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Us and Them: Experimental evidence on what creates efficiency in choices made by married couples.

by

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Abstract.

A recurring and puzzling pattern with experiments on intra-household behaviour is the common failure of couples to attain the cooperative solution. Using married couples from a low income area of Bogota, Colombia we conduct an experiment that raises the salience of the family vis-à-vis outsiders. In this experiment husbands and wives play a repeated voluntary contribution game. At the same time each participant plays an identical game with one stranger in the same session. When investments to the common pools are made from separate and non-fungible budgets, most subjects contribute more to the household pool than the stranger pool, but rarely contribute everything to the household even after repetition and opportunities for learning. Efficiency is not obtained. However, when subjects make contributions to the two games from a single budget many individuals converge rapidly on a strategy of investing everything in the household pool and contributing little to the pool with a stranger. Overall the amount invested in some pool rises. Our results are in line with games played with individuals in which in-group cooperation is higher when membership of the group is more salient. They suggest that strengthening family identity may raise intrahousehold cooperation, but at the expense of cooperation of interhousehold cooperation.

Keywords: Household choice, Public Good Experiment, Family, Colombia, Japan.
JEL Codes: C920, D130, D80.

Introduction.

In social dilemmas such as public goods games, cooperative behaviour may arise either through the incentives and structure of the environment or through the nature and preferences of the players. There are therefore good reasons for expecting households to be efficient: after all the players are engaged in a real life repeated game with a small number of players and, at least in principle, there are ties of love and altruism between the partners. Yet, actually, in the small, but growing number of economics experiments conducted on intra-household decision-making one continuing theme has emerged: the failure of couples to make choices that maximize the surplus for the household. This feature of the data is present in a variety of experimental designs across a number of quite different countries. In Vergard Iversen et al, 2011, for example, couples in Uganda fail to invest all their separate endowments into a common pool. In Nasra Ashraf, 2009, Philippine spouses routinely forego choices that would increase aggregate household payoffs, a result echoed in a modified dictator game experiment conducted by Jessica Hoel, 2012 in Kenya. In an experiment conducted in India, Mani, 2009, spouses routinely hide funds from one another while in France, many couples do not choose the cooperative solution in a prisoners dilemma game (Francoise Cochard et al, 2012). Meanwhile in experiments held respectively in India and Ethiopia, Alistair Munro et al, 2010 and Bereket Kebede et al, 2014 find that spouses typically invest only half their endowments in a common pool. In a slightly different approach, Ian Bateman and Alistair Munro, 2005, couples often jointly reject risky choices made separately in favour of a safer option. In some of the designs mentioned above, individual choices are private, in some cases choices are public and in some designs couples have a chance to discuss separate decisions before making their choices. These features do not seem to have a great impact on surplus maximization. Given the relatively limited number of experiments on household choice and the fact that they are scattered over the globe, it would be impossible to claim that the evidence against efficiency of the surplus maximizing kind is irrefutable. Nevertheless the experimental evidence to date lies against it. In this experiment we try a new tack, in a new pair of countries, with two design features.

Some recent experiments on behaviour in games suggest that manipulating group identities can alter play. For example UK subjects in Shaun Hargreaves-Heap and Daniel Zizzo, 2009, face trust games in which group identities are manipulated as part of the experimental design.

In some other experiments, existing social ties are primed for a treatment group of subjects and this seems to enhance within-group cooperative behaviour. In Rachel Kranton et al, 2014 group identity is made more salient for a group of US students by allocating people to groups on the basis of political party. Our conjecture is that, perhaps cooperation within the family is affected by the nature of opportunities for cooperation outside the family. [1]

With this in mind we design an experiment in which the salience of the trade-off between cooperating with a spouse or a stranger varies. In treatment one, our subjects play two simultaneous common pool games against their spouses and against an anonymous non-spouse of a different gender. Subjects have separate endowments for the games played with spouses[2] and non-spouses. In treatment two subjects have a single endowment for both games, but still two pools. For both treatments, the family is salient in the sense that it is easy for subjects to compare their treatment of their family member to their treatment of the non-spouse. But in treatment two (which perhaps better reflects reality) money contributed to the non-spouse pool has a more obvious opportunity cost in terms of contributions to the family. As we discuss below, this second treatment is not purely a manipulation of salience, since there are fewer restrictions on the choice set, compared to treatment one. However, for the kinds of subjects previously encountered in household experiments, who do not typically maximize household surplus, the presence or absence of the constraint should not be binding.

Though we do not know of an experiment with exactly our design, there are some important antecedents from the various parts of the research on social dilemmas. Polzer et al, 2002, for instance, nest one group of three in a larger group of 6 in a hypothetical voluntary contribution game and find that subjects favour contributions to the smaller group. Their results are part of a literature from social psychology that provides some evidence that individuals placed in competing social dilemmas will tend to favour cooperation in one arena over another according to patterns of social ties (Wit and Kerr, 2002). Meanwhile, there are

[1] Abigail Barr, 2004 reports higher levels in trust in villages with stronger kinship networks but does not report any formal results on intra- and inter-household behaviour. Nancy Buchan and Rachel Croson, 2004, found that among US and Chinese students in their sample, trust was higher for family members than for non-family members results echoed in a large number of social distance experiments such as, for instance, Tina Strombach et al, 2014.

[2] We use 'spouse' to refer to the partnerships. In a few cases the subjects are not formally married.

several examples of incentivized experiments with multiple simultaneous public goods games played with groups of strangers. Falk et al, 2013 have subjects play public good games in multiple groups and find that subjects invest more in the group where other subjects invest more. Bernasconi et al, 2009, have a design played between groups of 4 strangers, randomly matched after each round. One treatment features a single public good, while in another treatment two public goods games are played between the same subjects using a single budget per person. In McCarter et al, 2014, subjects in one treatment group play two simultaneous public good games with the same people, while in another treatment the two groups have distinct memberships. They find that total contributions are higher in the second case and more asymmetric.

A second feature of our design is repetition. In contrast to the typical design for a laboratory public good experiment, repetition of tasks has not been a widespread feature of designs for households.[3] There are good, practical reasons for this: compared to dealing with students in a laboratory, running experiments with couples is time-consuming, has a high opportunity cost for participants because of the typical need to organize childcare and often takes place outside the normal laboratory setting. Nevertheless, it is possible that a lack of opportunity to learn may be behind some of the absence of surplus maximization in previous experiments. To examine this possibility, in our design subjects play the same game five times, with feedback between rounds on payoffs and the choices made by partners.

Our key results are first that having a single endowment for both games makes a sharp difference. This treatment does seem to create surplus maximization in many households. Simultaneously for many individuals it is associated with almost zero contributions to the common pool game played with non-spouses. Secondly, repetition on its own does not seem to lead to efficiency. Subjects who play a common pool game just with their spouse contribute

[3] In the pioneering economic experiment on households, Elizabeth Peters et al, 2004, use a sample of US families in a repeated common pool game. Generally they do not find surplus maximization, though in most of their settings, the games involve a mix of family and non-family members. One case where they do find higher investments is when parents play with their children. Based on interviews with the subjects they interpret this as due to parents trying to teach children by example how to behave.

similar fractions of their endowment to what has been recorded in previous, single shot experiments. Moreover there is generally no clear time trend in contributions.

2. Background and Design.

In the first treatment, subjects play two voluntary contribution games simultaneously. One game is played with the spouse and one game with another person in the experiment (of the other sex)[4]. There is a single matching of non-spouse subjects at the start of game and subjects play five rounds with feedback about contributions and payoffs between rounds. Subjects have separate endowments of N, for each of the two games and any contribution, x made to a pool is multiplied by 1.5 and then split equally between the two relevant players. We call this the 'Separate' treatment (T1). The second treatment (T2) shares most features except that subjects have a single endowment of 2N, which can be kept or split between two common pool games: one with the spouse and one with a non-spouse of the opposite sex. We call this the 'Pooled' treatment. Again there are five rounds and a single matching of partners at the start of the experiment, amounts contributed to a pot are multiplied by 1.5 and divided equally between the two relevant players.

In both treatments, the monetary payoff of player i is given by the equation,

$$m_i = 2N + 0.5(x_i + x_{-i}) + 0.5(y_i + y_{-1}) \qquad (1)$$

Where x_i is his or her investment in the household pool, y_i is the investment in the non-family or anonymous pool and –i represents the other player in each of the two pools. To fix some ideas about how players might play this kind of game, suppose player i has preferences of the form,

$$U_i = U_i(m_i, m_{-i}, s_{-i})$$

Where m_{-i} is the spouses' monetary payoff and s_{-i} is the non-family partner's monetary payoff. Suppose that U is non-decreasing in all its arguments and strictly increasing in the first argument.

[4] We used a matching rule for the non-spouse game that mean that there was no possibility that two spouses would be matched with partners from the same couple.

In the separate treatment, the Nash equilibrium of a one shot game is characterized by two vectors **x** = ($x_1,\ldots,x_n$) and **y** = ($y_1,\ldots,y_n$) such that for all players i, and feasible x_i', y_i'

$$U_i(x_i, y_i) \geq U_i(x_i', y_i') \tag{2}$$

We say that a Nash equilibrium, (**x**,**y**) is strictly interior if $0 < \mathbf{x} < (N,\ldots N)$ and $0 < \mathbf{y} < (N,\ldots,N)$.

Proposition 1. Suppose (**x,y**) is a strictly interior Nash equilibrium of the one shot separate treatment game, then it is also a strictly interior Nash equilibrium of the one shot pooled treatment game.

Suppose the Nash equilibrium is unique in the one shot separate treatment game. We know that in a finitely repeated game, the only sub-game perfect Nash equilibrium is the Nash equilibrium of the stage game repeated m times (Benoit and Vishna, 1985).

Proposition 2. Suppose (**x,y**) is the unique Nash equilibrium of the one shot treatment 1 game, and suppose it is strictly interior. Then (i) the subgame perfect equilibrium of the finitely repeated separate treatment game corresponds to the Nash equilibrium of the stage game and (ii) this is also the sub-game perfect equilibrium of the pooled treatment game.

Consider a subject who has preferences of the form: $U_i = U_i(m_i + m_{-i}, s_{-i})$, strictly increasing in the first argument. This person does not care about who earns the income in the household. Since one unit of currency invested in the family pool becomes 1.5 units in total, this person will invest all of their family endowments in treatment 1 and invest all of the endowment (in one or both pools) in treatment 2.

Proposition 3. A subject who has preferences of the form: $U_i = U_i(m_i + m_{-i}, s_{-i})$ will invest all of their family endowments in treatment 1 and invest all of the endowment (in one or both pools) in treatment 2.

These propositions generate our two main hypotheses: Let p_1 be the proportion of subjects who set $x = N$ and $y < N$ in treatment 1; and let p_2 be the proportion of subjects who set $x \geq N$ and $y < N$ in treatment 2; then the null hypothesis is $p_1=p_2$ and the alternative is $p_1<p_2$[5].

Second, our main household efficiency hypothesis follows from Proposition 3 and is in two parts: (i) the null is $x=N$ in treatment 1 with the alternative of $x<N$; (ii) $x+y = 2N$ in treatment 2 with the alternative of $x+y<2N$.

3. Method.

Two contrasting groups of subjects (all married or cohabiting heterosexual couples) were recruited in two locations: Tokyo, Japan and Bogota, Colombia. The Japanese subjects were English-speaking, foreign PhD students, mostly from other Asian countries studying a variety of mostly non-economics subjects. They were recruited through email adverts, word of mouth and posters at an international family dormitory in the east of the city. Two research assistants were used, graduate students at a nearby university. All instructions were given in English and presented with the use of a script and printed guidance (see appendix).

In Colombia, subjects were couples recruited from poorer sections of the city of Bogota which is divided into 6 socio-economic strata. The neighbourhoods visited were all strata 1 and 2, the poorest. Some of them are illegally built with relatively high levels of violence. As with the Tokyo sample, recruitment was convenience-based: subjects were recruited through community leaders, NGOs and child-care centres. Five research assistants were employed, all students at a nearby university. The assistants (4 of whom had previous experience of experiments) were trained over two days and two pilots were run before the main sessions. All instructions were given in Spanish, using the Tokyo instructions as the basis for the translation.

In both locations, for logistical reasons one treatment was played per session and we alternated treatments between sessions. Subjects were greeted in an ante room and a brief

[5] Though, formally contributions could be lower in the pooled treatment, we write this as a one-sided alternative hypothesis given our expectation that spouses might contribution more to the family pool when the endowments are pooled.

introduction to the experiment was given to all players together. At that stage, men and women were led into separate rooms and given detailed instructions about the play of the game followed by tests of understanding. Once separated, spouses could not see or communicate with their partners (except through the game play). In both locations, there were 5 rounds of the game. After each round subjects received written feedback on the decisions of both their partners as well as their own payoffs from the previous round. After the end of the experiment, one round was publicly selected at random and all players were paid on the basis of that round. Prior to being paid, subjects also individually filled in a short demographic and attitudinal survey. The survey in Colombia was slightly more extensive than the instrument used in Japan and included some additional questions about attitudes to roles within the household.

4. Results

The sub-samples are very different (see Table 1). For the 25 couples in Japan, the range of occupations was small: all the families had at least one graduate student and in most cases this was the husband. All but one of the participants had at least an undergraduate degree and many couples had no children. The subjects came from 13 different countries, with Indonesia (9 couples) as the origin with the largest number of participants, while 4 couples came from Malaysia.

The 60 couples in the Colombian experiment were typically older than those in Japan, with less formal education and more children. They reported a wide range of occupations, the majority of which were manual. Thirty-three women described their main occupation as housewife, 14 men listed themselves as builder/painters, 9 as vendors, 4 as recyclers and so on. A near-majority (29) of men were in full-time employment with self-employment (21) representing the largest category. For women, the largest category outside of housewife was full-time employment (17). All the couples bar one were married and the mean number of years of marriage was 12.3. In the exceptional household the status of the relationship was disputed.

Table 1. Descriptive Statistics.

	Japan	Colombia
Individuals	50	120
Age (female)	31.3	35.5
Age (male)	32.4	38.6
% with no children	44.0	33.3
% with children by other partners	0	21.6
Mean children (per household)	0.84	1.7
Mean years of marriage*	5.02	12.3
% University Graduates	98	7.5
% Primary education or less	0	36.7
We share and manage our finances jointly (%)	40	44
Know at least one other non-spouse in the session	0.48	0.74
Trust others (7 = you can't be too careful)	3.65	5.03

* In Japan the question was 'years of living together'

With regards to education a minority of Colombian subjects had completed high school and around 1/3 have only primary level education. As noted above, most of our subjects in Colombia were self-classified as poor. One hundred and one lived in the poorest 2 strata of Bogota; with approximately half receiving *sisben*, a welfare payment made to low-income households. Seventy-seven individuals stated that their family earned less than the minimum salary while 33 chose the category "between 1 and 2 times the minimum salary." Eight reported income in the 2-3 times minimum salary category and 2 chose the 3-4 times minimum salary.[6] Fifty-three individuals reported that they shared the household finances equally with their spouse; thirty stated that they shared equally but kept some individual money for personal expenses. The remaining participants gave a variety of answers to the question about how they managed household finances.

[6] For 2010 the Colombian minimum salary was set by the national government at COP514,987 (US$252) per month. Employed workers earning up to twice the minimum are eligible for a transportation allowance, meaning that many households have a good understanding of how their income relates to the statutory minimum.

In Colombia, we asked the participants about their leisure time and personal spending money relative to their spouse. Three options were offered: the responder had more; responder and spouse were more or less equal and the spouse had more. Men were more likely to state that leisure was split equally (26/60), whereas the majority of women (54/60) fell equally into the two extreme categories. For personal spending, the majority of both men (32/60) and women (36/60) felt that their partner had more spending money! Approximately 80% of individuals believed that their spouse would not hide money from them if they received a windfall. The remainder stated that they might hide some money, though typically only a small proportion. The overwhelming majority also declared that they would not hide money from their spouses in the same situation, though here there was a small difference between the sexes, with 14 men, as opposed to 5 women stating that they would hide around 25%.

We also asked some questions about household and social norms. First, in both countries, individuals are broadly against what might be labelled as a 'traditional' model of marriage, in which women are obedient to their husbands and their elders, men have vetoes on household decisions and women's role is taking care of the household. Secondly, men and women's stated views are similar. Women are apparently more likely to strongly disagree about obedience to elders, but even for this question the pattern of male and female answers is not statistically significantly different ($p=0.133$, Fisher's exact test). Otherwise the differences between male and female responses are not remotely significant at standard levels of significance.[7]

Experimental Results.

Figures 1 summarizes the results, disaggregated by round, gender and treatment for Colombia while Figure 2 does the same for the Japan sample.

[7] A similar group of questions has been asked in India, north and south (Munro et al, 2010), in three regions of Ethiopia (Bereket Kebede et al, 2014) and amongst two ethnic groups in Northern Nigerian (Munro et al, 2011). Compared to the results here, in all three cases subjects were much more likely to agree with the 'traditional' model and men and women's responses were more likely to differ.

Result 1. In Colombia, treatment 1, (i) most subjects do not contribute all their endowments to the family pool; (ii) there is no clear time trend and (iii) subjects give more to the family pool than the strangers pool.

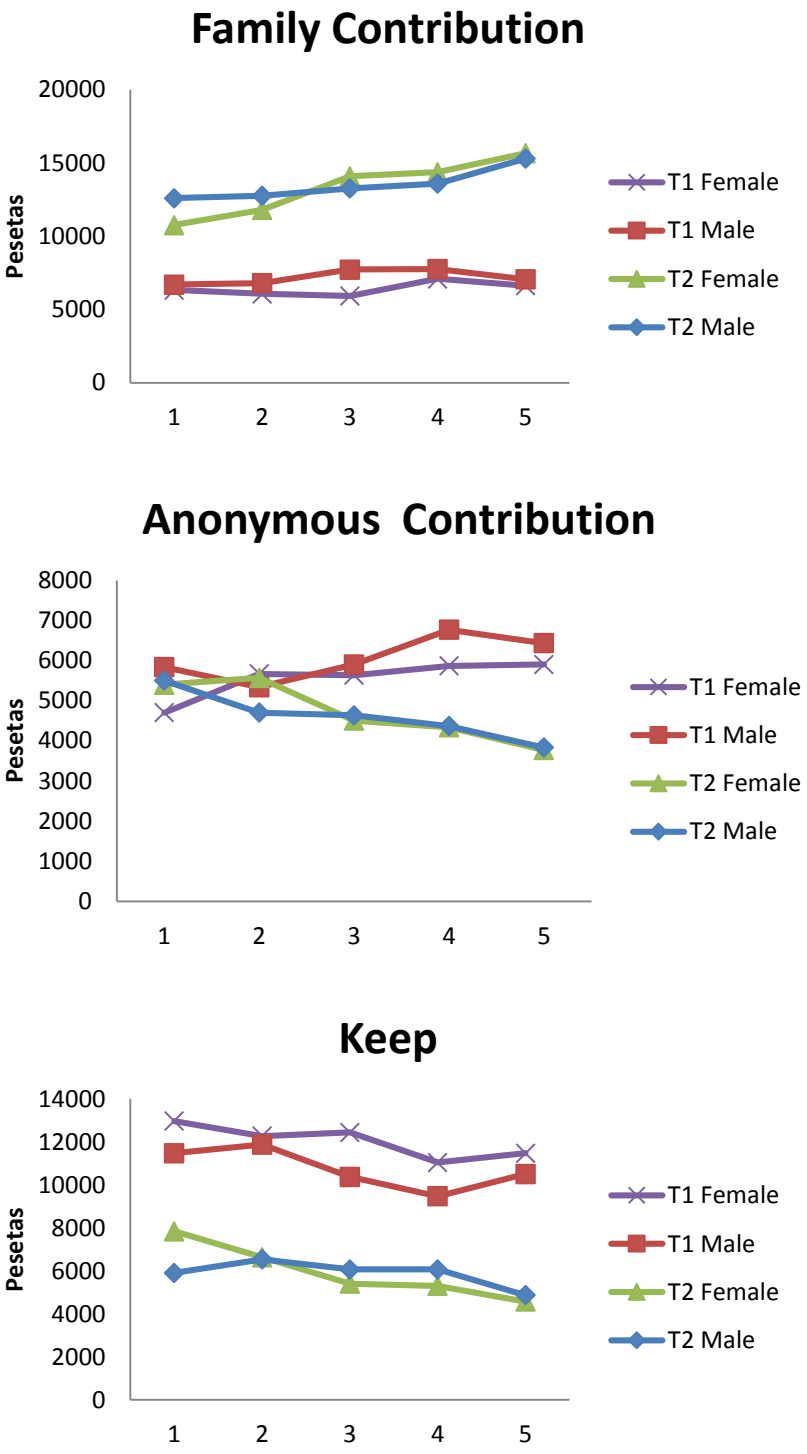

Figure 1. Summary of allocations (Colombia).

For Colombia, in the game played between spouses, initially spouses contribute just over half of endowments to the common pool. Over five rounds the amount varies slightly, but there is no statistically significant difference between the amounts contributed in rounds one and five (p=0.364, Wilcoxon signed rank test). By the end of 5 rounds, mean contribution to the family pool is 6,850. In the game played with non-spouses, initial contribution rates were below 50%. Rates of contribution appear to rise slightly in the figures, but the difference between rounds 1 and 5 is again not statistically significant (p=0.104, Wilcoxon signed rank test).[8] In the final round the mean contribution to the non-family pool is 6,166, while subjects keep on average 10,980 for themselves. Approximately half (50% of all observations) the subjects give more to the family pool, with the remaining observations split equally between giving the same to both pools (26.3%) and actually giving more to the non-family pool (23.7%). For comparison, in Peters et al, 2004, subjects alternate between a series of games against other family members and a series played against strangers. In a treatment where all the subjects are adults, they find that 9/26 subjects give the same on average in the strangers and family games and they fail to reject the null that individuals give the same in the family and strangers group. In contrast, here where the games are played in parallel subjects give significantly more to family than the non-family pool in all rounds (e.g. p = 0.000, 0.021, 0.017, 0.002, 0.08, Wilcoxon signed rank test for rounds 1 to 5 respectively).

Result 2. In Colombia, treatment 2, most subjects contribute more than half the total endowment to the family pool; (ii) the average amount contributed to the family pool rises while (iii) the amount kept and the amount given to the strangers' pool falls.

The results of treatment 2 are in contrast to treatment 1. First we note that in round 1 Colombian subjects contribute on average 12,000 to the family pool and 5,200 to the non-family pool. They keep on average 6500 in round one. Over time, the contribution to the family pool rises. After five rounds, the mean is 15,483. This is significantly higher than the first round (p = 0.000, Wilcoxon signed rank test) and higher than the fifth round in first treatment (p = 0.000). Overall, in treatment 2 5.7% of instances subjects give more to the non-

[8] In many public goods experiments, contributions made in games played between strangers fall off with repetition, especially when groups are large and there is rematching between rounds. Here we have only 2 players per group and there is no re-matching between rounds. Moreover nearly half the subjects stated that they knew other players in the same session.

family pool, in 13% of observations contributions to the two pools are equal and in 81.3% of cases, subjects give more to the family pool. Meanwhile the amounts kept back and contributed to the non-family pool fall over the five rounds. The amount kept in round 5 is significantly lower than in round 1 and the amount contributed to the non-family pool is significantly lower in round 5, compared to round 1 (p=0.010). It appears that, unlike in treatment 1, the adjustment process in contributions has not entirely finished by round 5.

Result 3. In Colombia, compared to treatment 1 subjects (i) give significantly more to the family pool in treatment 2 in each round and (ii) invest more in both pools in total.

We reject the hypothesis at the 1% level that the contribution to the family pool is the same in round one in both treatments (p = 0.000), whereas we accept the null hypothesis that contribution to the non-family pool is the same between treatments (e.g. for the first round, p = 0.561). The total amount kept is smaller than in treatment 1 (p = 0.000, two-sample Wilcoxon rank-sum test). Further, the amount kept back in round 5 is significantly lower in treatment 2 and the amount contributed to the non-family pool is also significantly lower in treatment 2 compared to treatment 1 (p =0.000 in both cases).

Result 4. The pattern of contribution rates in Japan is similar to Colombia although contribution rates are generally higher in this group across all pools and treatments.

Initially, in treatment 1 (see figure 2) subjects contribute around 4/5 of their endowment to the family pool and approximately 49% of the other endowment to the non-family pool. Neither of these contribution rates change significantly over the course of 5 rounds. In treatment 1 46% of subjects give their entire family endowment to the pool in the first round, rising to 58.3% in the last round. The difference is not significant (Fisher's exact test, one sided p=0.282). In treatment 2, mean contributions to the family pool are 1.35N in the first round while contributions to the non-family pool are 0.36N. By the fifth round contributions to the family pool are 1.63N in the final round. Contributions to the anonymous pool are approximately 21% of N.

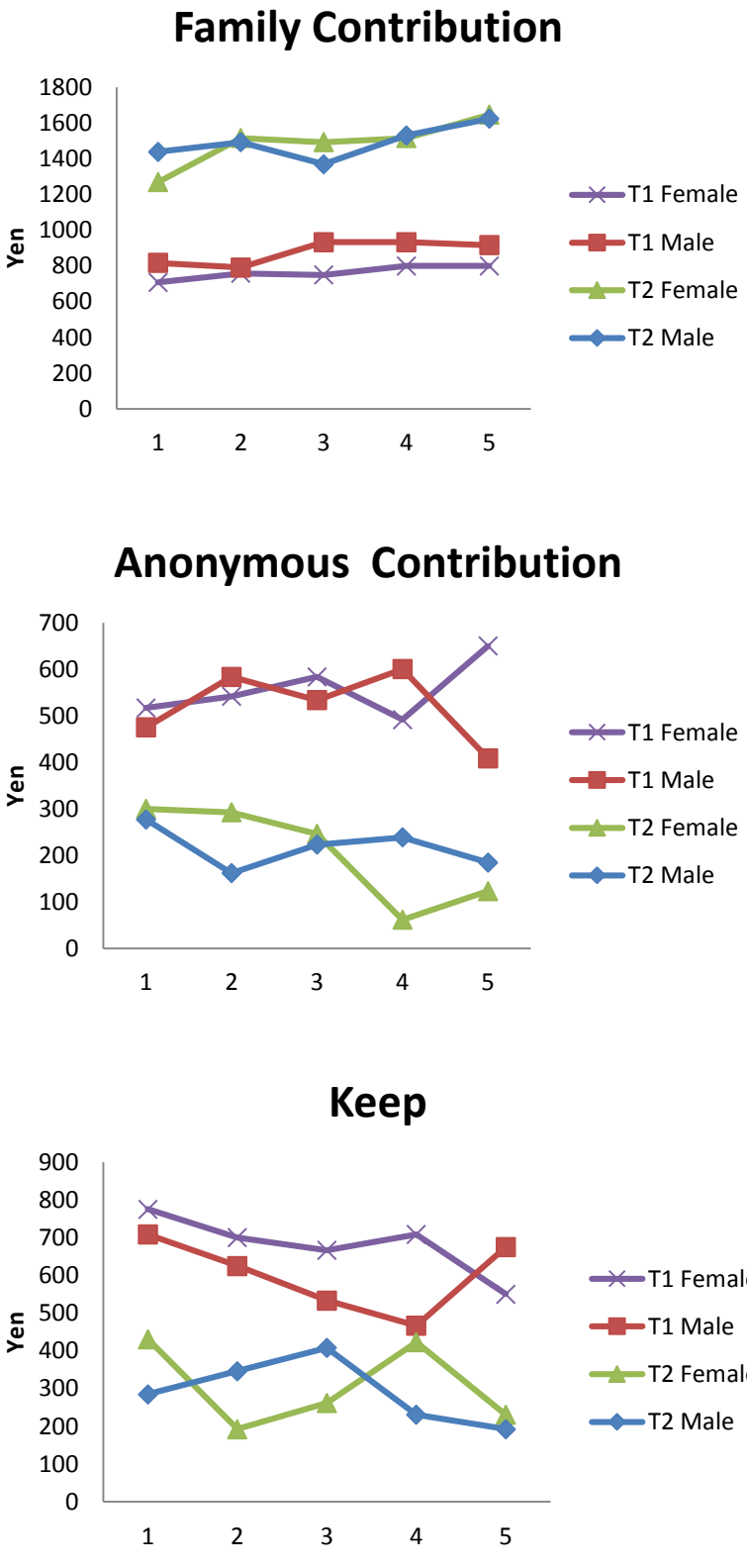

Figure 2. Summary of allocations (Japan).

Result 5. In Colombia, for men and women the proportion of subjects who contribute at least N to the family pool is higher in treatment 2 in every round. In Japan the proportion of households who contribute at least 2N is higher in treatment 2 in every round.

As figure 3 reveals, in both locations in each treatment some subjects do give N to the anonymous pool. However there are very few such subjects and there is no significant trend or difference between treatments. The fraction contributing at least N is higher in the family pool and starkly so in the second treatment in Colombia, where by the end of the experiment 80% of subjects are placing at least N in the family pool. In Japan the difference between treatments for the family pool is less stark. Nevertheless, 22/26 subjects give at least N to the family pool in the second treatment. In fact 15/26 subjects give their entire endowment to the family pool and 18/26 subjects keep nothing for themselves.

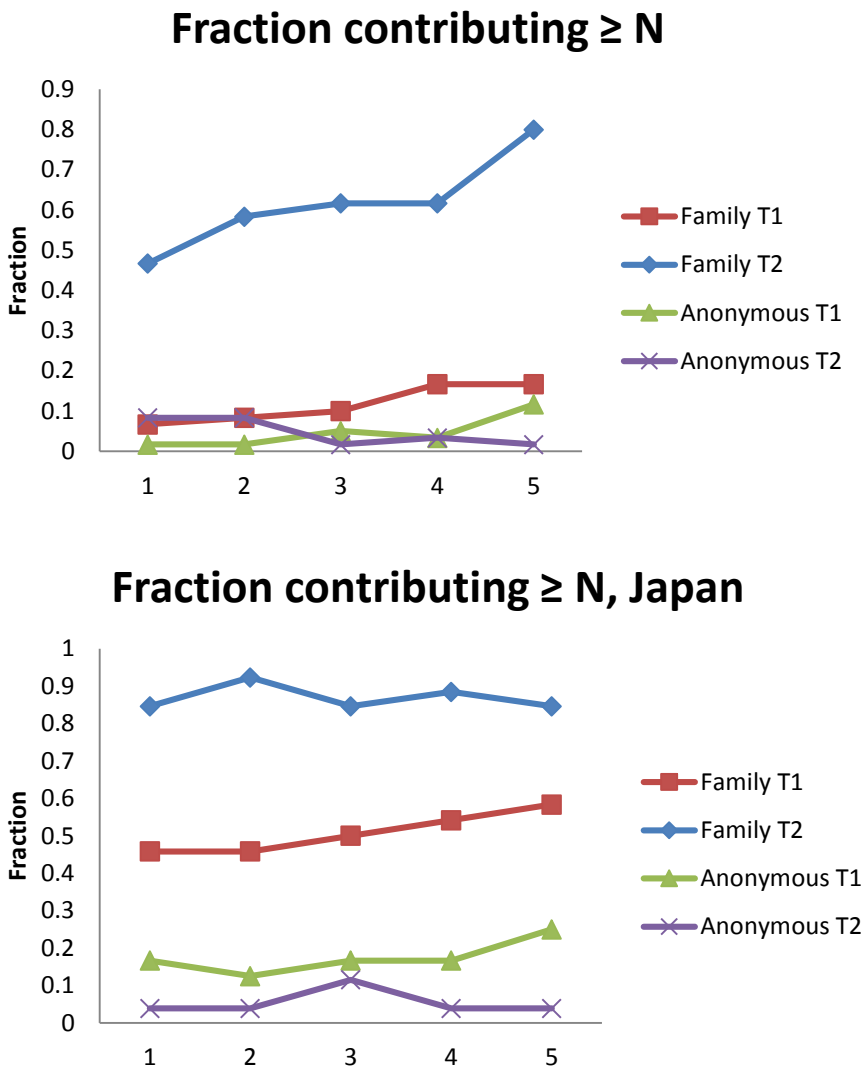

Figure 3. Contributing ≥N.

Tables 2 and 3 provide formal tests of the main hypotheses of the paper. In Table 2 we report tests of the null that the proportion of subjects who contribute at least N is unaffected by treatment. In Colombia all the differences (All, Female and Male) between treatments are highly significant in every round. In Japan, the comparisons for women and all are also significant at least at the 5% level in all rounds. For men the difference between treatments is significant at the 5% level for rounds 1 and 2, but not subsequently.

Table 2. Contributions in Colombia and Japan

	Number who contribute ≥ N to family pool.				Test of no Treatment difference		
Round	Female		Male		All	Female	Male
	Treatment 1	Treatment 2	Treatment 1	Treatment 2	p-value	p-value	p-value
Colombia (n=30 per treatment)							
1	2	13	2	15	0.000	0.001	0.000
2	3	16	2	19	0.000	0.000	0.000
3	3	20	3	17	0.000	0.000	0.000
4	4	20	6	17	0.000	0.000	0.004
5	6	25	4	23	0.000	0.000	0.000
Japan (Treatment 1: n=12; Treatment 2: n=13)							
1	3	10	6	12	0.004	0.100	0.027
2	5	12	6	12	0.000	0.010	0.027
3	5	12	7	10	0.010	0.010	0.286
4	5	12	8	11	0.008	0.010	0.281
5	5	11	9	11	0.039	0.040	0.459
p-values are for a 1-sided Fisher's exact test							

Result 6. In both countries, the proportion of subjects who contribute all they can to the family pool is higher in treatment 2.

Table 3 presents formal tests of the hypothesis that there is a between treatments difference in subjects who contribute all that they can to the household pool. In both countries, the number that contributes all is always higher in treatment 2, but there is a difference between Japan and Colombia. In Japan, the difference is never significant at standard p-values, mainly because even in treatment 1, nearly half the subjects given everything they can to the family pool.

Table 3. Keeping back money from the household

					Test of no difference	Treatment
Round	No. who keep nothing		Median kept		Keep nothing	Median
	Treatment 1	Treatment 2	Treatment 1	Treatment 2	p-value	p-value
Colombia (n=60 per treatment)						
1	4	12	12000	6000	0.029	0.000
2	5	13	12000	5000	0.036	0.000
3	6	12	12000	5000	0.100	0.000
4	10	13	10500	4500	0.332	0.000
5	10	17	12000	4000	0.095	0.000
Japan (Treatment 1: n=24; Treatment 2: n=26)						
1	11	13	850	50	0.496	0.011
2	11	16	500	0	0.204	0.023
3	12	15	600	0	0.397	0.023
4	13	13	500	50	0.496	0.082
5	14	18	500	0	0.306	0.001
p-values are for a 1-sided Fisher's exact test						

Falk et al, 2014 find that when strangers play parallel public goods games, their contributions depend on those of their neighbours. As many individuals are conditionally cooperative, behaviour in the parallel games can diverge: the game with the higher initial level of contributions sees contributions rise, while the game with lower contributions sees contributions fall. In our case, even in round 1 there is a clear and systematic treatment difference between how players contribute to the two pools. Nevertheless it is worth seeing how play evolves in response to decisions made in earlier rounds.

For tables 4 and 5 the following fixed effects model is estimated:

$$y_{it} = \beta_{0i} + \beta_{1i} y_{it-1} + \beta_{2i} y_{it-1} + \beta_{3i} y_{it-1} + \beta_{4i} y_{it-1} + \beta_{5i} t + \varepsilon_{it}$$

Contributions to pool i in period t are conjectured to depend on past contributions to the same pool ("Family") and to the Anonymous pool ("Anonymous"), as well as the observable contributions made to the family pool by the spouse ("Spouse") and to the anonymous pool by the other partner ("Stranger" in the tables). In all specifications we allow interaction terms with treatment. In one specification we also have interaction terms with gender ('All' in Tables 4 and 5), but we also estimate separate equations by gender.

Looking first at the constant terms in Table 4 we can see confirmation that contributions are higher in the family pool. With only 4 periods (after dropping the first period because of the lagged structure) and a fixed effect for each individual it is perhaps not surprising that so few of the other coefficients are significant. However, for the family pool, there is a significant trend toward increasing contributions. At the same time individuals respond negatively to their own past contributions to the family pool in treatment 1. In treatment 2 this effect is absent implying overall a positive trend in contributions. As the separate equations for male and female show, the impact of treatment 2 on female responses to past behaviour is somewhat larger than that for their husbands. In the case of contributions to the anonymous pool, male individuals respond negatively to past contributions by their anonymous partners but not in treatment 2. In fact it is notable that subjects are relatively unresponsive to past actions by their spouses or by the strangers.

Table 4 Fixed Effects: Japan

	Contribution to Family Pool			Contribution to Anonymous Pool		
Variables	All	Female	Male	All	Female	Male
$Spouse_{t-1}$	-0.106	-0.035	-0.038	0.090	0.171	-0.073
	(-0.57)	(-0.15)	(-0.16)	(0.60)	(0.83)	(-0.39)
$Family_{t-1}$	-0.304	-0.112	-0.458*	0.191	0.080	0.121
	(-1.63)	(-0.46)	(-1.84)	(1.26)	(0.38)	(0.61)
$Stranger_{t-1}$	0.261	0.470	-0.123	0.361*	0.482*	0.181
	(1.05)	(1.53)	(-0.46)	(1.79)	(1.78)	(0.84)
$Anonymous_{t-1}$	0.521**	0.649**	-0.011	-0.038	0.110	-0.648**
	(2.23)	(2.25)	(-0.03)	(-0.20)	(0.43)	(-2.35)
T2 x $Spouse_{t-1}$	0.131	0.024	0.186	0.006	-0.089	0.050
	(0.69)	(0.09)	(0.71)	(0.04)	(-0.37)	(0.24)
T2 x $Family_{t-1}$	-0.022	-0.318	0.664**	-0.310*	-0.177	-0.312
	(-0.11)	(-1.18)	(2.21)	(-1.96)	(-0.74)	(-1.29)
T2 x $Stranger_{t-1}$	-0.146	-0.481	0.179	-0.285	-0.477	-0.167
	(-0.59)	(-1.25)	(0.56)	(-1.42)	(-1.41)	(-0.65)
T2 x $Anonymous_{t-1}$	-0.640**	-0.946***	0.319	-0.052	-0.262	0.184
	(-2.47)	(-2.84)	(0.72)	(-0.25)	(-0.89)	(0.52)
Male x $Spouse_{t-1}$	0.078			-0.127		
	(0.48)			(-0.96)		
Male x $Family_{t-1}$	0.256			-0.079		
	(1.47)			(-0.56)		
Male x $Stranger_{t-1}$	-0.220			-0.125		
	(-0.92)			(-0.64)		
Male x $Anonymous_{t-1}$	-0.057			-0.465**		
	(-0.22)			(-2.23)		
Round	36.95*	30.24	53.97*	-23.53	-40.27*	-7.50
	(1.89)	(1.15)	(1.93)	(-1.48)	(-1.73)	(-0.33)
Constant	1106.71***	1202.63***	951.20***	499.84***	280.16	700.64***
	(6.47)	(5.67)	(3.67)	(3.60)	(1.50)	(3.36)
Observations	200	100	100	200	100	100
R-squared	0.125	0.267	0.131	0.126	0.115	0.173
Individuals	50	25	25	50	25	25
F	1.508	2.668	1.109	1.516	0.948	1.530

Looking at Table 5 we can see that as in Japan the constant term is larger for the family pool, compared to the anonymous pool. There is a significant and positive coefficient on the round in the family pool, that is not present in the anonymous pool. Women respond negatively to their own past contributions to the family pool in treatment 1, but this feature disappears in

treatment 2. Meanwhile, men respond negatively to their own past contributions to the anonymous pool, but this effect is absent in treatment 2.

Table 5. Fixed Effects: Colombia

	Contribution to Family Pool			Contribution to Anonymous Pool		
Variables	All	Female	Male	All	Female	Male
$Spouse_{t-1}$	0.033	0.138	-0.088	0.040	0.117	0.195*
	(0.30)	(1.01)	(-0.64)	(0.43)	(0.98)	(1.71)
$Family_{t-1}$	-0.216*	-0.301**	-0.245	0.008	-0.065	0.152
	(-1.96)	(-2.33)	(-1.60)	(0.08)	(-0.58)	(1.20)
$Stranger_{t-1}$	0.059	0.014	0.150	0.141	0.124	0.177
	(0.55)	(0.12)	(0.86)	(1.53)	(1.20)	(1.22)
$Anonymous_{t-1}$	0.248*	0.231	-0.189	-0.257**	-0.014	-0.350***
	(1.89)	(1.41)	(-1.44)	(-2.29)	(-0.10)	(-3.20)
T2 x $Spouse_{t-1}$	0.121	-0.048	0.286*	-0.160*	-0.250*	-0.114
	(1.08)	(-0.30)	(1.79)	(-1.67)	(-1.79)	(-0.86)
T2 x $Family_{t-1}$	0.363***	0.476***	0.194	-0.150	-0.058	-0.283*
	(3.11)	(3.04)	(1.09)	(-1.51)	(-0.43)	(-1.90)
T2 x $Stranger_{t-1}$	0.120	0.236	-0.038	-0.177	-0.171	-0.203
	(0.91)	(1.38)	(-0.18)	(-1.58)	(-1.15)	(-1.19)
T2 x $Anonymous_{t-1}$	0.086	0.142	0.054	0.127	-0.191	0.390**
	(0.64)	(0.72)	(0.29)	(1.11)	(-1.12)	(2.52)
Male x $Spouse_{t-1}$	-0.021			0.194**		
	(-0.21)			(2.25)		
Male x $Family_{t-1}$	-0.157			0.024		
	(-1.52)			(0.27)		
Male x $Stranger_{t-1}$	-0.027			-0.001		
	(-0.22)			(-0.01)		
Male x $Anonymous_{t-1}$	-0.425***			0.057		
	(-3.36)			(0.53)		
Round	575.0***	690.8***	384.1**	-72.6	-214.9	11.9
	(4.49)	(3.89)	(2.04)	(-0.66)	(-1.39)	(0.08)
Constant	7,028.5***	4,343.4***	9,631.4***	6,523.1***	7,629.2***	4,896.8***
	(7.88)	(3.52)	(7.35)	(8.56)	(7.12)	(4.49)
Observations	480	240	240	480	240	240
R-squared	0.153	0.215	0.119	0.066	0.079	0.099
Individuals	120	60	60	120	60	60
F	4.832	5.206	2.558	1.899	1.639	2.088

Robust z-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.

The tables and figures shown above reinforce the notion that the spouses in Japan are, on the whole, more cooperative with one another than those in Colombia. In particular, couples in Japan contribute relatively more to the family pool even in treatment 1 (76% of N in round 1 for instance compared to 54% in Colombia; p=0.000 for 2-sided t-test). There are of course a large number of ways in which the sample and location differ, so it is not possible to

determine the basis for the difference, but three obvious differences *between* the groups that also vary *within* groups are that the subjects in Colombia are generally older, have more children and are less educated. In Table 6 we use a random effects model for contributions to the two pools, estimating separate equations for each treatment.[9] Some caution must be made about the interpretation of these results given the high degree of collinearity between site and education (Goodman & Kruskal's gamma = 0.996 for the two variables).

Result 7. Generally individuals with higher levels of formal education contribute more to the family pool in both treatments; age, trust levels and acquaintance with other people in the experiment do not play a major role in behaviour.

[9] Three subjects did not answer all parts of the demographic and attitudinal survey and are therefore dropped here.

Table 6 Random Effects Model of Contribution Rates.				
VARIABLES	Family-T1	Family - T2	Anon - T1	Anon - T2
Japan	0.038	-0.031	-0.027	-0.049
	(0.30)	(-0.17)	(-0.28)	(-0.40)
Male	0.071**	0.062	0.010	-0.010
	(2.14)	(0.82)	(0.23)	(-0.18)
Age	0.001	0.003	0.001	-0.005*
	(0.54)	(0.68)	(0.44)	(-1.92)
Education: High School	0.210***	0.275***	0.037	-0.123*
	(3.48)	(3.00)	(0.91)	(-1.84)
Education: University	0.298**	0.522***	0.083	-0.124
	(2.09)	(5.30)	(0.81)	(-1.30)
Children	-0.016	-0.108***	-0.022*	0.053***
	(-1.03)	(-2.88)	(-1.82)	(2.98)
Round 2 dummy	0.006	0.086**	0.026	-0.037
	(0.20)	(2.09)	(1.09)	(-1.27)
Round 3 dummy	0.045*	0.146***	0.045	-0.070*
	(1.66)	(3.20)	(1.34)	(-1.83)
Round 4 dummy	0.089***	0.192***	0.076**	-0.109***
	(3.01)	(3.81)	(2.35)	(-2.96)
Round 5 dummy	0.051	0.314***	0.072**	-0.139***
	(1.41)	(6.11)	(2.15)	(-4.20)
Trust Others	-0.015	0.004	-0.000	-0.006
	(-1.26)	(0.14)	(-0.00)	(-0.34)
Known	0.023	-0.036	0.014	0.057*
	(1.16)	(-0.65)	(0.82)	(1.81)
Constant	0.414***	0.836***	0.407***	0.529***
	(2.82)	(2.73)	(3.70)	(2.59)
Observations	410	425	410	425
Number of individuals	82	85	82	85

Robust z-statistics in parentheses *** p<0.01, ** p<0.05, * p<0.1 Errors clustered at family level; Education refers to highest level attained (omitted category is 'Primary or less'; omitted category for round is round 1; Trust is a categorical variable (1-7) for the question "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?" with 7 = you can't be too careful. 'Known' = excluding spouse, number of people in the session known to you.

The dummy variable for Japan is not significant in any equation. At the same time, we can observe that the effects of differences in the sample characteristics are more prominent in the family pool where education seems to go some way towards explaining differences in behaviour. Levels of trust of strangers and the fraction of other participants known to the subjects also vary between the sub-samples and are included as control variables, but their

impact is not large and only in the case of the anonymous game played under treatment 2 is there an effect that is weakly significant.

5. Discussion.

We have presented an experiment on decision-making which uses for subjects a sample of graduate student couples in Japan and low income couples in urban sites from Colombia. We have two treatments and five rounds of a repeated game in each case. Past experiments have consistently found an absent of surplus maximizing choices amongst most married couples. Our results are from different locations, yet nevertheless, the results in treatment 1 are in line with those seen elsewhere: many spouses do not contribute all of their endowments to the family pool. This outcome occurs despite the repetition of games and the feedback between rounds that we employed. Additionally it is not as though the subjects simply stuck to their first round choices: out of the 170 participants in the two venues, just 10 made no change at all their contributions between the first and last rounds. Subjects consistently passed the tests of understanding used at the beginning of each session and many of our subjects were highly educated, so there is no evidence of confusion in the behaviour. It seems rather that as in other locations, many spouses are reluctant to place all their money in a pool that will be shared with their partners. Many women and men are willing to sacrifice household income in order to ensure their own rewards.

In treatment 1 subjects give more or less equally between the three ways money can be allocated. The pattern does not change significantly between rounds 1 and 5. In contrast, in treatment 2, subjects contribute most of their endowments to the family pool and keep much less than in treatment 1. This is the most surprising aspect of our results. Moreover, though the difference in contribution rates to the two pools is clear even in round one, the upward trend in family contributions continues through to round 5. Based on the simplest of economic models, these results are somewhat perplexing. Very few subjects are on the boundaries of the choice set in treatment one, so straightforward theories of allocation would predict that the results of the two treatments should be almost the same. In fact this is not the case. It is not simply that contributions to the family pool are higher in treatment 2, the amount kept back from the pool(s) also falls, suggesting that the treatment makes a general difference in attitudes to contribution. One speculative explanation of the results, is that in treatment 1

when subjects invest in the anonymous pool they perceive that they have a choice between ‘my money’ and ‘money shared with a stranger’. In treatment 2, the perceived opportunity cost of money shared with a stranger is ‘money shared with my spouse. In this circumstance, the trade-off is more salient and subjects as a result contribute relatively more to the family pool.

Around the world, in most countries, the majority of adults live with other adults in families. Natural groups, such as families have not received much attention in the general literature on public good games, yet games played within households may have important implication not just for understanding household behaviour but also for decision-making in general. Our results here suggest that the degree of cooperativeness between everyday partners may depend on other simultaneous social interactions. It is also possible that similar effects may occur in workplaces and other locations where individuals play what are essentially overlapping and sometimes competing repeated games with other individuals over an extended time horizon. Meanwhile, from a normative perspective our experiment has a mixed message: on the one hand, total contributions to the public goods rise when subjects are free to choose where they make contributions; on the other hand this leads to greater inequality in the way individuals treat other individuals within the shared environment.

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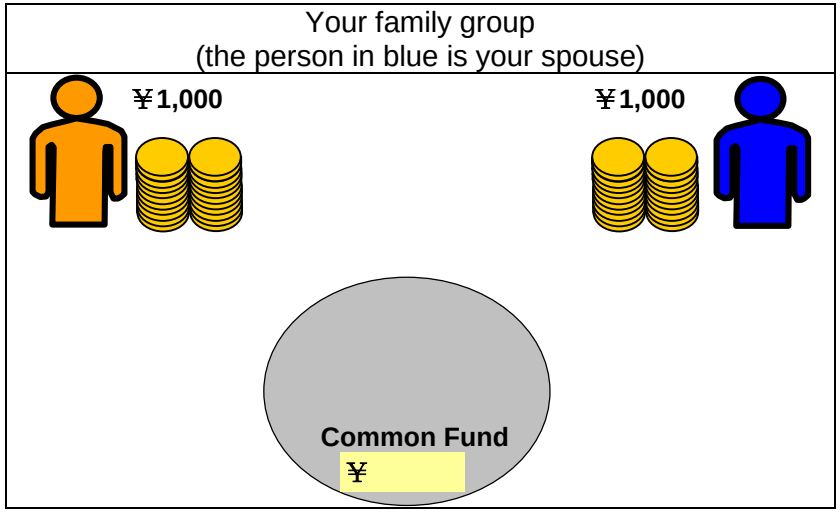
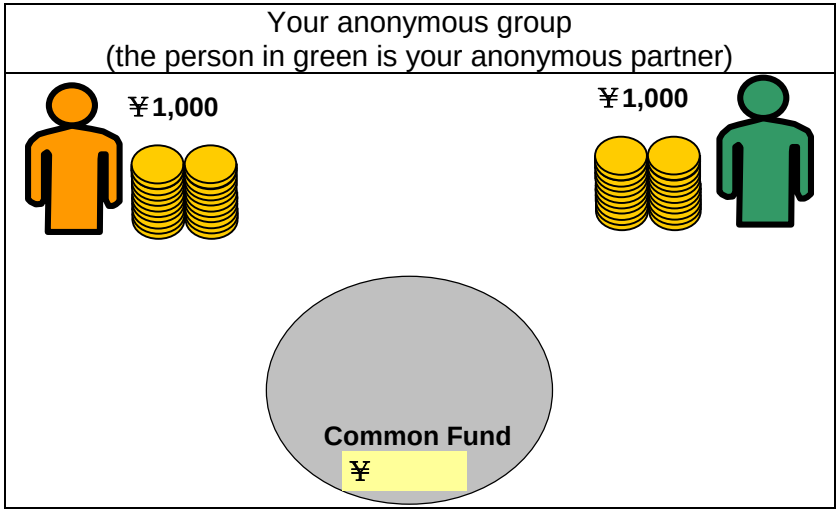
Appendix: Instructions for subjects (English language version).
Subject___

Thank you for taking part in this experiment.
You will take part in a variety of tasks, divided into several sections.
At the end of the experiment we will draw ONE task at random.
You will be paid according to the outcome in that task.
So, you should take every task seriously.

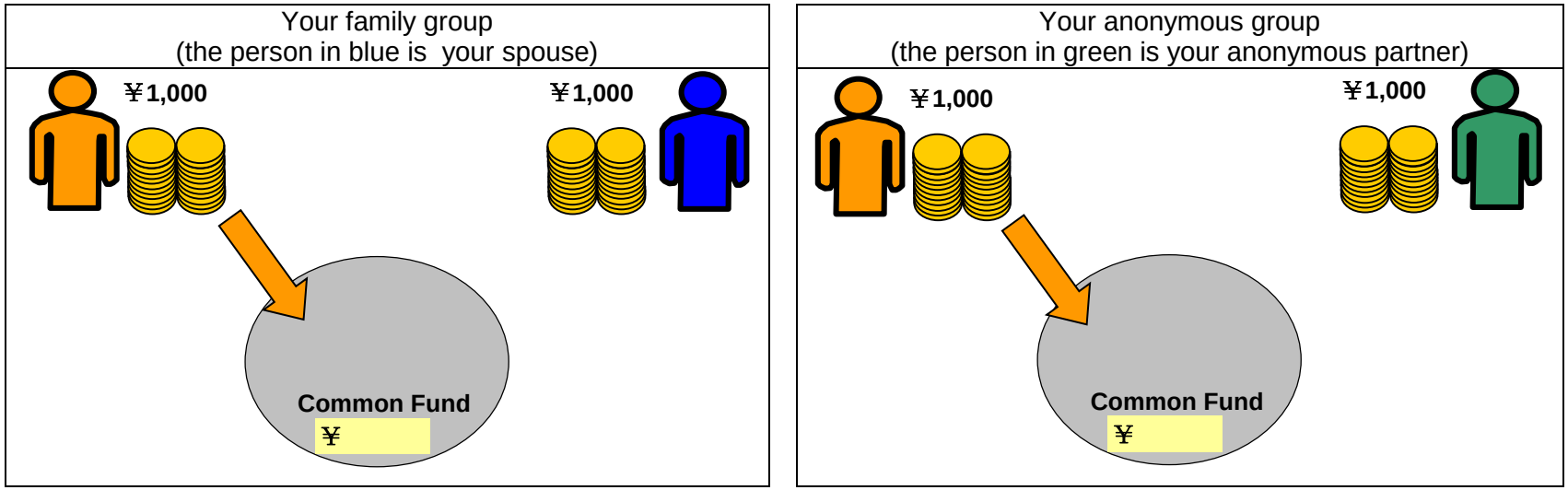
Section 1.

- In this section you are a member of two groups.
- In your *family group* your partner is your actual spouse.
- In your *anonymous group*, we have matched you with a partner who is also taking part in this session.
- You have the same anonymous partner for the whole section. We will not reveal who the other person is to you. And we will not reveal your identity to them.
- In this section you will face a series of 5 identical questions.
- In each question you will have two decisions, one for each of your groups. For each group you will receive a 1000 yen endowment, making 2000 yen in total.





[please wait until the experimenter asks you to turn over]



- For <u>each</u> group you have to decide how much to keep for yourself and how much to contribute. You can choose any amount from 0 to 1000 yen, as long as it is in units of 100 yen. Your partners will face the same decision.
- You won't know their actual decision until after the question. They won't know your decision until after each question as well.
- You can choose to contribute different amounts to each group or the same amount. It is entirely up to you.
- After you have made your two decisions the experimenter will come round and take a copy of them. We will hide your answers from non-partners.

For your family group we will add your contribution to the amount your spouse contributes. To that sum we will add half again. So, if there are 2000 yen in total we will add another 1000 yen to make 3000. If there are 1000 yen in total we will add another 500 yen to make 1500 yen and so on.

<u>After that you will each get half of the money.</u>

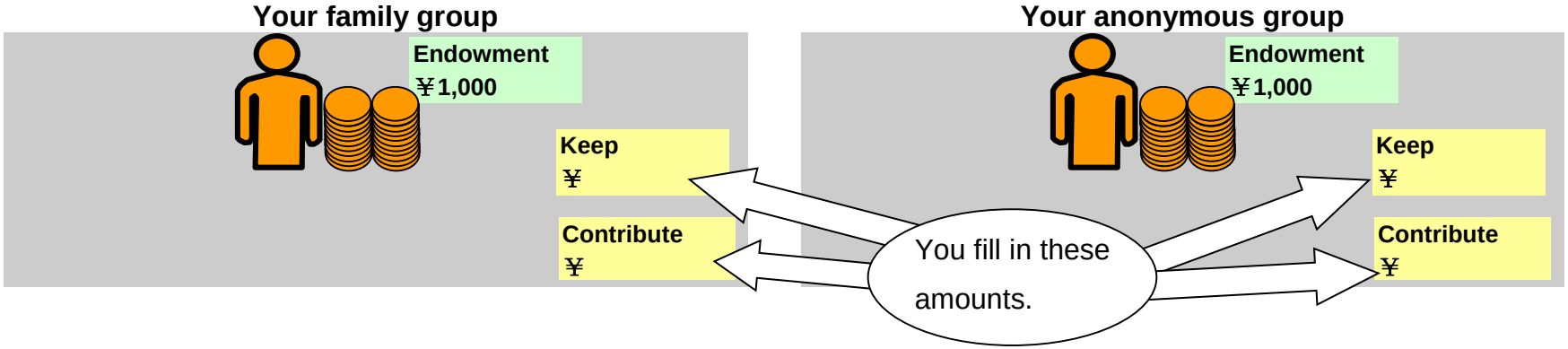
We will do the same for your anonymous group. Again we will add your contribution to the amount contributed by your partner. To that sum we will add half again. <u>And then we will split the amount equally between you and your anonymous partner.</u>

Once we have made these calculations, we will return to you and reveal your partners' contributions and your split of the total

[please wait until the experimenter asks you to turn over the page]

The questions.

- The question pages will look like this.
- You have to fill in the amounts where it says ‘keep’ and ‘contribute’:
- For each group the ‘keep’ and ‘contribute’ amounts must add up to your endowment of ¥1,000



Please don’t write below this line. We calculate this information.

We fill in your partner’s contribution here:	¥	We fill in your partner’s contribution here:	¥
Your final earnings	¥	Your final earnings	¥

Note that the final earnings figure includes the money you decided to keep.

To sum up: for each group your task is to decide how much to keep and how much to contribute to the common fund.

[please wait until the experimenter asks you to turn over the page]

Some important points

- You cannot change your answers after the question.
- After you have answered a question please wait for the experimenters to record your answer and reveal your partner's contribution.

- We will play the same question 5 times. You can give a different answer each time you play. Or you can give the same answer.
- At the end of the experiment, one question number from will be drawn at random.
- If one of these questions from this section is selected at the end of the experiment you will play out the option chosen by you.

Some checks of understanding so far:
(please write your answer in the boxes and wait for the experimenter to check them)

1. If you have a 1000 yen endowment for your anonymous group and you decide to keep 400 yen, how much do you contribute?

Your anonymous group

Keep
￥400

Contribute
￥

2. If you contribute 400 yen and your spouse contributes 400 yen how much will there be in total in the common fund for your family group?

I contribute 400 yen and my spouse contributes 400 yen. The total is	￥

3. How much we will add if 1000 yen has been contributed in total for your family group?

If the total contribution to the common fund is 1000 yen, the experimenters will add	￥

To sum up: for each question your task is to decide how much to contribute to your family group and how much to contribute to your anonymous group.

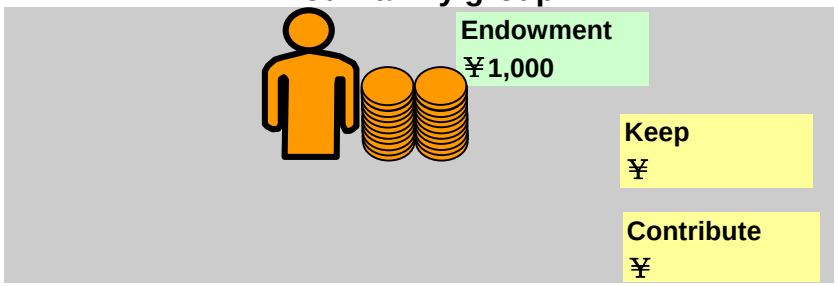
After you have made your decision please fill in the questionnaire.
[please wait until the experimenter asks you to turn over the page]

Section 1.

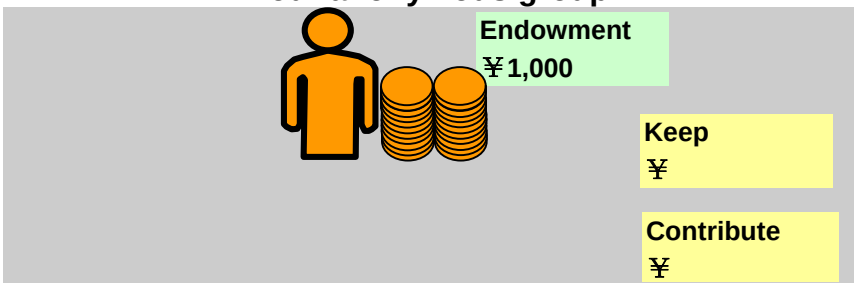
Question 1.

- For each group, please fill in the amounts marked ‘keep’ and ‘contribute’

Your family group



Your anonymous group



Please don’t write below this line. We calculate this information.

We fill in your partner’s contribution here:	¥
Your final earnings	¥

We fill in your partner’s contribution here:	¥
Your final earnings	¥

To sum up: for each group your task is to decide how much to keep and how much to contribute to the common fund.

After you have made your decision please wait.