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Can Reference to Others' Behaviour Foster a Cooperative Group in Intergroup Conflict Situations?

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This study examined the effect of others' behaviour on ingroup cooperation in intergroup conflict situations. Following cultural group selection theory, reference to other group members' behaviour enhances ingroup cooperation in these situations. The validity of the cultural group selection theory was confirmed using an evolutionary simulation and a vignette experiment. However, no empirical study has tested this theory in the lab to assess ingroup cooperative behaviour. Hence, this study conducted an experiment using a repeated public goods game with intergroup conflicts. In total, 132 Japanese undergraduates (54 references, 48 non-references, and 30 controls) participated in this study. Two three-person groups played a public goods game, and the group with the higher number of cooperators received a portion of the other group's public goods (intergroup conflict). The situation in which participants could refer to the feedback in each game trial was manipulated: reference condition (informed other members' decisions in a previous trial and the win/loss of intergroup conflict), non-reference condition (informed only win/loss), and control condition (no information). The results validated the hypothesis that ingroup cooperation is enhanced in situations where participants can refer to other members' behaviour more than in other situations.

Keywords
cultural group selection, public goods game, ingroup cooperation, intergroup conflict

Introduction

Researchers have argued why humans have highly cooperative nature. Prosociality enables humans to exist in groups, including interdependent interpersonal relationships and cooperative groups, gain essential resources, and achieve important goals. However, interdependent group living also has a free-rider problem, wherein defectors receive more benefits from public goods than cooperators. Some researchers have proposed solutions to this problem, such as reputation (e.g., Panchanathan & Boyd, 2004) or punishment systems (e.g., Yamagishi, 1986). However, these systems appear to function well in fostering cooperation within a group but not between groups.

Free riders are considered a severe and critical problem in group living, especially in intergroup conflict situations (Tooby & Cosmides, 1988). When groups engage in competition, the contribution of group members is directly linked to the group's defeat and serious damage to group members. Free-riding is enormously beneficial for an individual, as intergroup conflicts lead to an increase in their own resources when an ingroup wins. Thus, there is a dilemma between individuals' benefits and ingroup success in intergroup conflict situations. Nevertheless, social psychologists have demonstrated that ingroup cooperation, even while incurring costs, is enhanced in intergroup conflict situations (e.g., Bornstein, 2003; Sherif, 1966; Yokota & Nakanishi, 2017). Sober and Wilson (1998) proposed a multilevel selection theory to explain cooperative behaviour in intergroup conflict situations. Multilevel selection theory argues that the levels of selection pressure are hierarchical; thus, natural selection operates at two different levels: a group level and an individual level. Group-level selection refers to intergroup competition, while individual-level selection refers to intragroup competition (Price, 1970). Whether group members engage in ingroup cooperation depends on the balance of weights at these levels. Relatively strong pressure at the group level favours ingroup cooperation. Multilevel selection theory assumes that severe selection at the group level, such as frequent extinction of a defeated group, strictly limits the effect of intragroup selection on ingroup cooperation; thus, it generates no behavioural variance within a group, which results in the creation of a group in which all members cooperate (a cooperative group) or defect (a defective group). As there are no opportunities for defective groups to win in situations of severe intergroup conflict, only cooperative groups can survive. Therefore, the more intense the intergroup conflict situation becomes, the more the evolution of ingroup cooperation is favoured by selection pressure at a group level.

Cultural group selection theory (e.g., Richerson et al., 2016) emphasises the function of social learning—conformity—in the process, in that selection pressure at a group level reduces behavioural variance within a group that multilevel selection theory assumes. Boyd and Richerson (1985) argued that humans have two processes of information transmission, genetic and cultural. While genetic transmission drives evolution,

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cultural transmission is adaptive under high uncertainty, as it promotes conformity to the majority within a group (Henrich & Boyd, 1998; Kameda & Nakanishi, 2002). The cultural group selection theory states that culturally specific cooperative behaviour can evolve to establish and maintain large societies (Henrich, 2004). If more than half of the group members exhibited cooperation, conformity with the majority would have allowed us to cooperate. As cooperative groups have the capacity to win in intergroup conflict situations, the profit of cooperators in the group overwhelms the losing members. The repetition and accumulation of conformity to the majority transforms defectors into cooperators within a group, and as a result, a cooperative group is created. This logic can work contrarily in groups where fewer than half of the members are defectors. Conformity to defects within a group creates a defective group, which reduces the opportunities to win. These groups eventually become extinct. According to cultural group selection theory, conformity causes polarisation in that the variance reduces within a group and increases between groups.

Yokota and Nakanishi (2012) tested the validity of this theory by using an agent-based evolutionary simulation. In their simulation, 1,024 groups with 10 agents played a public goods game ten times. Subsequently, the number of cooperators was compared between the two randomly selected groups (intergroup conflict) in one generation. The situation in which an agent could refer to other members' behaviours and the intensity of intergroup conflicts were manipulated. At the end of one generation, based on the ranking of each group's collective resources and each individual's profits, the groups and individuals with the least were eliminated (selection pressure). The results showed that as intergroup conflict intensified, ingroup cooperation and conformity were enhanced only in situations where agents could observe others' behaviour in the present trial. Yokota and Nakanishi (2017) also showed that intergroup conflict enhances ingroup cooperation and conformity in a vignette experiment.

The evidence provided by Yokota and Nakanishi (2017) appears to be sufficient to confirm the validity of cultural group selection theory. However, since the incentives and benefits for participants were hypothetical in the simulation and vignette of this study, this theory should be tested in situations in which participants can gain real incentives. Efferson et al. (2008) also tested the validity of cultural group selection theory in a laboratory experiment, and their results supported the theory in a coordination game. However, there is little evidence to test cultural selection theory using a public goods game.

In this study, we aimed to replicate the results of Yokota and Nakanishi (2012) conceptually by conducting a laboratory experiment with a public goods game. The participants were randomly assigned to one of two groups of three individuals each. After participants played a public goods game, the cooperation rates of the groups were compared, and the group with more cooperators received a bonus reward, which was created by confiscating part of the other group's public goods (intergroup conflict). The intensity of intergroup conflict was manipulated by the cost of defeat in intergroup conflict. Feedback on other members' decisions in a previous trial and the result of intergroup conflict were also manipulated.

Based on cultural group selection theory, we hypothesised that as intergroup conflict intensifies, ingroup cooperation would be enhanced only in situations where participants could refer to other members' previous decisions regarding the public goods game (Hypothesis 1). Concerning the total amount of reward, the groups that could refer to other members' behaviour earned more than when they could not (Hypothesis 2). The incentive structure of a public goods game negatively affects the relationship between the number of cooperative decisions in these games and the total reward, as defection is the dominant strategy. However, cultural group selection theory argues that cooperation is rational, as conformity leads to the development of cooperative groups. Thus, the correlation between the amount of cooperation and the total amount of experimental reward should be weaker in intergroup conflict situations where reference to others' behaviour is possible, whereas a negative correlation would be observed in situations with no intergroup conflict and no reference to others' behaviour (Hypothesis 3).

Methods

A total of 132 undergraduates (87 women and 45 men) participated in the experiment. All participants provided signed informed consent as required by the Declaration of Helsinki.

Procedure

Participants were seated in a private booth and signed an informed consent document. Then, participants played the public goods game using a web-based social dilemma programme, *Dokolemma* (Nakanishi et al., 2020) on an iPad Air. In every session, six participants were randomly assigned to "Group A" or "Group B" each group consisted of three participants. The experimenter informed the participants that interactions and communication with other participants were not allowed to maintain anonymity. Participants played 50 public goods games, including those with intergroup conflicts. In every game, the participants received 15 yen and decided whether to contribute funds to their own group. Donated funds were doubled by an experimenter and distributed equally among all the ingroup members.

Manipulation of intergroup conflict

Intergroup conflict was manipulated based on the participants' decisions in the public goods game. Three conditions were included in this experiment: reference, non-reference, and control conditions. The reference and non-reference conditions involved intergroup conflict between an ingroup and outgroup, wherein the number of cooperators was compared between the two groups. The group with fewer cooperators had 20% of the total collected rewards confiscated, which the group with more cooperators received as a bonus. This confiscated bonus was distributed equally among all group members.

Manipulation of reference to others' behaviour

Reference to others' behaviour was manipulated in terms of feedback information related to a previous trial. Under the reference condition, participants could refer to information on all their decisions in a previous trial and

the intergroup conflict outcome. Under the non-reference condition, participants experienced intergroup conflict, but did not have access to feedback from the previous trial. No intergroup conflict or feedback manipulation was performed in the control condition. The number of participants subjected to the reference, non-reference, and control conditions was 54 (18 groups), 48 (16 groups), and 30 (10 groups), respectively.

Results

Figure 1 shows the mean cooperation rate within each group in each trial under the three conditions. To test Hypothesis 1, we performed a binomial generalised linear mixed model (GLMM) using R ver. 4.1.1 (R Core Team, 2021) using the lme4 package (glmer function). In the subsequent analyses, the level of significance was set at 5%. The dependent variable was the participants' decision (contribution to their own group or not), and the independent variables were reference to others' behaviour (dummy variable: reference condition = 1, no-reference and control condition = 0) and intergroup conflict (dummy variable: reference and no-reference condition = 1, control condition = 0). ID (a unique number to identify each participant), group ID (for group identification), and trials (50 trials) were included in the GLMM model as random-effect variables. The results showed that the main effect of reference (b = 1.32, SE = 0.45) was significant, but that of intergroup conflict was not (b = −0.24, SE = 0.52). Thus, ingroup cooperation was more enhanced in the reference condition than in the other conditions.

The linear mixed model (LMM), which included the average of the total amount of experimental reward for each participant, was established for Hypothesis 2 (reference condition: 1,377.22 yen, SD = 172.73; non-reference condition: 1,252.50 yen, SD = 238.80; control condition: 1,219.00 yen, SD = 221.33). To test Hypothesis 2, we performed LMM with the help of the lmerTest package (lmer function) using R ver. 4.1.1 (R Core Team, 2021). Group ID was incorporated into the LMM model as a random-effect variable. The results showed that the main effect of reference (b = 124.72, SE = 53.13) was significant, but that of intergroup conflict was not (b = −33.50, SE = 62.33).

We calculated the correlation coefficients between the frequency of cooperation and total reward amount for each condition. Consistent with Hypothesis 3, a significant negative correlation was exhibited in the control condition (r = −.41), while no significant correlations were found in the reference (r = .15, *ns*.) and non-reference conditions (r = −.24, *ns*.).

Discussion

This study conducted a laboratory experiment to generate empirical evidence to validate cultural group selection theory. We found that ingroup cooperation was remarkably promoted in situations in which participants could refer to other participants' behaviour in a public goods game with intergroup conflict. In intergroup conflict situations, the unavailability of references did not allow participants to cooperate with the ingroup. These results were consistent with the prediction of cultural group selection theory, which found that conformity enhances ingroup cooperation and creates cooperative groups.

One limitation of this experiment was the lack of evidence that the participants imitated the behaviour of other group members. While the participants knew others' behavioural history, no behavioural measurement was conducted to determine whether their decisions conformed to those of the majority or the minority. An alternative explanation is fear-based cooperation, in which other group

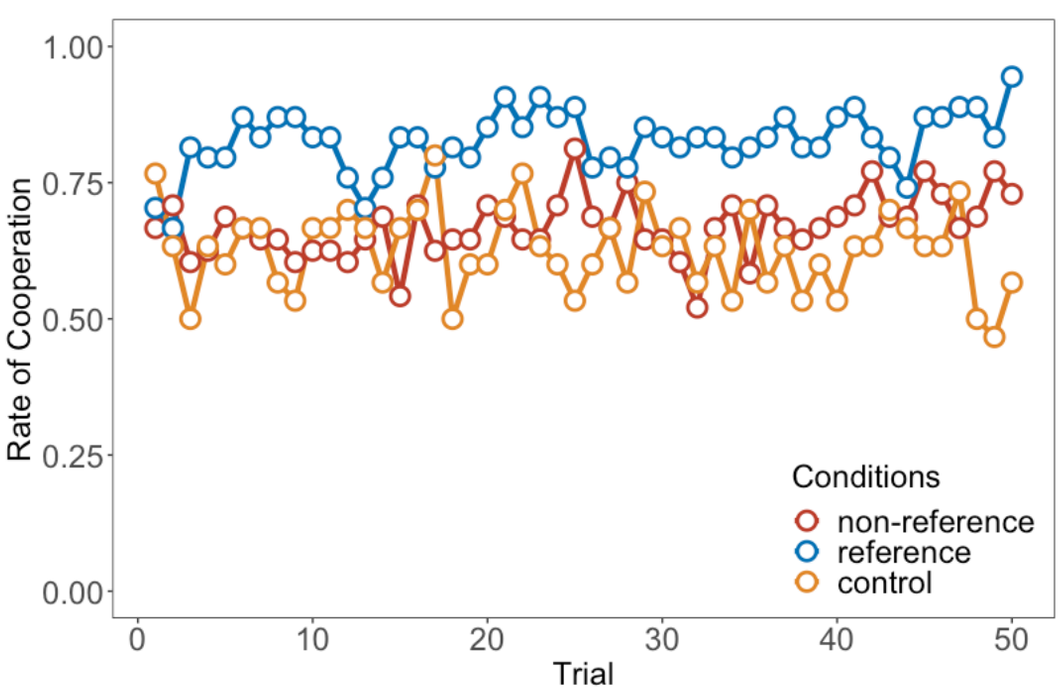

Figure 1. Cooperation rate across three conditions.

members' monitoring of their decisions places pressure on participants to be cooperative. Similarly, participants may refer to the number of outgroup cooperators to decide their own behaviour. Participants could estimate how many cooperators an outgroup possessed in terms of the outcome of an intergroup conflict, even though they did not inform the number of an outgroup's cooperators.

Another limitation was the experimental design of this study. The experiment did not include a condition in which participants could refer to others' behaviour without intergroup conflicts. In cultural group selection theory, intergroup conflict is not a necessary condition to enhance ingroup cooperation (Henrich, 2004), thus, we can expect that ingroup cooperation should be promoted only by conformity.

Moreover, the effect of reciprocity on ingroup cooperation was not controlled for in this study. Romano and Balliet (2017) showed that the power of reciprocity exceeded that of conformity in ingroup cooperation. Our findings should be confirmed using a revised experimental design to detect the pure effect of conformity on ingroup cooperation.

Another limitation was the group size and culture. The ideas of the majority and minority in a three-person group were unstable and vague. Furthermore, as Molleman & Gächter (2018) showed the East Asians referred social information more frequently than Westerners in a public goods game, our findings might be specific to Japanese. Therefore, future studies should conduct experiments with larger groups in Western countries and use behavioural measurements to detect participants' imitation of the majority's behaviour.

Cultural group selection theory requires the assurance of the assumption that the adaptive conformity tendency in the context of information seeking is applicable to public goods games. In other words, the tendency to imitate the majority has an adaptive nature in the context of information seeking, but not necessarily in the context of public goods. Yokota and Nakanishi (2012) partly explored this point, while Nakanishi and Yokota (2016) also reported negative simulation results. However, few studies have examined this issue empirically. Thus, whether the extent to which people refer to the actions of others during information seeking when deciding to cooperate in public goods games remains unclear. It is necessary to determine whether there is consistency between the situations in which multiple games are played.

The findings provide empirical evidence that conformity is adaptive, not only in an information-seeking situation, but also in an intergroup conflict situation involving a different adaptive task. Our findings question the hypothesis of domain specificity (Tooby & Cosmides, 1992). Following a domain-specific approach, natural selection operates to design cognitive mechanisms to solve specific adaptive problems across millions of generations (Cosmides & Tooby, 1994). Conformity to the majority is assumed to be a domain-specific psychological mechanism used to seek information on survival (e.g., Boyd & Richerson, 1985). Based on this hypothesis, it can be stated that conformity cannot function sufficiently to solve other adaptive tasks. However, our findings suggest that conformity can enhance ingroup cooperation in intergroup conflict situations, which is a different type of adaptive problem, wherein the adaptive tasks involved their reproductive success and the defence of the ingroup from outgroup threats (Tooby & Cosmides, 1988). Therefore, the results of this study imply that the function of domain-specific psychological mechanisms is not strictly fixed in adaptive problems. The flexibility of the cognitive mechanisms should be explored in future studies.

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Author contribution

DN developed the study concept and design, YN collected the data, and JI analysed the data. DN and KY wrote the manuscript.

Ethical statement

This study was conducted in accordance with the recommendations of the Ethics Committee of the Faculty of Humanities and Human Science at Hiroshima Shudo University, which also approved the study protocol (No. 2010-1).

Data accessibility & programme code

https://osf.io/5dzhf/

Supplementary material

The web-based social dilemma programme is available at https://ver2.jp/download/web/dokolemma/

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