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**Social Exchange and Coalition in  
Intra-Group Cooperation and Inter-Group Competition**

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**ABSTRACT**— Men exhibit a stronger tendency to favor the in-group over the out-group than women. We examined if this male-specific “coalitional psychology” represents in-group love or out-group hatred. One hundred and thirty-three college freshmen played a Prisoner’s Dilemma Game with a member of their own group and a member of another group. Both groups consisted of the same sex participants. An in-group bias — cooperation at a higher level with the in-group than the out-group — based on expectations of cooperation from the in-group was observed for both men and women. When such expectations were experimentally eliminated, women did not show any in-group bias whereas men still exhibited an in-group bias. The male-specific in-group bias in this condition was found to be a product of intra-group cooperation rather than inter-group competition. These findings suggest that the male-specific coalitional psychology is catered more toward within-group solidarity than promotion of aggression against the out-group.

(Total: 149 words)

People generally cooperate more with members of their own group than with outsiders. From the game-theoretic point of view, this “in-group bias” in cooperation is no surprise. The shadow of the future (Axelrod, 1984), which is more prominent in relations with members of the same group than with outsiders with whom one may not see again in the future, is a prerequisite for cooperation among fitness-enhancers. What is surprising, however, is the finding originally reported by Tajfel, Billig, Bundy, and Flament (1971) and later replicated in many studies that such in-group bias exists even in *minimal groups*. A minimal group consists of individuals who share a seemingly trivial social category while lacking interpersonal interactions and interdependence of interest. In a typical study involving minimal groups, participants are divided into two groups based on a trivial criterion such as preference for one painter over another. Then, participants play some forms of a game such as a one-shot prisoner’s dilemma game with either a member of their own group or of another group. Since they play a one-shot game, and the groups they belong to disappear as soon as the experiment is over, the shadow of the future cannot explain in-group bias in such an experiment. And yet, participants typically cooperate more with a member of their own group (an in-group member) than with a member of the other group (an out-group member) (Brewer, 1979; Yamagishi, Jin & Kiyonari, 1999; Wit & Wilke, 1992).

The presence of an in-group bias in minimal groups has since engendered a dispute on “in-group love” and “out-group hatred” as the source of inter-group conflict (Brewer, 1999; Halevy, Bornstein, & Sagiv, 2008). Many researchers have contended that altruistic behavior toward the in-group is the mirror image of spiteful behavior toward the out-group, such that these two behaviors are the two sides of the same coin (Tajfel & Turner, 1979, 1986; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). Others,

however, argued that the two can be independent from each other, and in-group love does not necessarily imply out-group hatred (Brewer, 1999). A series of minimal group experiments conducted by Yamagishi and colleagues (see Yamagishi et al., 1999, Yamagishi, 2007) provide evidence that in-group bias in minimal groups is a product of in-group love, promoting within group social exchange as will be shown below.

In a minimal group experiment, a participant unilaterally decides whether or not to give resources to another participant. Under such a gift-giving game situation, conditional altruists, who behave altruistically only to those who have earned a reputation of being altruistic, evolve and prosper. In other words, a system of indirect reciprocity based on some forms of *conditional altruism* has been shown to evolve (Nowak & Sigmund, 1998; Milinski, Semmann, Bakker & Krambeck, 2001; Takahashi & Mashima, 2006). Yamagishi and colleagues (e.g., Yamagishi, et al., 1999; Yamagishi & Mifune, 2008) argued that people use the reputation earning strategy by default when they face a group situation. Being cooperative and altruistic toward members of the same group is an “investment” to earn good reputation. A “default strategy” is a decision rule that is used by default, unless salient cues are present that indicate the inappropriateness of using such a strategy. It is a form of error management strategy (Haselton & Buss, 2000) designed to reduce a more serious error of losing a reputation at a cost of increasing the probability of committing a less serious error of failing to free ride when possible. If in-group bias in minimal groups is a default reputation management strategy as suggested by Yamagishi and colleagues, then the bias should disappear when it becomes salient that the strategy does not work. This was exactly what the researchers demonstrated in experiments using reward allocation games (Karp, Jin, Yamagishi, & Shinotsuka, 1993; Jin, Yamagishi, & Kiyonari, 1996), prisoner’s

dilemma games (Kiyonari, 2002; Yamagishi, et al., 2005; Yamagishi, Mifune, Liu, & Pauling, in press), a dictator game (Yamagishi & Mifune, 2008), and a trust game (Suzuki, Konno, & Yamagishi, 2007). For example, Jin and Yamagishi (1997) instructed their participants to play a prisoner's dilemma game with either an in-group or an out-group member, and manipulated commonality of knowledge of the two players' group membership. In the common knowledge condition in which both the participant and his/her partner mutually knew about their respective group memberships, the in-group bias was successfully replicated. This in-group bias, however, was completely eliminated in the private knowledge condition in which only the participant knew the two players' respective group memberships while his/her partner did not know which group the participant belonged to. The private nature of the knowledge about players' group memberships made it clear for the participant that he/she should not expect any in-group favoring behavior from the partner even though the partner is an in-group member, because the partner did not know that the participant was in the same group.

Across the studies cited above, participants generally exhibit an in-group bias in cooperation when and only when they expect similar in-group favoring behavior from other members of their own group. Such an expectation-based in-group favoring behavior produces an equilibrium, in which group members give to and receive from members of their group, through a process of self-fulfilling prophecy (see Vandello, Cohen & Ransom, 2008, for an analysis of such an equilibrium in the culture of honor among Southern Americans). The commonly observed in-group bias in the minimal group experiment is therefore no surprise from the evolutionary game point of view. It is the product of an evolutionary game in which intra-group cooperation enhances one's

reputation within the group (Yamagishi & Mifune, 2008).

Do the findings of minimal group experiments by Yamagishi and colleagues mentioned above lead to the conclusion that humans are *not* endowed with a psychological mechanism that prompts them to behave spitefully toward other groups? This is the question we want to address in this paper. This question was instigated by recent findings suggesting the presence of a male-specific coalitional psychology (Tooby & Cosmides, 1988). van Vugt, de Cremer and Janssen (2007), for example, proposed a “male warrior hypothesis” that men might have evolved a group-oriented psychology that motivates them to take spiteful behavior toward the out-group in a conflict between male coalitions. In a series of experiments, they demonstrated that men are more sensitive to cues of inter-group conflict and become more cooperative under such cues, whereas women do not change their behavior in response to such cues. Sidanius and his colleagues (Sidanius & Pratto, 1999; Sidanius & Veniegas, 2000) provided ample real-life examples that most inter-group conflicts take place between groups of men. They further showed evidence that “social dominance orientation” — cognitive and motivational tendency to see inter-group situations in terms of dominance hierarchy and to strive to achieve dominance over another group — is stronger among men than women (Pratto, Sidanius, Stallworth & Malle, 1994; Sidanius & Pratto, 1999; Sidanius, Pratto & Bobo, 1994). Yuki and Yokota (submitted) found that men were more sensitive than women to priming of inter-group competition, and that only men showed an in-group bias in reward allocation under the influence of inter-group priming in a replication of Karp et al.’s (1993) study.

If such a coalitional psychology is present only among men, but not women, we should expect different patterns of group-based cooperation and competition for men

and women. In-group love based on within-group exchange should be the predominant motive for women, who lack the coalitional psychology. By contrast, men who are controlled by the coalitional psychology besides psychology for within-group exchange, are expected to behave in a spiteful manner regardless of their expectation of cooperation from the in-group. The coalitional psychology should activate the out-group hatred in men once they realize that they are confronting with an out-group consisting of men.

Although results of the previous studies cited above, except Yuki and Yokota's (submitted) study in which men exhibited in-group favoring reward allocation under priming of inter-group conflict while women did not, failed to show a gender difference in in-group bias, we suspect that the general lack of the predicted male-specific in-group bias is due to the mixed-sex nature of the groups used in the past studies. According to the logic behind the coalitional psychology, such psychology has evolved in response to mate selection pressure on men — women do not improve fitness by gaining access to more men whereas men do improve fitness by gaining access to more women. Following this logic, the coalitional psychology should be relevant in a competition of a male coalition against another over access to women. The mixed-sex nature of the groups used in the previous studies may have prevented such a coalitional psychology from being activated, and this may explain why participants showed no in-group bias in the private knowledge condition. In situations where the group consists of only men, they should exhibit an in-group bias even in the private knowledge condition. Whether or not this prediction holds is the specific research question we addressed in the current study. Specifically, we tested the following two hypotheses:

*Hypothesis 1:* Spiteful behavior toward the out-group will be observed among

male participants, but not among female participants.

*Hypothesis 2:* An in-group bias in the private knowledge condition will be observed among male participants, but not among female participants.

## METHOD

### Participants

A total of 133 freshmen (69 men and 64 women) of Hokkaido University in Japan participated in this experiment to earn cash rewards. They participated in the experiment in a same-sex group of 8.<sup>1</sup>

### Basic Design

Participants played a prisoner's dilemma game with a randomly selected partner (another participant). Both players decided how much of an endowment of 100 yen (about US\$1) to provide to the partner (in an increment of 10 yen). The provided money was then doubled by the experimenter, and then was delivered to the partner. Participants played this prisoner's dilemma game six times, each time with another randomly selected participant. Participants were not informed of their partner's decision after each game; rather they were informed of the results of the game only after they had completed all the six games.

In two of the six games, participants were not informed of the group membership of their partner (control condition). This condition provided a base-line level of cooperation, and was used to control individual differences in the participant's general cooperative tendency. In two of the remaining four games, participants were informed of their partner's group membership, and at the same time, they were informed that their partner was informed of the participant's group membership as well. These two games constituted the common knowledge condition in which the two players' group

membership was mutually known. In one of these two games, participants played with a member of their own group, and in the other game, they played with a member of the other group. Finally, in the remaining two games, participants were informed of their partner's group membership, yet they were told that their partner did not know the group membership of the participant. In this *private knowledge condition*, participants played with a member of their own group in one game, and a member of the other group in the other game. The order of the six games was randomized.

### **Procedures**

Participants, sitting in plain view of the other participants who were of the same sex as themselves, first took a "picture preference test" used in previous studies for assigning them to two "minimal groups" (Jin & Yamagishi, 1997), and were divided into either a Klee group or a Kandinsky group according to their relative preference of the two painters. They also took a short questionnaire including items measuring their identification level with the in-group and the out-group (Grieve & Hogg, 1999).

After assigning participants to either of the two minimal groups, partitions were placed between participants, so as to prevent them from seeing each other. They then received the following instructions: 1) They would engage in several rounds (exact number unspecified) of "transactions" with other participants. Their transaction partner would change in each round; 2) They would each be given 100 yen at the beginning of each transaction; 3) Their task was to decide how much of the 100 yen to provide to their transaction partner. The money they provided would be doubled in value and be delivered to the partner. The remaining amount was theirs to keep. The partner would make the same decision, and the participant would receive twice the amount provided by the partner; 4) In some rounds, they would be informed of the group membership of

their partner, whereas in some others they would not. In some of the rounds in which they were informed of their partner's group membership, their partner would not be informed of the participant's group membership; 5) They would not be informed of how much they earned at the end of each transaction. Rather, they would be informed of their total earnings at the end of the experiment; 6) Their decisions — how much they provided in each round — would be completely anonymous, not only to other participants, but also to the experimenter they met in person.

A few questions assessing participants' understandings of the procedures were asked at the end of the instructions, and participants' answers were confirmed by the experimenter. The experiment was conducted using a computer placed on each participant's desk. In each transaction round, participants were first informed of their partner's group membership and the knowledge that their partner had about the participant's group membership. They were then prompted to decide how much they would provide to the partner. After they entered their decisions onto the computer, they were asked how much they expected their partner to contribute in a post-decisional questionnaire. The *post-decisional* short questionnaire also included an item confirming the success of the within-participant manipulations (partner's group and knowledge manipulation). After they finished all six games, the end of the transactions was announced and they completed a post-experimental questionnaire which included a social dominance scale (SDO<sub>6</sub> scale adopted from Pratto et. al., 1994) and items measuring their motivations during the transactions. Participants were individually paid, by a secretary in another room who are naïve to the conditions and hypotheses of the experiment, the amount they earned in the six games. The whole experiment, including the picture preference test, transactions, and the post-experimental questionnaire, took

approximately one hour.

## FINDINGS

One male and one female participant failed to correctly identify their knowledge condition in at least 2 out of the 4 games, as such their data were discarded from analyses.

### Group Identity

We first examined if the picture preference test successfully produced two minimal groups which participants identified with. Participants completed the social identity scale after the picture preference test (and before the transaction task). A “relative-ingroup identity score” was constructed by subtracting participants’ average out-group identity score from their average in-group identity score. The overall mean of this relative in-group identity was 0.22 ( $SD=1.04$ ), which was significantly greater than zero,  $t(130)=2.40$ ,  $p=.02$ ,  $Prep=.95$ ,  $\eta_p^2=.04$ . The male average was 0.22 ( $SD =1.06$ ), female average was 0.21 ( $SD=1.03$ ), and the sex difference was not significant,  $t(129)=0.05$ ,  $p=.96$ ,  $Prep=.51$ ,  $d=.01$ .

### Expectations

Figure 1 presents the average amount of money participants expected from their partners, in terms of deviations from the baseline score obtained in the control condition. There was practically no sex difference in expectations. No effect involving sex was significant in the partner’s group (in-group vs. out-group) X knowledge (common vs. private) X sex ANOVA. Both male and female participants clearly expected more cooperation from the in-group than the out-group in the common knowledge condition ( $M_{in-group}=12.79$  vs.  $M_{out-group}= -4.71$ ,  $t(67)=5.61$ ,  $p<.0001$ ,  $P_{rep}>.99$ ,  $d=.83$ , for men, and  $M_{in-group}=12.22$  vs.  $M_{out-group}= -2.86$ ,  $t(62) = 5.30$ ,  $p<.0001$ ,  $P_{rep} > .99$ ,  $d=.80$ , for

women). However, the partner's group membership did not affect participants' expectations in the private knowledge condition ( $M_{\text{in-group}}=-0.15$  vs.  $M_{\text{out-group}}=-0.44$ ,  $t(67)=0.14$ ,  $p=.89$ ,  $P_{\text{rep}}=.20$ ,  $d=.02$ , for men; and  $M_{\text{in-group}}=2.38$  vs.  $M_{\text{out-group}}=2.38$ ,  $t(62)=0.00$ ,  $p=1.00$ ,  $P_{\text{rep}}=.00$ ,  $d=.00$ , for women). The partner's group membership X knowledge interaction was strong,  $F(1, 129)=40.81$ ,  $p<.0001$ ,  $P_{\text{rep}}>.99$ ,  $\eta_p^2=.32$ . These results indicated a success of the knowledge manipulation in enhancing expectation of cooperation from the in-group only in the common knowledge condition.

[Insert Figure 1 here]

### **Spiteful Behavior toward the Out-group**

Figure 2 presents the average deviation scores from the control condition of the amount participants provided to their partners in each condition. A negative deviation score in the out-group conditions implies a spiteful behavior toward the out-group. As clearly shown in the figure, men (or women) did not behave in a spiteful manner, on average, in the common knowledge condition. In the private knowledge condition, in which coalition-based spiteful behavior toward the out-group is most expected among men, men tended to behave slightly in a spiteful manner, but their negative deviation score was far from significant,  $t(67)=0.86$ ,  $p=.39$ ,  $P_{\text{rep}}=.73$ ,  $d=.07$ . No evidence of spiteful behavior toward the out-group was observed. Hypothesis 1 was thus clearly rejected.

[Insert Figure 2 here]

### **In-group Bias in the Common Knowledge Condition**

Participants provided more money to the in-group than the out-group *in the common knowledge condition*, both among men ( $M_{\text{in-group}}=14.26$  vs.  $M_{\text{out-group}}=1.62$ ;  $t(67)=4.15$ ,  $p<.0001$ ,  $P_{\text{rep}}>.99$ ,  $d=.68$ ) and women ( $M_{\text{in-group}}=10.24$  vs.  $M_{\text{out-group}}=0.24$ ;

$t(62)=4.07, p<.0001, P_{rep}>.99, d=.59$ ). They also gave more money to the in-group than to those whose group membership was unknown (hereafter called the “unknown-group”):  $t(67)=5.46, p<.0001, P_{rep}>.99, d=.47$ , for men, and,  $t(62) = 4.07, p<.0001, P_{rep}>.99, d=.37$ , for women. The amount they provided to the out-group was not different from the amount they gave to the unknown-group:  $t(67) = 0.90, p=.37, P_{rep}=.74, d=.06$ , for men, and,  $t(62) = 0.14, p=.89, P_{rep}=.54, d=.01$ , for women.

### **In-group Bias in the Private Knowledge Condition**

A sex difference in in-group bias has emerged in the private knowledge condition, as predicted by Hypothesis 2. Female participants did not show any in-group bias,  $t(62)=0.00, p=1.00, P_{rep}=.50, d=.00$ . Furthermore, women did not give more money to the in-group,  $t(62)=1.54, P=.13, P_{rep}=.86, d=.08$ , or to the out-group,  $t(62)=1.18, p=.24, P_{rep}=.80, d=.08$ , than to the unknown group. Male participants, however, showed an in-group bias even in the private knowledge condition where they realized that the in-group member would not return the favor to them,  $t(67)=3.26, p<.01, P_{rep}=.99, d=.46$ . Furthermore, men gave more money to the in-group than to the unknown-group in the control condition,  $t(67)=3.08, p<.01, P_{rep}=.98, d=.21$ . Men gave slightly less to the out-group than to the unknown-group, but the difference was not statistically significant,  $t(67)=0.86, p=.39, P_{rep}=.57, d=.07$ . The interaction effect between partner’s group and knowledge was substantial among women,  $F(1, 62)=12.60, p<.001, P_{rep}=.99, \eta_p^2=.20$ , and not significant among men,  $F(1, 67)=2.48, p=.12, P_{rep}=.86, \eta_p^2=.04$ . The presence of a male-specific in-group bias in the private knowledge condition provided strong support to Hypothesis 2.

### **Correlation Analyses**

We examined the correlation between cooperation levels between the in-group

and the out-group for each knowledge condition and sex. Such correlations should be negative if in-group love and out-group hatred were two sides of the same coin. For women, the correlation was positive in both the common knowledge condition,  $r(N=63)=.36$ ,  $p<.01$ ,  $P_{rep}=.98$ , and the private knowledge condition,  $r(N=63)=.44$ ,  $p<.001$ ,  $P_{rep}=.99$ . For men, the correlation was slightly positive in the common knowledge condition,  $r(N=68)=.08$ ,  $p=.50$ ,  $P_{rep}=.68$ , and was significantly positive in the private knowledge condition,  $r(N=68)=.32$ ,  $p<.01$ ,  $P_{rep}=.97$ . We then examined if the male-specific in-group bias in the private knowledge condition was due to the social dominance orientation (Amiot & Bourhis, 2005; Sidanius, Pratto, & Mitchell, 1994), and found that men's social dominance score (Pratto, et al., 1994) did not correlate with their in-group bias,  $r(N=68)=.05$ ,  $p=.69$ ,  $P_{rep}=.61$ . Finally, we examined if the bias was related to inter-group competition or intra-group cooperation using the following two questions: I was motivated to "maximize the difference between my own group and the other group," I was motivated to "cooperate with other members of my group." The male specific in-group bias in the private-knowledge condition was not significantly correlated with the inter-group competition,  $r(N=68)=.19$ ,  $p=.11$ ,  $P_{rep}=.87$ , but was positively correlated with the intra-group cooperation,  $r(N=68)=.33$ ,  $p<.01$ ,  $P_{rep}=.97$ .

## DISCUSSION

Male, but not female, participants in our study provided more money to the in-group than to the out-group *despite the fact that they did not expect a more favorable treatment from in-group partners*. At the same time, the in-group bias among men was found not to be a consequence of spiteful behavior toward the out-group. This is consistent with the conclusion by Halevy, Bornstein, and Sagiv (2008), who demonstrated that practically no men in all male groups chose an option to reduce the

out-group's payoff even with no additional cost. While Yuki and Yokota (submitted) showed an in-group bias among men, but not among women, when their participants were primed by inter-group conflict, they were unable to determine whether the bias was produced by in-group love or out-group hatred.

Why do men behave in a cooperative manner toward the in-group even when they do not expect to be similarly treated by the in-group? What are the benefits one accrues from giving resources to the in-group when it is not a condition for receiving resources from similarly minded others? One answer to this question was suggested in Tooby and Cosmides' (1988) earlier treatment of coalitional psychology, who regarded coalitional psychology as a means to mobilize people to form a winning coalition. The size of a coalition is a value in itself since it enhances the probability of winning in a conflict with another coalition over mating opportunities. Cooperation in such a coalition is a signal of solidarity, or members' willingness to join in a winning coalition.

One important implication of the above argument by Tooby and Cosmides (1988) is that unconditional *aggression* against the opposing coalition is not a fitness enhancing strategy; fighting without an assurance that other in-group members would do the same is a sure way of losing fitness advantage. The best strategy is to go with the crowd, not in the front line. The male-specific intra-group cooperation that emerged in the private knowledge condition in this study can be a signal of group solidarity. Being cooperative toward the in-group is showing one's willingness to be a full-fledged member of a coalition. Expectation of being treated favorably by the in-group — which was a prerequisite for in-group favoring behavior in the common knowledge condition — is not required for people to show solidarity; the simple presence of a potentially opposing male group may be sufficient for the activation of such “solidarity mechanism”

(Yamagishi, 2001).

Summarizing the above arguments, the current study suggests that the presence of a coalitional psychology is unique to men, yet such psychology may not directly promote unconditional aggression toward the out-group. Rather, showing an unconditional in-group bias can be a signal to prove oneself as a full-fledged member of a coalition. The relationship between these two aspects—in-group solidarity and aggression toward the out-group—of the male-specific coalitional psychology can play a critical role in understanding inter-group conflicts and group-based discrimination. Separating the two, and further examining how the two interact with each other to produce an intricate pattern of behaviors in inter-group situations would constitute an exciting topic for future study.

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### **Endnote**

<sup>1</sup> In case less than 8 participants showed up, a same-sex confederate was brought in. However, the confederate's choices did not affect the actual participants' earnings. A randomly chosen participant was matched with two other participants in each round to determine the outcome of the two. The randomly chosen participant's earnings were

determined by the choice of one partner.

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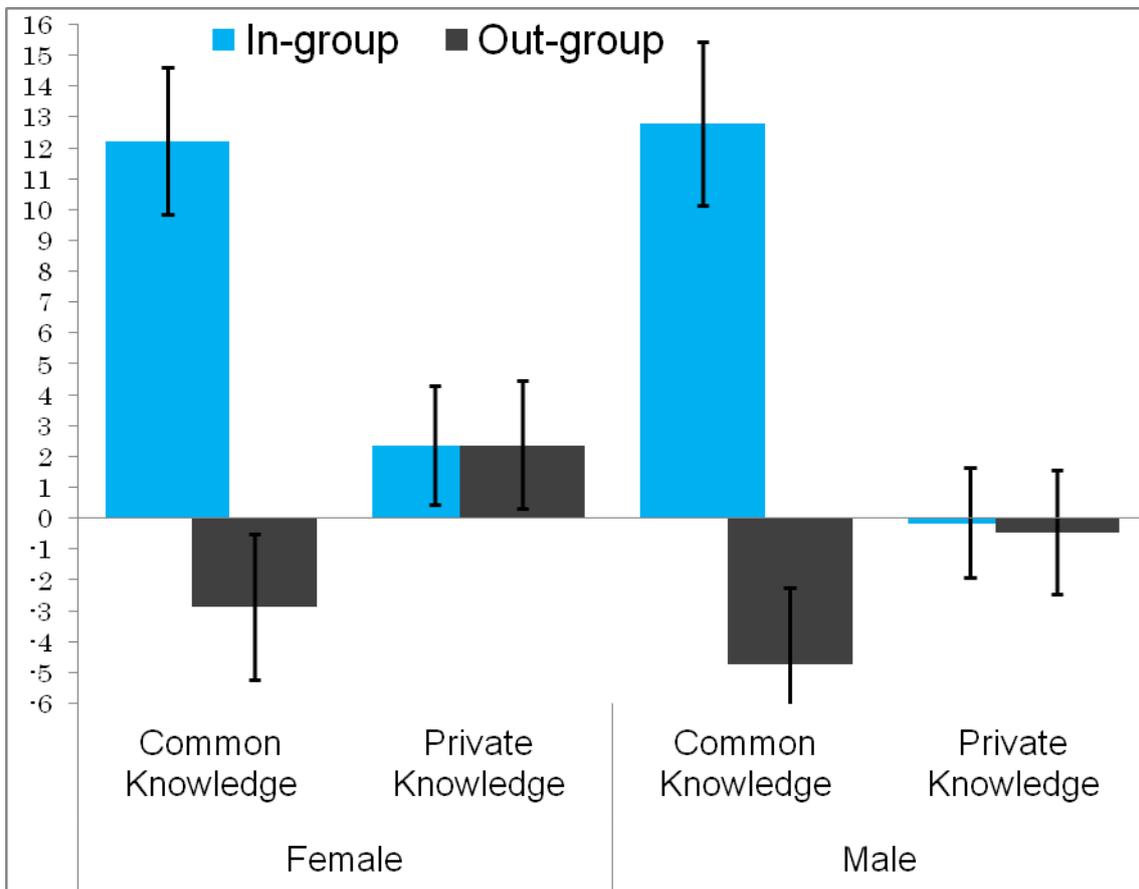


Figure 1 Levels of expectation of cooperation from in-group and out-group partners (deviation score from the expectation in the control condition).  
*Note.* Error bars represent standard errors.

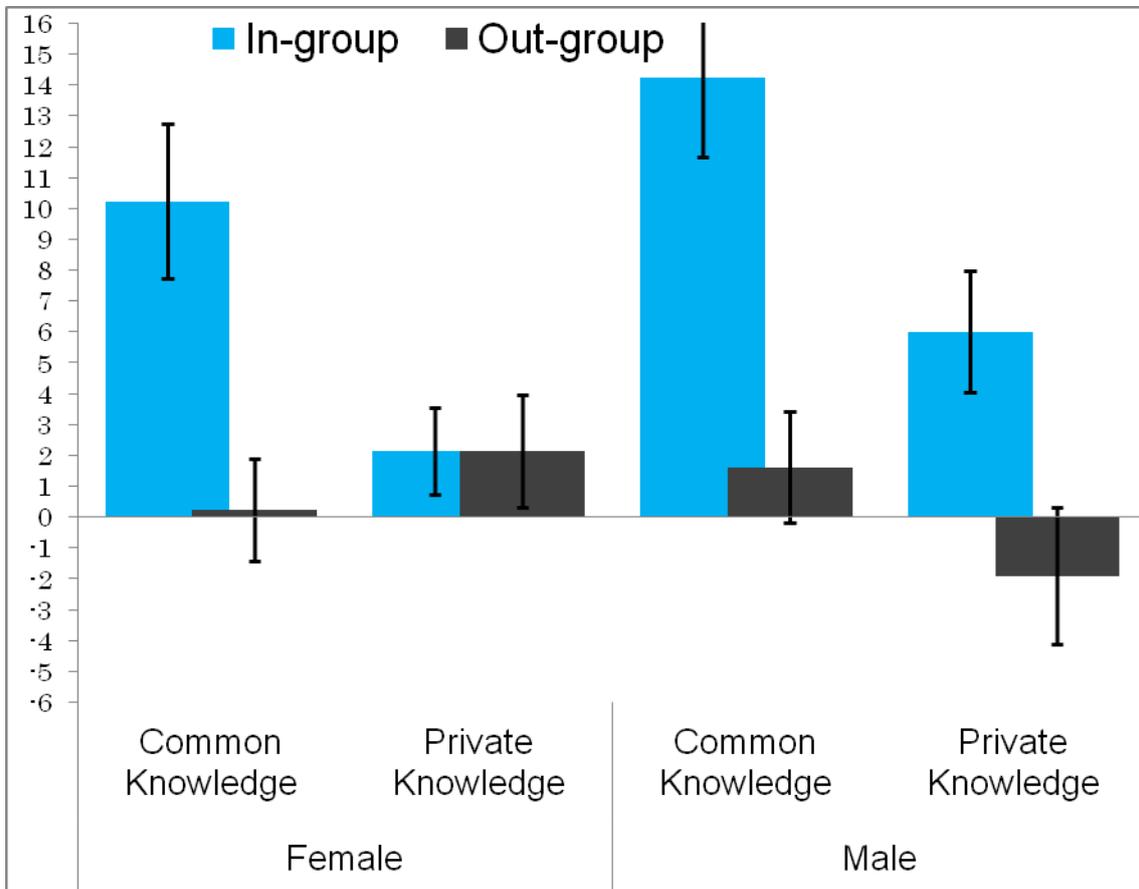


Figure 2 Levels of cooperation with in-group and out-group partners (deviation score from the control condition). *Note.* Error bars represent standard errors.