

SHARING, DISCOUNTING, AND SELFISHNESS: A JAPANESE–AMERICAN COMPARISON

Masato Ito and Daisuke Saeki

Osaka City University

Leonard Green

Washington University

Social discounting rates were compared between Japanese and American college students. In a series of psychophysical questionnaire tasks, participants chose between a hypothetical unshared monetary reward and a hypothetical monetary reward to be shared with other people (relatives or strangers), to determine amounts of the unshared reward subjectively equivalent to the shared reward. The participants also chose between sharing and not-sharing options in a one-shot dilemma game. Discount rates estimated by a hyperbolic function were higher among the Japanese students than among the American students. Moreover, the discount rates obtained in the relative condition were lower than in the stranger condition. In addition, participants who chose the sharing option in the dilemma situation showed lower discount rates. These results suggest that discount rates reflect a cultural difference as well as a degree of “selfishness.”

Key words: sharing, social discounting, one-shot dilemma games, questionnaires, selfishness, cross-societal comparison

People discount the value of a delayed reward relative to an immediate one of an equivalent nominal amount. So, too, do people discount the value of an uncertain reward relative to a certain one of equivalent nominal amount. These decreases in subjective value with delay and probability are well described by a hyperbolic discounting model of the following form (cf. Green, Myerson, & O’Staszewski, 1999; Mazur, 1987; O’Staszewski, Green, & Myerson, 1998; Rachlin, Raineri, & Cross, 1991; Saville, Gisbert, Kopp, & Telesco, 2010; Takahashi, Masataka, Malaivijitnond, & Wongsiri, 2008; Whelan & McHugh, 2009; for a review, see Green & Myerson, 2004):

The present study was in part supported by a Grant in Aid for Scientific Research from the Ministry of Education of Japan (#B10044001).

Address correspondence to: Daisuke Saeki, Department of Psychology, Faculty of Literature, Osaka City University, Sumiyoshiku, Osaka 558-8585, Japan (E-mail: pxi04337@nifty.ne.jp).

$$V = A/(1 + bX), \quad (1)$$

where V is the subjective, discounted value of the delayed or probabilistic reward; A is the actual amount of the reward (i.e., its undiscounted value); X is the delay until, or odds against, receipt of the reward; and b is the parameter that describes the rate of discounting. Larger values of b represent steeper rates of discounting.

Rachlin (1993) proposed that the sharing of a reward also leads to the discounting of its value relative to an unshared one, and thus "social discounting" can be described by a similar mathematical equation:

$$V = A/(1 + sN), \quad (2)$$

where V is the discounted value of a shared reward of amount A , N is the number of other people with whom the reward is to be shared (beneficiaries; Rachlin, 1993; Rachlin & Raineri, 1992) or the social distance (Jones & Rachlin, 2006, 2009; Rachlin & Jones, 2008), and s represents the degree of selfishness. If an individual was completely unselfish (i.e., $s = 0$), then the value of a reward (V) would be equal to its actual value (A) regardless of how many other people were sharing the reward. In contrast, larger values of s describe greater degrees of selfishness.

Jones and Rachlin (2006) examined the applicability of Equation 2 to a situation in which participants were offered the opportunity to share money with other people. The participants were presented with a series of written questions in which they were offered choices between a specific amount of (hypothetical) money (ranging from \$75 to \$155) that they could keep for themselves (i.e., the unshared option) or \$75 for themselves and \$75 for various persons (ranging from their dearest friend or relative to someone who was a mere acquaintance). Jones and Rachlin found that the amount of money a person was willing to forgo in order to give \$75 to another person decreased as a function of the perceived social distance between them, and that the function was well described by Equation 2.

Ito and Saeki (2000), using Japanese students as participants, examined the relation between the degree of selfishness quantified by Equation 2 and cooperation in a social-dilemma situation. In their study, N in Equation 2 was defined by the number of beneficiaries (Rachlin, 1993; Rachlin & Raineri, 1992) rather than social distance, as in Jones and Rachlin (2006, 2009). Participants first completed a questionnaire with a series of psychophysical tasks under two different sharing conditions (sharing with relatives and sharing with strangers). Based on indifference points obtained from these questionnaires, the discount rates of the social discounting model (parameter s in Equation 2) were obtained in each condition for each participant. Participants also made a choice under one of two different social-dilemma situations, the n -person version of a prisoner's dilemma game and a chicken game. It was found that Equation 2 well described the social discounting, indicating that the hyperbolic function, originally developed for continuous variables, could apply to a discrete variable, N (number of other people). It was also found that participants who made uncooperative choices in the social-dilemma situations had larger discount rates (i.e., were relatively more selfish) than participants who made cooperative choices. This result was evident in both of the sharing conditions (i.e., with relatives and with strangers) and for both of the social-dilemma

situations (i.e., the n -person version of a prisoner's dilemma and the chicken game), consistent with the view that the discount rate reflects degree of selfishness. These results show that discount rate estimated by the hyperbolic function in which N is defined by the number of beneficiaries can measure selfishness.

The present study extended this work to investigate possible cultural differences between Japanese and Americans in terms of social discounting. Because social discounting may represent people's attitudes toward other persons, the degree of social discounting may differ across cultures. It has been argued that the Japanese are more collectivistic than Americans (e.g., Markus & Kitayama, 1991). This notion originated in earlier and classical work by Benedict (1946), who proposed that informal mutual monitoring and sanctioning constituted the foundation of social order in pre-World War II Japan. If this idea is valid, then Japanese society would be expected to have greater social control over its citizens than American society has over its citizens. As a consequence, degree of selfishness might be expected to be relatively lower in Japanese than in Americans.

In a review, however, Takano and Osaka (1999) pointed out that the results from studies using questionnaires or experimental settings were inconsistent with the notion that Japanese are more collectivistic than Americans (e.g., Matsumoto, Kudoh, & Takeuchi, 1996; Matsumoto, Weissman, Preston, Brown, & Kupperbusch, 1997; Triandis, McCusker, Betancourt, Iwao, Leung, Salazar, et al., 1993; Yamagishi, 1988). For example, Yamagishi, using an experimental setting similar to the prisoner's dilemma, found that American students showed a higher level of cooperation than did Japanese students in a situation in which cooperation increased a member's monetary reward in a small group. Furthermore, Matsumoto et al. (1997) compared the individualism-collectivism scores on the interpersonal assessment inventory (ICIAI) across four different countries (Japan, Russia, Korea, and the United States) and reported that the Japanese sample was not more collectivistic than the U.S. sample.

Although the collectivism-individualism distinction is controversial, there are few studies comparing Japanese with Americans in terms of social discounting in particular, and discounting in general. One study made a direct comparison among Japanese, Chinese, and American students in their degree of discounting delayed and probabilistic rewards (Du, Green, & Myerson, 2002). Du et al. found that a hyperboloid function in which the denominator of Equation 1 was raised to a power described well the discounting of delayed and probabilistic rewards of all three groups, that the Americans and Chinese discounted delayed rewards more steeply than the Japanese, and that the Americans discounted probabilistic rewards most steeply and the Chinese the least steeply.

To compare differences between Japanese and Americans on a one-shot prisoner's dilemma task, Hayashi, Ostrom, Walker, and Yamagishi (1999) arranged experimental conditions such that participants were asked to make their choice either before the other person (self-first condition) or after the other person (other-first condition) had made his or her decision. The choice of the other person, however, was not revealed, regardless of the condition. Hayashi et al. found that Japanese participants differed in the proportion of cooperative choices they made between the self-first and other-first conditions, whereas American participants showed no difference between the

two logically identical conditions. Thus, there was a contrast in cooperative choices between Japanese and Americans.

Whether social discounting can be well described by Equation 2 for different cultural groups, and if so, whether there are differences between the groups in degree of social discounting, remains to be determined. Moreover, it is not known whether degree of social discounting is related to cooperation in social-dilemma situations like the one-shot prisoner's dilemma. Therefore, the present study, using the number of other people (beneficiaries) as a discount factor, addressed the following questions: First, are there cultural differences between Japanese and Americans in their degree of discounting monetary rewards that can be shared with other people? If the discount rate expressed by parameter s of Equation 2 represents degree of selfishness, then cultural differences should be evident between the two groups. Second, does the discount rate correlate with cooperation in a social-dilemma situation for both cultural groups? Such a finding would argue for the validity of discount rate as a measure of selfishness. It was predicted that people who have lower discount rates would be more likely to cooperate in the social-dilemma situation. Third, is degree of selfishness correlated with the difference in the proportion of cooperative choices between the self-first and other-first conditions when no information about the partner's decision is provided? An effect of the order in which the choice decision is made may extend the generality of Hayashi et al.'s (1999) finding, thereby supporting a cultural difference between Japanese and Americans.

Method

Participants

Five hundred nineteen students enrolled in undergraduate psychology courses at Washington University and Auburn University served as participants for the American sample, and 530 students in undergraduate psychology classes at Osaka City University and St. Andrews University (Izumi city, Osaka prefecture) served as participants for the Japanese sample. For both of the countries, participants were randomly divided into two sharing conditions: For the American students, 259 participants were assigned to the relative condition and the remaining 260 participants were assigned to the stranger condition. For the Japanese students, 268 participants were assigned to the relative condition and the remaining 262 students were assigned to the stranger condition. Furthermore, as explained in the next section, each participant was randomly assigned to one of eight types of conditions for the dilemma questionnaire. Participants were not paid for their participation in the experiment.

Questionnaires

Questionnaires were presented to each participant in a booklet (written in English for the American students and in Japanese for the Japanese students). The booklet consisted of two parts: a social discounting questionnaire for each of six conditions defined by the number of beneficiaries, and a dilemma questionnaire asking participants to choose between one of two options in either a one-shot prisoner's dilemma or a chicken game.

The following instructions (English version) were printed on the cover of the booklet for the relative condition:

Please read the following instructions carefully.

Task I

In Task I, you will be asked to make a series of hypothetical choices between monetary alternatives. On the following 6 pages, you will see "Option A" on the left and "Option B" on the right.

Option A will offer you an amount of money that will vary in every question, but which you can keep for yourself.

Option B will always offer you and other people \$1,300 collectively, but how the money will be used will be decided by the group. The money cannot be distributed to all persons equally. The number of people with whom you will share the money will vary for each page.

There are 30 choice questions on each page. For each question, you must choose one of the two options by circling either "A" or "B."

All questions must be completed in the order in which they are listed. You must respond to all choice problems. An example is shown below.

Question 1.

A: \$300 for yourself

B: \$1,300 shared among yourself and 3 relatives

If you would prefer the "\$300 for yourself," then you would circle "A." If you would prefer the "\$1,300 shared among yourself and 3 relatives," then you would circle "B."

Task II

In Task II, you will be asked to make a hypothetical choice regarding \$1,000. Page 7 presents this choice. There is only one question with two options, "C" and "D." Please read the question carefully, and choose one of the two options by circling either "C" or "D."

On pages 1 through 6, the social discounting questionnaire was printed, and on page 7 (the last page), the dilemma questionnaire was printed. In the social discounting questionnaire, the number of beneficiaries (1, 2, 4, 8, 14, and 24) varied from page to page either in an ascending or in a descending order. The order of presentation of the number of beneficiaries was counter-balanced across participants. Each page of the social discounting questionnaire contained 30 questions asking participants to choose between a hypothetical variable amount of unshared money (Option A) and a hypothetical

fixed amount of money (\$1,300 for the American participants and 130,000 yen for the Japanese participants) to be shared with other persons (Option B). These amounts of money were equalized between the two countries based on the exchange rate at the time of the experiment. The unshared amounts of money were increased or decreased through 30 questions from \$1,300 (130,000 yen) to \$1.3 (130 yen) in an ascending or in a descending order. The order of presentation of reward amount was counterbalanced across participants. The amount of unshared money was changed in a fixed percentage of the \$1,300 or 130,000 yen (i.e., percentages 0.1, 0.5, 1, 2, 4, 6, 8, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 92, 94, 96, 98, 99, and 100) through the 30 questions in the page.

The dilemma questionnaire consisted of a choice situation between two options, sharing and not sharing, in either a one-shot prisoner's dilemma or a chicken game task. There were four factors, divided into two types each, for a total of 16 possible conditions: the nature of the group (relative vs. stranger), the number of beneficiaries (2 vs. 10), the type of game (prisoner's dilemma vs. chicken game), and the order of the decision (self-first vs. other-first). Each participant was randomly assigned to one of eight types of dilemma conditions, except that the nature of the group (relative or stranger) was the same as in the social discounting questionnaire.

For the prisoner's dilemma game task with two beneficiaries, the relative condition, and the self-first condition, for example, the instruction was as follows (parentheses are for the Japanese version):

Suppose you and a relative are each given \$1,000 (100,000 yen). Both of you must individually choose what to do with \$1,000 (100,000 yen). One of the options below must be chosen:

C: Keep the \$1,000 (100,000 yen) for yourself

D: Make the \$1,000 (100,000 yen) "the deposit money"

For each person who chooses Option "D," another \$1,000 (100,000 yen) will be added to the "deposit money." After both people choose one of the options individually, any pooled "deposit money" will be divided between both of you equally, regardless of what each of you chose.

If you choose Option "C," you will get at least \$1,000 (100,000 yen) plus you will split the additional "deposit money" if your relative chose Option "D." The money given to you from the "deposit money" increases as the number of people who choose Option "D" increases, but if you are the only person who chooses "D," then you get \$1,000 (100,000 yen).

Your relative will make his or her choice after you, and will not know your choice.

Which option would you choose, C or D? (Please circle either C or D.)

For the chicken game task, the following sentence was added to the third paragraph of the above instructions:

However, if both of you choose Option “C,” then nobody will receive any money.

For the other-first condition, the word *after* was replaced by *before* in the sentence concerning the order of condition in the above instruction.

For the number of beneficiaries condition, the number of relatives or strangers was changed between conditions (2 beneficiaries or 10 beneficiaries).

Procedure

Participants were tested in groups of varying sizes in large classrooms. Each participant was given the booklet. It took about 20 to 30 minutes for the participants to complete the questionnaires.

Results

From choice data in the social discounting questionnaire, we estimated indifference points (i.e., the amount of the unshared money judged to be subjectively equivalent to the shared money) for each participant. Indifference points were determined by using the amount of the unshared money at which participants switched their preferences from the unshared money to the shared money for the descending order of unshared money, or from the shared money to the unshared money for the ascending order of unshared money. For some participants, however, we could not specify indifference points, for the following reasons: Seventeen American and 22 Japanese participants chose exclusively the monetary reward for themselves (Option A), 12 American and 8 Japanese participants chose exclusively the monetary reward that should be shared with other person (Option B), and 22 American and 17 Japanese participants switched their choices more than once in a series of 30 questions in which only one switch of preference is expected. Because we could not fit the discount functions to estimate discount rates for these participants, their data were not included in the following analyses.

To the indifference points obtained from the remaining participants, Equation 2 was fitted and the discount rates were estimated. For the participants for whom the indifference points could be specified (i.e., 468 American and 483 Japanese participants), percentages of cases where coefficients of determination (R^2) were more than 0.5 were 82% and 77% for the American and Japanese participants, respectively. Data from the participants whose R^2 values were less than 0.5 were not included in the following analyses of social discounting.

Table 1 shows the group median amount of unshared money judged subjectively to be equivalent to the shared money, along with interquartile ranges, for both cultural groups, as well as for sharing conditions (relative vs. stranger). The median values of the discount rate parameter (s) and coefficients of determination (R^2) for fits of the hyperbolic function (Equation 2) are also given in Table 1.

Figure 1 shows group median amount of unshared money judged to be subjectively equivalent to shared \$1,300 or 130,000 yen as a function of the number of other people with whom the money was to be shared. The left panel shows the results for the relative condition, and the right panel shows the results for the stranger condition. To compare the results from both

groups of participants on the same scale, amounts are expressed as a proportion of the actual amount of money to be shared. Filled and open circles

Table 1
Group Median Amount of Unshared Money Judged to be Subjectively Equivalent to the Shared Amount of Money as a Function of Country (U.S.A. vs. Japan) and Condition (Relative vs. Stranger).

Country	Group condition	<i>n</i>	Number of other people who shared the \$1,300 (U.S.A.) or the 130,000 yen (Japan)					<i>s</i>	<i>R</i> ²	
			1	2	4	8	14			24
USA	Relative	<i>n</i>	191	191	191	191	191	191		
		Median	682.5	487.5	292.5	162.5	91.0	65.0	0.871	0.999
		Q1	617.5	422.5	227.5	162.5	65.0	19.5		
	Stranger	Q3	747.5	682.5	422.5	227.5	117.0	91.0		
		<i>n</i>	193	193	193	193	193	193		
		Median	617.5	422.5	292.5	162.5	91.0	39.0	1.020	0.989
Japan	Relative	Q1	617.5	422.5	227.5	117.0	65.0	39.0		
		Q3	682.5	585.0	357.5	162.5	91.0	65.0		
		<i>n</i>	184	184	184	184	184	184		
	Stranger	Median	55250	42250	22750	9100	6500	3900	1.228	0.991
		Q1	42250	22750	11700	6500	2437.5	975		
		Q3	68250	48750	29250	16250	9100	9100		
Stranger	<i>n</i>	187	187	187	187	187	187			
	Median	48750	29250	16250	9100	3900	3900	1.697	0.998	
	Q1	35750	22750	9100	3900	975	975			
		Q3	61750	42250	22750	11700	9100	3900		

Note. Values of *s* and coefficients of determination (*r*²) for fits to Equation 2 are shown.

show the data from American and Japanese students, respectively. The solid and dashed curves show the best-fitting hyperbolic functions (Equation 2) for the American and Japanese students, respectively. The discount rates (*s*) and coefficients of determination (*R*²) are also shown in Figure 1. The percentage of data variance accounted for by Equation 2 was 99% for all conditions in the group level, and the discount rates were steeper for the Japanese students than for the American students in both sharing conditions, as shown by the fact that the open circles are below the filled circles.

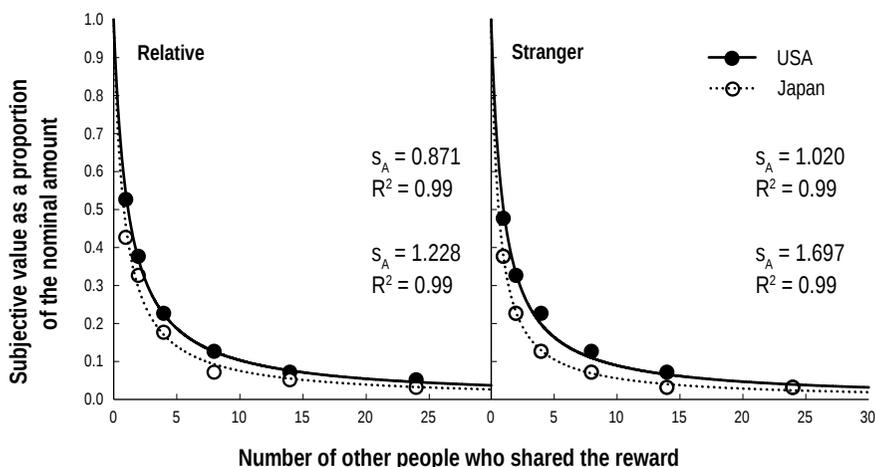


Figure 1. Median amount of the unshared money judged subjectively equivalent to the shared amount for Americans (filled circles) and Japanese (open circles) for the Relative (left panel) and Stranger (right panel) conditions. Values are expressed as the proportion of the actual (undiscounted) amounts (\$1,300 and 130,000 yen). Curves represent the best-fitting hyperbolic discount function (Equation 2). s_A and s_J are estimated discount rate parameters for the Americans and Japanese, respectively. Coefficients of determination (R^2) are also presented.

When the hyperbolic function was fitted to each participant's data separately, differences were found in the values of the discount rate parameter between the two sharing conditions as well as between the Americans and Japanese. The rate of discounting was lower under the relative condition than under the stranger condition, and the Japanese students discounted to a greater degree than did Americans: In the relative condition, median discount rates (s) for the Americans and Japanese were 0.851 and 1.252, respectively, and, in the stranger condition, median discount rates for the Americans and Japanese were 0.974 and 1.716, respectively. These findings were supported statistically by results from Mann-Whitney U tests. The discount rates were significantly lower in the relative condition than in the stranger condition for both the American and Japanese students ($z = 3.33$, $p < .01$, and $z = 4.29$, $p < .01$, respectively). Furthermore, there was a significant difference in the discount rates between the Americans and Japanese in the relative condition ($z = 7.23$, $p < .01$), and between the Americans and Japanese in the stranger condition ($z = 11.5$, $p < .01$).

Table 2 shows the proportion of participants who chose the sharing option in the dilemma questionnaire. An ANOVA using an arcsine transformation was conducted to assess the difference in the proportion of participants who chose the sharing option in the dilemma questionnaires, with the factors Japan/USA, relative/stranger, prisoner's dilemma/chicken game, 2/10 beneficiaries, and self-first/other-first order of decision. As a result, except for the order of decision, all of the main effects and one interaction between the game structure and the order of decision were statistically significant (see Table 3). The proportion of participants who chose the sharing option was significantly greater in the American students than in the Japanese students ($\chi^2 = 20.59$, $df = 1$, $p < .01$) and was significantly greater

in the relative condition than in the stranger condition ($\chi^2 = 24.09$, $df = 1$, $p < .01$). Furthermore, the proportion of participants who chose the sharing option was significantly greater in the chicken game condition than in the prisoner's dilemma condition ($\chi^2 = 59.37$, $df = 1$, $p < .01$) and was significantly greater in the 2-beneficiaries condition than in the 10-beneficiaries condition ($\chi^2 = 111.63$, $df = 1$, $p < .01$). The significant interaction between game structure and order of decision revealed that in the chicken game, both the American and Japanese students were more likely to choose the sharing option in the other-first condition than in the self-first condition ($\chi^2 = 6.31$, $df = 1$, $p < .05$).

Table 2
Proportion of Participants Who Chose the Sharing Option in the Dilemma Questionnaire

Order of decision	Country	2 beneficiaries				10 beneficiaries			
		Prisoner's Dilemma		Chicken		Prisoner's Dilemma		Chicken	
		Relative	Stranger	Relative	Stranger	Relative	Stranger	Relative	Stranger
Self-first	U.S.A.	0.806	0.742	0.938	0.813	0.375	0.344	0.636	0.394
	Japan	0.486	0.455	0.848	0.706	0.441	0.258	0.389	0.333
Others-first	U.S.A.	0.697	0.667	0.871	0.893	0.576	0.194	0.839	0.455
	Japan	0.576	0.429	0.903	0.788	0.310	0.152	0.611	0.500

When the data from the dilemma situations were analyzed in more detail, it was found that for the American students, the proportion of participants who chose the sharing option was larger in the relative condition than in the stranger condition (0.72 vs. 0.56) and also was larger in the 2-beneficiaries condition than in the 10-beneficiaries condition (0.80 vs. 0.48). Furthermore, the proportion was lower in the prisoner's dilemma game than in the chicken game (0.55 vs. 0.73). For the Japanese students, the pattern of choice proportions for the sharing option in the dilemma questionnaire was similar to that of American students; that is, the proportion of participants who chose the sharing option was greater in the relative than in the stranger condition (0.57 vs. 0.45), and greater in the 2-beneficiaries than in the 10-beneficiaries condition (0.65 vs. 0.37). As for the type of dilemma situation, the proportion of participants who chose the sharing option was reasonably lower in the prisoner's dilemma game than in the chicken game (0.39 vs. 0.63). Thus, the effects of the factors arranged in the dilemma questionnaires were robust and consistent between the American and Japanese students.

Figure 2 shows median discount rates obtained from participants who chose the sharing option and not-sharing option in the dilemma questionnaire for each cultural group. The median discount rate of American students who chose the sharing option (0.916) was significantly lower than that of American students who chose the not-sharing option (0.974) (Mann-Whitney U test, $z = 2.24$, $p < .05$). Similarly, the median discount rate of Japanese students who chose the sharing option (1.311) was significantly

Table 3
 ANOVA Table for the Effects of Country, Group, Dilemma Type,
 Number of People, and Order of Choice on Choice of "Sharing"
 in the Dilemma Questionnaire

Variable	df	χ^2
Country (A)	1	20.59***
Group (B)	1	24.09***
Dilemma type (C)	1	59.37***
Number of people (D)	1	111.63***
Order of choice (E)	1	0.95
A×B	1	0.37
A×C	1	0.89
A×D	1	1.00
A×E	1	0.26
B×C	1	0.19
B×D	1	3.06
B×E	1	0.74
C×D	1	1.43
C×E	1	6.31*
D×E	1	0.71
A×B×C	1	0.45
A×B×D	1	2.52
A×B×E	1	0.05
A×C×D	1	2.71
A×C×E	1	0.37
A×D×E	1	1.73
B×C×D	1	0.16
B×C×E	1	0.84
B×D×E	1	2.37
C×D×E	1	1.47
A×B×C×D	1	1.20
A×B×C×E	1	0.40
A×B×D×E	1	3.08
A×C×D×E	1	0.99
B×C×D×E	1	0.11
A×B×C×D×E	1	0.16
σ^2_e	25.39	

lower than that of Japanese students who chose the not-sharing option (1.654) (Mann-Whitney U test, $z = 3.32$, $p < .001$). Moreover, the median discount rate of participants who chose the sharing option was significantly greater in the Japanese students than in the American students for

the relatives condition (Mann-Whitney U test, $z = 4.76$, $p < .01$) and for the stranger condition (Mann-Whitney U test, $z = 8.19$, $p < .01$). Therefore, with respect to the correlation between discount rate (s) and choice of the sharing option in the dilemma situations, lower discount rates corresponded to choice of the sharing option, suggesting that discount rate represents degree of selfishness.

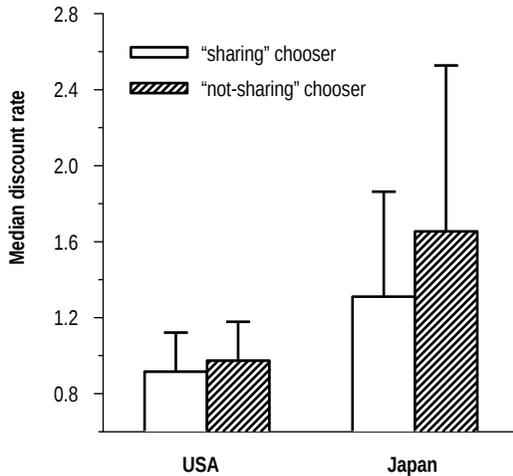


Figure 2. Median discount rate obtained from participants who chose the sharing and not-sharing option in the dilemma questionnaire for each country. Error bars represent quartile deviations.

Discussion

The present study evaluated whether there were differences between Japanese and American students in social discount rate estimated by the hyperbolic function, and choice of sharing hypothetical money in a social-dilemma situation. In addition, the correlation between discount rate and choice of the sharing option was examined. The question of interest here was whether those who discounted more steeply also would be less likely to choose the sharing option in the social-dilemma situation. The answer to this question is clear: The higher the discount rate, the lower the tendency to choose the sharing option in the dilemma questionnaires.

Previous findings have indicated that individuals who have high discount rates as determined by procedures like the current one but in which participants make choices between immediate amounts of money and delayed but larger amounts of money are less likely to cooperate in an iterated prisoner's dilemma game. More specifically, the higher the discount parameter (b in Equation 1), the greater the percentage of defection in an iterated prisoner's dilemma game (Harris & Madden, 2002; Yi, Johnson, & Bickel, 2005). The present findings extend these results to different cultural groups and to a social discounting task, and suggest that social discount rates reflect degree of selfishness.

The current findings indicate that in both Japanese and American students, discount rate depended on the group with whom the (hypothetical) money would have to be shared (i.e., relative vs. stranger). In addition,

discount rate was greater in the Japanese students than in the American students. For the Japanese students, even in the relative condition, median discount rate was greater than 1.0, demonstrating an apparent difference between Japanese and American students. Furthermore, the results of the dilemma situation showed that the proportion of Japanese students who chose the sharing option was lower than that of American students for both of the sharing conditions, the number of beneficiaries, and the two different social-dilemma games.

If discount rate reflects degree of selfishness, then the present results suggest that Japanese students are more selfish than American students, a conclusion contrary to the assumption of the collectivism/individualism dichotomy (Benedict, 1946; Markus & Kitayama, 1990). Although there has been controversy around the notion of collectivism/individualism, few studies have directly tested this idea (Takano & Osaka, 1999). The present study does not support the assumption that Japanese are more collectivistic than Americans, although there was a cultural difference in the discount rate (i.e., degree of selfishness) between Japanese and Americans. The results from an international survey of adolescents' lives and attitudes carried out under the auspices of the Japan Youth Research Institute (Sengoku, 2001) also are not consistent with the individualism/collectivism dichotomy. In one questionnaire, adolescents from four different countries (Japan, Korea, France, and the United States) were asked to respond to alternatives concerning attitudes on the value of life. The Japanese were more positive than Americans with regard to the statement, "My family's happiness is more important than national or social advancement," whereas the Japanese were less positive than Americans on the statement, "I want to contribute for the good of my own country." The results of the present study, along with those from Sengoku using younger participants, suggest that post-World War II Japanese society has changed. This suggestion is consistent with the assumption of recent cross-cultural comparisons noting that culture is not static but dynamic across time (e.g., Matsumoto et al., 1997). A comparison between different generations within Japanese society would appear to be an important topic for future research.

The present study, using the number of beneficiaries as the variable N in Equation 2, showed that the same form of hyperbolic discount function that describes delay and probability discounting (Equation 1) also describes social discounting (Equation 2) in individuals from different cultural groups. Although hyperbolic functions are functions for a continuous variable, not for a discrete variable such as the number of beneficiaries, a function for a discrete variable can be approximated by the hyperbolic discount function (Equation 2) as shown by the present results and those of Jones and Rachlin (see Batschelet, 1979).

Rachlin and Jones (2008, 2009) used a hyperboloid function in which N was raised to a power and found that the value of the exponent of the best-fitting discount function was 1.0; therefore, the hyperboloid could be reduced to Equation 2. From the results of Rachlin and Jones (2008, 2009) and those of the present study, it can be said that a simple hyperbolic discount function (Equation 2) is a valid mathematical model of social discounting (cf. Du et al., 2003; Green & Myerson, 2004).

The results from the present study and previous studies on discounting (Du et al., 2002; Rachlin & Jones, 2008, 2009) suggest that the process

of social discounting is different from that of delay discounting. Du et al. reported that American students discount the delayed rewards to a significantly greater extent than Japanese students. If delay discounting and social discounting are the same process, the same cultural difference has to be shown in the social discounting rate. In the present study, however, the opposite effect was found. Rachlin and Jones (2008) found that the reward amount effect is opposite between delay and social discounting. Furthermore, Rachlin and Jones (2009) reported a significant, but relatively low, correlation between delay and social discounting. These findings, therefore, suggest that delay discounting and social discounting are different processes.

Our findings are inconsistent with those of Hayashi et al. (1999), who found that Japanese participants in a prisoner's dilemma task were more likely to show cooperative choice in the self-first condition (i.e., when they made their choice of whether to cooperate or not before the other person had to make his or hers). In the prisoner's dilemma game used here, there was no difference in the proportion of participants, whether Japanese or American, who chose the sharing option between the self-first and other-first conditions. This inconsistency in findings between the present study and that of Hayashi et al. may be due to differences in procedural detail; the present study for example, used a questionnaire with a hypothetical reward, whereas the Hayashi et al. study used a real dilemma game with real money. The effects of these procedural differences remain to be examined in future research.

The results of the dilemma questionnaire in the present study revealed that several factors influence the choice of sharing option in a one-shot social-dilemma situation. In the present study, the proportion of participants who chose the sharing option was significantly greater in the relative condition than in the stranger condition. This difference can be explained by the difference in degree of familiarity with other members with whom the reward should be shared. In social psychology, it has been shown that the group identity has a great effect on cooperative choices in the social dilemma situation (Kollock, 1998). Accordingly, it is possible that in the relative condition, participants might think of other members as in-group members, whereas in the stranger condition, they might think of other members as out-group members.

Participants in the 2-beneficiaries condition showed a greater tendency to choose the sharing option than participants in the 10-beneficiaries condition in the one-shot dilemma questionnaire in the present study. This group size effect is common in the literature of social dilemma (Dawes, 1980). As the group size becomes larger, the reward amount given to other member(s) from the shared resource (i.e., "the deposit money" in the present study) becomes smaller. In the present study, when one of the members chose the sharing option, the other member received an additional \$1,000 (100,000 yen) from the deposit money in the 2-beneficiaries condition, whereas in the 10-beneficiaries condition, the other members received an additional \$200 (2,000 yen) from the deposit money. This difference may be one of the factors influencing choice of the sharing option in the present study.

As for the game structure, it was shown that the proportion of participants who chose the sharing option was significantly greater in the chicken game condition than in the prisoner's dilemma condition. This result shows that human participants were sensitive to the difference in the game

structure, consistent with the results reported in previous studies on social dilemma (Wahba, 1971). Furthermore, a significant interaction between the factors of game structure and order of decision indicates that the participants could understand the contingency between their choices and outcomes because, in the other-first condition, it is reasonable that participants in the chicken game condition tended to choose the sharing option to avoid the worst outcome (in the present case, no reward).

The significance of cross-cultural research is, first, to show that a given finding is not specific to a particular culture, and, second, to describe the relation between cultural groups and the strength of a phenomenon (e.g., Brislin, 1983). With regard to the first of these aspects of cross-cultural research, the present study demonstrated that the sharing of rewards with other people is a discount factor, that the discounting of shared rewards can be expressed by the same hyperbolic function as that presented by Jones and Rachlin (2006), and that the same form of mathematical function that describes delay and probability discounting also describes social discounting in two different cultural groups. So, too, the current findings demonstrate that for both Japanese and American students, the higher the discount rate, the greater the degree of selfishness (i.e., the less likely they are to choose the sharing option in a social-dilemma situation). With regard to the second aspect of cross-cultural research, our findings, like those of Du et al. (2002), demonstrate a cultural difference in the degree of discounting between the Japanese and American participants.

References

- BATSCHULET, E. (1979). *Introduction to mathematics for life scientists* (3rd ed.). Berlin: Springer Verlag.
- BENEDICT, R. (1946). *The chrysanthemum and the sword: Patterns of Japanese culture* (Reprinted ed.). Tokyo: C. E. Tuttle Co.
- BRISLIN, R. W. (1983). Cross-cultural research in psychology. *Annual Review of Psychology*, 34, 363-400.
- DAWES, R. M. (1980). Social dilemmas. *Annual Review of Psychology*, 31, 169-193.
- DU, W., GREEN, L., & MYERSON, J. (2002). Cross-cultural comparisons of discounting delayed and probabilistic rewards. *The Psychological Record*, 52, 479-492.
- GREEN, L., & MYERSON, J. (2004). A discounting framework for choice with delayed and probabilistic rewards. *Psychological Bulletin*, 130, 769-792.
- GREEN, L., MYERSON, J., & OSTASZEWSKI, P. (1999). Amount of reward has opposite effects on temporal and probability discounting. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 25, 418-427.
- HARRIS, A. C., & MADDEN, G. J. (2002). Delay discounting and performance on the prisoner's dilemma game. *Psychological Record*, 52, 429-440.
- HAYASHI, N., OSTROM, E., WALKER, J., & YAMAGISHI, T. (1999). Reciprocity, trust, and the sense of control: A cross-societal study. *Rationality and Society*, 11, 27-46.
- ITO, M., & SAEKI, D. (2000, July). *Discounting and shared rewards and selfishness*. Paper presented at the 27th International Congress of Psychology, Stockholm.
- JONES, B., & RACHLIN, H. (2006). Social discounting. *Psychological Science*, 17, 283-286.

- JONES, B. A., & RACHLIN, H. (2009). Delay, probability, and social discounting in a public goods game. *Journal of the Experimental Analysis of Behavior*, *91*, 61-73.
- KOLLOCK, P. (1998). Social dilemmas: The anatomy of cooperation. *Annual Review of Sociology*, *24*, 183-214.
- MARKUS, H. R., & KITAYAMA, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review*, *98*, 224-253.
- MATSUMOTO, D., KUDOH, T., & TAKEUCHI, S. (1996). Changing patterns of individualism and collectivism in the United States and Japan. *Culture and Psychology*, *2*, 77-107.
- MATSUMOTO, D., WEISSMAN, M. D., PRESTON, K., BROWN, B. R., & KUPPERBUSCH, C. (1997). Context-specific measurement of individualism-collectivism on the individual level: The individualism-collectivism interpersonal assessment inventory. *Journal of Cross-Cultural Psychology*, *28*, 743-767.
- MAZUR, J. E. (1987). An adjusting procedure for studying delayed reinforcement. In M. L. Commons, J. E. Mazur, J. A. Nevin, & H. Rachlin (Eds.), *Quantitative analyses of behavior: The effect of delay and of intervening events on reinforcement value* (Vol. 5, pp. 55-73). Hillsdale, NJ: Erlbaum.
- OSTASZEWSKI, P., GREEN, L., & MYERSON, J. (1998). Effects of inflation on the subjective value of delayed and probabilistic rewards. *Psychonomic Bulletin & Review*, *5*, 324-333.
- RACHLIN, H. (1993). The context of pigeon and human choice. *Behavior and Philosophy*, *21*, 1-17.
- RACHLIN, H., & JONES, B. A. (2008). Social discounting and delay discounting. *Journal of Behavioral Decision Making*, *21*, 29-43.
- RACHLIN, H., & RAINERI, A. (1992). Irrationality, impulsiveness, and selfishness as discount reversal effects. In G. Loewenstein & J. Elster (Eds.), *Choice over time* (pp. 93-118). New York: Russell Sage Foundation.
- RACHLIN, H., RAINERI, A., & CROSS, D. (1991). Subjective probability and delay. *Journal of the Experimental Analysis of Behavior*, *55*, 233-244.
- SAVILLE, B. K., GIBBERT, A., KOPP, J., & TELESKO, C. (2010). Internet addiction and delay discounting in college students. *The Psychological Record*, *60*, 273-286.
- SENGOKU, T. (2001). *Shinsennen seikatsu to ishiki ni kansuru chousa houkokusho* [A report on comparative and international survey of adolescents' life and attitude in new millennium]. Japan Youth Research Institute.
- TAKAHASHI, M., MASATAKA, N., MALAIVIJITNOND, S., & WONGSIRI, S. (2008). Future rice is discounted less steeply than future money in Thailand. *The Psychological Record*, *58*, 175-190.
- TAKANO, Y., & OSAKA, E. (1999). An unsupported common view: Comparing Japan and the U.S. on individualism/collectivism. *Asian Journal of Social Psychology*, *2*, 311-341.
- TRIANDIS, H. C., MCCUSKER, C., BETANCOURT, H., IWAO, S., LEUNG, K., SALAZAR, J. M., ET AL. (1993). An etic-emic analysis of individualism and collectivism. *Journal of Cross-cultural Psychology*, *24*, 366-383.
- WAHBA, M. A. (1971). Effects of game structure, range of pay-off and strategy of the other on cooperation in mixed-motive games. *Psychological Reports*, *28*, 683-689.

- WHELAN, R., & MCHUGH, L. A. (2009). Temporal discounting of hypothetical monetary rewards by adolescents, adults, and older adults. *The Psychological Record*, 59, 247-258.
- YAMAGISHI, T. (1988). The provision of a sanctioning system in the United States and Japan. *Social Psychology Quarterly*, 51, 265-271.
- YI, R., JOHNSON, M. W., & BICKEL, W. K. (2005). Relationship between cooperation in an iterated prisoner's dilemma game and the discounting of hypothetical outcomes. *Learning & Behavior*, 33, 324-336.

