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GENDER AND CULTURE IN A THRESHOLD PUBLIC GOODS GAME: JAPAN VERSUS CANADA

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Gender and Culture in a Threshold Public Goods Game: Japan versus Canada

by

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Abstract

We compare male and female behavior in Japan and Canada in the context of a threshold public goods game with both a strong free-riding equilibrium and many socially efficient threshold equilibria. Although higher rewards produce higher contributions, neither culture nor gender has any significant impact on the equilibrium selected, the amount contributed or the provision success rate. Nonetheless, culture and gender do affect behavior. Japanese females coordinate significantly less closely than Canadian females, while Japanese males coordinate significantly less closely than either Canadian males or Canadian females around an equilibrium. Coordination is related both to conforming and less variable behavior.

Keywords: Threshold public goods; gender; culture; free-riding

JEL Classification: H41; C92; Z10; J16

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1. Introduction

Most experimental studies that focus on gender differences in economic behavior use North American subjects. However, there is some experimental evidence that economic behavior can differ from one country to another. For example, in the context of public goods games, Burlando and Hey (1997) find that British subjects free ride more than Italians, while Cason et al. (1998) find that Japanese behave more spitefully early on, ultimately achieving more efficiency than Americans, while American behavior more closely matches equilibrium predictions. These studies both use mixed male-female groups to examine cultural differences in the laboratory.

It is also important to consider whether gender differences observed in North America are culturally specific, or widely present in different cultures. One paper that attempts this is Croson and Buchan (1999) who use subjects from the United States, China, Japan and Korea. They examine experimental evidence from a two-person trust game in which a proposer chooses to send all, some or none of a $10 endowment to an anonymous partner, the responder. The experimenter then triples any money sent and the responder is allowed to send some of this money back to the original proposer. No significant gender or culture effects are found among proposers, but among responders, women are significantly more generous than men. Country dummy variables show no significant differences between countries. However, as the authors point out, there were very few female participants in Japan and Korea, making it difficult to draw conclusions about potential gender differences in those countries.

We compare the behavior of all-male and all-female groups in Japan and Canada in the context of a threshold public goods game. A threshold public good is provided if and

only if enough money is raised from game participants who are given the opportunity to make such contributions, but prohibited from communicating with one another. Participants lose any money they contribute but obtain a preannounced monetary reward if enough money is raised from the group as a whole. There is a temptation to free ride because an individual will earn more money than anybody else if he/she contributes less than anybody else, and earn the highest possible amount if the public good is provided by the group despite his/her zero contribution. This game possesses a pure-strategy strong-free-riding equilibrium in which nobody contributes anything toward the public good. However, it also contains many pure-strategy threshold equilibria in which the group contributes exactly enough to ensure the public good is provided. In the threshold framework, cooperating to provide the public good, like free riding, is consistent with Nash equilibrium behavior. Thus, in contrast to the continuous public good setting, an examination of free riding versus cooperation is not obscured by being simultaneously a test of equilibrium versus disequilibrium behavior.[1]

Japan is a particularly interesting country to compare with Canada. Anthropologist Edward Hall argues that Japanese culture is primarily high-context, whereas American and northern European cultures are mainly low-context (Hall, 1977; Hall and Hall, 1987). Canada is also classified as a primarily low-context culture (Ogisu-Kamiya, 1997 and Ting-Toomey, 1992). According to Hall and Hall (1987), context profoundly affects communication. In high-context Japan, context is "widely shared" and participants are deeply involved with each other. Their "shared behavior patterns ... make the Japanese sensitive to even the subtlest of changes in emotional tone" (Hall and Hall, 1987, p. 60).

[1] Cadsby and Maynes (1999) provide a more formal theoretical description of this game and its Nash equilibria.

"Japanese depend heavily on nonverbal communication and are very sensitive to it" (Hall and Hall, 1987, p. 126). In contrast, in a low-context culture like Canada's, explicit and direct verbal communication is of paramount importance. If correct, Hall's ideas suggest that Japanese might coordinate more readily around an equilibrium outcome, while Canadians might find their attempts at such coordination thwarted by the prohibition on direct communication.

Sociologist Geert Hofstede (1991) also proposes that cultures endow individuals with different principles that influence behavior.[2] He argues that one dimension of national cultures is measured along a continuum from "collectivism" to "individualism," defining societies in which the interest of the group prevails over the interest of the individual as "collectivist," and those in which the interest of the individual prevails over the interest of the group as "individualist." Japan is an example of the former; Canada is an example of the latter. Along similar lines, Hall and Hall (1987, p.117) argue that when the Japanese negotiate, "everybody must win." If group interests and win-win attitudes actually do prevail over individual interests and individually competitive attitudes in Japan, the temptation to free ride might be mitigated or even absent when threshold public goods games are played in that country.

A contrasting point of view is provided by psychologist Toshio Yamagishi and his various co-authors (e.g. Yamagishi and Yamagishi, 1994; Yamagishi et al., 1998). They argue that the general level of trust, defined as "an expectation of goodwill and benign

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[2] Hofstede (1991) analyzes cultures based on a survey of IBM employees in 53 different countries or groups of countries. Through factor analysis of the responses to his survey questions, he identifies four dimensions along which he argues cultures may differ from each other: social inequality or power distance, individualism versus collectivism, gender concepts and roles, and uncertainty avoidance.

intent" (Yamagishi and Yamagishi, 1994, p. 132), is actually lower among Japanese than among Americans. Therefore, Japanese prefer to deal with others through ongoing relationships. These relationships are necessary precisely because of the low level of general trust and provide an incentive structure motivating interacting individuals to behave in a benign manner towards each other, even in the absence of goodwill. Thus, assurance, defined as "an expectation of benign behavior for reasons other than goodwill of the partner", and "based on the knowledge of the incentive structure surrounding the relationship" (Yamagishi and Yamagishi, 1994, p. 132) often substitutes for trust in Japan. Participants in our threshold public goods game make their decisions privately in the context of an ad hoc group brought together for the sole purpose of participating in an experiment. There is no obvious sanctioning or incentive system available to discourage self-interested free-riding behavior. Therefore, in contrast to both Hofstede and Hall, one might expect more of such behavior in Japan than in Canada, whose culture resembles that of the United States.

A recent paper by Buchan et al. (2000) provides experimental evidence consistent with relatively low levels of trust in Japan. In an experimental trust game conducted in the United States, China, Japan and Korea, Japanese subjects send a lower proportion of their endowments on average than subjects from any of the other countries. The difference in proportions sent is significant between Japanese and American subjects. The proportion returned by the recipients to the senders is also lowest among the Japanese subjects. However, this difference is not significant between the Japanese and the Americans.

In addition to such hypothesized general cultural differences between Canada and Japan, there is a widely held popular belief that gender relations and gender politics differ between Japan and North America. For example, Ogasawara (1998) studies the subtle relationship between males and females in a large Japanese company. This research was motivated by the difficulties the author encountered explaining the unique position of women in Japanese society to Americans she met while attending graduate school in the United States. Ogasawara's qualitative analysis demonstrates that different gender roles and positions between societies can produce different gender cultures and behaviors between societies as well. Such differences between Japan and North America might be reflected in the selection of varying approaches by male and female groups in Japan and Canada to the social dilemma posed by the threshold public goods game.

Kugihara (1999) recently conducted an empirical investigation of gender differences in social loafing behavior among males and females in Japan. Using a rope-pulling task, Kugihara (1999) found that while males exerted less individual effort when pulling as a group than when pulling alone, females exerted a similar effort under both conditions. Though the sample was small (two groups of nine females and two groups of nine males) this was interpreted as evidence that social loafing is more prevalent among males than among females in Japan. There were no financial incentives in this experiment. In contrast, when such incentives were present, there was no evidence of more free riding among men than among women beyond the first few periods of a threshold public goods experiment in Canada (Cadsby and Maynes, 1998). The question arises as to whether in an identical threshold public goods framework with salient financial incentives, free

riding, like social loafing during the rope-pulling task, might be more prevalent among males than among females in Japan.

Hofstede (1991) also stresses differing gender roles in his discussion of so-called "masculine" versus "feminine" cultures, another one of his four cultural dimensions. In "masculine" societies, "social gender roles are clearly distinct (i.e., men are supposed to be assertive, tough, and focused on material success whereas women are supposed to be more modest, tender, and concerned with the quality if life)". In contrast, in "feminine" cultures "social gender roles overlap (i.e., both men and women are supposed to be modest, tender and concerned with the quality of life)" (Hofstede, 1991, p. 82-83). Hofstede ranks Japan as the most masculine of countries, while Canada is 24th on a list of 53. Thus, if Hofstede (1991) is correct, one might expect a greater difference between the behavior of male and female groups in Japan than in Canada, supporting the notion that, though no significant difference was found in Canada beyond the first few periods (Cadsby and Maynes, 1998), Japanese males might free ride significantly more than Japanese females throughout a threshold public goods game.

Kashima et al. (1995) hypothesize that cultures may differ along Hofstede's individualism-collectivism dimension, while males and females across cultures may differ along a different dimension, termed "relatedness". Relatedness refers to the relationship between the self and others. Kashima et al. (1995) cite the influential work of Gilligan (1982) who argued that women tend to construct moral problems in terms of care and responsibility within relationships while men think of such issues in terms of abstract rights and rules applicable to themselves as individuals. Gilligan (1982) based her conclusions on interviews with women and men in the United States. Kashima et al.

(1995) test their hypothesis by administering a series of questionnaires to males and females in Australia, the continental United States, Hawaii, Korea and Japan. As expected, they find that both males and females in Australia and the United States exhibit strong individualism while those in Korea and Japan exhibit strong collectivism. Hawaii is somewhere in between. They also find that within each culture, females score significantly higher than males along the relatedness dimension. American and Australian females score higher than any other gender/culture grouping. In both the American and Australian cases, female relatedness is significantly higher than male relatedness. However, Kashima et al. are surprised to find that Japanese females score lower in relatedness than any other female grouping and lower even than Korean, Hawaiian and Australian males. American males score only slightly lower than Japanese females on this characteristic. Japanese males show significantly less relatedness than Japanese females and less than any other gender/culture grouping in this study.

Cadsby and Maynes (1998) examine the behavior of all-female and all-male groups playing a threshold public goods game in the laboratory. Both male and female groups contribute significantly more towards a threshold public good and achieve the threshold with significantly greater frequency when the monetary reward from provision is higher than when it is lower. Canadian female groups initially contribute significantly more than Canadian male groups, but this significance vanishes as the game progresses. However, Canadian female groups prove to be significantly better at coordinating around a selected equilibrium than Canadian male groups, particularly during the last five periods of the game. Cadsby and Maynes (1998) argue that this result is consistent with the different orientations of the males and females interviewed by Gilligan (1982). It is

certainly consistent with the high-relatedness found by Kashima et al. (1995) for women from the United States and Australia, countries that are culturally close to Canada. Kashima et al.'s (1995) finding that Japanese females exhibit much less relatedness than US and Australian females and about the same degree of relatedness as US and Australian males suggests that Japanese females could play a threshold public goods game quite differently than their Canadian counterparts. In particular, they might show much less tendency to coordinate closely around a selected equilibrium. This phenomenon could well be even more pronounced for Japanese males.

In the current paper, the Canadian experiments are replicated as closely as possible in Japan in order to compare the behavior of Japanese all-female and all-male groups with their Canadian counterparts. We examine six hypotheses suggested by the previous theoretical and empirical work discussed above.

Hypothesis 1: Japanese male and female groups, like Canadian male and female groups, will contribute more to a threshold public good and achieve provision more often, the higher is the reward resulting from provision.

Hypothesis 2: "Collectivistic" Japanese males and females will contribute more to a threshold public good and achieve provision more often than "individualistic" Canadian males and females.

Hypothesis 3: "Low-trust" Japanese males and females will contribute less to a threshold public good and achieve provision less often than "high-trust" Canadian males and females.

Hypothesis 4: Like the social-loafing behavior reported by Kugihara (1999), and consistent with Hofstede's (1991) view of males and females in "masculine" cultures,

Japanese males will contribute less than Japanese females to a public good, in contrast to Cadsby and Maynes' (1998) Canadian results that show no such gender differences.

Hypothesis 5: "High-context" Japanese males and females will coordinate more closely around a selected Nash equilibrium than "low-context" Canadian males and females.

Hypothesis 6a: "Low-relatedness" Japanese females will coordinate less closely around a selected Nash equilibrium than "high-relatedness" Canadian females.

Hypothesis 6b: "Very low-relatedness" Japanese males will coordinate less closely around a selected Nash equilibrium than Japanese females, Canadian males and Canadian females.

Clearly, both hypotheses 3 and 4 and hypotheses 5 and 6 are inconsistent with each other and represent alternatives based on different strands of the related literature.

The rest of the paper is organized as follows. The second section presents the experimental design. The results are reported in the third section and related to the six hypotheses stated above. Finally, conclusions are drawn in the fourth section.

2. Experimental Design

Sixteen new experimental sessions were conducted at Osaka University (twelve sessions) and Future University-Hakodate (four sessions) to generate Japanese data for purposes of comparison with the Canadian data previously reported in Cadsby and Maynes (1998). The Canadian subjects were first-year undergraduate students randomly selected and recruited by telephone from those living in residence at the University of Guelph. Unfortunately, cultural differences between universities made it impossible for us to recruit Japanese subjects in an identical manner. At Osaka University, the

experiments were first advertised by means of posters. Subsequently graduate student assistants recruited undergraduate students as subjects at a student cafeteria. At Future University-Hakodate, the experiments were first publicized and then first-year undergraduate students were recruited by means of a sign-up sheet. At Guelph and Osaka, few of the students knew each other. However, the Hakodate student population is relatively small and the subjects seemed to know each other quite well.

Like the Canadian sessions, the Japanese sessions each involved ten participants playing a threshold public goods game for 25 periods.[3] Of the 16 experimental sessions conducted in each country, half employed all-male groups, while the other half employed all-female groups. At the beginning of each session, an experimenter read the instructions aloud while the participants followed along on their own written copies.[4] The instructions informed the participants that each was endowed with an initial income of 10 tokens. The task was to decide individually and privately the number of tokens to contribute. If the group contributed the preannounced minimum of 25 tokens, each player received an equal number of additional tokens. A player's earnings equaled the initial endowment of 10 tokens, minus the contribution, plus the additional tokens. Treatments were conducted with reward levels of 5, 8, 10 and 15 additional tokens per player. If the threshold was not reached, contributions were not returned so that each player's earnings equaled the initial endowment minus the contribution.

[3] Cadsby, who conducted many of the Canadian experiments, helped run the first ten sessions at Osaka University and the four sessions at Future University-Hakodate to ensure that comparable procedures were used.

[4] Hamaguchi translated the English instructions into Japanese. The Japanese instructions were then used in a mock session with several graduate students at Osaka University to test the translation for clarity. Finally, Kawagoe checked the translation for accuracy. A copy of the instructions is available from the authors upon request.

At each session, a particular game was repeated 25 times. Repetition gives players an opportunity to learn about the game and the strategies of other players. It also affords the experimenters an opportunity to see if the players converge to an equilibrium or not. After each repetition or period, the group contribution for that period was announced publicly. However, individual contributions were not disclosed. The stage game is consistent with two types of pure-strategy equilibrium: a strong free-riding equilibrium in which nobody contributes anything and many threshold equilibria in which the group contributes just enough to achieve the threshold and thus receive the reward.

At the end of each session, token holdings were converted into money at a preannounced exchange rate. In the Canadian sessions, the exchange rate was chosen so that the average of the payoff in the strong free-riding equilibrium with that in the threshold equilibrium would be equal to about $28.40 Canadian. Undergraduate students at the University of Guelph could earn between $8.00 and $10.00 per hour at work-study jobs on the university campus. Since students at the Japanese universities generally earn from 800 to 1000 yen per hour in similar part-time positions, the Japanese exchange rate was chosen so that the comparable average would be about 2840 yen.[5] Each experimental session lasted between one and a half and two hours.

3. Results

In total, we conducted 32 sessions: 16 Canadian sessions reported previously in Cadsby and Maynes (1998) and 16 new Japanese sessions. Table 1 summarizes the

[5] The resulting exchange rates per token depended on the reward as follows: 10.1 yen (when reward equaled 5), 8.9 yen (when reward equaled 8), 8.27 yen (when reward equaled 10) and 7.0 yen (when reward equaled 15).

results, organizing them into panels by country and gender. For each session, the table shows the amount contributed in the first period and average group contributions as well as the number of times the public good was provided both by five-period intervals and over all 25 periods. Sessions fj02, fj08, mj02 and mj08 were conducted at Future University-Hakodate; the other Japanese sessions were conducted at Osaka University. The results for a given treatment appear to be very similar between the two Japanese universities. This impression was corroborated by Chow tests for each of the 25 periods, all of which failed to reject the null hypothesis that these results came from identical populations.

Figure 1 illustrates average group contributions for each period by gender and culture, aggregating across all eight sessions for each gender-culture grouping, regardless of reward level. All four groupings show a gradual decline in contributions from the earlier to the later periods. Canadian females contribute more than the other groupings in 19 out of 25 periods and Japanese males contribute less than the other groupings in 14 out of 25 periods. However, in the last five periods, Japanese males actually contribute more than the other groupings in two of the five periods.

Table 2 reports regression results for average group contributions measured over all 25 periods and three subintervals. The first subinterval extends from periods 1 to 5, the middle subinterval encompasses periods 6 to 20 and the final subinterval contains the last five periods. The independent variables in the regressions include the reward level as well as dummy variables for Japanese males, Canadian females and Canadian males. Also included are interaction terms for reward and each of the above three groups. Japanese females are represented by the intercept term. Since individuals participating in the same

session may respond to each other's actions, data from individuals in the same session are not independent. Therefore, it is necessary to use group averages so that each of the 16 sessions contributes just one observation to each regression. Similarly group data from one period are not independent of data from the other periods. Therefore, each regression uses data averaged over several periods.

During the first subinterval, the coefficient on reward level is equal to 0.263, but not significant. Canadian females are contributing significantly more than Japanese females (p=.0256), while Japanese males are contributing less (p=.0662). None of the interaction terms is significant. Thus, the early periods of the experimental sessions seem to lend some support to hypotheses 3 and 4, but none to hypotheses 1 or 2. This picture changes as the game progresses. During the middle subinterval, the reward coefficient rises to 0.878 and attains significance (p=.0483). However, there are no longer any significant differences attributable to gender or culture, nor are there any interaction effects between reward and any of the gender or culture variables. In the final subinterval, the reward coefficient increases further to 2.024 and becomes even more significant (p=.003). Once again there is no evidence that either gender or culture makes any systematic difference to the amount contributed or interacts with reward in any significant way. The same conclusion may be drawn when the data from all 25 periods are aggregated into a single regression. These results corroborate hypothesis 1, but reject hypotheses 2, 3, and 4.

Table 3 reports regression results for the number of times the public good is provided over all 25 periods and over the three subintervals. The independent variables are identical to those in the previous regression. During the first subinterval, neither the reward level nor any of the gender or culture variables are significant. During the rest of

the game, reward level becomes significantly positive, but neither gender nor culture appears to affect the frequency with which the public good is provided. Thus, we may conclude that while after a short learning period, the reward level significantly affects both the level of contributions and the extent of successful public-good provision, neither culture nor gender matters. Once again, hypothesis 1 is supported while hypotheses 2, 3, and 4 are rejected by the data.[6]

In Cadsby and Maynes (1998), we found that Canadian all-female groups were better able to coordinate around a selected equilibrium than Canadian all-male groups. Equilibrium coordination is calculated as the distance from the nearest equilibrium achieved by each group of ten players in each period with smaller distances corresponding to a higher level of coordination. To compare Japanese with Canadian behavior along this dimension, Figure 2 illustrates these distances by period, averaged over sessions by gender and culture. The picture suggests that Japanese male and female groups are both generally farther from an equilibrium in most periods than either Canadian male or Canadian female groups.

Table 4 reports the illustrated distances from equilibrium, averaged further over all 25 periods and over the three subintervals. On average, for all 25 periods together and over the middle and final subintervals, Canadian females are closest to an equilibrium, followed first by Canadian males, then by Japanese females and finally by Japanese males. This ordering is inconsistent with hypothesis 5, which predicts that Japanese will coordinate more closely around an equilibrium than Canadians. A t-test of the null hypothesis that the population means are equal was conducted for each pair of

[6] Non-parametric Mann-Whitney tests also show no significant difference in average contributions or provision rates based on either culture or gender.

gender/culture groupings in each time interval. The resulting p-values are also reported in Table 4. Over all 25 periods, they indicate that Canadian females are significantly closer to an equilibrium than Japanese females, lending support to hypothesis 6a. This is also true over the middle and final subintervals. Japanese males are significantly farther from an equilibrium than either Canadian males or Canadian females over the entire 25-period interval. The significant difference between Japanese and Canadian males seems to be based primarily on the earlier periods of the game: there is strong significance in the first subinterval, marginal significance in the middle subinterval and no significance at all in the final subinterval. In three of the final five periods, Japanese male groups are actually closer to an equilibrium than Canadian male groups. In contrast, the significant difference between Japanese males and Canadian females appears in the middle subinterval and endures through the final subinterval. Japanese males are also farther from an equilibrium than Japanese females, but this difference is significant only during the first subinterval. Thus, hypothesis 6b receives partial support from the data.

These equilibrium coordination tests do not differentiate between groups of players that focused on one type of equilibrium by the time they reached the final subinterval and those that were still switching between equilibria as the game was drawing to a close. In fact, all the sessions involving Canadian females focused on either a threshold or a free-riding equilibrium during the final subinterval. However, this was not the case for any of the other three culture/gender groupings. The group distance from focused equilibrium measure, also reported in Table 4 for the final subinterval, penalizes switching between a free-riding and a threshold equilibrium. It is calculated by averaging the distances from the one equilibrium to which the average group contribution during the last five periods is

closest. Of course, for the non-switching Canadian female sessions, this makes no difference. For all the other culture/gender groupings, the average distance from focused equilibrium is greater than the average distance from the nearest equilibrium in each period, reflecting the switching that took place. Measured by the group distance from focused equilibrium, Canadian females are significantly closer than Canadian males, Japanese females and Japanese males. This result lends further support to hypotheses 6a and 6b.

Cadsby and Maynes (1998, 2000) found that a group's ability to coordinate around an equilibrium was apparently related to a tendency of its members to behave alike. There are an infinite number of pure-strategy equilibria, making coordination potentially difficult. However, there are only two pure-strategy symmetric equilibria so that a tendency to behave alike may facilitate equilibrium selection, coordination and convergence. Such conformity is measured by calculating the average of the absolute individual differences from the mean group contribution on a period-by-period basis for each session. Averages by period and culture/gender grouping are illustrated in Figure 3. Japanese females are most conforming from periods 1 to 7 as well as 25, but Canadian females are most conforming during 14 of the 17 remaining periods. Japanese males are least conforming during 18 of the 25 periods.

Table 5 reports the conformity measure averaged further over all 25 periods and over the three subintervals. A t-test of the null hypothesis that conformity is equal was conducted for each pair of gender/culture groupings using session-level data averaged over each time interval. The resulting p-values are also reported in Table 5. Interestingly, over all 25 periods, the conformity measure is identical to the third decimal place for

Japanese and Canadian females. This masks an important difference between the two groupings. During the first subinterval, Japanese females are significantly more conforming than Canadian females (p=.0064). However, during the middle and final subintervals, Canadian females are more (but not significantly) conforming than Japanese females. It is worth recalling from Table 4 that while during the first subinterval Japanese females are closer (but not significantly) to an equilibrium than Canadian females, during the middle and final subintervals Canadian females are significantly closer to an equilibrium than Japanese females.

Canadian males are somewhat less conforming than either Canadian or Japanese females over all 25 periods. However, the results are significant only during the middle subinterval for the comparison with Canadian females (p=.0645).[7] Japanese males are significantly less conforming than Japanese females (p=.0008), Canadian females (p=.0066) and Canadian males (p=.0475) over all 25 periods. In the case of Japanese females, this significance extends to all three subintervals while in the case of Canadian females it extends only to the middle and final ones. In the case of Canadian males, there is marginal significance during the first and final subintervals. The nonconforming nature of Japanese male contributions mirrors their greater distance from equilibrium when compared to the other groupings. However, there is a sharp and puzzling contrast between the conformity and coordination results for Japanese males and females. Japanese female groups were unable to translate their consistently and significantly greater degree of conformity into significantly greater convergence to an equilibrium

[7] In Cadsby and Maynes (1998), Canadian females were also significantly more conforming than Canadian males during the final subinterval. In that paper, the authors employed data not only from the 16 Canadian sessions reported here, but also from six other sessions that were not replicated in Japan.

beyond the first subinterval. It appears that though a stronger tendency toward conformity may facilitate equilibrium convergence, it is not always enough to ensure greater convergence.[8]

Another factor that may be associated with convergence to a pure-strategy equilibrium is the extent to which individuals change or mix their strategies from period to period. Table 6 reports the variances of individual contributions averaged for each gender/culture grouping and measured over all 25 periods and over the three subintervals. A t-test of the null hypothesis that the means of these variances are equal is conducted for each pair of gender/culture groupings using session-level averages of the individual variances calculated over each time interval. The resulting p-values are also reported in Table 6. Over all 25 periods, Japanese males exhibit significantly higher individual variances than any of the other groupings. This difference is most pronounced and consistent between Japanese males and Canadian females, the groupings that are least conforming and equilibrium-focused and most conforming and equilibrium-focused respectively.

4. Conclusions

This paper compares the behavior of Japanese males and females with Canadian males and females in the context of a threshold public goods game possessing both a strong free-riding equilibrium and many socially efficient threshold equilibria. Economic theory provides little role for either culture or gender in such a framework, predicting

[8] All of the equilibrium coordination, focussed equilibrium coordination and conformity tests were repeated using non-parametric Mann-Whitney statistics. The inferences were all identical to those based on the t-tests reported in the tables and the text.

only that players should ultimately select one of the available Nash equilibria. Cadsby and Maynes (1998) find that there is no significant difference between the amount contributed to a threshold public good by Canadian males and the amount contributed by Canadian females. Only reward matters. This paper finds that Japan is no different than Canada in this respect. Higher rewards lead to higher contributions, but neither culture nor gender has any significant impact on the equilibrium selected, the amount contributed or the number of times the public good is provided. Thus, our reward hypothesis 1 is corroborated, while neither of our contrasting culture hypotheses 2 and 3 nor our Japanese gender hypothesis 4 receives support from the data.

Nonetheless, culture and gender do affect behavior. Cadsby and Maynes (1998) have shown that females converge significantly closer to a selected equilibrium by the final five periods of a 25-period game. This is consistent with the greater "relatedness" of females reported by Gilligan (1882) based on interviews with males and females in the United States. Kashima et al. (1995) report much lower levels of "relatedness" in Japan for females and even more dramatically for males, based on data compiled by means of a questionnaire. This provides the motivation for our hypotheses 6a and 6b, both of which are supported by the behavior of our subjects. In particular, Japanese females coordinate significantly less closely than Canadian females, while Japanese males coordinate significantly less closely than either Canadian males or Canadian females around an equilibrium. Japanese males also coordinate less closely around an equilibrium than Japanese females, but this difference is significant only during the early periods of the game. The contrasting idea that "high-context" Japanese males and females will

coordinate better around an equilibrium than "low context" Canadians, embodied in our hypothesis 5, is strongly rejected.

Coordination around an equilibrium is related both to conforming and less variable behavior. Canadian females, who coordinate most closely around an equilibrium, are also the most conforming and the least variable during the middle and final subintervals of the game. Japanese males, who coordinate least closely around an equilibrium, are also the least conforming and most variable throughout the game. However, greater conformity does not guarantee greater convergence. Though Japanese females are significantly more conforming than Japanese males throughout the game, they are only significantly closer to equilibrium during the first subinterval.

Both culture and gender do appear to affect group dynamics in a threshold public goods game, but perhaps in a surprising way. There is no evidence that the "collectivist" Japanese put more emphasis on group rather than individual welfare when compared with "individualist" Canadians. Rather, as in Cadsby and Maynes (1998), it is the notion of "relatedness" (Gilligan, 1982; Kashima et al., 1995) that seems to explain the greater levels of coordination around a Nash equilibrium among Canadian women and the lower levels of coordination among Japanese women and among both Japanese and Canadian men.

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Table 1
Summary of Japanese and Canadian Threshold Public Goods Sessions

		Tokens Exchanged							Number of Times Public Good Provided					
		First	Average by Five-Period Interval						Average by Five-Period Interval					
Session	Reward	Period	1-5	6-10	11-15	16-20	21-25	Overall	1-5	6-10	11-15	16-20	21-25	Overall
Panel A: Japanese Females														
fj01	5	28.7	23.7	23.5	14.0	12.9	6.8	16.2	1	1	0	0	0	2
fj02	5	32.1	22.5	13.4	15.8	11.7	6.6	14.0	2	0	0	0	0	2
fj03	8	29.1	23.6	14.0	14.5	11.9	4.8	13.8	2	0	1	0	0	3
fj04	8	30.5	22.3	17.8	21.1	16.3	9.0	17.3	2	0	0	1	0	3
fj05	10	27.8	25.6	22.4	22.6	18.8	19.8	21.8	2	2	2	1	0	7
fj06	10	26.5	23.8	22.8	20.5	18.3	10.1	19.1	2	1	1	0	0	4
fj07	15	25.5	22.7	26.5	23.5	25.3	26.7	24.9	1	3	2	2	4	12
fj08	15	36.6	28.3	20.4	22.4	22.2	24.3	23.5	4	1	1	1	2	9
Panel B: Japanese Males														
mj01	5	24.5	19.0	11.1	20.2	9.6	9.1	13.8	0	0	1	0	0	1
mj02	5	33.0	18.5	8.4	7.7	5.2	12.8	10.5	1	0	0	0	0	1
mj03	8	26.3	19.0	17.5	9.7	9.9	20.3	15.3	1	1	0	0	1	3
mj04	8	23.8	18.9	25.2	16.6	23.7	15.7	20.0	0	3	0	3	0	6
mj05	10	29.9	25.8	16.1	6.0	9.7	2.7	12.1	2	1	0	0	0	3
mj06	10	24.2	26.1	21.1	24.8	23.5	20.4	23.2	2	1	3	1	1	8
mj07	15	38.6	23.3	27.5	20.8	28.9	27.2	25.5	1	3	2	4	3	13
mj08	15	24.0	24.3	26.1	25.5	29.4	23.4	25.7	2	2	3	2	1	10

		Tokens Exchanged							Number of Times Public Good Provided					
		First	Average by Five-Period Interval						Average by Five-Period Interval					
Session	Reward	Period	1-5	6-10	11-15	16-20	21-25	Overall	1-5	6-10	11-15	16-20	21-25	Overall
Panel C: Canadian Females														
fc01	5	41	29.8	24.0	15.0	5.9	1.8	15.3	4	2	0	0	0	6
fc02	5	42	26.0	9.1	10.3	4.6	0.5	10.1	1	0	0	0	0	1
fc07	8	37.5	29.7	24.3	23.3	25.2	26.1	25.7	4	2	1	3	3	13
fc08	8	39.5	29.7	25.0	22.8	26.9	19.1	24.7	3	3	1	3	0	10
fc05	10	36.75	26.8	23.6	23.5	26.1	22.8	24.5	3	1	1	4	2	11
fc06	10	37	28.3	24.3	24.3	24.9	24.3	25.2	4	2	2	3	0	11
fc03	15	35.5	30.8	24.8	26.5	26.0	24.0	26.4	4	2	3	5	2	16
fc04	15	31.5	27.0	24.1	20.7	24.8	23.0	23.9	3	2	1	3	2	11
Panel D: Canadian Males														
mc01	5	39.5	23.3	14.4	11.0	3.7	2.0	10.89	1	1	1	0	0	3
mc02	5	28.3	25.7	20.5	18.8	11.6	6.6	16.6	3	0	0	0	0	3
mc07	8	29	23.8	22.0	17.0	24.6	15.8	20.6	2	2	0	2	0	6
mc08	8	29.25	24.1	20.7	22.1	20.6	9.9	19.5	1	1	1	1	0	4
mc05	10	23	25.5	25.2	23.8	25.3	23.2	24.6	2	3	3	3	1	12
mc06	10	29.5	23.4	19.7	17.0	15.8	6.0	16.3	1	1	1	0	0	3
mc03	15	32.5	25.4	25.2	24.6	24.3	25.8	25.1	3	3	2	3	5	16
mc04	15	23.5	26.6	20.4	19.5	17.2	17.7	20.3	2	2	1	0	1	6

Table 2
Regression Results for Average Group Contribution Measured over Various Intervals
for Japanese and Canadian Sessions Combined
(two-tailed p-values in parentheses)

	Periods 1 – 5	Periods 6 – 20	Periods 21 – 25	All 25 Periods
Intercept	21.56 (<.0001)	10.519 (.022)	-5.714 (.3694)	9.481 (.0147)
JM[1]	-5.23 (.0662)	-7.382 (.2343)	9.837 (.277)	-3.507 (.4982)
CF[1]	6.46 (.0256)	0.280 (.9636)	5.150 (.5653)	2.491 (.6297)
CM[1]	1.54 (.5757)	1.841 (.7643)	3.238 (.7172)	2.060 (.6898)
Reward	0.263 (.1768)	0.878 (.0483)	2.024 (.003)	0.984 (.0105)
Reward*JM	0.318 (.2452)	0.652 (.2854)	-0.728 (.410)	0.309 (.5430)
Reward*CF	-0.213 (.4337)	0.222 (.7132)	-0.102 (.907)	0.070 (.8897)
Reward*CM	-.093 (.7321)	-0.140 (.8161)	-.357 (.685)	-0.174 (.7314)

1. JM, CF and CM are dummy variables for Japanese males, Canadian females and Canadian males, respectively.

Table 3
Regression Results for Number of Times the Public Good is Provided Measured over Various Intervals for Japanese and Canadian Sessions Combined
(two-tailed p-values in parentheses)

	Periods 1 – 5	Periods 6 – 20	Periods 21 – 25	All 25 Periods
Intercept	1.104 (.2292)	-2.071 (.3497)	-2.208 (.0440)	-3.175 (.2655)
JM[1]	-1.100 (.3936)	-0.991 (.7498)	1.075 (.471)	-1.014 (.799)
CF[1]	1.340 (.3002)	1.656 (.5947)	1.674 (.2654)	4.670 (.2473)
CM[1]	0.189 (.8827)	1.778 (.5679)	0.080 (.9569)	2.047 (.6079)
Reward	0.093 (.294)	0.481 (.0336)	0.311 (.0055)	0.887 (.0035)
Reward*JM	0.024 (.8512)	0.2336 (.4422)	-0.113 (.4405)	0.146 (.7089)
Reward*CF	-0.009 (.9402)	0.142 (.6434)	-0.137 (.3527)	-0.005 (.9904)
Reward*CM	-0.033 (.7929)	-0.042 (.889)	0.005 (.9742)	-0.071 (.8565)

1. JM, CF and CM are dummy variables for Japanese males, Canadian females and Canadian males, respectively.

Table 4
Group Distance from Nearest Equilibrium Each Period, Measured over Various Intervals and Group Distance From Focussed Equilibrium in the Last Five Periods by Gender and Culture, and p-values for Pairwise t-tests of Equality of Means

	Group Distance From Nearest Equilibrium Each Period				Group Distance from Focussed Equilibrium
	Periods 1 – 5	Periods 6 – 20	Periods 21 – 25	All 25 Periods	Periods 21 – 25
Means for Groups of:					
Japanese Females (JF)	4.116	5.882	5.338	5.420	5.848
Japanese Males (JM)	6.225	5.979	5.767	5.986	7.061
Canadian Females (CF)	5.359	3.494	2.596	3.688	2.596
Canadian Males (CM)	3.996	4.764	4.839	4.626	5.789
Two-tailed p-values for t-test of equality of means using session-level data:					
JF vs JM	.0529	.9009	.7174	.4377	.4450
JF vs CF	.2206	.0242	.0226	.0431	.0187
JF vs CM	.9044	.2405	.7198	.3414	.9726
JM vs CM	.0150	.1045	.5035	.0365	.4872
JM vs CF	.2925	.0048	.0094	.0009	.0049
CF vs CM	.0980	.1768	.1003	.1843	.0534

Table 5
Average Conformity by Gender and Culture, Measured by Distance From Group Mean, for Various Intervals and p-values for Pairwise t-tests of Equality of Conformity

	Periods 1 – 5	Periods 6 – 20	Periods 21 – 25	All 25 Periods
Means for Groups of:				
Japanese Females (JF)	0.885	1.241	0.997	1.121
Japanese Males (JM)	1.510	1.556	1.555	1.547
Canadian Females (CF)	1.436	1.097	0.878	1.121
Canadian Males (CM)	1.215	1.384	1.105	1.295
Two-tailed p-values for t-test of equality of means using session-level data:				
JF vs JM	.0008	.0417	.0198	.0008
JF vs CF	.0064	.3299	.556	.9999
JF vs CM	.0637	.2892	.5887	.1402
JM vs CM	.0890	.2413	.1069	.0475
JM vs CF	.6677	.0095	.0232	.0066
CF vs CM	.2537	.0645	.3834	.2416

Table 6
Average Individual Variances by Gender and Culture, Measured Over Various Intervals, and p-values for Pairwise t-tests of Equality of Variances

	Periods 1 – 5	Periods 6 – 20	Periods 21 – 25	All 25 Periods
Means for Groups of:				
Japanese Females (JF)	1.249	2.539	1.653	2.516
Japanese Males (JM)	3.343	3.466	3.018	3.791
Canadian Females (CF)	1.919	1.488	1.018	1.939
Canadian Males (CM)	1.553	2.595	2.184	2.588
Two-tailed p-values for t-tests of equality of means using session-level data:				
JF vs JM	.0159	.0761	.1520	.0048
JF vs CF	.1954	.0562	.1686	.2431
JF vs CM	.6107	.9222	.5342	.8963
JM vs CM	.0368	.1617	.48	.0417
JM vs CF	.0648	.0022	.0444	.0014
CF vs CM	.4851	.0892	.1859	.3024

Figure 1
Average Group Contribution by Gender For Japanese and Canadian Sessions

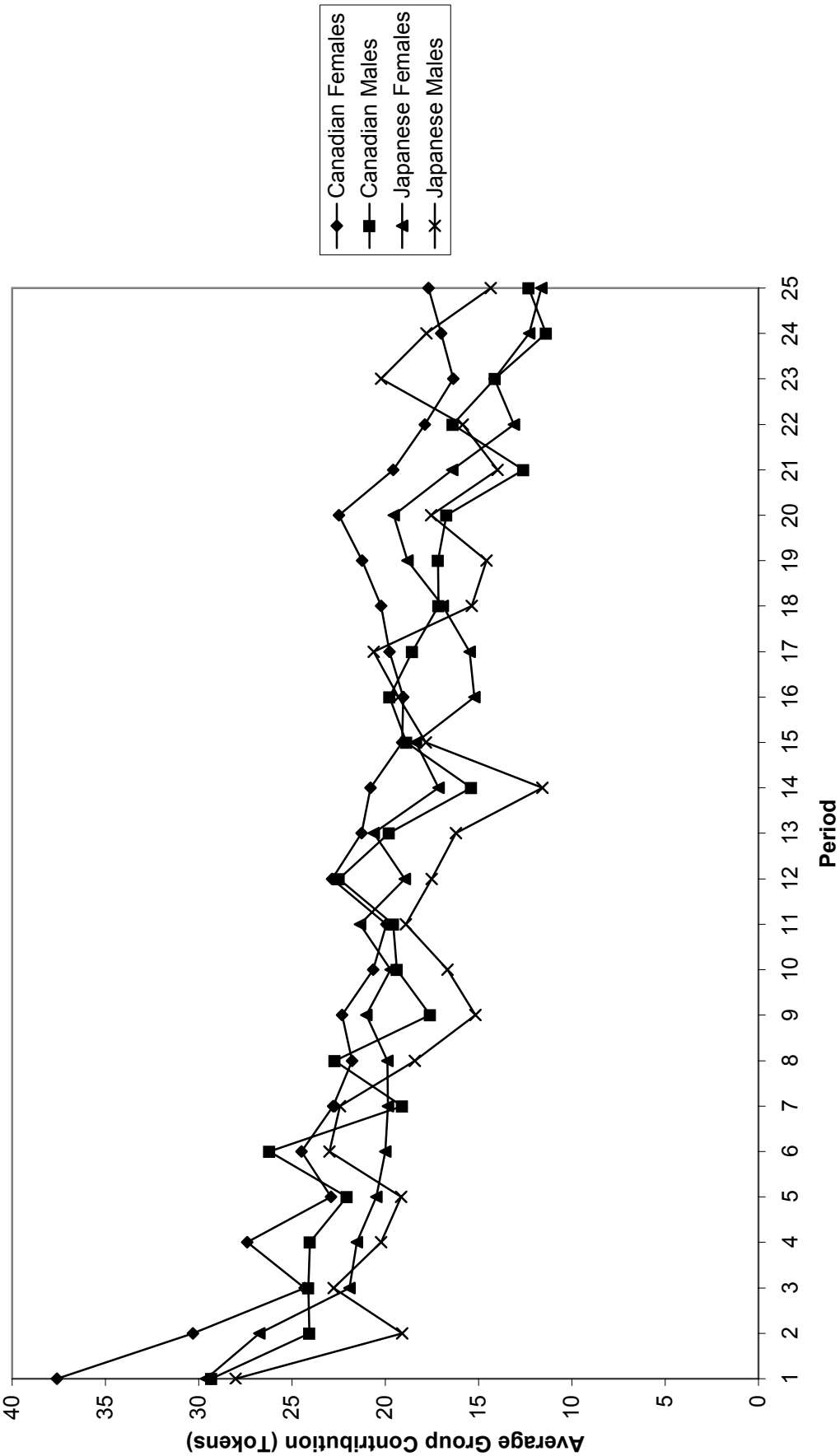

Figure 2
Equilibrium Coordination by Gender for Canadian and Japanese Sessions:
Average Group Distance from Nearest Equilibrium Each Period

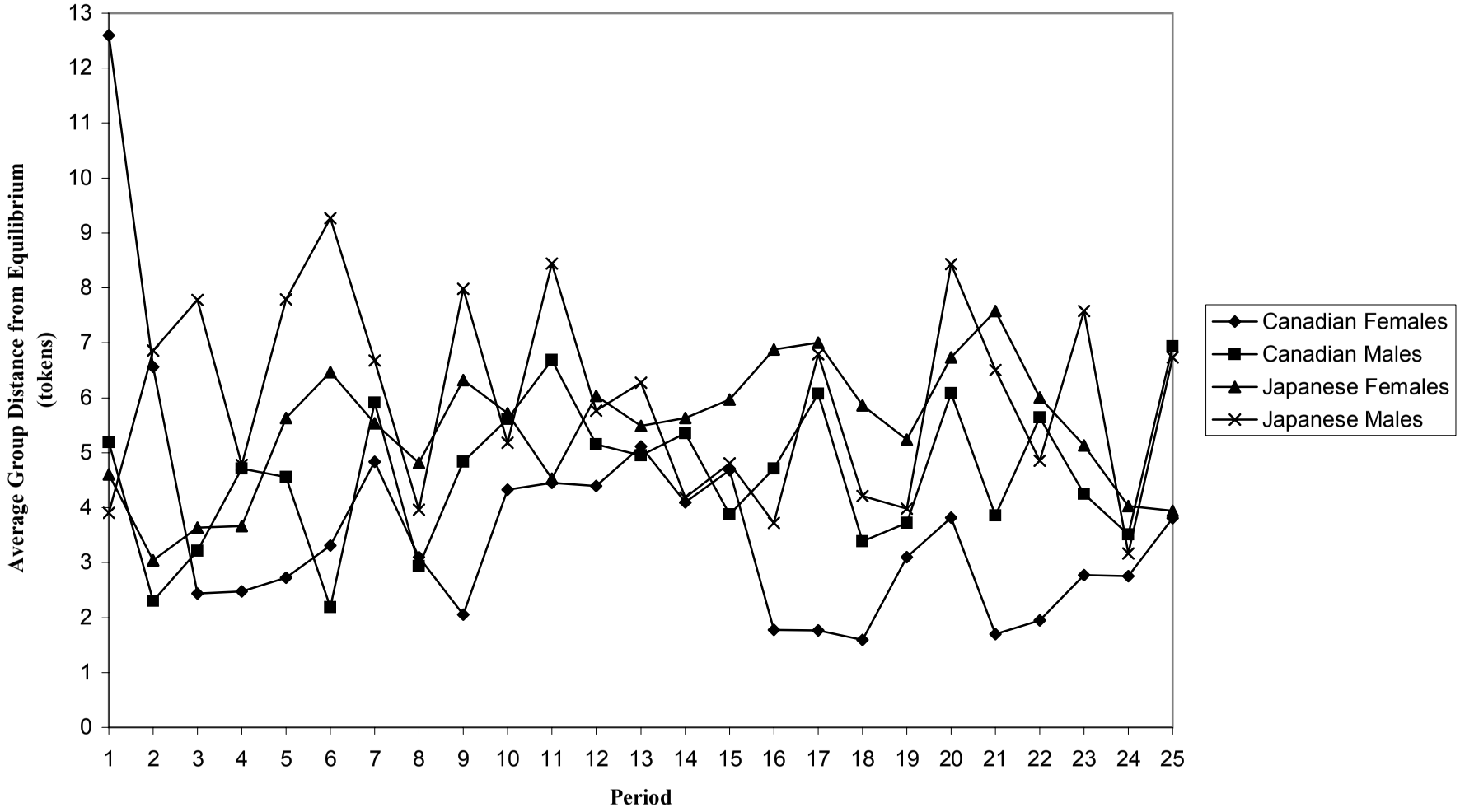

Figure 3
Conformity by Gender for Canadian and Japanese Sessions:
Average Distance Between Individual Tokens Contributed
and Group Mean Tokens Contributed Each Period