Research Report

Gender Differences in Cooperation and Competition

The Male-Warrior Hypothesis

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ABSTRACT—*Evolutionary scientists argue that human cooperation is the product of a long history of competition among rival groups. There are various reasons to believe that this logic applies particularly to men. In three experiments, using a step-level public-goods task, we found that men contributed more to their group if their group was competing with other groups than if there was no intergroup competition. Female cooperation was relatively unaffected by intergroup competition. These findings suggest that men respond more strongly than women to intergroup threats. We speculate about the evolutionary origins of this gender difference and note some implications.*

> A tribe including many members who, from possessing in high degree the spirit of patriotism, fidelity, obedience, courage, and sympathy, were always ready to aid one another, and to sacrifice themselves for the common good, would be victorious over most other tribes, and this would be natural selection.
>
> (Darwin, 1871, p. 132)

Evolutionarily minded social scientists assert that human altruism and cooperation are the result of the species' unique history of intergroup conflict and warfare (Alexander, 1987; Buss, 1999; Campbell, 1975; Tooby & Cosmides, 1988). Social psychological research is consistent with this idea. Humans spontaneously make "us versus them" categorizations and quickly develop deep emotional attachments to groups even when membership is based on trivial criteria, like the flip of a coin (Brewer, 1979; Ostrom & Sedikides, 1992; Tajfel & Turner, 1979). Humans also readily discriminate against members of out-groups (Fiske, 2002) and engage in costly altruistic actions to defend their group (De Cremer & Van Vugt, 1999; Sherif, 1966).

We hypothesize that an ancestral history of frequent and violent intergroup conflict has shaped the social psychology and behavior of men in particular. Compared with women, men are more likely to engage in intergroup rivalry because for them the (reproductive) benefits, for example, in access to mates and prestige gains, sometimes outweigh the costs (Buss, 1999; Tooby & Cosmides, 1988). Indeed, research on traditional societies shows that tribal warfare is almost exclusively the domain of men, and that male warriors have more sexual partners and greater status within their community than other men do (Chagnon, 1988). A U.S. study on male street gangs revealed that gang members have above-average mating opportunities (Palmer & Tilley, 1995). Finally, recent experiments in social psychology have shown that whereas women are more interpersonally oriented, men are more group oriented (Baumeister & Sommer, 1997); men also recall group events better than women (Gabriel & Gardner, 1999), and men engage more frequently in competitive between-group interactions than women do (Pemberton, Insko, & Schopler, 1996).

Thus, there is some theoretical and empirical support for the idea that men's behaviors and cognitions are more intergroup oriented than women's. We refer to this idea as the *male-warrior hypothesis*. This general hypothesis leads to the prediction that men, more than women, increase their altruistic group contributions during intergroup competition. In this article, we report three experiments in which we tested the male-warrior hypothesis using a social-dilemma task.

EXPERIMENT 1

Design and Procedure

One hundred twenty undergraduate students at the University of Southampton, England, participated in this experiment (mean

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age = 20.1 years). Forty of the students (33%) were men. Participants were randomly assigned to one of two experimental conditions (competition: individual vs. group). They arrived at the laboratory in 6-person groups to participate in what was described as a group investment experiment. Each participant was placed in front of a computer in a separate cubicle, and all instructions were administered via the computer. The task was a step-level public-goods game. Each member of the group received an endowment of £2 (approximately $4), which could be kept for him- or herself or invested in the group, but not divided between the two options. If the group as a whole contributed £8 or more to the group fund (i.e., if at least 4 of 6 members contributed their £2), then each group member would receive £4, regardless of whether he or she made a contribution. But if the group failed to contribute £8, no bonuses were given out, and only the contributors would lose their £2 investment. Several practice sessions ensured that all participants understood these instructions.[1]

Participants were told that the study was running simultaneously at 10 different universities in England. The universities, which were individually named (e.g., Birmingham, Exeter, Oxford, Southampton), were chosen on the basis of data indicating which other universities students apply to before coming to Southampton. We assumed that these universities provided a salient intergroup comparison (for similar procedures, see Kramer & Brewer, 1984; Van Vugt & De Cremer, 1999). In the *group* condition, the instructions said that the study was investigating how well student groups at these different universities performed the task relative to one another. In the *individual* condition, the participants also were told about these other participating universities, but the study was described as investigating how well students individually performed in such tasks. After receiving this information, participants decided whether or not to invest their £2 in the group. They were then debriefed, paid, and thanked for their efforts.

Results

We performed a logistic regression on the contribution decision, using a 2 (gender) × 2 (competition) design. There was no main effect for gender, $\chi^2(1, N = 120) = 2.05, p_{rep} = .77, \varphi = .13$, or for competition, $\chi^2(1, N = 120) = 0.16, p_{rep} = .36, \varphi = .03$. The predicted interaction between gender and competition was obtained, $\chi^2(1, N = 20) = 11.56, p_{rep} > .99, \varphi = .34$. The percentages (Fig. 1) show that, as predicted by our hypothesis, the men contributed more often in the group condition ($M = 92\%$, $SD = 27\%$) than in the individual condition ($M = 57\%$, $SD = 51\%$), $\chi^2(1, N = 40) = 7.03, p_{rep} > .95, \varphi = .42$. The percentage of female contributors was lower in the group condition ($M = 53\%$, $SD = 51\%$) than in the individual condition ($M = 78\%$, $SD = 42\%$), $\chi^2(1, N = 80) = 5.71, p_{rep} > .93, \varphi = .26$.

[1]The rational-choice prediction for the step-level public-goods game is that participants will contribute nothing. This game reflects a warlike situation in the sense that, depending on the size of members' contributions, the group either wins everything or loses everything.

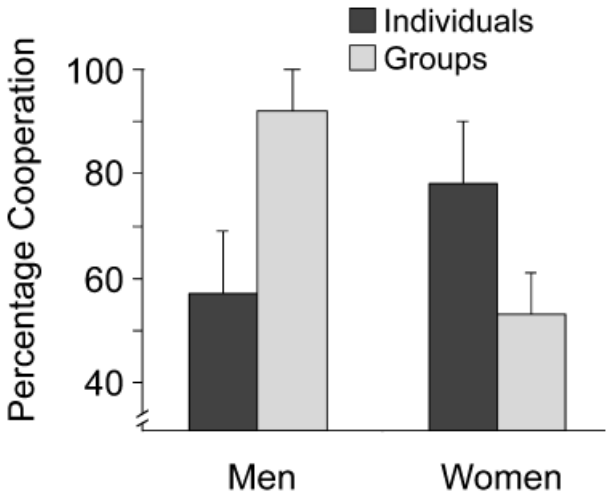

Fig. 1. Results from Experiment 1: percentage of participants who cooperated, as a function of condition and gender. Error bars represent standard errors above the mean.

The results of Experiment 1 demonstrate that men become more altruistic when their group is competing with other groups. To establish the reliability of this finding, we conducted a replication experiment, in which we asked participants how much of their endowment they wished to contribute, rather than to make an all-or-nothing contribution, so as to obtain a finer measure of their cooperativeness.

EXPERIMENT 2

Design and Procedure

Ninety-three undergraduate students at the University of Southampton participated in this experiment. Forty-three (46%) were men. Participants were randomly assigned to one of two experimental conditions (competition: individual vs. group). The procedures and instructions were essentially the same as in the previous experiment, with the following exceptions. Each group member was given an endowment of £3 (300 pence), any amount of which could be invested in the group. The public good (a bonus of £5 for each member, regardless of his or her contribution) was provided if the sum of investments exceeded £12.

Results

We performed a 2 (gender) × 2 (competition) analysis of variance on the contribution level. There was a main effect of competition, $F(1, 89) = 10.81, p_{rep} > .99, \eta^2 = .108$, and a marginally significant main effect of gender, $F(1, 89) = 3.05, p_{rep} > .83, \eta^2 = .033$, with women ($M = 201.30$, $SD = 46.16$) contributing more than men ($M = 188.51$, $SD = 62.30$). This effect was qualified by the predicted Gender × Competition

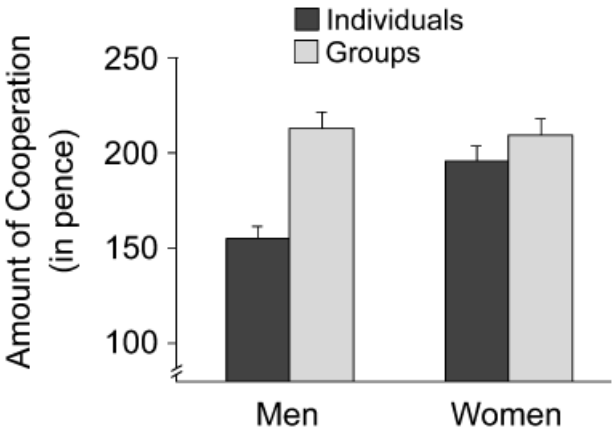

Fig. 2. Results from Experiment 2: mean amount contributed 0–300 pence), as a function of condition and gender. Error bars represent standard errors above the mean.

interaction, $F(1, 89) = 4.23$, $p_{rep} > .88$, $\eta^2 = .045$. The means (Fig. 2) show that, as predicted, men contributed more in the group condition ($M = 212.60$, $SD = 56.64$) than in the individual condition ($M = 155.06$, $SD = 54.96$), $F(1, 89) = 13.37$, $p_{rep} > .99$. For women, there was no difference between the group condition ($M = 209.25$, $SD = 33.65$) and the individual condition ($M = 196.00$, $SD = 52.77$), $F(1, 89) < 1$.

In a third experiment, we attempted to replicate this effect with iterated trials of the same public-goods task. We also examined a potential psychological mediator of the impact of intergroup competition, group identification (Brewer, 1979; Tajfel & Turner, 1979).

EXPERIMENT 3

Design and Procedure

Ninety undergraduate students at the University of Southampton (mean age = 21 years) participated in this experiment. Forty-eight (53%) were men. Participants were randomly assigned to one of two experimental conditions (competition: individual vs. group), and the competition manipulation was the same as in the previous experiments. The dependent measure was the mean contribution level (0–300 pence) across six trials. Participants also answered a postexperiment questionnaire with five questions about their group identification (e.g., "I identify with the group I am in"), responding to each on a scale from 1, *not at all*, to 9, *very strongly* (Van Vugt & De Cremer, 1999). The group-identification measure had good reliability ($\alpha = .79$).

Results

A 2 (gender) × 2 (competition) analysis of variance on the mean contribution level showed a main effect of gender, $F(1, 86) = 6.67$, $p_{rep} > .93$, $\eta^2 = .072$, with women ($M = 235.45$, $SD = 50.05$) overall contributing more than men ($M = 197.13$, $SD = 88.98$).[2] There was also a significant main effect of competition, $F(1, 86) = 5.84$, $p_{rep} > .93$, $\eta^2 = .064$, qualified by the predicted Gender × Competition interaction, $F(1, 86) = 7.68$, $p_{rep} > .95$, $\eta^2 = .082$ (see Fig. 3, top panel). Men contributed more in the group condition ($M = 235.12$, $SD = 46.22$) than in the individual condition ($M = 159.13$, SD = 105.02), $F(1, 86) = 14.71$, $p_{rep} > .99$. Again, for women, there was no difference between the group ($M = 232.35$, $SD = 49.81$) and individual ($M = 237.56$, $SD = 51.13$) conditions, $F(1, 86) < 1$.

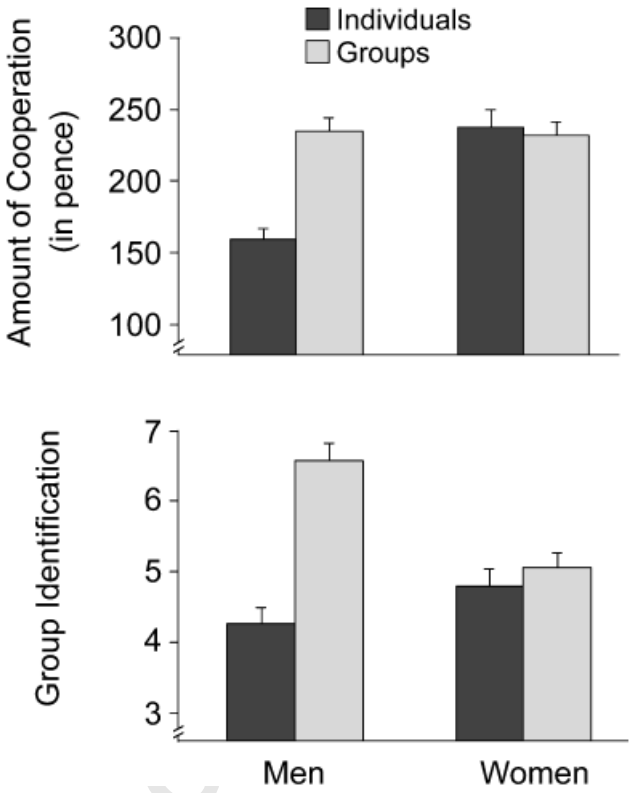

Fig. 3. Results from Experiment 3: amount of cooperation (upper panel; 0–300 pence) and group identification (lower panel; 1 = low group identification, 9 = high group identification), as a function of condition and gender. Error bars represent standard errors above the mean.

Does group identification mediate the enhanced cooperation rates of men in response to an intergroup threat? A 2 (gender) × 2 (competition) analysis of the group-identification scale yielded no main effect for gender, $F(1, 86) = 1.63$, $p_{rep} > .72$, $\eta^2 = .019$, but there was an effect of competition, $F(1, 86) = 11.12$, $p_{rep} > .99$, $\eta^2 = .115$, which was qualified by a Gender × Competition interaction, $F(1, 86) = 7.11$, $p_{rep} > .95$, $\eta^2 = .076$. As predicted, men identified more strongly with the group in the group condition ($M = 6.56$, $SD = 1.15$) than in the individual condition ($M = 4.27$, $SD = 2.07$), $F(1, 86) = 19.74$, $p_{rep} > .99$. There was no such difference for women (Ms = 5.06 in the group

[2]There was a main effect of trial, $F(5, 430) = 8.83$, $p < .001$, $p_{rep} > .99$, $\eta^2 = .093$, revealing that group contributions decreased from Trial 1 to Trial 6. However, because gender and competition did not interact with trial, we do not discuss this factor further.

condition vs. 4.80 in the individual condition, *SD*s = 1.54 and 2.12, respectively), $F(1, 86) < 1$ (see Fig. 3, lower panel).

We tested mediation for men and women separately using a bootstrap method, as suggested by Shrout and Bolger (2004) for small sample sizes. For men, competition predicted group identification, $\beta = .573$, $F(1, 46) = 22.45$, $p_{rep} > .99$. In a model with competition and group identification predicting cooperation, competition was no longer significant, $\beta = .232$, $F(1, 45) = 2.23$, $p_{rep} < .82$, $\Delta R^2 = -.036$. A bootstrap test with 1,000 replications indicated a significant indirect effect, $\beta = .185$, confidence interval = [.043, .409]. The nonsignificant final path from competition to cooperation suggests full mediation by group identification for men.[3] There was no mediation for women ($\beta = -.060$, n.s.). These results show that men's cooperative behavior increases during intergroup competition because an intergroup threat enhances males' group identification.

DISCUSSION

The results of three experiments show that men identify and cooperate more with their group under conditions of intergroup threat than where there is no threat, whereas women's cooperation is largely unaffected by this manipulation.[4] Our research thus supports the male-warrior hypothesis, the idea that men's social behavior and psychology are more strongly intergroup driven than women's.

This hypothesis accounts for some previously unexplained sex differences in cooperation, for example, the fact that men make more competitive choices in social dilemmas between groups than women do (cf. the group-discontinuity effect; see Wildschut, Pinter, Vevea, Insko, & Schopler, 2003). The male-warrior hypothesis also speaks to the broader social science literature. Male intergroup rivalries are a universal feature of human societies, in wars, civil conflicts, gang rivalries, and competitive team sports (Keegan, 1994; Palmer & Tilley, 1995; Pemberton et al., 1996). Compared with women, men engage more in risky, heroic forms of helping (Eagly & Crowley, 1986), identify more with large social units (Baumeister & Sommer, 1997; Gabriel & Gardner, 1999), and are higher in social-dominance orientation (Sidanius & Pratto, 2001). The anthropological literature reveals that tribal warfare is largely the domain of men (Chagnon, 1988). Finally, in humans' closest genetic relative, the chimpanzee, coalition formation in defending territory is primarily a male activity (Boehm, 1999; Wrangham & Peterson, 1996).

We do not mean to imply that men cooperate within their group only for intergroup reasons. Men also contribute to groups through providing food, trading, and rearing offspring (Kenrick, Li, & Butner, 2003). Nor do we mean to imply that women are completely insensitive to intergroup conflict, or do not contribute as much to group welfare as men do. On the contrary, women, on average, contributed more to the group than men across our three experiments. Our findings merely demonstrate that men respond more strongly than women to intergroup conflict.

These findings fit nicely with an evolutionary hypothesis about specific male intergroup adaptations—the male-warrior hypothesis—and such evolved intergroup traits are likely to be reinforced through cultural processes, for example, during childhood socialization (Eagly & Crowley, 1986). Women's social psychology is likely to be shaped more strongly by different kinds of needs, such as defending their offspring and creating supportive social networks (Taylor, Klein, Lewis, & Gruenewald, 2000). Investigating the way men and women respond differently to various group and individual threats is a fruitful avenue for further investigation.

Future research should also address various implications of the male-warrior hypothesis. One implication is that people should assign more weight to "intergroup" personality traits such as physical ability, fighting prowess, bravery, courage, and heroism when evaluating men than when evaluating women. Further, status in a group and, perhaps, attractiveness as a mate should be more strongly associated with contributions to intergroup activities for men than for women. Men should also generally be more interested than women in what might be considered intergroup hobbies and professions, like playing team sports, watching war movies, and joining the military.

We should note a limitation of our research, a limitation that is intrinsic to experimental public-goods research. Because the payoffs in our experiments were not substantial, we do not know if men in reality would be willing to take huge risks to defend their group. Yet the literature on warfare and suicide terrorism suggests that men are quite prepared to sacrifice themselves on behalf of their group (Atran, 2003; Keegan, 1994). Another limitation is that intergroup competition in our experiments was merely symbolic. As in most social-identity experiments, groups were not competing with each other for a tangible reward. Prestige battles between universities, however, are significant in Britain (and in the United States), and we therefore assume that our participants were genuinely affected by the manipulation.

To conclude, evolutionary scientists assert that humans' unique capacity to cooperate in large groups derives from a long history of intergroup conflict. Here we have argued that intergroup conflict has shaped the psychology and behavior of men in particular, and we have provided data to support this proposal. The male-warrior hypothesis deserves further attention from social and evolutionary scientists interested in understanding the roots of human altruism, cooperation, and intergroup aggression.

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[3]Alternative mediation tests produced essentially the same results, *z*(Sobel) = 1.99, $p_{rep} > .88$, and MacKinnon's $z_\alpha z_\beta = 10.58$, $p_{rep} > .93$.

[4]Further research might shed light on the differences between the experiments in women's cooperation levels.

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