

Original Article

Attractiveness and Cooperation in Social Exchange

Chisato Takahashi, Graduate School of Letters, Hokkaido University, N10 W7 Kita-ku, Sapporo, Japan 060-0810. Email: chisato@lynx.let.hokudai.ac.jp.

Toshio Yamagishi, Graduate School of Letters, Hokkaido University, N10 W7 Kita-ku, Sapporo, Japan 060-0810. Email: Toshio@let.hokudai.ac.jp. (Corresponding author)

Shigehito Tanida, Graduate School of Letters, Hokkaido University, N10 W7 Kita-ku, Sapporo, Japan 060-0810. Email: stanida@lynx.let.hokudai.ac.jp.

Toko Kiyonari, Department of Psychology, Neuroscience and Behaviour, McMaster University, 1280 Main Street West, Hamilton, Ontario, Canada L8S 4K1. Email: Tokoki@aol.com

Satoshi Kanazawa, Interdisciplinary Institute of Management, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, UK. Email: S.Kanazawa@lse.ac.uk

Abstract: We tested the hypothesis that physically more attractive men are less likely to cooperate in social exchange than less attractive men, while physical attractiveness has no effect on women's tendency toward cooperation, with four different experimental games (Prisoner's Dilemma with 99 players, Allocator Choice with 77 players, Faith with 16 players, and Trust with 21 players). Pictures of the game players were taken after they participated in one of the four games, and those pictures were presented to another set of participants (85 raters in Study 1 and 2, 36 raters in Study 3) for attractiveness ratings. Both male and female raters who were unaware of the photographed game players' actual behavior in the game judged the faces of male defectors (who defected in one of the four games) to be more attractive than those of male cooperators, but they did not give differential attractiveness ratings to female defectors and female cooperators.

Keywords: social exchange, facial attractiveness, prisoner's dilemma, trust game, cooperation.

Introduction

Physical attractiveness is a major asset in various domains of social life including marriage (Elder, 1969) and the labor market (Hamermesh and Biddle, 1994; Roszell, Kennedy, and Grabb, 1989; Umberson and Hughes, 1987). In the domain of social exchange, Mulford, Orbell, Shatto, and Stockard (1998) found that participants who played the prisoner's dilemma game (PD) were more likely to enter a game with and cooperate with others they found more physically attractive. Based on their findings, Mulford and colleagues argued that the advantages of attractiveness stem from both a "taste" for beauty as well as the attractiveness stereotype (Dion, Berscheid, and Walster, 1972). Although

participants preferred to play with attractive others in part because they thought that attractive people were more cooperative than unattractive people (i.e., based on the attractiveness stereotype), this preference persisted even after controlling for perceptions of cooperativeness. Thus, they concluded that “taste for beauty”—the fact that physical attractiveness itself is a resource that others value—was an additional reason for their finding.

In a social exchange, one hopes to acquire a particular resource in exchange for the resources desired by one’s partner. A partner’s willingness to provide the desired resource depends on the total value of the package offered. Given that attractiveness constitutes a portion of that total, an attractive individual might actually provide fewer tangible resources in exchange situations than unattractive individuals, who cannot supplement their resource package with attractiveness. Thus, attractive individuals can get away with cooperating less in social exchanges than unattractive individuals.

To test this hypothesis, Mulford and colleagues conducted a prisoner’s dilemma game experiment, in which players decided with whom they wanted to play the game. After playing the games, players assessed both their own and their partner’s physical attractiveness. The results of their study confirmed that attractive participants were less cooperative than unattractive ones. However, their findings are qualified in two important ways. First, the finding of the negative relationship between attractiveness and cooperation was based on the participants’ self-rating, and the relationship between attractiveness to others and behavior was not investigated. Second, the negative relationship predicted between attractiveness and cooperation was only found for female players. Among male participants, the opposite relationship was observed; attractive men were more cooperative than unattractive men.

Mulford and colleagues explain the sex difference in the relationship between self-rated attractiveness and a cooperative tendency in terms of the availability of other resources that men and women can use in social exchange. Men have many personal attributes (such as status and the ability to accumulate tangible resources) that are valued by their partners in social exchange whereas attractiveness is “the *only* personal attribute valued by potential partners for females” (p. 1587). Thus, “the opportunity cost of not exploiting one’s physical attraction to the full would be greater for females than for males” (p. 1587). Furthermore, since physical attractiveness is one of many personal attributes men can use in exchange, they “simply do not recognize the opportunity that their looks give them as frequently as do their female counterparts” (p. 1587).

The findings by Mulford and colleagues briefly summarized above are not in accord with the widely-shared understanding of the theory of mate-selection among mammalian species. For all mammalian species, including humans, the female contributes greater parental investment than the male, and selects the males with whom she wants to mate because she is more discriminating in how to spend her parental investment; thus mating is a female choice (Kanazawa and Still, 1999; Trivers, 1972). Among humans, this is particularly true for *short-term* mating. While men exercise some control over mate choice in long-term mating due to high male parental investment, short-term mating is largely determined by female choice. While men are unlikely to reject even unattractive female partners for opportunistic sex (Buss and Schmitt, 1993; Clark and Hatfield, 1989), women exhibit a strong preference for attractive men who are, presumably, of good genetic quality.

In a recent study, Zaatari and Trivers (2006) found that the level of offers in the ultimatum game is positively correlated with male players’ fluctuating asymmetry (FA),

while it has no relationship with female players' FA. Fluctuating asymmetry is known to be negatively related to human attractiveness (Gangestad, Thornhill, and Yeo, 1994; Hughes, Harrison, and Gallup, 2002; Thornhill and Gangestad, 1999). The explanation Zaatari and Trivers provide for their finding is that "more symmetrical men would be more likely to make small offers ... because their superior phenotypic quality increases their ability to gain access to resources anyway, especially if physical aggression is involved" (p.3). Conversely, more asymmetrical men who are less likely to gain access to resources "benefit relatively more from cooperative interactions and therefore to make more generous offers" (p.3).

Fluctuating asymmetry can result from developmental instability, providing an honest signal to immunological competence, although validity of this conclusion has been challenged by Kalick, Zebrowitz, Langlois, and Johnson (1998), Weeden and Sabini, (2005) and others. Whether attractiveness serves as a predictor of health, men with high bilateral symmetry are known to be generally rated as attractive by women and enjoy greater access to sexual partners (Gangestad et al., 1994; Mealey, Bridgstock, and Townsend, 1999; Perrett et al. 1999; Rhodes, 2006). They are also more likely to pursue an opportunistic mating strategy, avoiding long-term relationships and sustained parental investment for many years (Gangestad and Simpson, 2000).

Long-term mating and short-term mating are alternative strategies that men can pursue to increase their inclusive fitness. While attractive men can pursue an opportunistic mating strategy, less attractive men must attract long-term mates by accumulating resources and demonstrating their willingness to invest in a woman and her offspring. Acquiring resources often requires cooperation with other members of the community, especially for those who have difficulty obtaining the resources independently. Demonstrating a willingness to cooperate with others is thus critical for men in acquiring resources through mutual cooperation in the community. Physically more attractive men pursuing a short-term mating strategy would not have to acquire resources and status through cooperation with other members of their community to the same degree that less attractive men would. This logic leads us to predict that physically more attractive men are less cooperative in social exchange than are less attractive men. In contrast, since women are the ones who choose, and do not need to be chosen by, short-term partners, the above-mentioned logic does not apply to women.

Mulford and colleagues' findings are inconsistent with this hypothesis, and, further, with the Zaatari and Trivers' (2006) finding. However, Mulford and colleagues' analysis used only *self-rated* assessments of male and female physical attractiveness. Self-rated assessments of attractiveness may play an important role in calculated choice of strategies for long-term mating. In contrast, the logic of mate selection is related to attractiveness to others affecting the likelihood of access to short-term mating. The self-ratings of attractiveness in Mulford et al.'s study were very weak predictors of attractiveness to other people. The correlation between self-rated attractiveness and ratings provided by other participants in the experimental session ranged from -.26 to .24 for men (median = .10) and from .00 to .23 for women (median = .14). Mulford et al.'s (1998) experiment, therefore, does not address the question of whether men who are perceived by others to be more attractive (and thus more likely to be sought after by women for short-term mating) are more or less likely to cooperate in social exchange.

Both the logic we presented above and the one Zaatari and Trivers (2006) provide lead to the hypothesis that the negative relationship between physical attractiveness and cooperation is unique to males. What is common in our and Zaatari and Trivers' (2006)

argument is the contention that physically attractive (and thus phenotypically and genetically superior) men can acquire scarce resources on their own, without cooperation with other men. Zaatari and Trivers' (2006) argument applies to scarce resources in general, whereas ours is specific to short-term mating partners. Nonetheless, both lines of reasoning lead to the hypothesis that physically attractive men, but not physically attractive women, are less cooperative.

The purpose of our study is to examine the above hypothesis. Specifically, we conduct a test of the following two hypotheses with three studies.

Hypothesis 1: Attractive men are less cooperative than unattractive men.

Hypothesis 2: The effect of attractiveness on cooperation is weaker among women than among men.

We tested these two hypotheses in three studies by comparing the participants' actual behavior (cooperation or defection) with ratings of their physical attractiveness provided by judges who were ignorant of the players' behavior. While the PD and other experimental games are often used to study economic decision-making, at a more abstract level, they are nonetheless models of social exchange involving cooperation, altruism, reciprocation, and trust (or a lack thereof). That players are not merely concerned with maximizing their profits within a series of economic transactions has been demonstrated in numerous studies of experimental games that show that players regard experimental games as instances of social exchange whereby the principle of reciprocity tends to dominate their behavior (Falk, Fehr, and Fischbacher, 2003; Fehr and Fischbacher, 2003; Fehr and Gächter, 2000; Hayashi, Ostrom, Walker, and Yamagishi, 1999; Kiyonari, Tanida, and Yamagishi, 2000; McCabe, 2003; Pruitt and Kimmel, 1977).

Study 1: Allocator Choice Game

Photographs of participants had been taken following previous game experiments conducted in the social psychology laboratory at Hokkaido University by Yamagishi and his colleagues over the last few years. In Studies 1 and 2, we decided to use these photographs of the participants whose cooperative behavior was already known to us. Specifically, we presented the photographs of game players to a group of judges and asked them to rate the physical attractiveness of each player. The two hypotheses were then tested by comparing the relationship between the attractiveness ratings (by the judges) of the game players with their actual behavior in the game they played.

Photographs of the participants in Makimura, Nogari and Yamagishi's (2002) experiment were used in Study 1, in which an Allocator Choice game (Foddy, Platow, and Yamagishi, submitted) was played by two players: an allocator and a recipient. The allocator distributed an endowment of 1,200 yen (about \$10) between him- or herself and one other recipient in any way he or she preferred. Their role was the same as the dictator in the Dictator Game (Kahneman, Knetsch, and Thaler, 1986). Compared to PD players, whose behavior may reflect their trust in their partner as well as their concerns for the welfare of their partner, an allocator's behavior is a more straightforward reflection of his or her concern for both fairness in general and the recipient's welfare specifically. The recipient's behavior is irrelevant to our analysis, and thus is not discussed here.

Method

Game Players

One hundred and sixty Japanese undergraduate students at Hokkaido University participated in the Allocator Choice experiment in 12-person or 16-person groups. Monetary incentives were emphasized during the recruitment of potential participants into the participant pool, and no class credit was involved. Half of the participants were assigned the role of allocator and the rest the role of recipient. For the present analysis, we used photographs of and the data collected from allocators. Among the 80 allocators, 77 (52 male and 25 female) agreed to have their photographs taken for use in later experiments. The 77 photographs of the allocators were rated on attractiveness by a group of raters unrelated to the game players.

Measurement of attractiveness of the game players

Photographs were taken after participants completed the post-experimental questionnaire. The faces used in this study may thus reflect a temporary emotional state resulting from the allocator's choice in the experiment (cf., Yamagishi, Tanida, Mashima, Shimoma, and Kanazawa, 2003, pp. 299-300). The photograph of each player (allocator) was edited to exclude hair, ears, and clothes. Specifically, a rectangle surrounding the upper forehead, below the chin, and inside the ears on both sides of the face was cut out of the photograph, and used as the stimulus picture. Eight photographs thus edited were then printed in color on each sheet of paper. Ten of these sheets (the last sheet with only 7 photographs) followed the instructions printed on the first page of the stimulus booklet. Each photograph was 51 mm high and 46 mm wide. The presentation order of the 77 photographs was randomized for each rater, disregarding the sex of the target photographs. Eighty-five (45 males, 40 females) students in a vocational school for physical therapists received the stimulus booklet in a classroom, and rated the photographs of all 77 players on a 7-point scale (1 = *extremely physically unattractive*, 7 = *extremely physically attractive*). No mention of the experimental game was made to the raters. In the following analysis, we use the means of male and female raters' separately. For *overall* attractiveness, we use unweighted means of the male and female raters' evaluations to control for the unequal numbers of male and female raters. The statistical unit of the following analyses is the player (photograph) rather than the rater.

We have information on the photographed players' actual behavior as well as their attractiveness ratings. We tested whether players who were rated as more attractive by a set of raters behaved more or less cooperatively (measured by the proportion of the endowment they gave to the recipient) compared to those who were rated less attractive by the same set of raters. Both Hokkaido University (from which the players came) and the vocational school (from which the raters came) are located in the same city of Sapporo. However, because Sapporo is a large metropolis with about two million residents and the educational backgrounds of the two populations are widely different (which in the context of the highly stratified Japanese educational system means that the photographed players and the raters probably went to entirely different high schools), it is extremely unlikely that any of the raters knew any of the photographed players personally.

Results

Measure of cooperation

We used the proportion of the endowment (1,200 yen) that the participant chose to give to the recipient as the measure of cooperation. The participants did not know who

their recipient was or the recipient's sex. On average, the participants chose to give 37% ($sd = 18$) of their endowment to the recipient.

Attractiveness ratings

The reliability of the attractiveness ratings was very high (Cronbach's $\alpha = .96$). The overall attractiveness rating of the 77 photographs was 3.60 ($sd = .48$). Female players were rated more attractive (3.70, $sd = .64$) than male players (3.57, $sd = .38$), but the difference was not statistically significant, $F(1, 75) = 1.43$, *ns*. The main effect of the rater's sex ($F(1, 75) = 85.19$, $p < .0001$), and the interaction effect of the player's sex by rater's sex ($F(1, 75) = 57.12$, $p < .0001$), were both significant. Males were more generous in attractiveness ratings than females, and this tendency was more pronounced for male photographs than for female photographs. Regardless of the player's sex, male and female raters gave consistent ratings to the photographs as shown by high correlations between male and female rater's ratings ($r = .89$ for photographs of male players, and $.95$ for photographs of female players).

Attractiveness and cooperation

Table 1 shows the correlations between the player's attractiveness rating and the amount he or she gave to the recipient, broken down by the player's and the rater's sex. The pattern of correlations is consistent with hypotheses one and two; more attractive males were less cooperative (and more selfish) than less attractive males, whereas a woman's physical attractiveness was not related to her allocation decision. We then conducted a multiple regression analysis to test if the effect of attractiveness on cooperation (shown with the correlation coefficients in Table 1) was statistically different between males and females. In the regression analysis with the cooperation level (the proportion of the endowment given to the recipient) as the dependent variable, and sex (0 = male, 1 = female), overall attractiveness and their interaction term as the independent variables, we found the predicted interaction effect between sex and physical attractiveness was not significant ($b = .13$, $t(73) = 1.54$, $p = .13$). The correlation coefficients shown in Table 1 support hypotheses one and two, but the support for the second hypothesis is weak since the predicted sex by attractiveness interaction effect did not reach the statistical significance.

Study 2: Faith and Trust Games

While the results of the first study support hypothesis one, support for the second hypothesis was inconclusive due to the non-significant interaction effect between player's sex and attractiveness on cooperation. We thus decided to use photographs of participants available from another experiment, conducted by Kiyonari, Yamagishi, Cook, and Cheshier (2006), to test the effect of physical attractiveness on cooperation. While this experiment was conducted both in the US and Japan, participants' photographs were taken only in Japan. Thus we only analyze the Japanese data.

Study 2 uses two different experimental games: The Faith Game and the Trust Game. From the allocator's point of view, the Faith Game (Kiyonari and Yamagishi, 1999) is identical to the Allocator Choice Game used in Study 1; to divide the endowment of 2,400 yen (not 1,200 yen as in Study 1) unilaterally between him- or herself and his or her partner. The difference between the two games lies in the choices of the recipient, which is not relevant to our analysis.

The allocator (or trustee) in the Trust Game (Dasgupta, 1988; Kreps, 1990) faces the same decision of dividing the endowment of 2,400 yen between him- or herself and his or her partner. The difference between the Trust Game and the Faith Game is in the way the endowment was provided to the allocator. In the Faith Game, the endowment of 2,400 yen was given by the experimenter. In the Trust Game, the endowment is provided by a recipient (i.e., truster). The truster faces a choice between either receiving a fixed amount of 800 yen from the experimenter or providing 2,400 yen to the allocator (trustee) to divide between the two. If the truster chooses the option of receiving 800 yen from the experimenter, the allocator (trustee) also receives 800 yen instead of a chance to divide 2,400 yen between the two. The trustees' behavior may thus reflect their motive to reciprocate as well as their concerns for fairness and the truster's welfare, whereas the allocator's behavior in the Faith Game only reflects his or her concerns for fairness and the truster's welfare. All the participants who played the role of trustee in this experiment were told that their partner had chosen to entrust the 2,400 yen to them as in Study 1.

Table 1. Study 1 (Allocator Choice Game) and Study 2 (Faith Game and Trust Game). Correlation between attractiveness of the photographed player (allocator/trustee) and the amount he or she gave to the recipient or the truster

Study 1		
	Player's Sex	
Rater's Sex	Male (<i>n</i> = 52)	Female (<i>n</i> = 25)
Overall	-.27*	.01
Male	-.26 ⁺	.05
Female	-.27*	-.03
Study 2		
	Male (<i>n</i> = 15)	Female (<i>n</i> = 20)
Overall	-.64**	.24
Male	-.70**	.20
Female	-.56*	.26

⁺ < .10, * *p* < .05, ** *p* < .01

Method

Game players

Fifty-five undergraduate students at Hokkaido University, scheduled from the same participant pool used in the first study, participated in the Faith Game (*n* = 27) or the Trust Game (*n* = 28) in the role of allocator or trustee. There was absolutely no opportunity for the two players (the allocator/trustee and the recipient/truster) to meet before, during, or after the experiment.

Measurement of attractiveness of the game players

Thirty-five of the game players (14 in the Faith Game and 21 in the Trust Game; 15 males and 20 females) agreed to have their photographs taken for use in later studies. Photographs were taken after the participants completed the post-experimental questionnaire following either the Faith or Trust game. The photographs were printed in color on sheets of paper, six photographs per page (with only five photographs on the last sheet), in random order for evaluation by each rater. The photographs were not edited as in the first study to examine if the same pattern would emerge even when attractiveness judgments can be influenced by such ephemeral factors as hair style. They included the participant's hair and shoulders. The size of each photograph was 53 mm in height and 40 mm in width. Thirty-six students (15 males, 19 females, 2 who did not indicate their sex) from the same vocational school used in the first study rated the photographs of the 35 players on a 9-point scale (1 = *not at all physically attractive* to 9 = *very physically attractive*).

Results

Measure of cooperation

In the following analysis, we used the proportion of the endowment (2,400 yen) that the allocator or the trustee gave to the recipient or the truster as the measure of cooperation. On average allocators in the Faith Game gave 31% ($sd = 21$) of the 2,400 yen, and trustees in the Trust Game gave 42% ($sd = 13$). We further examined whether the attractiveness of the allocators and the trustees had differential effects on the amount of money they gave to the recipient/truster using multiple regression analysis predicting cooperation from game type, sex of the player, attractiveness rating, and all two- and three-way interactions of the three independent variables. In this regression analysis, neither the main effect of game type nor any of the interactions involving the game type were statistically significant, confirming the equivalence of the two games, at least for our purposes. Thus, we decided to pool data from both games for the remaining analyses.

Attractiveness Ratings

The reliability of the attractiveness judgment was very high (Cronbach's $\alpha = .96$). The overall attractiveness rating for the 35 photographs was 3.80 ($sd = .85$). As in Study 1, the female players were rated more attractive (4.00, $sd = .76$) than males (3.54, $sd = .92$), but the difference was not statistically significant, $t(33) = 1.64$, $p = .11$. The correlation between male and female raters' attractiveness evaluations was again very high for both male players ($r = .94$) and female players ($r = .87$).

Attractiveness and cooperation

The correlation between physical attractiveness and the amount of money given to the recipient/truster was significant and negative among men ($r = -.64$, $p < .05$) and was positive but not significant among women ($r = .24$, ns). As shown in Table 1, this was true regardless of the rater's sex. As in Study 1, we tested the player's sex and attractiveness interaction effect, with a multiple regression analysis of cooperation with player's sex (0 = male, 1 = female), overall attractiveness of the player, and the interaction term of player's sex and attractiveness as the independent variables, and found the attractiveness by player's sex interaction effect was significant ($b = -.18$, $t(31) = 2.95$, $p < .01$). The results

of Study 2 thus support the two hypotheses; physically more attractive men cooperate less than physically less attractive men, while physical attractiveness does not affect women's cooperation rates.

Study 3: Prisoner's Dilemma Game

The players in the first two studies were not informed of the sex of their partners. In the third study, players were informed of their partner's sex. In addition to further testing hypotheses one and two, this allows us to examine if the negative relationship between attractiveness and cooperation observed among male participants of the first two studies are limited to the same-sex or cross-sex relationships. A prisoner's dilemma (PD) game was used in Study 3. PD games share a few features with the other games we used in the first two studies. Most importantly, players provide resources to another player at a cost to themselves when they choose to cooperate in the PD game, as in the Allocator Choice, Faith, or Trust Game. On the other hand, the PD game differs from the other games in that the choices of the two players are mutual or symmetrical, whereas they are asymmetrical in the other games. An additional goal of the third study is to examine whether this difference affects the predicted relationship between attractiveness and cooperation.

The PD game was played between two participants matched from a group of 5 or 6 participants. Each participant was provided with an endowment of 600 yen. Each PD player decided either to *give* 200 yen from the endowment to his or her partner or *take* 200 yen from the partner's endowment. The money given by a player was doubled by the experimenter before being given to the partner (the partner received 400 yen), and the partner from whom a player took lost twice the money the player gets (the partner lost 400 yen). Regardless of the choice of the partner, a player is better off taking rather than giving—she earns 600 yen for taking versus 200 yen for giving when the partner gives, and she loses 200 yen for taking versus 600 yen for giving when the partner takes. Each participant played a one-shot, two-person PD game with each of the other participants in the group knowing who he or she was; each participant therefore made five or six separate decisions to cooperate or defect. No feedback was provided after each PD game concerning the decision made by each particular partner. Instead, a summary result was provided to the participant after they had made all of their decisions.

Method

Game players

Ninety-nine (53 males, 46 females) Japanese undergraduate students at Hokkaido University, scheduled from the same participant pool used in the first two studies, participated in this PD experiment in groups of five- or six-people. Before the PD game experiment, they participated in a group-discussion session, which is irrelevant to our analysis. In contrast to the first two studies, participants in the third study knew who their potential partners would be.

Measurement of attractiveness of the game players

The PD players' photographs were taken one week after the experiment, thereby eliminating the possibility that whatever choices they had made in the experiment or the outcomes of the games could have affected their physical appearance temporarily. Seventy-eight of the original 99 participants returned to participate in the second study, in

which they performed a face recognition task that was unrelated to the current study. After they performed the task, they agreed to have their photographs taken. (One of the photographed players failed to make all five decisions, and thus we dropped this player from the data and used the remaining 77 of the 78 photographs in the analysis.) The photograph of each PD player was edited to exclude hair, ears, and clothes in a manner similar to Study 1. Eight photographs thus edited were then printed in color on each sheet of paper. Ten of these sheets (the last sheet with only five photographs) followed the instructions printed on the first page of the stimulus booklet. Each photograph was 51 mm high and 46 mm wide. The presentation order of the 78 photographs was randomized for each rater, disregarding the sex of the target photographs. Eighty-five (45 males, 40 females) students from the same vocational school used in the first two studies received the stimulus booklet in a classroom, and rated the photographs of all 78 PD players on a 7-point scale (1 = *extremely physically unattractive*, 7 = *extremely physically attractive*). No mention of the PD game was made to the raters. As in the first two studies, we analyzed the unweighted means of the male and female raters' ratings as the overall attractiveness measure.

Results

Cooperation rates

Since each experimental group included at least two males and two females, each player played the game with partners of both sexes. We can therefore construct two measures of cooperation: cooperation rate with male partners and cooperation rate with female partners. On average, both male players and female players cooperated more with female partners (.46, $sd = .41$, among male players; .49, $sd = .46$, among female players) than with male partners (.38, $sd = .42$, among male players; .33, $sd = .40$, among female players), and the main effect for partner's sex ($F(1, 75) = 8.33, p < .01$) was significant. No other effects were significant in the PD player's sex \times partner's sex ANOVA.

Attractiveness ratings

The reliability of the attractiveness judgments was very high (Cronbach's $\alpha = .96$). The overall mean attractiveness rating for the 77 photographs was 3.58 ($sd = .49$). A PD player's sex \times rater's sex ANOVA shows a main effect for PD player's sex (female PD players were rated more attractive, 3.79, $sd = .52$, than males, 3.41, $sd = .38$; $F(1, 75) = 14.63, p < .001$), a main effect for the rater's sex (male raters gave more generous ratings, 3.74, $sd = .42$, than female raters, 3.40, $sd = .61$; $F(1, 75) = 114.77, p < .0001$), and an interaction effect between the player's sex and the rater's sex (the difference between female and male attractiveness was more pronounced for female raters; $F(1, 75) = 70.21, p < .0001$, men judging men = 3.68, $sd = .35$; men judging women = 3.82, $sd = .48$; women judging men = 3.10, $sd = .44$; women judging women = 3.75, $sd = .60$). Regardless of the PD player's sex, male and female raters gave consistent ratings to the photographs as shown by high correlations between male and female raters' ($r = .88$ for photographs of men, .86 for photographs of women).

Attractiveness and cooperation

Table 2 reports the correlations between the player's attractiveness rating and his or her cooperation rate (i.e., the proportion of games in which he or she cooperated with each of the other participants), broken down by the player's sex, rater's sex, and the partner's

sex. Consistent with our hypothesis, there was a significantly negative correlation between male PD players' attractiveness ratings and their rates of cooperation with female partners ($r = -.39, p < .05$), while the correlation between female PD players' attractiveness ratings and their rates of cooperation with male partners was not significant ($r = .19, ns$). We also found that male PD players' attractiveness ratings were negatively correlated with their rate of cooperation with male partners ($r = -.30, p < .05$). Physically more attractive men were more likely to defect on both women and men. Female players' attractiveness was not correlated with their cooperation rate with female partners ($r = .06, ns$) either.

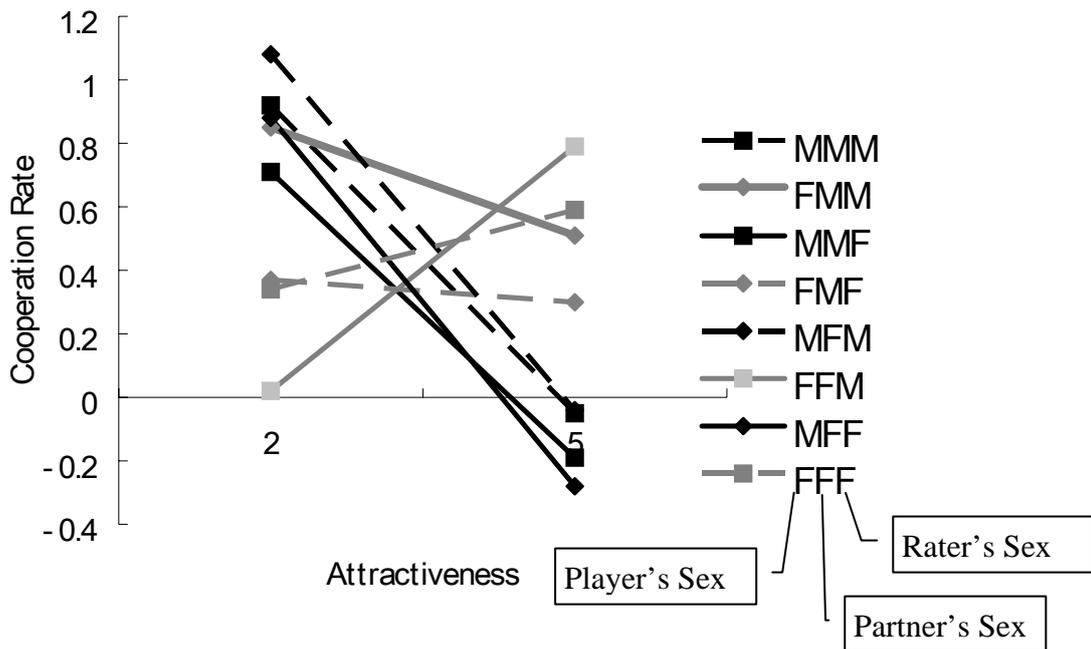
Table 2. Study 3 (Prisoner's Dilemma Game). Correlation coefficients between attractiveness ratings of the photographs and the cooperation rates of the photographed PD players

Attractiveness Ratings	<i>N</i>	Cooperation rate in PD games with		
		of male partners	female partners	overall partners
Male player's overall attractiveness	41	-.30*	-.39*	-.31*
Male player's attractiveness rated by men	41	-.28 ⁺	-.32*	-.26 ⁺
Male player's attractiveness rated by women	41	-.31*	-.41**	-.34*
Female player's overall attractiveness	36	.19	.06	.12
Female player's attractiveness rated by men	36	.27	.19	.24
Female player's attractiveness rated by women	36	.11	-.04	.03

⁺ $p < .10$, * $p < .05$, ** $p < .01$

Figure 1 depicts regression lines representing the effect of attractiveness on cooperation for the eight combinations of player's, partner's, and rater's sex. The figure clearly indicates that more attractive males were less cooperative with females and males than less attractive males. No such pattern was observed for female players. In a General Linear Model analysis in which cooperation rates with males and females were used as a within-subjects factor (i.e., each participant has a cooperation rate with males and another cooperation rate with females) and PD player's sex and the overall attractiveness level of the player as between-subjects variables, the only significant effects were the main effect of player's sex ($F(1, 73) = 5.84, p < .05$) and the interaction between player's sex and player's attractiveness ($F(1, 73) = 6.09, p < .05$). No other effects were significant. As shown in the pattern of the regression lines, this interaction effect indicates that the effect of attractiveness was particular to male players, as we predicted in Hypotheses 1 and 2. The results thus support the two hypotheses. They also provide evidence that attractive men's tendency to defect is not limited to exchange with female partners.

Figure 1. Regression line for each combination of the player's, partner's sex, and rater's sex in Experiment 1



General Discussion

Based on the theories of mate selection (Trivers, 1972) and strategic pluralism in mating (Gangestad and Simpson, 2000), as well as the physical fitness argument by Zaatari and Trivers (2006), we predicted that, compared to less attractive men, attractive men would be less likely to share tangible resources with others in social exchange. Conversely, no such effect was predicted for women. We tested this hypothesis in three laboratory experiments, using four different experimental games (Prisoner's Dilemma, Allocator Choice, Faith, and Trust Games). The data generally supported our hypothesis. First, in all three studies, attractive men consistently contributed fewer tangible resources than less attractive men. Furthermore, the effect of attractiveness on contribution level was weaker among women than among men in all three studies, although the interaction between sex and attractiveness reached statistical significance only in Studies 2 and 3.

It is important that the same pattern of results—attractive men were less cooperative whereas physical attractiveness was unrelated to cooperation among women—was robust across games. The three studies differed from each other not only in the type of games used, but also in other aspects of the study. The game players' pictures were taken right after they finished playing the game in the first two studies, such that emotional expressions may have affected the judges' attractiveness ratings, whereas this possibility did not exist in the third study. The players' pictures were edited to exclude hair and shoulder in the first and the third study, whereas they were not edited in the second study. Players did not see each other in the first two studies, whereas they saw each other before the game in the third study. None of these variations affected our results. The success in replicating the same pattern across these studies indicates that the finding was not caused by particular features of a specific game.

The explanation we have suggested for the tendency of attractive men to withhold cooperation is tentative. Zaatari and Trivers (2006) provide an alternative explanation, and the data presented in this study do not provide specific support for either explanation. Another study that includes measures of the game player's physical strength will provide a

useful clue in addressing this issue. While the apparent consistency of our conclusion across methods (handsome men defect more often no matter what game they play) increases our confidence in the findings, our results nonetheless need to be replicated, especially in other societies and cultures. Further theoretical and empirical work is necessary to determine how mating strategies by men and women interact with cultural and social factors. While the current studies were conducted with photographs of Japanese game players and Japanese raters, game players and raters from other cultures in future studies will be useful in analyzing the relationship between mating strategies in different cultural and social context in producing the tendency of attractive men to behave in a less cooperative manner in social exchange. This is particularly important given the finding by Penton-Voak, Jacobson, and Trivers (2004) that attractiveness judgment of masculine and feminine male faces depends on culture and prospect of finding long-term mates.

Acknowledgments: The research reported in this paper has been supported by a grant from Japan Society for the Promotion of Science to the second author. We thank Paul Wehr and Mark Radford for their comments and editorial help, and colleagues at Hokkaido University who helped us recruit potential participants from their classes. Direct all correspondence to Toshio Yamagishi, Graduate School of Letters, Hokkaido University, N10 W7 Kita-ku, Sapporo, Japan 060-0810; email: Toshio@let.hokudai.ac.jp

Received 4 July 2006; Revision received 20 August 2006; Accepted 21 August 2006

References

- Buss, D. M., and Schmitt, D. P. (1993). Sexual strategies theory: An evolutionary perspective on human mating. *Psychological Review*, *100*, 204-232.
- Clark, R. D., and Hatfield, E. (1989). Gender differences in receptivity to sexual offers. *Journal of Psychology and Human Sexuality*, *2*, 39-55.
- Dasgupta, P. (1988). Trust as a commodity. In D. Gambetta (Ed.), *Trust: Making and breaking cooperative relations* (pp. 49-72). Oxford: Blackwell.
- Dion, K., Berscheid, E., and Walster, E. (1972). What is beautiful is good. *Journal of Personality and Social Psychology*, *24*, 285-90.
- Elder, G. H., Jr. (1969). Appearance and education in marriage mobility. *American Sociological Review*, *34*, 519-33.
- Falk, E., Fehr, E., and Fischbacher, U. (2003). On the nature of fair behavior. *Economic Inquiry*, *41*, 20-26.
- Fehr, E., and Fischbacher, U. (2003). The nature of human altruism: Proximate patterns and evolutionary origins. *Nature*, *425*, 785-791.
- Fehr, E., and Gächter, S. (2000). Fairness and retaliation: The economics of reciprocity. *Journal of Economic Perspective*, *14*, 159-181.
- Foddy, M., Platow, M., and Yamagishi, T. (manuscript submitted for publication). Group-based trust in strangers: Evaluations or expectations?
- Gangestad, S. W., and Simpson, J. A. (2000). The evolution of human mating: Trade-offs and strategic pluralism. *Behavioral and Brain Sciences*, *23*, 573-644.
- Gangestad, S. W., Thornhill, R. and Yeo, R. A. (1994). Facial Attractiveness, Developmental Stability, and Fluctuating Asymmetry. *Ethology and Sociobiology*, *15*, 73-85.

- Hamermesh, D., S., and Biddle, J. E. (1994). Beauty and the labor market. *American Economic Review*, 84, 1174-94.
- Hayashi, N., Ostrom, E., Walker, J., and Yamagishi, T. (1999). Reciprocity, trust, and the sense of control: A cross-societal study. *Rationality and Society*, 11, 27-46.
- Hughes, S. M., Harrison, M. A., and Gallup, G. G. (2002). The sound of symmetry: Voice as a marker of developmental instability. *Evolution and Human Behavior*, 23, 173-180.
- Kahneman, D., Knetsch, J. L., and Thaler, R. H. (1986). Fairness and the assumptions of economics. *Journal of Business*, 59, 285-300.
- Kalick, S. M., Zebrowitz, L. A., Langlois, J. H., and Johnson, R. M. (1998). Does human facial attractiveness honestly advertise health?: Longitudinal data on an evolutionary question. *Psychological Science*, 9, 8-13.
- Kanazawa, S., and Still, M. C. (1999). Why monogamy? *Social Forces*, 78, 25-50.
- Kiyonari, T., Yamagishi, T., Cook, K., and Cheshier, C. (2006). Does trust beget trustworthiness? Trust and trustworthiness in two games and two cultures. *Social Psychology Quarterly*, 69, 270-283
- Kiyonari, T., Tanida, S., and Yamagishi, T. (2000). Social exchange and reciprocity: Confusion or a heuristic? *Evolution and Human Behavior*, 21, 411-427.
- Kiyonari, T., and Yamagishi, T. (1999). A comparative study of trust and trustworthiness using the game of entronement. *Japanese Journal of Social Psychology*, 15, 100-109 (in Japanese with an English abstract).
- Kreps, D. M. (1990). Corporate structure and economic theory. In J. Alt, and K. Shepsle (Eds.), *Perspective on positive political economy* (pp. 90-143). Cambridge: Cambridge University Press.
- Makimura, Y., Nogari, M., and Yamagishi, T. (2002). An experimental study of the “dual-route model” of ingroup-favoring behavior. *Proceedings of the 43rd Annual Meetings of the Japanese Society of Social Psychology*, 214-215 (in Japanese).
- McCabe, K. (2003). A cognitive theory of reciprocal exchange. In E. Ostrom and J. Walker (Eds.), *Trust and reciprocity: Interdisciplinary lessons from empirical research* (pp. 147-169). New York: Russell Sage Foundation.
- Mealey, L., Bridgstock, R., and Townsend, G. C. (1999). Symmetry and perceived facial attractiveness: A monozygotic co-twin comparison. *Journal of Personality and Social Psychology*, 76, 151-158.
- Mulford, M., Orbell, J., Shatto, C., and Stockard, J. (1998). Physical attractiveness, opportunity, and success in everyday exchange. *American Journal of Sociology*, 103, 1565-1592.
- Penton-Voak, I. S., Jacobson, A., and Trivers, R. (2004). Populational differences in attractiveness judgments of male and female faces: Comparing British and Jamaican samples. *Evolution and Human Behavior*, 25, 355-370.
- Perrett, D. I., Burt, M., Penton-Voak, I. S., Lee, K. J., Rowland, D. A., and Edwards, R. (1999). Symmetry and human facial attractiveness. *Evolution and Human Behavior*, 20, 295-307.
- Pruitt, D. G., and Kimmel, M. J. (1977). Twenty years of experimental gaming: Critique, synthesis and suggestions for future. *Annual Review of Psychology*, 28, 363-392.
- Rhodes, G. (2006). The evolutionary psychology of facial beauty. *Annual Review of Psychology*, 57, 199-266.
- Roszell, P., Kennedy, D., and Grabb, E. (1989). Physical attractiveness and income attainment among Canadians. *Journal of Psychology*, 123: 547-59.

- Thornhill, R., and Gangestad, S. (1999). The scent of symmetry: A human sex pheromone that signals fitness. *Evolution and Human Behavior*, 20, 175-201.
- Trivers, R. L. (1972). Parental investment and sexual selection. In B. Campbell (Ed.), *Sexual Selection and the Descent of Man 1871-1971* (pp. 136-179). Chicago: Aldine.
- Umberson, D., and Hughes, M. (1987). The impact of physical attractiveness on achievement and psychological well being. *Social Psychology Quarterly*, 50, 227-36.
- Weeden, J., and Sabini, J. (2005). Physical attractiveness and health in Western societies: A review. *Psychological Bulletin*, 131, 635-653.
- Yamagishi, T., Tanida, S., Mashima, R., Shimoma, E., and Kanazawa, S. (2003). You can judge a book by its cover: Evidence that cheaters may look different from cooperators. *Evolution and Human Behavior*, 24, 290-301.
- Zaatari, D., and Trivers, R. (2006). Degree of fluctuating asymmetry and behavior in the ultimatum game. Manuscript.