INGROUP COOPERATION AND OUTGROUP COMPETITION: DO RELATIONSHIPS WITHIN THE INGROUP AFFECT REPRESENTATIONS OF THE OUTGROUP?

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ABSTRACT

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When deciding whether to engage in a conflict, individuals must assess how likely they are to win. Research has shown that when individuals are unlikely to win a fight they see their opponents as physically larger. This project tests whether cues of ingroup cooperativeness are used as an indication that one will succeed in a conflict with an outgroup member. In two experiments, ingroup cooperativeness is manipulated by having subjects play a public goods game with either a cooperative or a selfish ingroup. This manipulation did not affect perceptions of an outgroup member's physical size, regardless of whether the groups were real (Study 1 – university affiliation) or minimal (Study 2 – over- or under-estimators). In Study 1, the manipulation appears to not have been an effective cue to ingroup cooperativeness. In Study 2, the outgroup may not have been sufficiently threatening to elicit assessments of the likelihood of winning a conflict. To test whether ingroup cooperativeness plays a role in decisions to engage in conflict, future studies should address the limitations in the present studies.

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Introduction

In group situations, such as sporting events or political marches, displays of commitment to the ingroup seem to co-occur with displays of contempt towards an outgroup. Research suggests that the former does not necessarily lead to the latter (Brewer, 1999). However, it is possible that in specific circumstances ingroup cooperation could inform the individual's decision to engage in a conflict. By considering an adaptive function of ingroup relationships in intergroup conflicts, this project seeks to test mechanisms by which displays of commitment to the ingroup could lead to aggression towards an outgroup.

Evolution of Conflict Decision-Making

Animals from many different species use physical conflict as a means of attaining and controlling resources. For instance, baboons use aggression as a way of imposing dominance (Hausfater, 1974), male lions brawl amongst themselves over access to female lions (Packer & Pusey, 1982), and chimpanzees raid neighboring chimpanzee groups to expand their territory (Mitani, Watts, & Amsler, 2010). Despite being recognized as more prosocial than many other species, humans also use physical conflicts to access material resources, increase status, and become more desirable to mates (Buss & Shackelford, 1997).

Even though aggression can be beneficial, engaging in it at every opportunity is unlikely to worthwhile in the long run. In addition to risking death, being aggressive may lead to serious physical injury or damage to the individual's reputation. Furthermore, physical conflicts demand effort and time that could be used in more efficient ways, thereby imposing opportunity costs. Thus, the decision to initiate a physical confrontation must consider the likely costs and benefits. This raises the question: how do individuals decide whether engaging in a physical conflict will be worthwhile?

To answer this question, evolutionary biologists have developed models describing which decision-making strategies would be most likely to evolve. Maynard Smith and Parker (1976) show that to determine the likelihood of success in a conflict, individuals must assess their ability to attain and control resources and the value of possessing the resource both relative to the opponent's ability and the value of the resource to the opponent. One's ability to attain and control resources relative to the opponent's ability is referred to as the *resource holding potential* (RHP). For example, personal strength and number of individuals in one's group are indicators of RHP. If one is physically strong and the opponent is physically weak, then one has a higher resource holding potential. Assuming that the resource is equally valuable to both individuals, the individual that bears the highest RHP is more likely to reap benefits from a conflict. However, a resource may not be equally valuable for both individuals – a situation referred to as *payoff asymmetry*. For example, an individual who does not have food stocked for the winter would receive a larger payoff for attaining more food than an individual who had stock for the winter. Even if the one individual had a higher RHP, the benefit of attaining food may be so high for the other individual that it offsets the potential cost of fighting for the latter individual. Thus, according to Maynard and Smith (1976) decision to engage in a conflict over a resource must consider the RHP and payoff asymmetry of both parties.

If this model accurately describes animal decision-making, indicators of RHP and payoff asymmetry should influence animal aggression. This has been observed in many studies on animal behavior. Payoff asymmetry, for example, is a well-documented precursor to conflict – animals deprived of food tend to be more aggressive than those who are not deprived of food (Houston & McNamara, 1999). Size – a reliable indicator of RHP – has also been found to predict aggression (Schuett, 1997). There is also evidence in social species that the number of

individuals in a group may function as an indicator of RHP. For example, Benson-Amram, Heinen, Dryer, and Holekamp (2011) found that hyenas were less likely to approach outgroup hyenas if hyena audio recordings led them to believe they were outnumbered. This sensitivity to the number of individuals in rival groups holds for species with different phylogenetic histories, such as chimpanzees (Wilson, Hauser, & Wrangham, 2001) and lions (McComb, Packer, & Pusey, 1994).

Humans likely faced the selective pressures of intergroup conflict. The fossil record shows evidence of interpersonal violence among early humans (Thorpe, 2003) and other hominids (Berger & Trinkaus, 1995). Furthermore, Bowles (2009) reviewed archeological and ethnographic data and estimated that homicides may have accounted for 14% of deaths on average. These data indicate that aggressive encounters affected human fitness for most, if not all, of our evolutionary history. Therefore, modern humans should have cognitive mechanisms selected to deal with interpersonal conflicts. If this is the case, how do these mechanisms carry out their function?

Cognitive Mechanisms for Human Conflict Decision-Making

Maynard Smith and Parker's (1976) evolutionary model describes the functions that conflict-related decision-making mechanisms should fulfill. Such mechanisms would need to be able to assess resource holding potential (RHP) and payoff asymmetries as well as generate courses of action. With these functions in mind, psychologists can infer which design features these cognitive mechanisms should have.

Neuberg, Kenrick, and Schaller (2011) propose that the adaptive problems faced by humans resulted in a self-protection system that would carry out the decision-making processes required by evolutionary-biological theory. They describe the system in two processes: (1)

detecting the threat of a conflict and (2) outputting cognitive, emotional, and/or behavioral experiences that prepare the individual to make decisions – either escalate or de-escalate conflict. To detect cues of impending conflicts, the first process must be sensitive to situational characteristics correlated with RHP and payoff asymmetries. For example, displays of anger frequently precede physical aggression which, in turn, is associated with larger RHP and payoff asymmetries. Studies reviewed by Neuberg et al. (2011) show that individuals detect anger expressions more rapidly and effectively than other expressions (Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007; Fox, Lester, Russo, Bowles, Pichler, & Dutton, 2000; Schupp et al., 2004), suggesting a mechanism for detecting interpersonal threats.

The system's second process should prepare the individual to follow through with the course of action suggested by the threat-detection process: either conflict escalation (e.g., fighting, displaying threat signals) or conflict de-escalation (e.g., fleeing, surrendering resources). To accomplish this, the second process can affect the individual's behavior, emotions, or cognitions so that the optimal action (according to the first processes' calculations) is most likely to be pursued. An example highlighted by Neuberg et al. (2011) is the emotion of fear. They point out that fear – but not other negative emotions – is felt when encountering members of groups stereotyped as aggressive (Schaller & Neuberg, 2008), and that this emotion specifically encourages fleeing behavior. In sum, the second process seems to act as an output of the system, preparing the individual for action.

Studies by Fessler and colleagues illustrate how the outputs of the self-protection system are not only emotional and behavioral, but can even be perceptual, such as distortions of the perceived size of the aggressor. They argue that perceiving an opponent as smaller – less formidable – motivates the individual to escalate the conflict, and perceiving an opponent as

larger motivates the individual to de-escalate conflict. If such perceptual biases are to be functional, they should operate according to the relevant RHP computations. This is consistent with the evolutionary model – since formidability is a reliable indicator of RHP, a bias in its perception can emphasize differences in RHP and lead to more adaptive responses. Some of their studies show how cues pertaining to RHP of the individual and the opponent affect perceptions of the opponent's size.

Throughout their studies, Fessler et al. find that cues of RHP and payoff asymmetries affect perceptions of physical formidability. Fessler and Holbrook (2013a), for example, had participants rate the size of an outgroup male while participants were either bound to their seats or not bound to their seats. Because constricting movement reduces RHP, the self-protection system should induce the individual to de-escalate conflict. Fessler and Holbrook's (2013a) results support this rationale as participants who were bound to their chairs perceived the outgroup male as physically larger.

In addition to detecting indices of RHP, the self-protection system must also assess payoff imbalances. If the opponent in a confrontation has more to gain in escalating a conflict, they may be willing to incur larger costs than one is prepared to bear. Fessler, Holbrook, Pollack, and Hahn-Holbrook (2014) argue that parents would often have found themselves in such a situation. For those who are rearing their children, sustaining wounds in battle would mean being unable to provide resources for their offspring as well as for themselves – a large inclusive fitness cost. Fessler et al. (2014) found that parents rated a threatening male as physically larger than did non-parents, indicating that the possibility of bearing larger costs induces the system to prepare for conflict de-escalation.

Insofar as cues indicate RHP or payoff asymmetries, they should affect outputs of the self-protection system. For instance, Fessler and colleagues also found that lacking upper body strength (Fessler, Holbrook, & Gervais, 2014) or encountering impulsive opponents (Fessler, Tiokin, Holbrook, Gervais, & Snyder, 2014) make the individual perceive the opponent as more formidable. Another source of information regarding RHP and payoffs are the people in one's surroundings.

The Role of Groups in Conflict Decision-Making

Much like when confronting a single aggressor, individuals in a group conflict must base their decisions on an assessment of their RHP and payoff asymmetry of escalating the conflict (Tooby & Cosmides, 1988). The group affords unique indicators of these elements and can therefore sway individual decision-making by engaging the self-protection system.

Fessler and colleagues conducted studies demonstrating group-level influences on the system's processes. A notable characteristic that should inform the individual's RHP is the relative sizes of the groups. Being in the group with more members signals a greater likelihood of success and should produce outputs that motivate conflict. Fessler and Holbrook (2013b) demonstrated this in a study in which men who were accompanied by friends (vs. alone) rated a threatening outgroup male as less formidable.

However, number of group members is not the only arbiter of intergroup conflicts. The degree to which group members coordinate effectively is also important to the likelihood of success. Groups that are able to time their actions so as to maximize damage while minimizing costs (for example, by coordinating to target essential outgroup members) are more likely to succeed in a conflict. This can be seen in occasions such as historic military confrontations as

well as current sporting events. Therefore, individuals who can base their decisions on indicators of efficient coordination will more effectively distinguish wasteful from fruitful conflicts.

When an individual decides to engage in an intergroup conflict, they are implicitly deciding to share the potential costs and benefits that may come from the conflict with other group members. Because relationships within the group vary in how cooperative they are (e.g., some individuals may withhold resources, restrict mating, abuse their hierarchical standing, or not reciprocate favors), it can be disadvantageous to an individual that all group members receive their share of the profit. Furthermore, uncooperative relationships in the group add uncertainty as to whether all members will split attained resources equally, will carry out their coordinated efforts as agreed upon, or are withholding information as to whether all will benefit equally from a conflict. Consequently, members of an uncooperative group[1] risk failure in coordinating actions and should have a lower RHP than those of a cooperative group. Before inducing the individual to participate or not in the conflict, the self-protection system should then be sensitive to how cooperative other group members are.

Fessler and Holbrook (2014) give initial evidence for this by showing that individuals who walked in synchrony (vs. in their own pace) perceived an antagonist man to be less formidable. They argue that synchronizing actions with others indicates that they are willing and able to coordinate, which increases the potential for winning conflicts. However, to my knowledge, no study has directly manipulated the cooperative relationships among group members in addition to measuring how outgroup threats are seen.

[1] The term *cooperative* will be used to refer to the likelihood of coordinating given the understanding that coordination is a type of cooperation (Thomas, DeScioli, Haque, & Pinker, 2014). Moreover, the overall cooperativeness of an individual may function as a cue of the likelihood of coordinating with other ingroup members.

The Present Research

This project includes two studies aimed to test whether cooperative relationships within the group affect how outgroup males are represented. To manipulate ingroup relationships, participants played a public goods game (Marwell & Aimes, 1979) against ingroup members who, unbeknownst to the participants, were computerized players that were either cooperative or selfish (e.g., Park & Stone, 2010). In this economic game, participants could contribute amounts of a personal endowment to a private or a public account. At the end of each round, they received the amount they had invested in their private account in addition to a subset of 300% of what all players had invested in the public account. The computerized players either contributed more than 90% (cooperative) or less than 10% (selfish) of their endowments to the public account.

The public goods game mimics some features of coordination problems. For example, if all participants contribute to the public account (i.e., coordinate), they receive the largest possible payoff. Alternatively, if there are selfish group members, investment in the public account may lead to losses. Thus, the public goods game is similar to a coordination problem in conflict situations. As compared to other economic games (e.g., prisoners dilemma), this may render it more informative of whether group members are likely to coordinate in an actual conflict.

While the public goods game was used to manipulate the cue fed into the self-protection system, the two studies used different strategies to assess the system's output. In the first study, Michigan State University students reported how formidable they believed a threatening student of a rival university (University of Michigan) was on the measures used by Fessler and colleagues in their research program. Using real groups in the manipulation of ingroup relationships and measurement of perceived outgroup formidability has the advantage of providing a rich context (e.g., experience based on past interactions, strong identification).

The second study addresses potential limitations and attempts to extend the conclusions of the first study. To begin with, minimal groups were used instead of university affiliation (Tajfel, Billing, Bundy, & Flament, 1971; Ratner, Dotsch, Wigboldus, & van Knippenberg, 2014). This tests whether the effect generalizes to other groups which lack a rich context to ground participants' judgments. Second, participants completed the study in group sessions and were led to believe that they would compete with the outgroup participants in the room on a series of strength tasks. This confers a more consequential situation where participants may suffer or enjoy the results of a competition. Finally, a reverse correlation image classification procedure (RCP; described in more detail below) was used to gauge participants' mental representations[2] of the outgroup.

[2] I remain agnostic as to whether the measures used by Fessler et al. assess perception or representations. Fessler et al. (2013) concede that their measure does not guarantee that perception is being assessed purely (also, see Firestone & Scholl, 2015, for a critique of measures of perception). Furthermore, distorted representations would likely have the same function as distorted perceptions (Fessler & Holbrook, 2013).

Study 1

Method

Participants. 355 Michigan State University undergraduates participated in the experiment (61% female; 67% white, 13% Asian, 11% black). The sample size varies for each analysis depending on how many students completed the measure. The total sample size grants the study approximately 80% power to detect an effect of $d = 0.30$ (two-sided independent-samples *t*-test; alpha = .05).

Materials and Procedure. Subjects were recruited to participate in a study about the university community and person perception in which they would interact with other MSU students and provide their opinions on students' characteristics. They completed the procedure in a computer lab in sessions of three to eight participants.

To manipulate the participants' relationship with the ingroup, they played a rigged public-goods game with computerized players purported to be the other MSU students in the lab. Participants began each of four rounds with 50 tickets. In each round, participants invested their tickets in a private or a public account. The total number of tickets invested in the public account was then tripled and redistributed equally to all participants. Therefore, at the end of the round they received what they invested in their private account and their share of what was redistributed from the public account. The manipulation of ingroup cooperativeness was how much the computerized players invested in the public account. In the cooperative-ingroup condition, computerized players consistently invested most (about 90%) of their tickets in the public account. In the selfish-ingroup condition, they invested very little (about 10%) in the public account. At the end of the game, the average number of tickets each participant earned

throughout the rounds would be entered in a raffle for a 50 dollar gift-card to a local supermarket.

After seeing the game's results, participants read a description of an encounter with a male undergraduate student from the University of Michigan (UM), which is known to rival MSU in athletic competitions. The description instructed participants to imagine they were leaving a football game MSU played against UM. They pictured themselves walking down a poorly lit street when a male in his late twenties wearing a UM football jersey came toward them angrily cursing MSU for having won the game. They were then asked to estimate the height, size, and muscularity of the man on the items used by Fessler and Holbrook (2013). They also indicated how likely on a 9-point scale (1 = *not at all likely*; 9 = *extremely likely*) they would have been to feel fear, swear at the man, physically aggress the man, cross the street, turn around and walk away, and tell the man to leave them alone.

For exploratory purposes, participants then completed two seven-block Implicit Association Tests (IAT; Greenwald, McGhee, & Schwartz, 1998; McDonald, Asher, Kerr, & Navarrete, 2011). First, they completed an evaluative IAT with *MSU* and *UM* as the target categories, and *positive* and *negative* as the attribute categories. Then, they completed a stereotype IAT with the same target categories, but *physical* and *mental* as the attribute categories. Pictures of White males in MSU and UM t-shirts were used as the target category stimuli, while words were used as the attribute category stimuli (Table 1). The *D* score for was used as a measure of implicit attitudes and stereotypes (Greenwald, Nosek, & Banaji, 2003).

Next, they completed two versions of a 10-item measure of group identification ($\alpha = .91$; e.g., "I feel a bond with [group]"; 1 = *strongly disagree,* 7 = *strongly agree*; Leach et al., 2008). In the first version, the items referred to MSU as the ingroup ($\alpha = .91$); in the second, they

referred to UM as the ingroup (α = .85). As a manipulation check, participants indicated on a 7-point scale (1 = *not at all*; 7 = *extremely*) how supportive, trustworthy, helpful, and cooperative they thought MSU students were (α = .92). After answering standard demographic questions (in addition to questions about their weight, height, physical strength), participants completed a funneled debriefing to determine whether they were aware of the study's goal or suspected the players of the public goods game to be computerized.

Results and Discussion

To assess whether the manipulation of MSU student cooperativeness was effective, an independent-samples *t*-test was performed comparing participants in the cooperative and selfish conditions on the average ratings of student cooperativeness. Participants who played the public goods game with cooperative MSU students (M = 5.31, SD = 0.96) did not think MSU students were significantly more cooperative than did participants who played with selfish MSU students (M = 5.22, SD = 1.05), $t(333) = 0.81$, $p = .421$, $d = 0.08$ 95% CI [-0.12, 0.29]. Even though the manipulation did not affect self-reports of ingroup cooperativeness, the main analyses were done in case *self-reports* of ingroup cooperativeness are not the relevant variable to conflict decision-making. For example, if the self-reports are too vulnerable to social desirability effects or if implicit knowledge of ingroup cooperativeness is more important than explicit knowledge in swaying perceptions of outgroup formidability.

While there should be a main effect of ingroup cooperativeness on perceptions of outgroup formidability, a more powerful test of the hypothesis would also consider identification with the ingroup. If one does not identify with the ingroup, then ingroup cooperativeness would have a much smaller effect on perceptions of outgroup formidability. Thus, the effect of ingroup cooperativeness on outgroup formidability might be moderated by identification with the

ingroup. To test this, three exploratory multiple regressions were performed on the perceived size, muscularity, and height of the UM man (Fessler & Holbrook, 2014). The predictors in the regression were the participants' conditions (effects-coded: 1 = cooperative, -1 = selfish), the participants' identification with MSU, and the interaction between the former and the latter. After excluding two outliers, the regression on perceived size of the UM assailant revealed no main effect of the ingroup cooperativeness manipulation (b = 0.34, SE = 0.31, p = .267), no main effect of identification with MSU (b = 0.07, SE = 0.06, p = .233), and no interaction effect between both predictors (b = -0.05, SE = 0.06, p = .394).[3] The results were the same for perceived muscularity (manipulation: b = 0.19, SE = 0.33, p = .564; identification: b = 0.09, SE = 0.06, p = .127; interaction: b = -0.04, SE = 0.06, p = .501) and height (manipulation: b = 0.08, SE = 0.83, p = .921; identification: b = 0.15, SE = 0.16, p = .323; interaction: b = 0.01, SE = 0.16, p = .967). To test whether ingroup cooperativeness is more relevant to individuals of a specific sex, race, or ethnicity, the effects of the manipulation on overall perception of outgroup formidability for each sex, race, or ethnicity within the sample was assessed using independent-samples t-tests. These tests also revealed no effect of ingroup cooperativeness on perceptions of outgroup formidability (Table 2). Thus, ingroup cooperativeness does not seem to affect perceptions of outgroup formidability, regardless of identification with the ingroup, sex, race, or ethnicity.

To explore whether there was an effect on automatic evaluations of the outgroup instead of self-reports, the IATs' D scores were compared between conditions using independent-samples t-tests. These analyses suggest that the manipulation of ingroup cooperativeness does

[3] When the outliers were included, there were significant main effects of the manipulation (participants in the cooperative ingroup condition found the UM assailant to be larger than did those in the self ingroup condition, p = .042) and identification (those who identified more with MSU found the UM male to be larger, p = .037), and a marginally significant interaction effect (identification had a stronger positive association with perceived size for those in the selfish ingroup condition, p = .083). Because these effects depended on the inclusion of only two cases out of 335, I chose to focus on the effects when the outliers were removed.

not affect participants' implicit stereotypes of UM student formidability (cooperative ingroup: *M* = 0.08, *SD* = 0.30; selfish ingroup: *M* = 0.07, *SD* = 0.31), *t*(309) = 0.37, *p* = .714, *d* = 0.04 95% CI [-0.16, 0.24], or their implicit attitudes toward UM students (cooperative ingroup: *M* = 0.39, *SD* = 0.31; selfish ingroup: *M* = 0.40, *SD* = 0.33), *t*(309) = 0.31, *p* = .755, *d* = 0.03 95% CI [-0.17, 0.24]. The same results were found for individuals of all sexes, races, and ethnicities within the sample (with the exception of Asian participants; see Table 3).

While ingroup cooperativeness does not seem to greatly affect implicit stereotypes or attitudes of outgroups, it could be the case that implicit attitudes are only affected by ingroup cooperativeness when there are implicit stereotypes of the outgroup as formidable. Therefore, a regression was performed with the strength IAT, manipulation, and their interaction predicting implicit attitudes. There was a main effect of the strength IAT (those who had a stereotype of UM students as stronger tended to have more negative attitudes toward UM[4]; *b* = 0.16, *SE* = 0.06, *p* = .005), but no main effect of the manipulation (*b* = -0.01, *SE* = 0.02, *p* = .739) or an interaction effect (*b* = -0.01, *SE* = 0.06, *p* = .907).

This study offers a test of the hypothesis insofar as the manipulation check did not provide useful information. For example, if implicit knowledge of ingroup cooperativeness is more relevant than the explicit knowledge assessed by self-report or if the measure was affected by extraneous variables such as social desirability. If this was the case and the manipulation was in fact successful at manipulating the relevant aspects of perceived ingroup cooperativeness, it would seem like ingroup cooperativeness does not affect explicit or implicit perceptions of outgroup formidability.

[4] Due to the relative nature of the *D* score, these results could also be interpreted as an association between seeing MSU students as *mental* (i.e., intellectual) and having positive attitudes toward them.

A more likely explanation for the null effects in this study is that the participants may not have found the short interaction in a computerized game to be diagnostic of their ingroup's cooperativeness. Some of the participants' comments at the end of the sessions suggest that they may have justified ingroup selfishness as a misunderstanding of the game's instructions (by themselves or their ingroup), or as coming from individuals who were not representative of their ingroup. The short interaction provided by the public goods game may not be well suited to change people's opinions of ingroup members with which they interact frequently.

Another limitation of Study 1 is the conflict scenario. The cognitive mechanisms used to deal with intergroup conflict were selected in situations of imminent conflict. Because the conflict scenario they were exposed to was hypothetical, it may be the case that the relevant cognitive mechanisms were not activated during the study.

Study 2 addresses the limitations of Study 1. Instead of using groups with which participants have had frequent interactions, Study 2 will test the effect in a minimal-groups context, which should be more amenable to the manipulation. Furthermore, testing the effect in a minimal-groups context will indicate whether mere membership in a group is sufficient to bring about the effect. The participants will be led to believe that the groups in the study will engage in a physical confrontation. This should activate the relevant cognitive mechanisms to a greater extent than when reading about a hypothetical scenario. Finally, in addition to Fessler et al.'s self-report measures of formidability, Study 2 will use a reverse correlation procedure (RCP) to assess representations of a typical outgroup member's face. The RCP is a data-driven, inconspicuous measure that produces visual renderings of faces that approximate peoples' actual representations. Thus, Study 2 will arguably be a stronger test of the effect of ingroup cooperativeness on perceptions of outgroup formidability.

Study 2

Influencing people to think they will lose a confrontation affects how they represent their opponents (Fessler et al., 2013). Because the RCP is data-driven, it offers a way of rendering representations of outgroup males that are arguably more similar to individuals' actual representations. Furthermore, the procedure is less vulnerable to biases of self-reports (e.g., expectancy effects) since the measured traits are not mentioned to the participants generating the classification images. Thus, the RCP may be an especially powerful method of detecting differences in representations of outgroups members.

The procedure works by having participants judge whether blurry images of objects belong to the category. To assess representations of the category *dominant male*, for example, blurry face stimuli are generated by superimposing random visual noise on a base face with a neutral expression (Dotsch & Todorov, 2012). The researchers then have participants judge which of two face stimuli appearing side-by-side belong to a dominant male. Finally, the faces participants deemed as belonging to a dominant man are superimposed to generate a classification image. An independent sample can then rate the classification image on the traits (e.g., formidability, trustworthiness) of the researchers' choosing.

To implement the RCP, this study was comprised of two parts. In the first part, participants were assigned to minimal groups, completed the ingroup relationship manipulation, the formidability scales, as well as the RCP, which had participants select face stimuli that appeared to belong to outgroup males. The stimuli selected by the participants were used to generate, for each condition, an average face of all faces participants considered as that of an outgroup member (i.e., classification image). In part two, a different sample of participants rated the classification images on traits related to formidability.

Method

Part 1: Generating the classification images.

Participants. 272 MSU undergraduates were recruited from the subject pool (65% female; 62% white, 18% Asian, 8% black). The sample size varies for each analysis depending on how many students completed the measure. The total sample size grants the study approximately 80% power to detect an effect of $d = 0.35$ (two-sided independent-samples *t*-test; alpha = .05).

Materials and procedure. Participants completed the study in a room with eight cubicles containing computers. They were told that the study was about perception and strength, and that they would complete perception tasks and a strength competition. They were instructed not to communicate with each other in any way before the strength competition.

First, they completed the minimal group assignment used by Ratner et al. (2014). This consisted of a task in which participants estimated the number of dots that appeared on their computer screens. They were told that people systematically vary in numerical estimation style and that we wanted to see how they tended to perceive object quantities: if they either over- or under-estimate the number of objects. After finishing the task, they received randomized feedback indicating that they were under- or over-estimators. All participants were unaware of the estimation styles of other participants. They were also told that the over- and under-estimators would later compete in a series of strength tasks.

To manipulate the cooperativeness of ingroup members, participants took part in the public goods game used in Study 1. They played against computerized players purported to be the ingroup members in the room and that contributed either more than 90% or less than 10% of

their endowments to the public account. The participants did not know the actual investment decisions of other participants, only of the computerized players.

Next, participants estimated the size and muscularity of the typical outgroup member using Fessler and Holbrook's (2013) rating scales. After estimating an outgroup member's formidability, they completed the reverse correlation procedure (RCP). Participants were told that research indicates that people can tell whether other individuals are over- and under-estimators even in poor visual conditions. Furthermore, they were told that in the task they would look at images of past participants who completed the numerical estimation style task and indicate who they believed were under- or over-estimators. The RCP consisted of 300 trials in which participants saw two blurry faces. In each trial, they indicated which of the two faces they believed belonged to an individual whose numerical estimation style is the opposite of theirs – i.e., an outgroup member. As a manipulation check, they rated their ingroup's supportiveness, trustworthiness, and cooperativeness on a 7-point scale (1 = *not at all*; 7 = *extremely)*. Finally, they answered the demographic and debriefing questions used in Study 1.

Part 2: Rating the classification images. A separate sample of 128 students evaluated the condition-level classification images in an online survey. They rated the faces on 9-point scales (1 = *not at all*; 9 = *extremely*) of strength, dominance, and aggressiveness, as well as the size and muscularity scales from Fessler and Holbrook (2013).

Results and Discussion

An independent-samples *t*-test revealed that those in the cooperative ingroup condition (M = 4.99, SD = 1.09) judged their ingroup to be significantly more cooperative than those in the selfish ingroup condition (M = 3.56, SD = 1.51), $t(266) = 8.73$, $p < .001$, d = 1.06 95% CI [0.80, 1.31]. Thus, it appears that participants' opinions of the minimal groups were substantially

amenable to the short interactions of the public goods game. In the following sections, results will be reported for self-reports of outgroup formidability and the ratings of faces generated with the RCP.

Part 1: Self-reported formidability of the outgroup. Despite the effective manipulation, there was no difference between those with a cooperative ingroup (size: $M = 3.61$, $SD = 1.42$; muscularity: $M = 3.14$, $SD = 1.58$) and those with a selfish ingroup (size: $M = 3.78$, $SD = 1.28$; muscularity: $M = 3.21$, $SD = 1.47$) in perceived size ($t(267) = 1.01$, $p = .313$, $d = 0.12$ 95% CI [-0.12, 0.36]), or muscularity of the outgroup ($t(267) = 0.41$, $p = .681$, $d = 0.05$ 95% CI [-0.19, 0.29]). Nevertheless, there was a difference in perceived height ($t(262) = 2.17$, $p = .031$, $d = 0.26$ 95% CI [0.02, 0.50]) of the outgroup between those in the cooperative ingroup condition (height: $M = 70.07$, $SD = 3.49$) and those in the selfish ingroup condition (height: $M = 71.31$, $SD = 5.40$). These results give some indication that ingroup cooperativeness affects perceived outgroup formidability. However, due to the multiple comparisons that were performed as well as the weak effect only on perceived height, it is unclear whether this is more than just noise. The effect of the manipulation on overall perceived outgroup formidability was tested separately for individuals of different sexes and races/ethnicities. These analyses revealed that ingroup cooperativeness is not more relevant for specific groups of individuals than others (Table 4).

Part 2: Representations of the outgroup generated with the RCP. While self-reports of perceived formidability may not have been substantially influenced by the manipulation, the representations generated with the RCP may be more sensitive to the interactions with ingroup members. Thus, another test of the hypothesis can be done by comparing formidability ratings of the RCP's visual renderings from both conditions (Figure 1). A paired-samples *t*-test reveals that the outgroup face images were not different on perceived size ($t(126) = 0.85$, $p = .397$),

muscularity ($t(126) = 0.90$, $p = .371$), height ($t(125) = 0.39$, $p = .700$), or aggression ($t(126) = 1.85$, $p = .066$) for those in the cooperative (size: $M = 2.43$, $SD = 1.06$; muscularity: $M = 3.83$, $SD = 0.73$; height: $M = 70.15$, $SD = 2.12$; aggression: $M = 3.82$, $SD = 0.97$) and selfish ingroup conditions (size: $M = 2.33$, $SD = 1.00$; muscularity: $M = 3.76$, $SD = 0.96$; height: $M = 70.31$, $SD = 2.88$; aggression: $M = 3.64$, $SD = 1.07$).

The results seem to suggest that even though the manipulation was effective, it did not influence perceptions of outgroup formidability. However, it may be the case the perceptions of ingroup cooperativeness were associated with perceptions of ingroup strength in such a way that the effect of cooperativeness on outgroup formidability was inhibited. To understand this, consider what would be inferred about a person's strength if they were cooperative or selfish. Because nurturing interpersonal relationships is a strategy to access more resources, it may be more likely to be used by those who have trouble accessing resources otherwise – i.e., less formidable individuals. Thus, if ingroup members are cooperative, one may infer that they are also physically weak. This would have opposing effects on one's RHP – having cooperative ingroup members increases RHP, but weak ingroup members decrease RHP – and perceptions of outgroup formidability would remain unaffected. If this in fact is the case, those in the cooperative ingroup condition should have rated their ingroup as weaker than did those in the selfish ingroup condition. To test for this effect, an independent-samples *t*-test was performed on ratings of ingroup formidability. Contrary to the rationale outlined, those in the cooperative ingroup condition ($M = 4.74$, $SD = 1.11$) thought their ingroup was stronger than did those in the selfish ingroup condition ($M = 4.08$, $SD = 1.46$), $t(267) = 4.10$, $p < .001$, $d = 0.50$ 95% CI [0.26, 0.74]. Thus, despite the compounding effects that having ingroup members that are both cooperative and strong should have on perceived outgroup formidability, the manipulation did

not affect how outgroup members were seen. In the next section, limitations of the present studies, directions for future research, and the theory outlined in the introduction will be discussed.

General Discussion

According to previous work, perceptions of outgroup formidability should be influenced by how likely one is to reap benefits from a confrontation. In theory, this likelihood would be greater if ingroup members signaled interest in coordination. Two experiments aimed to test the hypothesis that having cooperative ingroup members leads to perceiving outgroup members as less formidable. Both experiments did not confirm this hypothesis – perceptions of outgroup formidability were independent from ingroup cooperativeness. The reasons for these null results may be different for both studies.

The main limitation in Study 1 appears to be the manipulation of ingroup cooperativeness. The ingroup in this study was the participants' university, and because interactions with ingroup members are so frequent, participants' views of their ingroup's cooperativeness may not have been swayed by short interactions in the public goods game. Furthermore, the conditions of the game – i.e., no face-to-face contact with ingroup members – may have prevented participants from using the interactions as diagnostic information on their ingroup's cooperativeness.

To address these limitations of the first study, future studies could make the manipulation of ingroup cooperativeness seem more diagnostic of their ingroup dispositions. This could be achieved in a few ways. Some of them are: (1) increasing the clarity of the public good game's instructions, (2) adding more interactive features in the game, such as the option to comment on other players' behaviors, and (3) emphasizing that the players were selected at random from the ingroup. These alterations may prevent participants from justifying the selfishness of their ingroup as a misunderstanding of the game's instructions or as the result of playing with individuals who are not representative of their groups.

While using real groups has the advantage of increasing external validity, testing the effect in a minimal-groups context provides useful information on the necessary conditions for the effect to emerge. The ability of Study 2 to make such contributions may have been compromised by its limitations. Perhaps the main issue with study concerns how much the design provoked a threat of a physical conflict. Despite being told that a physical competition between the groups would take place, participants may have been unmotivated to do well in the competition leading them to not feel threatened. In the absence of feelings of threat, the cognitive mechanisms involved in calculating the odds of winning a conflict might not have been activated. To address this, a future study could increase the stakes of the competition either by introducing prizes for winning or costs for losing. This might have the interactive effect of increasing participants' motivation to do well and their expectations of how motivated the outgroup is. Under these conditions, the participants may take their ingroup's cooperativeness into consideration when judging the formidability of the outgroup.

While addressing the limitations discussed might be enough to bring about the effect, it may be the case that there is no effect to be detected, at least under the conditions that could be tested in a laboratory. A potential reason for this is that ingroup cooperativeness is probably not the main variable the decision-making mechanism has to consider when calculating the odds of winning an intergroup conflict. Number and strength of ingroup members, weapons or other material means available to harm the outgroup, and a suitable terrain may take precedence when considering the likelihood of winning a conflict. That is not to say that ingroup cooperativeness does not play a role. Ability and willingness to strategize and coordinate may be signaled through cooperative behaviors. However, those signals may play a more important role in conditions under which other factors are less relevant. For example, in large-scale post-

agriculture-era battles when the number of individuals was too large to compare precisely, the weapons were similar between groups, and the battle happened in a terrain previously scouted, then signals of coordination and commitment to the ingroup (e.g., chants of war) may have played an important role in individual decisions to keep fighting. Nevertheless, to determine the role of ingroup cooperation in conflict situations, experiments such as the present ones must be run, especially if possibilities are to be ruled out.

Conclusion

Despite an enthusiastic (and perhaps rightly so) endorsement of falsificationism in psychological science, theories about human thought are not easily discarded. As noted by post-Popperian philosophers, along with substantive theories come auxiliary hypotheses about the workings of measurements and the adequacy of procedures in establishing the conditions required by the theory for it to be relevant. If even one or two of these auxiliary hypotheses are incorrect, then the attempt at testing the theory is uninformative as to whether the theory or the auxiliary hypotheses (or both) are incorrect. When researching consequential topics such as intergroup conflict, developing strong tests of the theories is crucial. And developing these tests requires an iterative process of exploratory work determining which measures and procedures are most adequate. While certainties are never achieved, and testing auxiliary hypotheses runs into similar problems as testing the substantive theories, continuing to gather data on important questions about the human mind is preferable to preemptively giving up. Hopefully, future studies that better address the auxiliary hypotheses of the present studies will lend stronger tests of the role of ingroup cooperativeness on how we see outgroup members.

APPENDIX

Table 1:

Word stimuli used in the attribute categories of the IATs

Positive	Negative	Physical	Mental
Joy	*Agony*	*Athletic*	*Math*
Love	*Terrible*	*Strong*	*Brainy*
Peace	*Horrible*	*Basketball*	*Aptitude*
Wonderful	*Nasty*	*Run*	*Library*
Pleasure	*Evil*	*Agile*	*Scientist*
Glorious	*Awful*	*Jump*	*Idea*
Laughter	*Failure*	*Dance*	*Learn*
Happy	*War*	*Rhythm*	*Thinking*
		Muscular	*Bookish*
		Football	*Reading*

Table 2:

Effect of the manipulation on perceived outgroup formidability (mean on Fessler's scales) for male, female, white, black, and Asian participants in Study 1

	Cooperative ingroup *M*(*SD*)	Selfish ingroup *M*(*SD*)	*t*(*df*)	*p*	*d* [95 CI]
Male	-0.12(0.81)	-0.27(0.83)	1.04(128)	.299	0.16 [-0.14, 0.46]
Female	0.13(0.80)	0.12(0.78)	0.10(202)	.919	0.01 [-0.24, 0.26]
White	0.10(0.71)	0.06(0.80)	0.39(224)	.694	0.05 [-0.19, 0.29]
Black	-0.05(1.01)	-0.25(0.76)	0.67(35)	.506	0.16 [-0.30, 0.61]
Asian	0.02(1.06)	-0.08(0.94)	0.34(40)	.734	0.08 [-0.36, 0.51]

Table 3:

Effect of the manipulation on IAT D scores for male, female, white, black, and Asian participants in Study 1

		Cooperative ingroup *M*(*SD*)	Selfish ingroup *M*(*SD*)	*t*(*df*)	*p*	*d* [95 CI]
Male	Attitude IAT	0.38(0.32)	0.38(0.34)	0.03(117)	.977	0.004 [-0.30, 0.31]
	Strength IAT	0.01(0.33)	-0.004(0.32)	0.31(117)	.760	0.05 [-0.25, 0.35]
Female	Attitude IAT	0.39(0.30)	0.41(0.33)	-0.44(188)	.663	-0.06 [-0.31, 0.20]
	Strength IAT	0.13(0.28)	0.12(0.31)	0.29(188)	.772	0.04 [-0.21, 0.29]
White	Attitude IAT	0.43(0.27)	0.42(0.33)	0.36(209)	.726	0.04 [-0.20, 0.29]
	Strength IAT	0.10(0.30)	0.09(0.32)	0.05(209)	.961	0.01 [-0.24, 0.25]
Black	Attitude IAT	0.33(0.34)	0.42(0.36)	-0.75(31)	.458	-0.17 [-0.63, 0.28]
	Strength IAT	0.09(0.33)	-0.03(0.37)	0.95(31)	.351	0.22 [-0.24, 0.67]
Asian	Attitude IAT	0.13(0.32)	0.37(0.30)	-2.33(35)	.026	-0.52 [-0.96, -0.07]
	Strength IAT	0.01(0.30)	0.06(0.31)	-0.43(35)	.672	-0.10 [-0.53, 0.34]

Note. Larger means indicate stronger associations between U of M and strength and U of M and negativity.

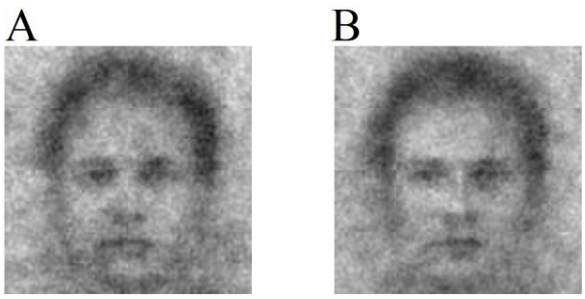
Table 4:

Effect of the manipulation on perceived outgroup formidability (mean on Fessler's scales) for male, female, white, black, and Asian participants in Study 2

	Cooperative Ingroup *M*(*SD*)	Selfish Ingroup *M*(*SD*)	*t*(*df*)	*p*	*d* [95 CI]
Male	-0.23(0.85)	0.06(0.93)	-1.55(89)	.125	-0.31 [-0.71, 0.09]
Female	-0.003(0.75)	0.06(0.71)	-0.56(169)	.578	-0.08 [-0.38, 0.21]
White	-0.15(0.74)	0.02(0.82)	-1.39(163)	.167	-0.21 [-0.51, 0.09]
Black	0.03(0.94)	0.31(0.78)	-0.77(20)	.450	-0.29 [-1.02, 0.45]
Asian	0.18(0.80)	0.02(0.74)	0.64(42)	.528	0.18 [-0.37, 0.72]

Figure 1:

Classification images of an outgroup member's face generated with the reverse correlation procedure for cooperative (A) and selfish ingroup (B) conditions



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