experiment, a questionnaire was administered regarding Social Value Orientation. The participants were classified as “pro-socialist,” “individualist,” “competitor,” and “other.”¹¹ Among the participants, 78% were “pro-socialist.” When there was no imaginary future person, Option B was selected only when all three group members were “pro-socialist.” In this case, “pro-socialists” comprised 76% of the participants who chose Option A. However, when there was an imaginary future person, pro-socialists comprised 79% of those in the groups that chose Option A. Pro-socialists comprise 73% of participants in the groups that chose Option B. Thus, the difference in the proportion of pro-socialists in the two situations was small. In other words, there was no impact on the selection of Option B, depending on whether or not individual participants were pro-socialist. However, following discussions in which one person out of the three took on the role of an imaginary future person, that person’s behavior changed and had an impact on those around them.

Saito (2018b) used the data from this experiment to conduct the following thought experiment. Macro-economically speaking, based on a discount rate r , G1 gain W_A is taken to be the present value of the most selfish payoff stream (i.e., G1 selecting Option A and the other generations all selecting Option B) and G1 gain W_B to be the present value when all generations choose sustainable Option B. In other words, the following are taken to be true:

¹⁰ Nakagawa et al. (2016), using a new qualitative-deliberative approach, discovered that the existence of a neutral icebreaker, who began the discussion with an attitude that was neutral toward Options A and B, contributed to the selection of the sustainable Option B.

¹¹ A participant had three sets of payoff levels for himself or herself and a virtual person to choose from. Those who chose the option that gave the same payoff to them are pro-socialists, those who maximized their own payoff are individualists and those who maximized the difference between his or her own and the other person’s payoff are competitors (Van Langer et al, 1997). Please note that the terms “individualist” and “competitor” in social psychology differ from those in economics.

$$W_A = 36 + \sum_{t=1}^{\infty} \frac{18}{(1+r)^t}, \quad W_B = \sum_{t=1}^{\infty} \frac{27}{(1+r)^t}$$

If $r = 1$, then $W_A = W_B = 54$. If $r > 1$, then $W_A < W_B$. If the first generation lasts 30 years, $(1 + 0.023)^{30} \approx 2$. Thus, if the discount rate is converted to an annual rate, Option A will be chosen if the discount rate is 2.3% or above, and Option B if it is lower than 2.3%. The result of the experiment by Kamijo et al. (2017) is interpreted as “a change toward a lower generational discount rate” due to the introduction of the “social mechanism” of an imaginary future generation¹².

Table 2. Results of an ISDG experiment in Bangladesh

Selection of Option B	Dhaka	Bogra
With imaginary future person	29%	86%
Without imaginary future person	31%	74%
Proportion of pro-socialists	20%	45%

It is not possible to conclude from one experiment that introducing a new mechanism of an imaginary future generation is effective. It will be necessary to see results obtained in various areas with different historical and cultural backgrounds and different degrees of economic development. Considering this, Shahrier et al. (2017a) chose to carry out an ISDG experiment in Dhaka, a megacity in Bangladesh with a rapidly growing population, and in Bogra, a contrasting rural area. In the Japanese experiment, the participants were students; however, the Bangladeshi participants were recruited from within the community, with 252 participants in Dhaka and in Bogra. As shown in Table 2, regardless of whether there was an imaginary future person, there was a big difference in the selection of Option B between Dhaka and Bogra. Selection of Option B in Dhaka was around 30% and selection of Option B in Bogra was around 80%. When comparing the situation depending on whether there was an imaginary future person, it was observed that in Bogra, the selection of Option B increased compared to Dhaka; however, it did not increase in Dhaka. In a Social Value Orientation questionnaire after completion of the experiment, the proportion of pro-socialists in Dhaka was 21% and in Bogra was 45%, with a clear difference between

¹² I would like to note that doubt remains regarding the suitability of a macroeconomic framework that takes the payoff for the current generation to be the present value of an unlimited payoff stream for all generations. See Hiromitsu (2015) regarding philosophical issues surrounding time discount rates.

the two places. In Bangladesh, a monetary incentive was given, in that money was paid to a value corresponding to the option chosen in the Social Value Orientation questionnaire.

However, at the Kochi University of Technology, no monetary incentive was paid to participants. Therefore, the proportion of pro-socialists is rather low in Bangladesh.

In response to the results of the study by Shahrier et al. (2017a), the issue is the design of a mechanism that allows sustainable selection in the ISDG in Dhaka too. In the study by Kamijo et al. (2017), one person represented the imaginary future generation, and it would be possible to increase that number. For example, it would be possible for all participants in the decision-making to be part of the imaginary future generation. However, is it possible to accept decisions made by members of an imaginary future generation as members of the current generation? As a result, Shahrier et al. (2017b) proposed the Future Ahead and Back mechanism (FAB) mechanism, as follows.

Stage 1: All three participants select either Option A or Option B as the imaginary future generation, and submit a request to the current generation, i.e., themselves.

Stage 2: All three participants select either Option A or Option B as the current generation, and if the selection is the same as in Stage 1, the process ends.

Stage 3 : If the decision is not the same, a majority decision is taken.

Based on the FAB mechanism, the selection rate of Option B was 85%, about the same as in Bogra, when the imaginary future generation was one person. However, pro-socialists in this experiment were 28%, a little higher than the 20% in Shahrier et al. (2017a).

Sustainable decision-making was made possible by the addition of two stages to the majority decision mechanism before the event, which is often used in democracy, in other words, by complementing the majority decision.

As mentioned above, in many countries, including Japan, the sustainability of debt is an important issue. Hiromitsu (2017) and Arai and Nakagawa (2018) carried out subject experiments using an imaginary future generation¹³. Hiromitsu (2017) carried out experiments in different parts of Japan, for two scenarios, whereby the burden is postponed for 30 years or more (Option A) or it is shared between the current generation and future generations (Option B). The question was posited to ordinary people in their late teens to their seventies in teams of three, who were asked to choose between the two options through discussion. As in Kamijo et al. (2017), current generation teams and imaginary future generation teams (in which one of three people was asked to be an

¹³ Saito (2018a) created a fictitious deliberation narrative with the imaginary future generation surrounding consumption tax.

imaginary person of the future) were created. Of the 83 current generation teams, 60 (72.3%) chose Option B, and of the 65 imaginary future generation teams, 57 (87.7%) chose Option B. In addition, the “silver democracy hypothesis” (that older people tend to postpone a burden) was investigated; although the selection of Option B declined as age increased, the decline was small compared to the profit-and-loss arithmetic implied by their own life expectancy. Next, the pros and cons of the “deliberative democracy hypothesis” (that Option B is more likely to be chosen than Option A in a discussion) was investigated; the hypothesis seemed to be supported by the fact that the rate of selection of Option B was 71.6% before discussion but rose to 87.7% after discussion; Hiromitsu (2017) surmises that there could perhaps have been pressure to conform.

Arai and Nakagawa (2018) recruited 379 ordinary people from Kochi Prefecture in Japan and conducted a deliberation experiment in which teams of four were created with current generation teams and imaginary future generation teams in which all members were in the imaginary future generation. Employing the Harvard case method in business schools, teaching materials were developed to teach national and prefectural financial administration in a short time. Among these, as national policies, maintaining the status quo or reducing the amount of money given to local prefectures (two policies) were proposed, and as prefectural policies, maintaining the status quo or support for specific regional agglomeration aimed at regional self-reliance (two policies) were proposed. The participants assigned to the current generation group debated about the most favorable policies among the four (2 x 2) for society in 2047 and then chose one of the four, and then reported their preference as an individual. Meanwhile, the imaginary future generation group was asked to undertake two procedures. First, before the debate, they were asked to have the (retrospective) experience of reading newspapers from 30 years ago and sending advice to the people of 30 years ago. They then “time-shifted” to 30 years in the future, as a group debating from the perspective of the year 2047, which of the four policies they would want people to choose in 2018 and then chose one of the four. After this stage, they reported their selection as an individual living in 2017. After the experiment, they filled in questionnaires designed to measure the qualities of “generativity” (engaging actively in behavior that creates value for the next generation) and “critical thinking” (the quality of being able to think logically without bias). If their score was higher than the median value in at least one of these two indicators, an imaginary future person was more likely than a current generation person to choose to support specific regional agglomeration aimed at regional self-sustainability¹⁴. In other words, people with a high score in at least one of

¹⁴ Please see Huta and Zuroff (2007) regarding “generativity,” and Hirayama and Kusumi (2004) regarding “critical thinking.”

these indicators came to choose a scenario that took account of future generations, owing to the experience of the “social mechanism” of becoming a future generation person in the twin procedures.

Nakagawa et al. (2018) recruited 155 ordinary participants in Kochi Prefecture – where 84% of the land area is forested – using the case method to present them with the history, current situation, and issues for debate surrounding Kochi’s forests, and also with five relevant policy options or scenarios (maintenance of the status quo; intentional neglect of inefficient forests; minimum care for inefficient forests; provision of forest roads allowing the continuance of forestry business; and turning the forested land into recreation forests). When no conditions were imposed, before debate, the current generation groups’ most favored option was turning the forested land into a recreational forest. When asked to debate the future of Kochi’s forests in the four-person team, their most favored scenario changed to minimum care for inefficient forests. Meanwhile, the future generation persons were asked to undertake the same twin procedures as in Arai and Nakagawa (2018). The scenario selected by most individuals after giving advice to people from 30 years ago was to provide forest roads to continue the forestry business, and the scenario selected most frequently after they had subsequently debated as an imaginary future generation was also the provision of forest roads. In other words, in this experiment, it was found that even without debate, the “social mechanism” of looking back at the past had a big effect on scenario selection.

As the falling birth rate and the aging of society continues, what kind of electoral system would be right for a sustainable society? Hizen (2018), as a mechanism to reflect the voice of children, conducted an experiment using the voting system suggested by Demeny (1986)¹⁵. Demeny voting gives voting rights to children, with the parents exercising those rights by proxy. Three types of participants are used - Type X with two votes, his or her own and that of a child, Type Y with one vote, and Type Future Generation with no vote. Participants voted either for Option A (where the current generation receive a large reward) or for Option B (where it is split evenly between the current and future generations). First, when both participants are Type Y, that is, when the voting is normal, the half of Type Y who voted for Option B voted for Option A when Demeny voting was used. In other words, many Type Y participants (equivalent to the older generation at the life stage of having no children or adult children), under normal voting, take account of future generations and chose Option B. However, under Demeny voting, the half of Type Y participants switched allegiance to Option A, which was beneficial to themselves. In other words, it seems that Demeny voting does not work as intended. As a result, Hizen (2018)

¹⁵ See also Kamijo et al. (2015).

suggests the necessity of introducing systems other than voting. Suggested examples included “Mission: The Future,” established as an executive branch of government in Sweden to investigate long-term problems, and the ombudsman system, established in Hungary to oversee the executive branches of government from the viewpoint of the future.

Hiroimitsu (2018) showed the results that were different from the “silver democracy hypothesis” and concluded that as they age and approach Nirvana, the judgment of individuals becomes unbiased. Saito and Kameda (2018) answered that question. To verify the strength of the desire of older people to represent the welfare of future generations, they conducted a postal survey of 2,000 randomly sampled residents of Bunkyo ward in Tokyo aged 18 or older (772 valid responses). The survey revealed that it is possible to anticipate the level of a person’s desire to represent future generations from their life stage alone (respondents were classified into the three stages of: no children, children but no grandchildren, grandchildren). The question used to assess desire to represent future generations was: For the sake of generations as yet unborn, would you like to take on the role of giving advice on existing social policies from the position of future generations? The most important point of the question is that it does not ask about grandchildren with a real presence but about “generations as yet unborn.” In other words, as people progress through life stages, they focus on the welfare of future generations that will comprise society after their own death. This fact suggests the possibility that the sustainability of future generations is understood in relation to “third parties with no connection to oneself” who will come after one’s own grandchildren. Saito and Kameda (2018) emphasize the possibility that when people face the problem of sustainability, they are buoyed by “expanded egoism,” seeing it not as a problem related to unselfish altruistic behavior but as their own problem. Although “expanded egoism” has been obscured by the market and democracy, another possible explanation is that “expanded egoism” or “futurability,” fostered as human beings have progressed through life stages, is a social system similar to an imaginary future generation.

Japan has faced various Natech events (Natech - Natural Hazard Triggering Technological Disaster). Kurashiki (2018) assumed population changes in a city in the Osaka area and a Nankai trough megathrust earthquake, and asked participants to propose various policies from the perspective of risk communication and verified the effect of an imaginary future generation. In the future, this is likely to become an important future design research problem.

5. What is the premise of the imaginary future generation?

Kobayashi (forthcoming book in 2018) and Kobayashi (2018b) developed an argument, as follows, regarding the rationalization of the introduction of an actor (imaginary future generation) representing the good of future generations. The image of a human being in Rawls' (1971) theory of justice is that of a self-interested rational individual. Behind a "veil of ignorance" ("original position," in which a person does not know the generation to which they belong, nor their own age, wealth, or health), a person should apply the difference principle (the maximin rule, a social system in which the utility of the least-fortunate generation is maximized within its various systems). However, even if a social contract can be agreed upon in the original position, when the veil of ignorance is lifted, and history begins, a self-interested rational generation has no incentive to follow such a social contract. In other words, the current generation has no incentive to sacrifice its own gain to secure gains for future generations. This is because we face the time inconsistency problem, whereby future generations can impose no penalty if the social contract is broken (Calvo, 1978).

If an imaginary future generation is introduced into society ahead of time, it is possible for the happiness of the least-fortunate generation to improve in that society. People in the original position behind the veil of ignorance, in anticipating that happiness, agree to the introduction of an imaginary future generation as a social contract (Kobayashi, 2018b). To establish such a new social contract, the imaginary future generation must possess strong altruism with regard to future generations. Kobayashi (2018b) weakened the assumption of self-interested rational individuals and claimed that people possess "weak altruism" with regard to future generations. When people from future generation fulfill their assigned roles, they are able to gain empathy from others (Smith, 2010). The receipt of empathy from others causes positive feelings, strengthening the altruism of these imaginary future persons, helping establish a new social contract theory.

In constructing his principle, Rawls (1971) excluded the environment that could foster human feelings of altruism and empathy, imagining instead a self-interested rational actor. However, as shown in behavioral ecology research by Saito and Kameda (2018), humans have "expanded egoism." If we can activate futurability by introducing the social mechanism of the adoption of an imaginary future generation, our conclusion of this type of social contract can be the new social contract theory of Kobayashi (forthcoming book in 2018) and Kobayashi (2018b).

However, if the starting point for our discussion is *not* the assumption of a self-interested rational actor, Hiromitsu (2015, 2018) considers that the agreement of people in the same generation supports the intergenerational principle, and what supports that agreement is "the reasonable" described by Rawls (1993). "The reasonable" is a concept

that Rawls contrasts with “the rational” and refers to people who understand that if other people respect the fair conditions of cooperation, it is necessary to respect that principle themselves, even sometimes at the expense of their own gain. In addition, Hiromitsu (2018), while focusing on the fact that Rawls himself intended “the reasonable” to be only a political concept, claims that this image of human beings is analogous to that of Hume, who says they have altruism as their true character. If we see the expansion of reasonableness to include the fate of future generations as “futurability” within future design, this provides a logical foundation for the framework for designing, or agreeing to, social systems that activate such futurability.

6. Practical application of future design

Parallel to the above experimental research, the practical application of future design is underway¹⁶. The main framework for laboratory experiments and field experiments is researchers presenting scenarios that are likely to happen in the future. This enables us to understand if the selected scenarios change when the future is considered from the present and vice versa, as an imaginary future generation. However, in future design practice, the participating citizens themselves design the scenarios, and the issue is their choice of scenarios and present-day policies. The scenarios proposed differ qualitatively when the future is considered from the present and when the present is considered from the future. The following paragraphs describe cases in Yahaba, Iwate Prefecture, and in Matsumoto, Nagano Prefecture.

In Yahaba, Iwate Prefecture, an imaginary future generation was created in the present to represent the interests of future generations and approach vision design and decision-making from their perspective. It verified the possibility of decisions taken through negotiation between these future generation representatives and the current generation, which consider the conflicting interests of different generations.¹⁷ Because the Cabinet Office required all municipalities to produce a “long-term vision” for 2060, five monthly workshops were held between late 2015 and March 2016. Four teams of five or six people were created from the residents of Yahaba and two teams were asked to think about the Yahaba of 2060, as members of the current generation, and propose policies for the present time. These were ordinary workshops to draw up policies for the future. Meanwhile, the

¹⁶ Although Yoshioka (2018) did not use future design methods such as the imaginary future generation, he held workshops for residents over a seven-year period in Yahaba in Iwate Prefecture, and observed that the thinking of participants could be changed from taking a cheap and reliable water supply for granted to believing it unreasonable to expect such facility without any cost to oneself. Since 2015, future design practice in Yahaba has grown out of such waterworks workshops making Yoshioka (2018) a pioneer in future design.

¹⁷ See Hara et al. (2017), Hara and Saijo (2017), Saijo (2017), Hara (2018a), and Hara (2018b).

remaining two teams were asked to “travel to 2060 in a time machine” and draw up policies from there.

I would like to outline the nature of the debate, with reference to Hara (2018b). Let us start from the position of the imaginary future generation. First, their overriding aim was to secure and build a prosperous life for the future people of Yahaba, and debates arose about ideas on the livelihood of people in the future, their lifestyles, and their values. For example, while the current generation proposed policies to directly increase the population such as “free medical care for children,” the imaginary future generation did not specifically aim at population increase, instead discussing the possibility of population increase as a result of their vision and policies. Second, they did not propose individual strategies and long-term ideas to achieve their aim; instead, they made a narrative connecting strategies and ideas. Third, for them, existing systems, etc., were seen as flexible and open to change if this helped achieve their aim. Fourth, they showed a willingness to actively incorporate any radical technical innovations that may occur in the future. Fifth, they demonstrated the strongest possible sensibility and awareness in considering new strategies to respond to urbanization and the aging of society. Sixth, having become aware of the current problems, they produced a new vision that does not prolong them.

Now, let us examine the current generation. First, improving life in the present became their primary focus. For example, they proposed things such as “eliminating waiting lists for nursery schools” or “increasing care facilities for the elderly.” Second, they tended to consider improvements to existing facilities and frameworks. Third, they tended to propose policies that put no burden on the current generation. Fourth, they put weight on policies with an impact in the short term. Fifth, they tended to consider policies in comparison with those of other regions. Sixth, they tended to take existing frameworks and systems as immutable.

The current generation saw the future as an extension of the present time, constructed visions that resolved current problems and issues, and produced ideas rooted within current conditions and restrictions. Meanwhile, the imaginary future generation was creative, giving the highest priority to the resolution of problems that were the most complicated and time-consuming and depicting the future freely, regardless of current circumstances. They noted the physical and aesthetic merits and resources of the region and considered how to utilize them on a continuing basis.

Nakagawa et al. (2017) conducted interviews with several participants about six months after this practical application of future design in Yahaba and obtained the following findings. The locals who had been imaginary future persons experienced no conflict between the part of themselves that was a current generation individual and the

part that was an imaginary future person, having a comprehensive overview of both sides. In addition, the very act of thinking as an imaginary future person was “a joy,” and they found themselves automatically thinking like an imaginary future person in their everyday lives. The fact that the impact of the practical experience remained after six months shows that the effect of introducing imaginary future persons is “robust.” Therefore, it is possible to activate the futurability of humans by inducing them to think like imaginary future persons. However, when the current generation considers the future, they always see future generations are outside the self.

In Yahaba, the first 26 of 1,000 randomly sampled residents were recruited to participate in discussions between January and March 2017. Let us summarize this practical application of future design with reference to Hara (2018a). The theme was a plan for public facilities and municipal housing in 2060, and given the effectiveness of Shahrier et al.’s (2017b) FAB mechanism, the deliberations were carried out based on the following arrangement. The first session of deliberations were from the perspective of the current generation; in the second session after one month later, there were proposals for policies and long-term ideas, as an imaginary future generation in 2060; and, in the third session, vision proposal and decision making were welcomed from the perspective of either the current or future generation. After each session of discussions, the participants filled out various questionnaires. For example, as shown by Nakagawa et al. (2017), it was ascertained that the viewpoints of both a current generation person and an imaginary future person could coexist within one individual. In addition, when examining the “degree of shared viewpoint” – a yardstick showing the extent to which persons in the current and future generation shared views – it was found that the higher that yardstick the stronger a person’s awareness of the current generation’s responsibility, and that in policy proposals, there was focus on both “the possibility of realization” and “leaving scope for future generations to be in a position to decide for themselves.” In addition, language analysis of the deliberations revealed that there were many opinions and proposals relating to facilities as physical items, in the first set of discussions; however, elements not in the first session of discussions emerged as the second and third sessions of discussions progressed, for example, concern about the current residents of municipal housing.

Nishimura, Inoue, and Musha (2018) held three days of workshops for local government workers in November 2017 in Matsumoto in Nagano Prefecture to discuss to work out a basic concept for the new city hall due to be rebuilt, followed by two days of workshops for the general public in January and February 2018. The current generation group attached information to a blank map and conducted the “spatial journey task” of

writing down the problems of each region. Meanwhile, the imaginary future generation group, in addition to the blank map task, conducted the “spatial and temporal journey task” in which, based on a timeline for Matsumoto City from 1960 to 2060, they looked back at past events and imagined the shape of the region and society in the future. On the timeline, they also wrote down predictions for various future statistics and technological innovations. At the local government employee workshops, on the first day, all groups experienced the spatial journey task, and on the second day, only the future generation group experienced the temporal journey task. In the future generation group, there was a lively exchange of views at the meta-level regarding the future, and the functions that remain for local government after continued low birthrate and the increasing use of AI. Meanwhile, the starting point in the current generation group was current problems, and they considered methods to resolve them. The general public workshops obtained the same results.

Nishimura, Inoue, and Musha (2018) administered questionnaires on discount rates before and after the event. There was no change in with the current generation group; however, with the future generation group, the discount rate was lower after experiencing the temporal journey task, and they acquired a long-term viewpoint. Furthermore, women’s discount rate was lower than that of men. Their experiment was designed to compare the “spatial task” and the “spatial and temporal journey task” + “imaginary future generation,” and it may have been possible to verify the effect of the imaginary future generation if there had been “spatial and temporal journey task” groups without the introduction of an imaginary future generation element.

In India, Suzuki (2018) was successful in bringing about compulsory regulations for companies to show their corporate social responsibility spending as “one additional line” in their income statement, and it seems that such spending rose by yen 300 billion in a year. This could be a good example of future design researchers stepping out of the laboratory to engage in social innovation.

Other future design projects are in progress, including those relating to renewable energy in Suita City in the Osaka metropolitan area, infrastructure in Uji City in the Kyoto metropolitan area, and urban redevelopment in Ohnuma Town in Hokkaido (Takeda and Sugino, 2018).

In addition, Matsunaga and Managi (2018) question the nature of social sustainability, proposing replacing GDP with a new inclusive wealth measure (wealth available to the society for the creation of well-being, which will be available to those alive today and future generations), and calculating it in practice. This is likely to become an indispensable

indicator for evaluating future design research.¹⁸

7. Outstanding issues with future design

Future design research began in earnest in late 2015 or in 2016 and now encompasses a variety of issues. With reference to Kobayashi (2018a), let us examine three such issues.

The first is the question of whether the imaginary future generation will function as intended. In the experiments viewed, people have been found to activate futurability, and in the practical applications of future design, they have been discovered to exercise, in addition to the aforementioned futurability, an “originality” not found when the future is viewed from the position of the current generation. That said, the mechanism of the “mind” at work is still unclear. As a result, Aoki (2018) conceived a research area dubbed “neuro future design.” Cooperation among psychology, biology, and neuroscience and related fields is essential.

Meanwhile, even if many people are willing to become imaginary future persons, this gives rise to the new problem of how they will function within existing organizations. This problem also relates to the second issue; will it be possible to make up for the impulse and optimism of democracy merely by the construction, within the existing frameworks, of new organizations such as a Ministry of the Future, future departments within various bodies, and a future discussion chamber? We certainly do not yet know how the policies themselves will be drawn up, how policies will be chosen from among various proposals, and how these policies will be pursued. In other words, with the issue of designing “social mechanisms” that offer places where the general public can demonstrate futurability and originality, we also face the issue of designing new “social mechanisms” that attempt to implement such ideas. We must learn to construct social mechanisms in which members of the public that understand the perspective of future generations draw up and implement various policies, not as a task for the sake of others, but as one that relates directly to them. This has the potential to significantly change the existing representative democracy.

The second future design research issue outlined by Kobayashi (2018a) is the validity of the creation of an imaginary future generation (with new systems such as a Ministry of the Future) within a democracy. For example, with Demeny voting, parents with proxy votes for their children ultimately obtain the right to vote more than once, which is contrary to the democratic principle of “one person one vote” and lacks validity. With the rationalization of the imaginary future generation examined in section 5 is the necessity to consider the validity of a Ministry of the Future and of various social mechanisms that may

¹⁸ See the June 2018 future design special issue of *Trends in the Sciences* for a summary of the report on the first future design workshop event held in January 2018.

be proposed at some point.

The third future design issue mentioned by Kobayashi (2018a) is what needs to be done so that ordinary people automatically become imaginary future persons. According to Kobayashi (2018a), “the next generation to whom we are bound to contribute must be regarded as something that has permanence,” and we must understand that there is value in contributing to the progress of human intelligence, in other words, to progress in “expanded reason.” If “expanded reason” rings alarm bells regarding the sustainability of the natural environment and societies of the next generation, we should begin countermeasures now. According to Kobayashi (2018a), if “progress in expanded reason” can be considered an asset, implementing countermeasures today is logical if the value of that asset is expected to be undermined in the future. Self-sacrificing behavior on behalf of the next generation is transformed, for the current generation, into logical behavior to maintain the value of its own asset.

In addition to these three issues outlined by Kobayashi (2018a), another important aspect, which requires care, is reforming the impulsive market from the viewpoint of future design. For example, one concept is using the market by setting limits within the carbon budget on fossil fuel that can be burnt each year and trading the relevant emission rights (volume). How this relates to futurability is yet unknown.

Finally, let us investigate the possibility of radical innovation in science from the viewpoint of future design. For example, although the futurability of humans is not a quality that ought to survive from the viewpoint of evolutionary biology, it does find a way to stay alive. It is important to reexamine existing frameworks to investigate why this should be so. It is also the norm to discount future gains in economics, but for the sake of the current generation and not future generations. In reality, every field lacks the viewpoint of future generations. Thus, perhaps a revolution in science itself is required.

The participation of a large number of ordinary citizens and researchers in future design would be welcome.

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