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Do Men Become Warriors? — An Empirical Test of the Male Warrior Hypothesis

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This study examines whether men exhibit outgroup aggression in an intergroup situation created in a laboratory setting. According to the male warrior hypothesis, men have psychological mechanisms that allow them to engage in intergroup conflict and outgroup aggression. However, there is little empirical evidence that men behave aggressively toward outgroup members. To test whether men engage in outgroup aggression in intergroup situations, we conducted a laboratory experiment using a modified Intergroup Prisoner's Dilemma–Maximizing Differences (IPD–MD) game. The game consisted of three pools: ingroup cooperation, outgroup exploitation, and outgroup aggression. Participants decided how much of their endowment to allocate to each pool. We also manipulated whether participants were informed of the group's gender composition prior to the game, testing the theoretical prediction that men are more likely to form coalitions for outgroup aggression. The results showed no gender differences in contributions to the outgroup aggression or exploitation pools, nor was there an effect of the information manipulation. However, both men and women anticipated that outgroup members would engage in outgroup aggression.

Keywords
outgroup aggression, gender composition, male warrior hypothesis

Introduction

The fundamental psychological mechanisms shaped through intergroup conflict have been investigated across various academic fields. In particular, researchers have proposed that these evolutionarily adaptive mechanisms underlie ingroup favoritism—manifested as cooperation with ingroup members and noncooperation with outgroup members. Recently, researchers have increasingly examined the psychological mechanisms that underlie outgroup aggression, a distinct aspect of ingroup favoritism (e.g., De Dreu et al., 2016). Previous studies showed that, in intergroup situations, people primarily engage in ingroup cooperation—another aspect of ingroup favoritism. On the other hand, outgroup aggression, which could serve as a potential source of conflict, is less likely to emerge (e.g., Balliet et al., 2014; Halevy et al., 2008; Yamagishi & Mifune, 2009).

Meanwhile, evolutionary psychologists have proposed the male warrior hypothesis (McDonald et al., 2012; Van Vugt et al., 2007). The hypothesis posits that intergroup conflict shaped psychological mechanisms that trigger ingroup cooperation and outgroup aggression in the service of acquiring and protecting reproductive resources in intergroup situations. Although some evidence supports this hypothesis (Muñoz-Reyes et al., 2020; Yuki & Yokota, 2009), its validity remains limited, particularly because direct behavioral evidence of outgroup aggression among men is scarce.

This study tested whether men engaged in outgroup aggression using an intergroup game (Cacault et al., 2015) that modified the Intergroup Prisoner's Dilemma–Maximizing Differences game (Halevy et al., 2008). The modified intergroup game included three pools, each of which contains initial funds. Participants decided how much of their own funds to contribute to each pool in intergroup situations. Participants' contributions to the three pools corresponded to ingroup cooperation, outgroup exploitation, and outgroup aggression. In the ingroup cooperation pool, participants' contributions were doubled and distributed equally among other ingroup members. In the outgroup exploitation pool, participants' contributions are subtracted from the outgroup's funds and distributed equally among ingroup members. In the outgroup aggression pool, participants' contributions are also subtracted from outgroup's funds, but unlike the outgroup exploitation pool, they are not distributed among ingroup members. Outgroup exploitation pool represents the benefits allocated to the ingroup, whereas outgroup aggression reflects behavior that harms the outgroup without providing any benefit to ingroup members. Men may reap some psychological or subjective benefits from outgroup aggression. If so, as predicted by the male warrior hypothesis, contributions to the exploitation pool should increase specifically among men.

In addition, half of the participants were told that all participants in the experimental session were of the same gender, whereas the other half were not informed of the gender composition of the session. The male warrior hypothesis implies that psychological mechanisms shaped by intergroup conflict enable men to form coalitions capable of planning, initiating, and executing acts of aggression against outgroup members (McDonald et al., 2012; Van Vugt et al., 2007). Ingroup members can serve as potential coalition partners. Therefore, information

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about the gender of other participants should increase contributions to the outgroup exploitation pool.

Methods

Participants

A total of seventy undergraduates (36 men, 34 women; *M*age = 19.93, *SD* = 1.05) participated in the experiment. A monetary reward was provided upon participation in the experiment. Experimental rewards were paid via bank transfer at a later time. Between two and six participants took part in each session. In total, twelve sessions were conducted. Participants were randomly assigned to one of two conditions: the no-information condition (20 men, 25 women) and the information condition (16 men, 9 women).

Procedure

Participants received a card displaying their ID number and were led to one of the small booths in the experimental room. After being seated, participants viewed the informed consent form on an iPad screen. All participant responses were entered via the iPad. The instructions and questionnaires were prepared using Qualtrics. First, participants were told by the experimenter that eight individuals, including themselves, were participating simultaneously across multiple laboratories via the web (although, in fact, there were no other participants). They were also told that the eight individuals were divided into two groups, and that they belonged to one of them. Participants then read the consent form and agreed to take part in the experiment. Next, they entered their ID number, gender, age, and their group assignment. Group assignment was determined by their ID number: Those with even numbers were assigned to Group A, and those with odd numbers to Group B. After completing the initial Social Identity Scale (Hogg et al., 2006; Kaiser & Pratt-Hyatt, 2009), participants were randomly assigned to either the information or no-information condition (see *Experimental manipulation* below). Participants then read the instructions of the experimental game and answered comprehension check questions to confirm their understanding. They then decided on the amount of their contributions. Finally, participants completed the post-questionnaire, read the debriefing, and provided consent for the use of their data. It took approximately one hour to complete. All experimental protocols were approved by the Ethics Committee of Hiroshima Shudo University (Approval No. 2021-0011).

Experimental task and post-questionnaire

(a) Experimental game

The game employed in this study was a modified version of the Intergroup Prisoner's Dilemma–Maximizing Differences (IPD–MD) paradigm (Cacault et al., 2015). Participants received 300 yen for each of three group pools—900 yen in total—and decided how to allocate their funds. In the game, three group pools were set up: Pool A, Pool B, and Pool C. Participants decided how much of their funds, provided by the experimenter, to contribute to each pool. Pool A represented ingroup cooperation. Contributions to Pool A are doubled and equally distributed among ingroup members, including the contributors themselves. Pool B represents outgroup exploitation, where contributions to the pool lead to a deduction from the outgroup's total funds. Contributions to Pool B resulted in an equal deduction from the total funds of the outgroup, which is then doubled, added to the participants' contributions and distributed equally among ingroup members. For instance, if a participant contributed 100 yen to Pool B, 100 yen (25 yen per outgroup member) is deducted from the total funds of the outgroup, and 200 yen is evenly distributed among ingroup members (50 yen per ingroup member). Pool C represented outgroup aggression, whereby the outgroup's total funds were directly reduced. When participants contribute to Pool C, the amount is doubled and deducted directly from the outgroup's total funds. The deducted funds do not benefit the ingroup in any way. This task was implemented as a one-shot game. Next, participants rated their expectations (or inferences) regarding the extent to which ingroup and outgroup members contributed their funds to each pool.

(b) Experimental manipulations

In this experiment, information about the gender of the other participants was manipulated. Participants were randomly assigned[i], via written instructions, to either an *information* or a *no-information* condition. In the information condition, participants were informed (via on-screen instructions) that all of the participants were of the same gender—either all men or all women—matching their own gender. In the no-information condition, participants were not provided with any information about the gender of the other participants. In line with the male warrior hypothesis, providing gender information was expected to enhance men's contributions to each pool.

(c) The post-questionnaire

The post-experimental questionnaire, which included the Social Identity Scale and the Social Dominance Orientation Scale, was completed after participants made their contribution decisions to the three pools. Social Dominance Orientation (SDO, Sidanius & Pratto, 1999) refers to an individual's general preference for group-based hierarchy and inequality. Prior research has consistently shown a relationship between SDO and discriminatory attitudes or behaviors (e.g., Pratto et al., 1994). According to Social Dominance Orientation theory, men are more likely to direct discriminatory attitudes and behaviors toward other men (Pratto et al., 1994). In the present study, we investigated individual differences in tendencies toward outgroup aggression by assessing levels of SDO. The post-questionnaire also included the questions assessing participants' understanding of the experimental instructions, as well as demographic information (gender, age, and grade).

The Social Identity Scale (Hogg et al., 2006; Kaiser & Pratt-Hyatt, 2009) was used to measure the degree of identification with both the ingroup and the outgroup. Participants responded to all 13 items, which were rated on a 5-point Likert scale (1. *strongly disagree*, 2. *somewhat disagree*, 3. *neither agree nor disagree*, 4. *somewhat agree*, 5. *strongly agree*). Participants responded to all items twice—once with reference to their own group (ingroup: initial $\alpha = .95$, $\omega = .96$; later $\alpha = .95$, $\omega = .96$) and once with reference to another group (outgroup: initial $\alpha = .93$, $\omega = .95$; later $\alpha = .89$, $\omega = .92$).

The Japanese version of the SDO Scale (Mifune & Yokota, 2018; α = .85, ω = .90) consists of sixteen items, which are rated on a 7-point Likert scale (1. *strongly disagree / strongly oppose* to 7. *strongly agree / strongly support*).

Results

The analyses were conducted using R (version 4.4.2; R Core Team, 2024) and HAD (version 18_008; Shimizu, 2016).

Behavior

We performed a generalized linear mixed model (GLMM) using the Poisson distribution, with participant ID and sessions as random effects. Condition and gender were modeled as between-participant factors, and pool as a within-participant factor, all treated as fixed effects. The amount of money offered was used as the dependent variable. No significant main effects of both gender or condition were observed (bs < 0.51, SEs > 0.20, ps > .09). However, significant main effects were found when comparing cooperation with exploitation (b = 0.57, SE = 0.03, p < .01) and cooperation with aggression (b = 0.67, SE = 0.03, p < .01). No interaction effect between gender and condition was detected (b = 0.49, SE = 0.03, p = .24). In contrast, other interaction effects were statistically significant (bs > 0.08, SEs > 0.03, ps < .04), except for the interaction between condition and the comparison of cooperation versus aggression (b = 0.08, SE = 0.04, p = .07). The main effect of pool, which was significant in the GLMM fixed effects, was confirmed to be statistically significant in the subsequent main-effect test ($\chi^2(2)$ = 60.71, p < .001). We also conducted separate GLMMs for each of the three pools. Since more than half of the data in the aggression pool consist of zero values (cooperation: 7%, exploitation: 32.86%, aggression: 51.43%), a zero-inflated GLMM was employed to analyze the aggression data. In all pools, no main effects of gender or condition and no interaction effect were found (bs < 1.36, SEs > 0.30, ps > .18). The statistical value of each parameter of the GLMM model have been published on OSF (https://doi.org/10.17605/OSF.IO/A6V2F).

Expectation

Due to space constraints, we report only the main results of the GLMM analysis (see https://doi.org/10.17605/OSF.IO/A6V2F). The four-way interaction effect of condition, gender, group, and cooperation-aggression[ii] (b = 0.21, SE = 0.11, p < .05) was significant. Next, we conducted separate GLMMs for each of the three pools. The three interaction effects of group × gender × condition were significant in both exploitation and aggression pools (all $|b|$s > 0.17, SEs < 0.10, ps < .02). A 2 (gender) × 2 (group) GLMM was conducted for the cooperation pool to follow up on the significant gender × group interaction (b = −0.09, SE = 0.03, p < .01)[iii]. The simple main effect tests showed that men expected ingroup members to be more cooperative than outgroup members (p < .01), but women showed no such difference (p = .22). GLMM analyses separated by gender were conducted for both the exploitation pool and the aggression pool. In the exploitation pool, only the main effect of group (b = 0.07, SE = 0.03, p < .02) was significant for men. The simple main effect tests revealed that men expected outgroup members to be more likely to exploit than ingroup members in the no-information condition (p < .02), but no difference was found in the information condition (p = 1.00). In the aggression pool, for men, the interaction effect between group and condition was also significant (b = −0.24, SE = 0.05, p < .01), but not for women (b = −0.01, SE = 0.08, p = .84). The simple main effect tests revealed that men expected outgroup members

Table 1. The descriptive statistics of behavior by gender and condition.

Gender		Men		Women	
Condition		No-information	Information	No-information	Information
n		20	16	25	9
Cooperation	*M*	162.00	203.13	172.00	197.78
	SD	93.39	93.93	108.09	128.14
Exploitation	*M*	91.50	125.00	88.00	66.67
	SD	104.64	111.06	80.73	55.90
Aggression	*M*	83.00	96.25	34.40	50.00
	SD	88.92	106.58	53.24	96.82

Table 2. The summary statistics of expectation by gender, condition, group, and pool.

Gender		Men				Women			
Condition		No-info.		Info.		No-info.		Info.	
Group		In	Out	In	Out	In	Out	In	Out
n		20		16		25		9	
Cooperation	*M*	134.00	145.00	170.63	178.75	136.00	133.20	155.56	150.00
	SD	83.50	81.27	87.21	87.17	67.21	69.63	84.57	90.14
Exploitation	*M*	110.00	118.00	108.75	108.75	98.00	93.20	90.00	95.56
	SD	75.53	74.10	83.10	73.020	52.84	54.83	53.85	62.67
Aggression	*M*	83.50	105.00	102.50	101.25	56.40	71.20	45.56	56.67
	SD	77.27	95.56	82.99	84.76	59.22	58.19	37.79	45.00

Note. "No-info" and "Info" refer to the no-information condition and the information condition, respectively."In" and "Out" refer to ingroup and outgroup, respectively.

to be more aggressive than ingroup members in the information condition ($p < .01$). However, no difference was found in the no-information condition ($p = .73$). Similarly, the simple main effect tests showed that women expected outgroup members to be more aggressive than ingroup members regardless of whether information about gender composition was provided ($ps < .01$).

Discussion

This study aimed to examine whether men's outgroup aggression, as predicted by the male warrior hypothesis, emerges in an intergroup situation. To test this, we conducted a laboratory experiment using an intergroup game (Cacault et al., 2015), in which we manipulated information about the participants' gender composition. The results showed no gender differences in contributions to each type of outgroup aggression (exploitation or aggression). In addition, the manipulation of information had no effect on outgroup aggression, which is consistent with the arguments of McDonald et al. (2012). They point out certain limitations of coalition formation for outgroup aggression, such as the individual differences among ingroup members (e.g., body size). Therefore, the argument that men's psychological mechanisms promote coalition formation for outgroup aggression may be open to question.

The results regarding expectation showed that men anticipated outgroup members to engage more in exploitation and aggression, whereas women expected them to engage more in aggression. As a side note, Spearman's correlational analysis revealed significant positive relations between behavior and expectation for both exploitation and aggression (men: $r = .69$ and $r = .82$; women: $r = .50$ and $r = .49$, see supplementary materials for details). These results suggest that a cue of significant intergroup interaction, such as outgroup threat (e.g., Cottrell & Neuberg, 2005; Yuki & Yokota, 2009), may be necessary for the gender differences in outgroup aggression to emerge. A considerable limitation of this experiment is the small sample size, which reduces the statistical power and compromises the stability of results. A replication study with a sufficient sample size should be conducted in the future.

Notes

[i]Due to the variations in the number of participants and the gender composition across sessions, the assignment of participants to condition was determined by the experimenter using gender composition and participant ID number. Then, mistakes in assigning female participants resulted in unequal sample sizes between the information and no-information conditions.

[ii]The variable name *cooperation-aggression* was computed to represent the contrast between the cooperation pool and the aggression pool.

[iii]A 2 × 2 GLMM showed the main effect of group ($b = 0.06$, $SE = 0.02$, $p < .01$) and the interaction effect between group and gender ($b = -0.09$, $SE = 0.03$, $p < .01$), whereas the main effect of gender was not significant ($b = -0.02$, $SE = 0.15$, $p = .91$).

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Author contribution

NM, HS and ST developed the study concept and design, and KY collected, analyzed data and wrote the manuscript.

Ethical statement

All experimental protocols were approved by the Ethics Committee of Hiroshima Shudo University (Approval No. 2021-0011).

Data accessibility & program code

https://doi.org/10.17605/OSF.IO/A6V2F

Supplementary material

Electronic supplementary materials are available online at https://doi.org/10.17605/OSF.IO/A6V2F.

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