

Ingroup Favoritism and Outgroup Non-Cooperation in a Stag Hunt Coordination Game

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According to the bounded generalized reciprocity theory (BGR), people are endowed with psychological devices that facilitate within-group cooperation under a situation of conflicting interests. When interacting with ingroup members, they approach the situation as one of aligned interests and expect their partner to follow suit. So far, the role of expected cooperation in ingroup favoritism remains elusive. Against this backdrop, we probed whether expected cooperation is necessary for ingroup favoritism to occur. To this end, we employed a stag hunt game (SH), which instantiates a situation of aligned interests, and tested a BGR-derived prediction that ingroup favoritism in this game would be associated with ingroup-specific elevation of expected cooperation. We found support for this view. Unexpectedly, people also cooperated less in SH with outgroup members than with unclassified strangers. This pattern has seldom been observed empirically and cannot be accounted for by existing theory.

Keywords

ingroup favoritism, cooperation, bounded generalized reciprocity theory, stag hunt game, minimal groups

Introduction

We humans navigate ourselves across various interdependent situations. From resisting the temptation to defect to coordinating on a shared course of action, people cooperate with others in pursuit of mutual benefit (Balliet et al., 2017). Yet the extent to which they cooperate is contingent on their interaction partner. For example, people are apt to cooperate more with members of their own group than those of relevant outgroups. This phenomenon, dubbed ingroup favoritism, is cross-culturally ubiquitous (Romano et al., 2021) and occurs even in arbitrarily formed

groups (minimal groups; Tajfel et al., 1971) as well as a number of natural groups such as those based on national (Romano et al., 2017), political (Abbink & Harris, 2019), and religious affiliations (Chuah et al., 2014).

One prominent account of ingroup favoritism is the bounded generalized reciprocity theory (BGR; Yamagishi et al., 1999). According to BGR, ingroup favoritism is a byproduct of pronounced within-group cooperation fostered through an evolutionary history of group living, rather than unpreferential treatment of outgroup members (i.e., outgroup derogation). People are bequeathed with the group heuristic by which they default to perceiving the group as a system of indirect reciprocity (Yamagishi & Mifune, 2008). Within this system, a favor given to one member is reciprocated by another member of the group. As such, reputation constitutes a critical social currency because defection against an ingroup member risks reputational damage that undermines one's access to future cooperative benefits and may even result in ostracism (Mifune et al., 2010; Yamagishi & Mifune, 2008). The group heuristic is adaptive in that it intuitively disposes people to cooperate with ingroup members for mutual gain, even when greater individual gain is available (Maeda & Hashimoto, 2020).

BGR has clarified the proximate mechanisms behind ingroup favoritism (Yamagishi et al., 1999). Consider the prisoner's dilemma (PD), in which mutual cooperation yields the highest joint payoff, but one could gain a larger payoff at the expense of the partner by choosing not to cooperate (Fig. 1). BGR argues that when playing PD with an ingroup partner, people approach the game as if they were playing an assurance game (AG). AG is a kind of coordination game, in which both players benefit by matching their actions. In AG, mutual cooperation is desirable for both players. Hence, it structurally removes the lure of unilateral defection. Yet cooperation is still not guaranteed because people could still suffer a loss should the partner not cooperate as well. As such, if they cannot expect the partner to cooperate, people may refrain from cooperating themselves so as to secure a moderate payoff. BGR further holds that people expect ingroup, but not outgroup, partners to cooperate in AG (Yamagishi et al., 1999). Only when the transformation of subjective game structure is accompanied by expectations are people willing to cooperate with ingroup partners.

Research has tested these theoretical assumptions using the knowledge manipulation technique (Kiyonari, 2002; Yamagishi et al., 2005, 2008). Jin and Yamagishi (1997) had participants play PD with ingroup partners in two conditions: a mutual knowledge condition and the unilateral knowledge condition. In the mutual knowledge condition, participants knew that they would be paired with an ingroup member and that the partner also knew that he/she would be paired with an ingroup member. In the unilateral knowledge condition, only the participant knew that the partner was an ingroup member. Because

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Figure 1
 Game structures of the prisoner’s dilemma, the assurance game, and the stag hunt game

		A Prisoner’s Dilemma		B Assurance Game		C Stag Hunt Game	
		Other		Other		Other	
		C	NC	C	NC	C	NC
Self	C	200, 200	0, 300	200, 200	0, 0	200, 200	0, 100
	NC	300, 0	100, 100	0, 0	100, 100	100, 0	100, 100

Note: C = cooperate; NC = not cooperate. (A) In the prisoner’s dilemma, both players mutually benefit from C-C relative to NC-NC. Playing NC while the other plays C, however, yields the highest individual payoff at the expense of the other player. (B) In the assurance game, C-C is mutually desirable. Playing NC, however, would be preferable should the other player play NC. (C) In the stag hunt game, C-C is mutually desirable. Playing NC, however, protects against the worst outcome and secures a small but guaranteed payoff.

participants in both conditions knew that they were paired with an ingroup member, they were assumed to have approached the game as AG. Jin and Yamagishi (1997) found that participants showed ingroup favoritism only in the mutual knowledge condition. In fact, the cooperation rate towards ingroup members in the unilateral knowledge condition did not differ significantly from when participants played PD with outgroup partners. This is because the mutual knowledge condition affords the expectation that the partner will cooperate, whereas the unilateral knowledge condition does not. By implication, the ingroup context generates the expectation of partner cooperation in AG, and this elevation is a necessary condition for ingroup favoritism.

However, in studies using the knowledge manipulation technique, the structural transformation of PD into AG is assumed rather than directly instantiated. A more direct approach to examine whether expectations are necessary for ingroup favoritism is to have people play an actual AG, and test whether ingroup favoritism in this game is related to ingroup-specific elevation of expected cooperation. Research has found that in the stag hunt game (SH; a coordination game with a similar payoff structure to AG), people tend to display ingroup favoritism (Ahmed, 2007; Peryman & Kelsey, 2021; Stoddard & Leibbrandt, 2014; but see Brooks et al., 2018). This implies that people hold higher levels of expected cooperation from ingroup than outgroup members. However, these studies did not measure expected cooperation. As such, it remains unclear whether it is expectations that explain ingroup favoritism in SH. In this study, we seek to clarify this point using minimal groups. We predict that people will be more likely to cooperate in SH with ingroup partners than outgroup members and unclassified strangers, with no significant difference between the latter two¹. We will measure expected partner cooperation after the cooperation decision, and exploratorily assess the effect of expectations on ingroup favoritism in SH.

Methods

We conducted a within-subject online experiment with 300 participants recruited from Yahoo! Crowdsourcing (<https://crowdsourcing.yahoo.co.jp/>). The experiment was carried out in three batches with 100 participants each, between November 5 and 7, 2025. Participants received a fixed payment of 100 Japanese yen for participation, plus an additional performance-based bonus of up to 200 yen depending on their decisions in SH. After excluding data based on our pre-registered criteria (Open Science Framework: <https://osf.io/r97g5/overview>), the final analytic sample consisted of 287 participants (212 males, 75 females, $M_{age} = 50.21$, $SD_{age} = 10.00$).

Participants accessed a Qualtrics questionnaire on their computers. First, they were ostensibly assigned to either the Klee group or the Kandinsky group based on their choices in the painting preference task (Tajfel et al., 1971). Unbeknownst to them, however, all participants were assigned to the Klee group regardless of their choices.

Next, participants were told that they would complete a decision-making task (i.e., SH) with another participant. Participants were to choose between options A and B. If both players chose A, they each received 200 yen. If one chose A and the other chose B, the former received 0 yen while the latter received 100 yen. If both chose B, they each received 100 yen. Participants played a total of three rounds: one with a member of the Klee group (ingroup condition), one with a member of the Kandinsky group (outgroup condition), and one with a participant whose group membership was undisclosed (control condition). In the ingroup and outgroup conditions, participants were informed that both players knew each other’s group membership, whereas in the control condition, neither player knew to which group the partner belonged.

In each round, participants indicated their own choice (A or B) and predicted their partner’s choice (A or B). They then completed comprehension check items assessing their understanding of their partner’s group membership and whether their partner knew that they belonged to the Klee group. Participants were told that they were matched in

real time, though no actual matching occurred. Following data collection, matching for the ingroup condition was simulated to calculate and pay additional rewards. The order of the rounds was randomized, and participants were not informed of the outcomes of any previous rounds.

Then, participants completed the Social Value Orientation (SVO) Slider Measure (Murphy et al., 2011). They chose their preferred allocation from nine options representing different distributions between self and other. The payoff points listed in each option were multiplied by 100 to convert them into yen. The scores were expressed as angles, with higher angles indicating stronger prosocial orientation. Following the procedure used in previous studies (Böhm et al., 2021; Clemens et al., 2025; Columbus et al., 2023), participants indicated their social preferences towards three targets in the following order: a member of the Klee group (ingroup), a member of the Kandinsky group (outgroup), and an anonymous other (control). Finally, they reported their age and gender.

Results

Effect of the partner's group membership on cooperation

Participants cooperated the most in the ingroup condition (78.05%), followed by the control condition (71.08%) and the outgroup condition (65.85%). We regressed cooperation on condition using a generalized linear mixed model with a binomial distribution and a logit link function. We found evidence for bidirectional ingroup favoritism. Compared to the control condition, cooperation was significantly higher in the ingroup condition ($\beta = 1.72$, $SE = 0.44$, $z = 3.86$, $p < .001$, $OR = 5.57$, 95% CI [2.33, 13.31]) and significantly lower in the outgroup condition ($\beta = -1.07$, $SE = 0.40$, $z = -2.69$, $p < .01$, $OR = 0.34$, 95% CI [0.16, 0.75]).

Exploratory analysis: effect of the partner's group membership on expected cooperation

Mirroring the patterns in actual cooperation, participants expected ingroup partners to cooperate the most (80.84%), followed by unclassified strangers (71.08%) and outgroup partners (66.90%). Compared to the control condition, expectations were significantly higher in the ingroup condition ($\beta = 2.01$, $SE = 0.43$, $z = 4.71$, $p < .001$, $OR = 7.50$, 95% CI [3.24, 17.35]) and significantly lower in the outgroup condition ($\beta = -0.69$, $SE = 0.35$, $z = -1.98$, $p < .05$, $OR = 0.50$, 95% CI [0.25, 0.99]).

Ingroup favoritism, outgroup non-cooperation, and expectations

To exploratorily examine whether the observed ingroup favoritism was related to differential expected cooperation, we dummy-coded cooperation (1 = cooperation, 0 = non-cooperation) and created a variable called "ingroup favoritism" by subtracting participants' cooperation in the outgroup condition from that in the ingroup condition. In the same manner, we defined "ingroup expectation" as the ingroup minus outgroup differential of expected cooperation (1 = expected cooperation, 0 = expected non-cooperation). We then regressed ingroup favoritism on ingroup expectation using an ordinal logistic regression. Participants who expected their ingroup partners to cooperate more than their outgroup partners were

significantly more likely to show ingroup favoritism ($\beta = 4.24$, $SE = 0.41$, $z = 10.35$, $p < .001$, $OR = 69.64$, 95% CI [31.17, 155.59]).

We performed a parallel analysis for outgroup non-cooperation by recalculating all difference scores as the outgroup minus control differentials. Participants who expected less cooperation from outgroup members relative to unclassified strangers were significantly less likely to cooperate with outgroup members ($\beta = 4.23$, $SE = 0.43$, $z = 9.89$, $p < .001$, $OR = 69.06$, 95% CI [29.82, 159.90]).

We further confirmed that the effects of expected cooperation on ingroup favoritism and outgroup non-cooperation held when controlling for differential social preferences measured by SVO. The differential SVO itself was not associated with participants' willingness to cooperate (see supplementary materials for details).

Discussion

Ingroup favoritism in cooperation and expectations in SH

We found evidence that people are more likely to cooperate in the stag hunt game with ingroup than outgroup members because of higher levels of expected cooperation. People were not only most cooperative with ingroup partners but also expected the highest levels of cooperation from them. Importantly, ingroup favoritism in SH was associated with differential expectations of cooperation between ingroup and outgroup partners. We also ruled out an alternative explanation based on social preferences: the effect of expectations held even after controlling for the influence of differential social preferences between ingroup and outgroup, and social preferences themselves were unrelated to ingroup favoritism in SH. These results suggest that the ingroup context generates the expectation that the partner will cooperate, which helps people converge on mutual cooperation despite the presence of a risk-minimising non-cooperation option (Mehta et al., 1994). That said, we caution against drawing causal conclusions because we measured expectations after behavioral decisions. To establish the causal role of expected cooperation in ingroup favoritism, future research should measure expectations prior to behavior.

Bounded generalized reciprocity theory and the role of expectations

Our findings reinforce the BGR-based explanation for the psychological mechanisms underlying ingroup favoritism. BGR builds on the goal/expectation theory (Pruitt & Kimmel, 1977), which holds that cooperation in PD requires both (i) a goal of mutual cooperation and (ii) the expectation that the partner will cooperate. By implication, people should cooperate more with ingroup than outgroup members insofar as the ingroup context satisfies both conditions (Yamagishi et al., 1999; Yamagishi & Kiyonari, 2000). Previous research employing the knowledge manipulation technique suggests that a goal (i.e., the transformation of subjective game structure) alone does not induce ingroup favoritism unless it is accompanied by expected cooperation (e.g., Jin & Yamagishi, 1997).

However, in the knowledge manipulation technique, structural transformation was assumed rather than directly instantiated. Our study bypassed this assumption by using

SH. By holding structural transformation constant, this allowed for a cleaner test of whether expected cooperation is necessary for ingroup favoritism. Kiyonari (2002) suggests that expectation without a goal is insufficient to produce ingroup favoritism. Taken together, our findings support the BGR view that both structural transformation and expected cooperation are necessary for ingroup favoritism to occur.

In addition, experiments employing the knowledge manipulation technique left ambiguous where expectations come from. It was not clear whether they arise from the mere fact that the partner is an ingroup member, or from the mutual knowledge that both players have transformed their subjective game structure. Using SH, our study created a situation in which transformation could be assumed to occur equally regardless of partner group membership. This ruled out the possibility that expectations derive from mutual knowledge of shared structural transformation. The finding that people expected higher levels of cooperation from, and actually cooperated more with, ingroup than outgroup partners suggests that mutual knowledge of structural transformation is not a necessary condition for the emergence of cooperative expectations. Rather, it is the mere fact that the partner shares group membership that generates expectations of cooperation. Nevertheless, we would like to note that because we used SH in lieu of AG, factors specific to SH such as risk aversion may have influenced the participants' decision making (Harsanyi & Selten, 1988)². In order to more directly test the predictions of BGR, future research should examine whether the present findings replicate using AG.

Outgroup non-cooperation

Unexpectedly, we also observed outgroup non-cooperation: people were less likely to cooperate with outgroup members than with unclassified strangers, and expected outgroup members to be less cooperative. As with ingroup favoritism, it was associated with the differential expectations between outgroup partners and unclassified strangers, but not with differential social preferences. Although it falls outside the scope of our study, it warrants attention because it is rarely observed empirically. Research has consistently shown that ingroup favoritism manifests primarily as preferential treatment of the ingroup, whereas outgroup cues per se seldom trigger unprovoked aggression or non-cooperation (Balliet et al., 2014; Brewer, 1999; Halevy et al., 2008, 2012; Imada & Mifune, 2024; Mummendey & Otten, 1998; Yamagishi & Mifune, 2016; but see Imada et al., 2025). When outgroup derogation does occur, it tends to arise from histories of intergroup conflict (Jing et al., 2017) or as a byproduct of within-group cooperation pressures (Bornstein, 1992; De Dreu et al., 2020). Neither of these conditions was present in our study.

Furthermore, outgroup non-cooperation is theoretically difficult to accommodate. BGR holds that ingroup favoritism is a byproduct of a system of indirect reciprocity operating within group boundaries. As such, it predicts that people treat outgroup members and strangers equivalently as those who fall outside this system (Yamagishi et al., 1999). Outgroup non-cooperation is also difficult to reconcile with other

prevailing theories of ingroup favoritism such as social identity theory or parochial altruism theory. Both theories, albeit for different reasons, predict that people choose not to cooperate with outgroup partners regardless of their expected choice (Choi & Bowles, 2007; Simpson, 2006). This was not the case because outgroup non-cooperation observed in our study was associated precisely with lower levels of expected cooperation from outgroup partners than unclassified strangers. Furthermore, neither theory can explain why people expected outgroup members to be uncooperative in the first place. In sum, existing theories of ingroup favoritism cannot account for the outgroup non-cooperation observed in our study.

What underlies outgroup non-cooperation remains an open question for future research. That said, given its low prior probability, it might have emerged by chance. Although we applied several exclusion criteria to ensure data quality (see OSF), the web-based nature of the experiment precluded full control over the experimental setting. This may have introduced response noise. Future research should therefore employ more tightly controlled environments to probe whether outgroup non-cooperation replicates.

Notes

¹We also examine cooperation with unclassified strangers (i.e., someone whose group identity is undisclosed) as a control condition for exploratory purposes.

²A key difference between AG and SH lies in the payoff for unilateral non-cooperation (Fig. 1). In AG, not cooperating while the partner does cooperate yields the lowest individual outcome, whereas in SH, it secures a moderate payoff. This implies that SH presents a stronger temptation not to cooperate than does AG. As such, risk aversion plays a greater role in SH, which makes expectations of partner cooperation particularly important in decision making. Possibly, using SH instead of AG may have overemphasized the role of expectations in ingroup favoritism.

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Author contribution

Yuta Imagawa: Conceptualization, Data curation, Formal analysis, Visualization, Validation, Project administration, Methodology, Investigation, Writing – original draft, Writing – Reviewing and Editing. **Kuniyuki Nishina:** Conceptualization, Formal analysis, Methodology, Writing – Reviewing and Editing. **Nobuhiro Mifune:** Conceptualization, Formal analysis, Methodology, Writing – Reviewing and Editing. **Asako Miura:** Conceptualization, Data Curation, Formal analysis, Funding Acquisition, Resources, Project administration, Methodology, Writing – Reviewing and Editing.

Ethical statement

The study was approved by the Research Ethics Committee of the Department of Behavioral Studies, Graduate School of Human Sciences, The University of Osaka (approval number: HB025-087)

Data accessibility & program code

Data and program code are available on OSF: <https://osf.io/r97g5/overview>

Supplementary material

Electronic supplementary materials are available on OSF: <https://osf.io/r97g5/overview>

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