

“WE” ARE REMEDY FOR SOLIDARITY: GROUP ENTITATIVITY ENHANCES GROUP IDENTIFICATION AND COOPERATION IN UNFAVORABLE SITUATIONS

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Adversity faced by the in-group may decrease group identification and cooperation. However, it is unknown whether group entitativity can mitigate the adverse effects on group identification and cooperation. To address this research gap, we conducted three studies in which we manipulated group entitativity (low vs. high) and task situation (unfavorable vs. favorable). Study 1 ($N = 157$) and Study 2 ($N = 154$) showed that group entitativity attenuated the negative effect of unfavorable situations on group identification. Heightened group entitativity satisfied the need to belong among members in unfavorable situations, which correlated with a partial increase in group identification. Similarly, Study 3 ($N = 192$) found that group entitativity mitigated the previously observed reduced cooperation among members in unfavorable situations, and group identification mediated the relationship between task situation and cooperative behavior. These findings provide valuable insights for groups to implement effective interventions aimed at bolstering solidarity.

Key words: group entitativity, adversity, need to belong, group identification, cooperative behavior

INTRODUCTION

Organizations or companies inevitably encounter various unfavorable situations during their development and growth. These unfavorable situations can weaken employee morale, leading to lower group identification and cooperation, thereby hindering the team's ability to operate effectively (e.g., Branscombe et al., 2002; Fisher & Sakaluk, 2020; O'Brien et al., 2004). In such critical times, boosting employee morale and enhancing group identification and team cooperation is particularly important.

Group identification and cooperation are viewed as crucial factors for addressing challenges and promoting group performance (Rabinovich & Morton, 2011; Xue et al., 2018). Previous research has found that group identification and cooperation were

Supplementary Materials may be found in the online version of this article.

This work was supported by the National Natural Science Foundation of China (32171050).

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influenced by dispositions (e.g., Big Five personality traits; Barrick & Mount, 1991; Poropat, 2009) and specific contexts (e.g., active involvement or engagement of leaders in the group's activities; Stevens et al., 2018). These studies have explored external boundary conditions influencing the strength of group identification and cooperation. However, existing research has not addressed an important but neglected issue: how are group identification and cooperation influenced by intrinsic group characteristics? It is worth noting that group identification and cooperation are both essential variables in the field of group cognition, while the study of group cognition is inseparable from intrinsic group characteristics (Stuart et al., 2020; Tajfel & Turner, 2001). Furthermore, a group characteristics perspective is critical to understanding group members' psychological processes and behaviors (Hamilton, 2007; Toseland et al., 2004). According to social identity theory (SIT; Tajfel & Turner, 1979), individuals develop identification with their group through social categorization, which involves the process of intrinsic group characteristics. Conducting relevant research from the group characteristics perspective is beneficial for deepening our understanding of the development of group identification and distinguishing it from other group cognition variables. It is worth noting that group entitativity, as the fundamental characteristic of groups (Hamilton, 2007) reflected in similarity and interdependence within the group, plays a crucial role in predicting members' psychological processes and group behaviors (Albaram & Lim, 2023; Blondé & Falomir-Pichastor, 2021). Therefore, in the present study, we sought to explore how entitativity affects group identification and cooperation in unfavorable situations. Addressing this question not only contributes to the existing body of knowledge on theories of group identification and cooperation but also provides theoretical guidance for strengthening group solidarity in unfavorable situations.

Effects of Unfavorable Situations on Group Identification and Cooperation

Identification with a group is defined as an individual's recognition of their identity as a member of a distinct group (Leach et al., 2008). Individuals with strong identification internalize the norms and values of the group and engage in cooperation, pursuing collective interests and goals, thereby enhancing group innovation and allocating resources more efficiently (Xue et al., 2018). Different empirical studies regarding the relationship between unfavorable situations and group identification have yielded inconsistent results. Some studies have found a negative effect of unfavorable situations on group identification. For example, group failure generally weakens identification with the group (Snyder et al., 1986). Prior research has generally presumed that individuals would deidentify or disidentify with an organization that has lost its prestige (e.g., Elsbach, 2001; Frandsen, 2012). Furthermore, members of low-status groups show lower group identification than members of high-status groups (Ellemers et al., 1988, 1990, 1992; Ellemers & van Laar, 2010; Rathbone et al., 2022). However, other research has shown the positive relationship between adversity and group identification (e.g., Kateri et al., 2022; Walsh et al., 2019). Walsh et al. (2019) analyzed data from a survey of former employees of a defunct technology firm. The results found that the extent to which the perceived identity of a failed organization satisfies former members' need to belong was

positively associated with their identification with the organization. In addition, other studies have found a positive correlation between low group status and high group identification (Kateri et al., 2022; Tague et al., 2020).

Cooperation, as a strategy for group adaptation to the social environment, assists the group in addressing collective challenges (Bogart et al., 2018). The results of the relationship between unfavorable situations and intragroup cooperation are mixed. Research has showed that groups that received success feedback exhibited more cooperation than groups that received failure feedback (Jackson, 2011). Lettinga et al. (2020) have also found that adverse environment (both in childhood and adulthood) was associated with decreased investment in collective actions. Additionally, lower cooperation levels are observed in low-income residential areas in Zurich (Falk & Zehnder, 2013). Furthermore, Cox et al. (2020) found that groups composed only of high-status individuals demonstrate the highest level of cooperation, while cooperation is lowest among groups composed solely of low-status individuals; results for mixed groups fall in between. By contrast, other studies have found that individuals exhibit more cooperation in unfavorable situations (Aktipis et al., 2011; Smaldino et al., 2013). The increase in cooperative behavior in unfavorable situations depends on specific conditions. When individuals expect in-group support or identify strongly with the group, they tend to exhibit cooperative behavior in the face of adversity (Drury et al., 2016).

Effects of Group Entitativity on Group Identification and Cooperation

Group entitativity indicates the extent to which a collection of individuals is perceived as being tightly bonded together in a coherent unit (Campbell, 1958; Fischer et al., 2013), significantly impacting individual cognition and behavior within the group (Cai & Bae, 2023). Group entitativity is different from group identification. Entitativity describes the characteristics of the group as a whole (Hamilton, 2007), whereas group identification generally refers to the psychological importance that individuals attach to their group membership (Leach et al., 2008). Research indicates that two feature clusters of perceptual cues contributing to perceived entitativity (i.e., groupness) are similarity and interaction (e.g., Gaertner & Schopler, 1998; Kim et al., 1997; McGarty et al., 1995). In a highly entitative group, the members are considered to have a high degree of similarity and level of interaction (Lickel et al., 2001).

Similarity, or homogeneity, refers to the degree of resemblance or shared characteristics among individuals in certain aspects (Dang et al., 2018). These shared characteristics may include values, interests, experiences, appearances, traits, and so forth (Jetten et al., 2001; Koltermann et al., 2020). Sometimes, high perceived entitativity is accompanied by increased interactions or interdependence among aggregate members (Castano et al., 2002; Gaertner et al., 2006). Intragroup interactions make group members feel that they occupy specific roles (Serpe & Stryker, 2011). Moreover, groups high in entitativity are perceived as more effective in reducing feelings of self-uncertainty (Hogg et al., 2007) and capable of providing sufficient social support for members engaging in the protection of the group identity (Effron et al., 2018; Effron & Knowles, 2015; Hogg, 2004).

Some research implies that group entitativity may buffer the negative impact of

adversity on group identification. For example, Tague et al. (2020) showed that adversity directed at in-group predicts group identification of high entitative groups and the relationship is mediated by the need to belong. Furthermore, perceived group entitativity has been directly investigated as an antecedent of identification (Sani et al., 2005). The more individuals perceive themselves as being part of a highly entitative group, the higher their identification (Castano et al., 2003; Crawford & Salaman, 2012; Hogg et al., 2007).

In contrast to the negative impact of unfavorable situations on cooperation, enhancing group entitativity can stimulate cooperative behavior (Li et al., 2021). Previous studies have shown that increased group entitativity promotes more cooperation in prisoner's dilemma tasks (Gaertner et al., 2006). Workgroups also necessitate a high level of entitativity to ensure cooperation in an organizational context (Blanchard & Allen, 2023). Moreover, synchronized actions have been shown to increase individuals' perceived group entitativity and, consequently, their propensity to cooperate in public goods games (Fischer et al., 2013).

The Role of the Need to Belong

The need to belong is a fundamental human motivation to maintain lasting and positive interpersonal relationships with others, pursuing a sense of mutual respect and dependency (Allen et al., 2022; Baumeister et al., 2007; Baumeister & Leary, 1995). According to the need to belong theory (Baumeister & Leary, 1995), all human beings need social connections and the need to belong may have an evolutionary basis that guides individuals into social groups. This basic psychological need has significant implications for group identification and social interactions (Phinney, 1992; Sellers et al., 1998).

The decreased group identification among members in unfavorable situations might be related to the failure to satisfy the need to belong (Baumeister & Leary, 1995; Brewer, 1991; Greenaway et al., 2017; Vignoles et al., 2006). According to SIT (Tajfel & Turner, 2001), part of an individual's self-esteem derives from identifying with their group. Individuals seek positive social identification to maintain self-esteem, and the positive or negative value of social identification is intrinsically related to social comparison. In social comparison, groups in unfavorable situations frequently receive negative evaluations when compared to groups in more favorable situations. These negative evaluations pose a threat to group members' self-esteem, leaving the need to belong unfulfilled and preventing the development of identification with the in-group (Ellemers et al., 1990; Fisher & Sakaluk, 2020). Sociometer theory proposes that the need to belong subsumes self-esteem which is perceived as central to identity (Leary & Baumeister, 2000; Vignoles et al., 2006). Additionally, rejection-identification model (RIM), derived from SIT, posits that group members will proactively strive to increase the satisfaction of the need to belong and enhance their identification with the in-group to alleviate self-threat when their group experiences unfavorable situations (Kateri et al., 2022; Stuart et al., 2020; Tague et al., 2020).

Previous studies have also provided empirical evidence supporting the important

role of the need to belong in group identification. For example, the fulfillment of the need to belong predicted identification with high school over time, which was true for both high-school students (Bizumic et al., 2009) and college students (Greenaway et al., 2017). Furthermore, Easterbrook and Vignoles (2013) demonstrated that satisfying the need to belong results in increased identification with novel groups over time. Feeling a sense of belonging with other students on a Physics course was also positively related to identification as a physicist (Seyranian et al., 2018). Finally, Grozev et al. (2024) found that students who felt a greater sense of belonging with fellow students had higher levels of discipline identification during the COVID-19 pandemic. Therefore, satisfying the need to belong is a critical factor in the development of group identification.

The Moderated Mediation Effects

We predict that high-entitativity groups may increase their group identification by satisfying members' need to belong in unfavorable situations. Specially, the need to belong positively correlates with group entitativity. Firstly, similarity and interaction, the two key feature clusters of perceptual cues contributing to perceived entitativity, are related with the need to belong. According to the social identity perspective, the fulfillment of the need to belong is facilitated by the categorical perception outlined in self-categorization theory (Turner et al., 1987). Categorical perception leads to group members (including the self) being seen as depersonalized and interchangeable exemplars of a homogeneous group. More prototypical members are generally more favorably regarded, and thus, they may experience a greater sense of belonging (Easterbrook & Vignoles, 2013; Hogg et al., 1993). Additionally, group members can experience a sense of unique contribution and belonging to their in-group as a result of their interactions within the group (Serpe & Stryker, 2011). Secondly, previous research has shown a positive correlation between group entitativity and participants' reported satisfaction with psychological needs (McConnell et al., 2019). Research indicates that groups capable of fulfilling the need to belong are frequently those that can provide social support and a sense of security (Kateri et al., 2022), especially when group members are encountering unfavorable situations (Castano et al., 2002). Easterbrook and Vignoles (2013) also found that feelings of belonging are primarily gained from perceptions of intragroup similarity and interactions among group members.

We further argue that group identification may mediate the moderated effects of group entitativity on the relationship between the task situation and cooperative behavior. Specifically, group identification is an important psychological process that highlights the emotional and cognitive connections between individuals and groups, and has serious implications for their experience and behavior (for reviews, see Cartwright & Zander, 1968; Tajfel & Turner, 1979). Therefore, group identification is considered a near indispensable construct in understanding intra- and intergroup dynamics (Leach et al., 2008). Most studies have shown a positive correlation between group identification and cooperative behavior (e.g., de Cremer & van Vugt, 1999; Smith et al., 2003; Wang, 2023). Furthermore, group identification is regarded as having the most direct and critical impact on cooperative behavior (e.g., Cai & Bae, 2023; de Cremer & van Vugt,

1999). For example, heightened perceived entitativity increases individuals' consumption of products linked to their in-group identity by enhancing group identification (Li et al., 2021). In highly entitative communities, members tend to have strong identification and actively participate in cooperative endeavors supportive of community development (Cai & Bae, 2023).

In terms of research paradigms, previous studies have predominantly utilized the public goods game (Miao et al., 2021) and the prisoner's dilemma game (Gaertner et al., 2006) to investigate cooperative behavior. Nonetheless, participants still own the ultimate benefits in these economic game paradigms, and it is difficult to distinguish between contributions made for one's benefit and those toward group goals. Moreover, factors such as trust and reciprocity significantly influence individuals' investment amounts (Mitkidis et al., 2015). To address these questions, this study employed an adapted cognitive effort task (Reddy et al., 2015) to investigate group members' cooperative behavior. The more willing individuals are to cooperate, the greater cognitive effort they invest in cooperative tasks (McEllin & Michael, 2022). This cognitive effort task emphasizes group benefits and requires individuals to expend actual cognitive effort, aligning more closely with the social context of most group cooperation tasks involving human cognitive processes.

Overview of the Present Research

In summary, this research aims to investigate whether group entitativity can mitigate the negative impact of unfavorable situations on group identification and cooperative behavior, as well as the underlying mechanisms. The following hypotheses are offered.

Hypothesis 1: Group members in unfavorable situations will exhibit lower group identification compared to those in favorable situations when group entitativity is low.

Hypothesis 2: Group entitativity moderates the relationship between the task situation and group identification through the mediation of the need to belong.

Specially, the relationship between the task situation and the need to belong is moderated by group entitativity. When group entitativity is low, group identification is higher for members in favorable situations compared to those in unfavorable situations. However, under conditions of high group entitativity, there is no difference in group identification between these two task situations.

Hypothesis 3: Group entitativity moderates the effect of the task situation on group identification, which subsequently affects cooperative behavior.

Specially, the relationship between the task situation and group identification is moderated by group entitativity. When group entitativity is low, members in favorable situations will exhibit more cooperative behavior compared to those in unfavorable situations. However, under conditions of high group entitativity, there is no difference in cooperative behavior between these two task situations.

Three studies were conducted to test these hypotheses. Study 1 examined the influence of the task situation on group identification. Study 2 investigated how group entitativity modulates the influence of the task situation on group identification, while Study 3 explored how group entitativity regulates the impact of the task situation on

cooperative behavior. Across three studies, we manipulated task situation and group entitativity, measuring self-reported group identification (Studies 1 and 2) and actual cooperative behavioral choices (Study 3). We received approval from the Committee for Protecting Human and Animal Subjects in the School of the Psychological and Cognitive Sciences of Peking University. All participants in the three studies signed the informed consent at the beginning of the study and were paid for their participation. We deposited the data and code for analyses at the Open Science Framework (OSF; <https://osf.io/k8rw5/>).

STUDY 1

In the current study, we manipulated the task situation (unfavorable vs. favorable) by providing a status (low vs. high) based on the group's performance relative to that of other groups in the Raven's Progressive Matrices (RPM) task (Hu et al., 2016; Miao et al., 2021). Favorable conditions refer to the group attaining a high status in the task, while unfavorable conditions refer to the group attaining a low status. We also included a neutral condition (i.e., the group attaining a middle status) in Study 1, which has received less attention in previous studies. The inclusion of a neutral condition aims to further examine whether the effect of the task situation on group identification is linear. We hypothesized that the task situation and group identification would follow a linear relationship, with groups in favorable situations having the highest level of group identification, followed by neutral situations, and groups in unfavorable situations having the lowest level of identification.

METHOD

Participants

For a one-way analysis of variance (ANOVA) used to examine the differences in 3 different situations (unfavorable vs. neutral vs. favorable), a power analysis using G*Power 3.1 (Faul et al., 2007), assuming a medium effect size with $f = .25$, $\alpha = .05$, and $power = 80\%$, suggests a required sample of 159 participants. Based on previous studies (e.g., Cohen, 1988, 1992; Giner-Sorolla et al., 2024), a medium effect size is commonly used as a justification for power analysis. We decided to recruit 159 college students through online social media advertising. The group identification scale data of 2 participants were not recorded due to procedural errors and were therefore excluded from the analysis. Finally, data from 157 participants ($M_{age} = 21.29$, $SD_{age} = 2.11$; 122 female) were included in the analysis. Participants were randomly assigned to 3 different task situations: unfavorable situations (51 participants, 39 females), neutral situations (53 participants, 40 females), and favorable situations (53 participants, 43 females). The chi-square test indicated no significant differences in the gender distribution across the 3 situations, $\chi^2(2) = .56$, $p = .757$. Further analysis regarding the effects of gender can be found in Supplementary Materials Section 1.

Design and Procedure

The current study employed a between-participant factorial design, with the factor referring to the task situation (unfavorable vs. neutral vs. favorable). Before the experiment, we collected digital photos of 8 female and male confederates. These photos were sourced from 16 randomly selected strangers with their permission. We ensured that participants had not seen these photos before to eliminate the influence of

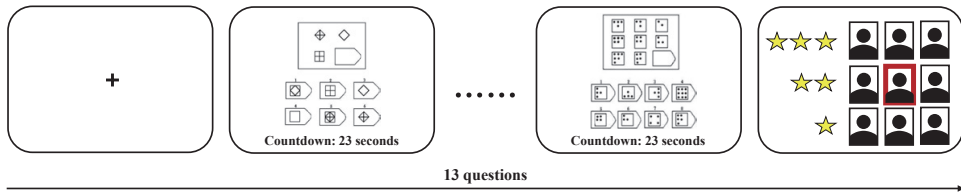


Fig. 1. The Raven's Progressive Matrices Task

Note. In this example, participants were assigned to the middle-status group (i.e., neutral situations). The black-and-white avatars in the flowchart would be replaced by photos of participants and confederates in the formal experiment.

familiarity. Participants were required to send their digital photos to the experimenter one day prior to the experiment. We standardized all photos by retaining only the facial information, adjusting the size, and converting them to grayscale.

Upon arrival at the laboratory, participants were asked to sign a list containing the names of 9 same-sex participants (including their own names). They were informed that some participants were already in the lab, while others had not arrived yet (in reality, each participant took part in the study independently). Three to 6 names were already on the sign-in sheet to lessen participants' suspicions. Then, the experimenter led the participant into an individual cubicle containing a desktop, a desk, and a chair. Participants were informed that the other 8 individuals listed would simultaneously participate in the experiment in separate cubicles, each with 1 experimenter. Participants were told that because some participants had not yet arrived at their designated cubicles, they needed to fill out a questionnaire collecting personal information (e.g., age and gender) first. Then, the experimenter temporarily left the room. After about 5 minutes, the experimenter came back into the room and told the participant that the formal experiment could begin since all participants had arrived. The above procedure was designed to make the participants believe they are simultaneously participating with the other 8 participants.

Participants were randomly assigned to groups of 3 utilizing the Minimal Group Paradigm (Tajfel et al., 1971; Wen & Zuo, 2018). In this task, participants were asked to choose 1 envelope from 5. There were 9 envelopes, 4 of which had been chosen. This setup was also aimed at reducing participants' suspicion about whether others were participating in the experiment simultaneously. Each envelope contained a colored strip, which could be red, green, or blue, representing 3 different groups respectively. After participants had made their choice within 2 minutes, the grouping information was displayed on the screen. Behind each colored dot, there were 3 photos representing the 3 members of that group. The participants' photos were highlighted with a yellow border and placed randomly. To strengthen the participant's awareness of their group identity, the experimenter provided each participant with a colored wristband (red, green, or blue) corresponding to their group and instructed them to wear it on their wrist until the end of the experiment.

In the next phase, participants were asked to complete a task comprising 13 challenging questions from the RPM task (Miao et al., 2021), each presented for 23 seconds. Each question consists of a visual geometric design with a missing piece, with 6 to 8 choices to fill in the missing piece. Following the test, group status to which the participant belonged (randomly assigned by the computer) in comparison with 2 other groups was displayed at the center of the screen (Cheng et al., 2022). Participants were told that group status was determined by comparing the aggregate performance of the 3 group members to that of other groups. There were 3 different statuses—low, middle, and high—represented by 1, 2, and 3 yellow pentagonal stars, respectively. We manipulated the task situation (unfavorable vs. favorable) by giving pre-programmed feedback about group status. If the group was assigned to unfavorable/neutral/favorable situations, they would receive low/middle/high status feedback. Behind each status, there were 3 photos, and the photo of the participant was highlighted with a red border (Fig. 1). Subsequently, participants completed scales measuring their emotional states and perception of group status.

Previous studies have affirmed that low status is associated with a greater prevalence of negative emotions than high status (Hu et al., 2014; Iyer & Achia, 2021; Li et al., 2021). These negative emotions

may significantly influence group members' cognition and behavior (Kraus et al., 2011). Therefore, following the approach taken by Miao et al. (2021), participants' emotional states were measured and included as control variables in the statistical analysis. To allow participants more time to process group status, they were asked to fill out the group identification scale 2 minutes later. We implemented the RPM task using MATLAB R2021b.

Finally, participants were debriefed and asked to complete a post-experiment questionnaire to determine whether they understood the purpose of the experiment.

Measures

Emotional states. To assess participants' emotional states (Hu et al., 2014), participants were asked to what extent they felt happy/pleased/proud/sad/upset/disappointed (1 = *not at all*; 7 = *very much*). We calculated the positive emotion score by averaging 3 items related to positive emotion (Cronbach's $\alpha = .92$) and the negative emotion score by averaging 3 items related to negative emotion (Cronbach's $\alpha = .89$).

Perception of group status. Participants were asked, "How do you perceive the status of your group in the experiment in comparison to other groups?" and rated the item on a scale ranging from 1 (*very inferior*) to 7 (*very superior*; Hu et al., 2014).

Identification with the group. Identification with the group (Leach et al., 2008) was measured with 3 items (e.g., "I feel solidarity with [In-group]"). Participants rated their agreement with each item on a scale ranging from 1 (*not at all*) to 11 (*very much*). The scale was internally consistent, with a Cronbach's α of .87.

RESULTS

Manipulation Check

A one-way ANOVA revealed a significant main effect of perceived group status, $F(2, 154) = 76.22, p < .001, \eta_p^2 = .500, 95\% \text{ CI } [.380, .580]$. Post-hoc comparisons (Bonferroni) showed that members of low-status groups perceived lower status ($M = 2.31, SD = 1.07$) than those of middle-status groups ($M = 3.94, SD = 1.18, p < .001, \text{Cohen's } d = 1.45$) and high-status groups ($M = 5.13, SD = 1.24, p < .001, \text{Cohen's } d = 2.47$), while members of middle-status groups perceived lower status than members of high-status groups ($p < .001, \text{Cohen's } d = .98$). Therefore, the RPM task effectively manipulated participants' perceptions of group status. This confirmed that the manipulation of the task situation was successful.

Group Identification

We first conducted 2 separate one-way ANOVAs, with negative emotions and positive emotions as dependent variables respectively. The results showed that group status significantly influenced participants' emotions (please refer to Supplementary Materials Section 3.1 for more details). Therefore, we included emotions as control variables in subsequent analyses.

A one-way ANOVA performed using group identification as the dependent variable, with gender, positive emotions, and negative emotions as covariates, showed that the main effect of the task situation was significant, $F(2, 151) = 8.49, p < .001, \eta_p^2 = .100, 95\% \text{ CI } [.020, .190]$. Post-hoc comparisons (Bonferroni) revealed that members in favorable situations ($M = 8.42, SD = 1.77$) had higher identification with their groups than members in unfavorable situations ($M = 7.30, SD = 1.71, p = .049, \text{Cohen's } d = .64$).

and neutral situations ($M = 6.67$, $SD = 2.23$, $p < .001$, Cohen's $d = .87$). Participants in neutral situations ($M = 6.67$, $SD = 2.23$) and unfavorable situations ($M = 7.30$, $SD = 1.71$) did not exhibit a significant difference in group identification ($p = .803$, Cohen's $d = .32$).

DISCUSSION

The results of Study 1 confirmed Hypothesis 1, indicating that group members in unfavorable situations had significantly lower group identification than members in favorable situations (Ellemers et al., 1990). However, there was no significant difference in group identification between members in unfavorable situations and members in neutral situations. These results showed that the relationship between the task situation and group identification was not linear. The possible explanation is that the need to belong might be satisfied for members in favorable situations, thereby having higher group identification compared to those in unfavorable and neutral situations, where members' need to belong was not fulfilled (Fisher & Sakaluk, 2020). In Study 2, we measured participants' need to belong and manipulated group entitativity to provide more related empirical evidence.

STUDY 2

The purpose of Study 2 was to further investigate the psychological mechanisms through which the task situation influences group identification and the role of group entitativity. Specially, in Study 2, we examined the hypothesis that group entitativity mitigates the negative effect of unfavorable situations on individuals' need to belong, which subsequently increases group identification. Drawing on a study by Hogg et al. (2007), we manipulated group entitativity through written descriptions about whether group members responded similarly in a pre-filled self-description and self-evaluation questionnaire. Unlike Study 1, Study 2 did not include a neutral situation. This decision was based on two reasons. First, the results of Study 1 indicated that group identification did not differ significantly between favorable and neutral situations. Second, in Study 2, we introduced group entitativity as a between-subjects variable. More complex experimental designs increase the difficulty of detecting effects, requiring a larger sample size to achieve sufficient statistical power.

METHOD

Participants

A sample size of 128 participants was required to obtain a medium effect size (f) of .25 with an error probability (α) of .05 and a power of 80% for an interaction in a 2 (task situation: unfavorable vs. favorable) \times 2 (group entitativity: low vs. high) between-participant ANOVA, based on G*Power estimation (Faul et al., 2007). We decided to collect more than 128 participants as we could before the mid-term of the semester

to prevent an inadequate valid sample size. Finally, we recruited 157 college students through online social media advertising. The experimental data of 3 participants were not recorded due to procedural errors and were therefore excluded from subsequent analysis. Data from 154 participants ($M_{age} = 21.36$, $SD_{age} = 1.69$; 92 female) were included in the analysis. All participants were randomly assigned to 4 different groups: low-entitative groups in unfavorable situations (38 participants, 28 females), low-entitative groups in favorable situations (38 participants, 21 females), high-entitative groups in unfavorable situations (38 participants, 20 females), and high-entitative groups in favorable situations (40 participants, 23 females). The chi-square test revealed no significant differences in the gender distribution across groups, $\chi^2(3) = 4.27$, $p = .234$. Further analysis regarding the effects of gender can be found in Supplementary Materials Section 1.

Design and Procedure

This study adopted a 2 (task situation: unfavorable vs. favorable) \times 2 (group entitativity: low vs. high) between-participants design. Following the paradigm used by Hogg et al. (2007), before the formal experiment, participants completed a self-description and self-evaluation questionnaire, consisting 3 sociability statements (Bucher et al., 2016), 5 self-confidence statements (Bi & Huang, 2009), and 4 self-esteem statements (Rosenberg, 1965; see Supplementary Materials Section 3). Participants took part in the formal experiment through an online platform. Once participants entered the online virtual meeting room, the experimenter instructed them to sign an electronic list containing the names of 8 participants (with 3 to 6 names already signed). Participants were informed that the other 7 individuals on the electronic list were in separate virtual meeting rooms and would be participating in the experiment simultaneously (in reality, there was only 1 real participant). At this point, the only people in each virtual conference room are the participant and experimenter. Initially, participants were asked to complete the envelope choosing task and were assigned to a certain group, each consisting of 3 individuals. Then they proceeded to complete the RPM task used in Study 1 and their group was randomly assigned to either the unfavorable situation or the favorable situation. After completing these tasks, participants completed scales measuring their emotional states and perception of group status. Subsequently, they were further randomly assigned to the conditions of high or low group entitativity. The manipulation of group entitativity was modified based on previous studies (Hogg et al., 2007; Li et al., 2024). Similarity and interaction are 2 feature clusters of perceptual cues contributing to perceived entitativity (Gaertner & Schopler, 1998; McGarty et al., 1995). Therefore, entitativity manipulation had 2 phases. In the first phase, we manipulated individuals' perceived similarity to other members within the group. Participants were informed by the experimenter that the upcoming phase involved a group decision-making task. Before undertaking this task, we calculated the similarity among the pre-filled questionnaire responses submitted by each member within their respective assigned groups to gain a comprehensive view of the group. If participants were assigned to the high group entitativity condition, they saw the following description:

The results of the response similarity analysis showed that members responded very similarly to each other ($\alpha = .86$, with the higher value of α reflecting higher similarity, $0 < \alpha < 1$), which indicated that members tended to think and behave in the same way.

If participants were assigned to the low group entitativity condition, they were shown the following description:

The results of the response similarity analysis showed that members responded very differently from one another ($\alpha = .41$, with the lower value of α reflecting lower similarity, $0 < \alpha < 1$), which indicated that members tended to think and behave in very different ways.

In the second phase, we manipulate group members' perceptions of their opportunity to interact. The experimenter primed participants about the group decision-making task. High entitativity participants were told that the group would self-organize via the "chat room," establishing a clear division of labor, a leadership structure, and a set of agreed principles regarding task approach. Low entitativity participants were told that the group members would introduce themselves to one another via the "chat room," but individuals were left to decide how they wanted to approach the task themselves. All participants were told that before the group task, they would answer some questions about themselves and their group. First, they completed the group entitativity scale. Then, they sequentially filled out scales measuring satisfaction of the need to belong and identification with the group 2 minutes later. Finally, participants were debriefed and were asked to finish a post-experiment questionnaire to determine whether they had guessed the purpose of the experiment.

Measures

Emotional states. Participants' emotional states (Hu et al., 2014) were assessed using the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988), which is a 20-item scale divided into 2 subscales: Positive Affect (10 items; e.g., enthusiastic, inspired, proud), and Negative Affect (10 items; e.g., irritable, upset, afraid). Both subscales were rated on a 5-point Likert scale anchored by 1 (*not at all*) and 5 (*very much*). In the current study, Cronbach's α were .89 (Positive Affect) and .91 (Negative Affect).

Perceived group entitativity. A 4-item (e.g., "[In-group] people have a lot in common with each other") scale assessed perceived group entitativity (Hogg et al., 2007). For each item, participants indicated a number between 1 (*not at all*) and 11 (*very much*). The higher the score, the greater the group entitativity participants perceived. In the current study, Cronbach's α was .95.

Need to belong. Participants reported on a 7-point Likert scale (1 = *not at all*, 7 = *very much*; McConnell et al., 2019) to what extent they agreed with these 8 items (e.g., "I feel close and connected with other people who are important to me"). The higher the score, the higher the degree to which the participant's need to belong was satisfied. In the current study, Cronbach's α was .89.

Scales measuring the *identification with the group* (Cronbach's $\alpha = .86$) and *perception of group status* were the same as in Study 1.

RESULTS

Manipulation Check

Since we measured participants' perceptions of group status immediately after they received feedback from the RPM task, we conducted an independent samples *t*-test to assess their perceptions of group status, which served as the manipulation of the task situation. The results revealed that members of high-status groups ($M = 5.12$, $SD = 1.26$) perceived higher status than members of low-status groups ($M = 2.54$, $SD = 1.10$), $t(152) = 13.51$, $p < .001$, Cohen's $d = 2.18$, 95% CI [1.780, 2.570], indicating that the manipulation of the task situation (unfavorable vs. favorable) was successful.

A 2 (task situation: unfavorable vs. favorable) \times 2 (group entitativity: low vs. high) between-participant ANOVA was conducted to assess the impact of the 2 independent variables on participants' perceived group entitativity. The main effect of group entitativity was significant, $F(1, 150) = 18.15$, $p < .001$, $\eta_p^2 = .110$, 95% CI [.030, .210]. Participants in the low group entitativity condition ($M = 6.43$, $SD = 2.08$) perceived less entitativity compared to participants in the high group entitativity condition ($M = 7.88$, $SD = 2.22$), confirming that the manipulation of group entitativity was successful. The main effect of the task situation was significant, $F(1, 150) = 8.50$, $p = .004$, $\eta_p^2 = .050$, 95% CI [.010, .140]. Members in unfavorable situations ($M = 6.66$, $SD = 2.12$) perceived less entitativity than members in favorable situations ($M = 7.66$, $SD = 2.30$). The interaction between the task situation and entitativity was not significant, $F(1, 150) = 2.34$, $p = .128$, $\eta_p^2 = .020$, 95% CI [.000, .070].

Group Entitativity Moderated the Impact of the Task Situation on Group Identification

Two 2 (task situation: unfavorable vs. favorable) \times 2 (group entitativity: low vs. high) between-participant ANOVAs were conducted to assess the impact of the 2 independent variables on negative emotions and positive emotions. The results showed a significant effect of the task situation on participants' emotions (please refer to

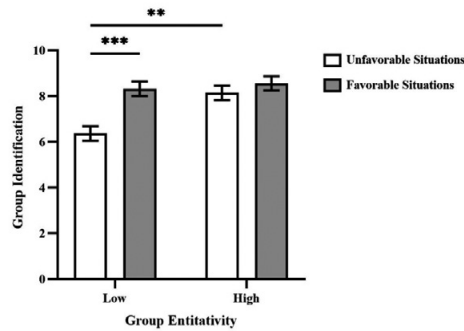


Fig. 2. Group Identification Among Members in Unfavorable Situations and Favorable Situations Under the Conditions of Low and High Entitativity in Study 2

Note. Error bars represent standard error of means.

** $p < .01$, *** $p < .001$.

Supplementary Materials Section 3.2 for more details). Therefore, we included emotions as control variables in subsequent analyses.

A 2 (task situation: unfavorable vs. favorable) \times 2 (group entitativity: low vs. high) between-participant ANOVA was conducted to assess the impact of the 2 independent variables on participants' group identification, with their gender, positive emotions, and negative emotions as covariates. The main effect of the task situation was significant, $F(1, 147) = 10.43, p = .002, \eta_p^2 = .070, 95\% \text{ CI } [.010, .150]$. Members in unfavorable situations ($M = 7.26, SD = 2.01$) reported lower identification with their in-group than members in favorable situations ($M = 8.44, SD = 2.13$), in accordance with the findings of Study 1.

The interaction between the task situation and entitativity was significant, $F(1, 147) = 15.36, p < .001, \eta_p^2 = .100, 95\% \text{ CI } [.020, .190]$. Simple effects analyses (Fig. 2) indicated that under conditions of low group entitativity, members in unfavorable situations ($M = 6.37, SD = 1.39$) had lower levels of identification with their in-group than members in favorable situations ($M = 8.32, SD = 1.79$), $F(1, 147) = 25.67, p < .001, \eta_p^2 = .150, 95\% \text{ CI } [.060, .250]$. By contrast, under conditions of high group entitativity, there was no significant difference in group identification between members in unfavorable situations ($M = 8.15, SD = 2.14$) and members in favorable situations ($M = 8.56, SD = 2.42$), $F(1, 147) = .22, p = .637, \eta_p^2 = .002, 95\% \text{ CI } [.000, .040]$. Furthermore, members in unfavorable situations reported significantly higher group identification in the high entitativity condition ($M = 8.15, SD = 2.14$) than in the low entitativity condition ($M = 6.37, SD = 1.39$), $F(1, 147) = 12.63, p = .001, \eta_p^2 = .080, 95\% \text{ CI } [.020, .170]$. By contrast, for members in favorable situations, no significant difference was found between these 2 conditions of group entitativity ($M = 8.56, SD = 2.42$ vs. $M = 8.32, SD = 1.79$), $F(1, 147) = 3.81, p = .053, \eta_p^2 = .030, 95\% \text{ CI } [.000, .090]$. The above results indicated that group entitativity significantly moderated the relationship between task situation and group identification.

The Moderated Mediation Model: The Moderating Effect of Group Entitativity

Data analyses were performed using Statistical Package for the Social Sciences (SPSS; Version 23.0). Based on previous studies, we hypothesized that the task situation and entitativity interactively influence the need to belong, subsequently impacting group identification. Therefore, we used Hayes' (2013) PROCESS Model 8 with 5,000 bootstrapping resamples to assess the moderated indirect effect of the task situation on group identification via the need to belong, with group entitativity as the moderator (Table 1). Additionally, gender, positive emotions, and negative emotions were included as control variables. We *z*-standardized all variables in the model. We also used Hayes' (2013) PROCESS Model 59 to enable a more comprehensive testing of moderation of the b-path (the relationship between the need to belong and group identification) and the direct path (the relationship between the task situation and group identification) for an exploratory aim, as detailed in Supplementary Materials Section 2.

The interaction between the task situation and entitativity significantly predicted both group identification ($\beta = -.29, p < .001, 95\% \text{ CI } [-.440, -.150]$) and the need to belong ($\beta = -.33, p < .001, 95\% \text{ CI } [-.450, -.210]$; Equation 1 and Equation 2), which indicated that group entitativity moderated the impact of the task situation on the need to belong and group identification. After incorporating the mediating variable into the equation, the need to belong significantly and positively predicted group identification ($\beta = .42, p < .001, 95\% \text{ CI } [.230, .600]$), and the predictive effect of the interaction between

Table 1. Moderated Mediation Analysis of the Effect of Group Entitativity on Group Identification

Variables	Equation 1			Equation 2			Equation 3		
	(DV: Group identification)			(DV: Need to belong)			(DV: Group identification)		
	β	<i>SE</i>	<i>t</i>	β	<i>SE</i>	<i>t</i>	β	<i>SE</i>	<i>t</i>
Gender	-.12	.07	-1.65	-.03	.06	-0.45	-.11	.07	-1.59
Positive emotion	.40	.08	4.80	.26	.07	3.70***	.29	.08	3.57***
Negative emotion	.02	.08	0.24	-.12	.06	-1.79	.07	.07	0.90
Task situation	.24	.08	3.18**	.21	.06	3.41***	.15	.07	2.04*
Group entitativity	.06	.08	0.81	.49	.07	7.41***	-.14	.09	-1.60
Task situation \times Group entitativity	-.29	.08	-3.92***	-.33	.06	-5.33***	-.15	.08	-2.01*
Need to belong							.42	.09	4.47***
<i>R</i> ²	.31			.52			.40		
<i>F</i>	11.19***			27.06***			13.69***		

Note. DV = dependent variable; *SE* = standard error; Gender: 1 = male, 2 = female; Task situation: 0 = unfavorable, 1 = favorable; Group entitativity: 0 = low, 1 = high.

* $p < .05$, ** $p < .01$, *** $p < .001$.

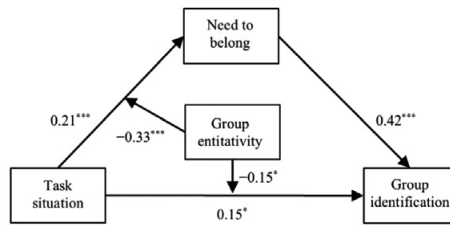


Fig. 3. Path Analysis of the Moderated Mediation Model

Note. Solid lines represent statistically significant paths.

* $p < .05$, *** $p < .001$.

the task situation and group entitativity decreased but remained significant ($\beta = -.15$, $p = .046$, 95% CI $[-.310, -.003]$). This demonstrated that the moderating effect of group entitativity on the relationship between the task situation and group identification was significantly mediated by the need to belong. The moderated mediation model was supported (Fig. 3).

Further examination of the bootstrap 95% CI for the indirect effects (5,000 times) revealed that when group entitativity was low, the mediating effect of the need to belong was significant, with an indirect effect value of .23, 95% CI $[.110, .360]$. In contrast, when group entitativity was high, the mediating effect of the need to belong was not significant, with an indirect effect value of $-.05$, 95% CI $[-.130, .030]$. This demonstrated that participants' need to belong was satisfied in favorable situations, which correlated with an increase in group identification in the low group entitativity condition, whereas the need to belong did not mediate the relationship between the task situation and group identification in the high group entitativity condition.

DISCUSSION

The results of Study 2 confirmed Hypothesis 2, indicating the indirect effect of the task situation on group identification through the need to belong was conditioned on group entitativity. Under conditions of low group entitativity, the indirect effect was positive, suggesting that the unfulfillment of belonging needs among members in unfavorable situations associated with a low level of group identification. However, members in unfavorable situations reported significantly higher group identification when group entitativity was high compared to when it was low. There was no significant difference in group identification between members in unfavorable situations and members in favorable situations under conditions of high group entitativity. Additionally, the moderated mediation analysis revealed that the relationship between the task situation and group identification was dependent on group entitativity. In accordance with SIT and RIM, for members in unfavorable situations, their need to belong could not be fulfilled, which could be associated with lower group identification compared to members in favorable situations under conditions of low group entitativity. Nevertheless, increased

perceived group entitativity can satisfy the need to belong among members in unfavorable situations, which partially increases group identification, with no significant difference from members in favorable situations. For members in favorable situations, the need for positive social identity and belonging among its members was already fulfilled. Therefore, the impact of group entitativity on group identification among members in favorable situations was limited.

STUDY 3

Study 3 aimed to investigate whether the moderating effect of group entitativity on group identification extends to the behavioral level and explore the psychological mechanisms through which the task situation influences cooperative behavior.

METHOD

Participants

Similar to Study 2, a sample size of 128 participants was required to obtain a medium effect size (f) of .25 with an error probability (α) of .05 and a power of 80% for an interaction in a 2×2 between-participant ANOVA, based on G*Power estimation (Faul et al., 2007). To prevent an inadequate valid sample size, we decided to collect over 128 participants through online social media advertising as we could before the end of the semester. Eventually, we recruited 194 college students, and 2 participants' experimental data were not recorded due to procedural errors. The final valid sample consisted of 192 participants ($M_{age} = 21.42$, $SD_{age} = 2.03$; 134 female). Participants were randomly assigned to 4 different groups: low-entitative groups in unfavorable situations (50 participants, 31 females), low-entitative groups in favorable situations (48 participants, 37 females), high-entitative groups in unfavorable situations (47 participants, 34 females), high-entitative groups in favorable situations (47 participants, 32 females). The chi-square test revealed no significant differences in the gender distribution, $\chi^2(3) = 2.76$, $p = .430$ across groups. Further analysis regarding the effects of gender can be found in Supplementary Materials Section 1.

Design and Procedure

Study 3 adopted a 2 (task situation: unfavorable vs. favorable) $\times 2$ (group entitativity: low vs. high) between-participants design. The pre-experimental procedure mirrored that of Study 1, aiming to foster the belief among participants that they were simultaneously engaging with the other 8 participants. Furthermore, akin to Study 2, participants filled out a self-description and self-evaluation questionnaire. During the formal experiment, participants were tasked with completing the envelope choosing task and the RPM task in individual cubicles, consistent with Study 1 and Study 2. They were then randomly assigned to either the unfavorable situation or the favorable situation, and each group consisted of 3 individuals. Participants filled out scales measuring their emotional states and perceived group status. Subsequently, they were randomly assigned to one of 2 conditions: high or low group entitativity. The manipulation and check were consistent with Study 2. Similarly, participants completed the group identification scale after a 2-minute interval.

During the second phase, participants were asked to complete an adapted version of the Card Choice Effort Task (CCET; Reddy et al., 2015; Fig. 4). This task was originally designed to measure an individual's willingness to exert cognitive effort for different levels of rewards. In this experiment, the more cognitive effort participants expended for the group goal, the higher their level of cooperation was assumed to be. Each trial began with a fixation, followed by the presentation of 2 cards indicating the task difficulty. The red card represented an easy task, selected by pressing the "F" key, while the green card represented a

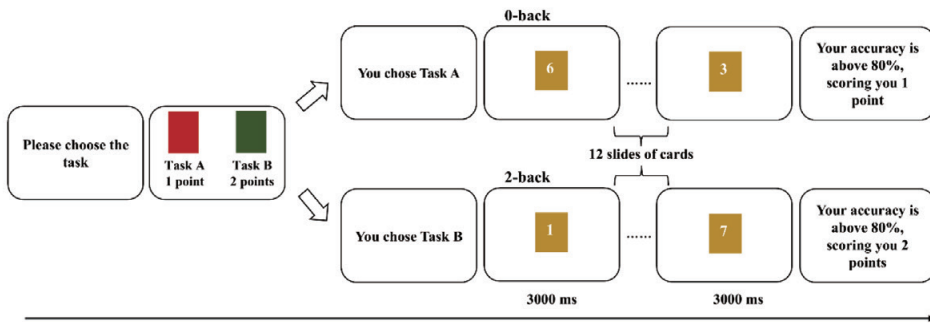


Fig. 4. Flowchart of One Trial in the Card Choice Effort Task

Note. Task A and Task B are represented by red and green cards, respectively. The task cards presented during the 12 slides of the 0-back and 2-back tasks are shown in yellow.

difficult task, selected by pressing the “J” key. Below each card, the scores that the group would receive upon completing that task were indicated. The colors representing task difficulty and the corresponding keys were counterbalanced across participants. If the participant chose to complete the easy task, 12 blue cards or 12 yellow cards would be sequentially presented at the center of the screen. In the center of each card, there was a random integer between 1 and 4, and between 6 and 9. For blue cards, participants were required to judge the parity of the number (press “F” for odd, “J” for even), while for yellow cards, participants needed to judge whether the number was less than 5 (press “F” for less than 5, “J” for greater than 5). If the participant chose to complete the difficult task, the screen would still sequentially present 12 blue cards or 12 yellow cards, each with a random integer in the center. Unlike the easy task, participants were required to judge the cards according to the 2-back rule: for example, when presenting the 3rd card, participants needed to judge the 1st card. Participants were given 3,000 ms to judge each card in both tasks. When participants chose to complete the easy task and achieved an accuracy rate of 90% or higher, they could score 1 point for their group. For the difficult task, they were required to achieve an accuracy rate of 80% or higher to score 1 point, 2 points, or 4 points (randomized across trials). Participants needed to complete a total of 36 trials. The scoring ratios for the easy and difficult tasks were 1:1, 1:2, and 1:4, with 12 trials for each scoring ratio condition. At the beginning of the experiment, participants were informed that the total group score was obtained by summing the scores of the 3 group members. The higher the total score accumulated by all members within the group, the more likely members of that group were to receive additional monetary rewards together. After understanding the rules, participants were asked to complete a practice session. Once they could correctly perform both the easy and difficult tasks, they proceeded to the formal session. This eliminated the confounding factor of individuals choosing the easy task more frequently because they could not complete the difficult task successfully. The CCET was programmed using MATLAB R2021b software. Finally, participants were debriefed and probed for suspicions.

Measures

We used the same scales for measuring emotional states (PANAS; Cronbach’s $\alpha = .90$ for items of positive emotions, Cronbach’s $\alpha = .91$ for items of negative emotions), perceived group status, group entitativity (Cronbach’s $\alpha = .96$), and identification with the group (Cronbach’s $\alpha = .84$) as in Study 2.

RESULTS

Evaluating the Difficulty Level of the Card Choice Effort Task

To assess the difficulty level of the easy and difficult tasks in the adapted CCET, we recruited 44 participants (28 females, $M_{\text{age}} = 21.82$, $SD_{\text{age}} = 2.54$) to complete the task.

After completing the 12th, 24th, and 36th trials, participants rated the difficulty of both the easy and difficult tasks on a scale from 1 (*very easy*) to 9 (*very difficult*). Paired-sample *t*-tests on the difficulty ratings revealed that participants' perceived difficulty level for the difficult task ($M = 5.73$, $SD = 1.98$) was significantly higher than for the easy task ($M = 1.88$, $SD = 1.32$), $t(43) = -11.65$, $p < .001$, Cohen's $d = 1.76$. Participants indicated that, despite the higher difficulty level of the difficult task, it was still achievable with cognitive effort. This ruled out the possibility that participants chose the easy task more frequently due to concerns about their ability to handle the difficult task.

Manipulation Check

Similar to Study 2, an independent samples *t*-test was employed to assess the effectiveness of the task situation manipulation. The results revealed that members of high-status groups ($M = 4.85$, $SD = 1.38$) perceived higher status than members of low-status groups ($M = 2.28$, $SD = 1.43$), $t(190) = 12.65$, $p < .001$, Cohen's $d = 1.83$, 95% CI [1.490, 2.160], indicating that the manipulation of the task situation was successful.

A 2 (task situation: unfavorable vs. favorable) \times 2 (group entitativity: low vs. high) between-participant ANOVA was conducted to assess the impact of the 2 independent variables on participants' perceived group entitativity. For perceived group entitativity, the main effect of group entitativity was significant, $F(1, 188) = 19.08$, $p < .001$, $\eta_p^2 = .090$, 95% CI [.030, .180]. Participants in the low group entitativity condition ($M = 5.69$, $SD = 2.41$) perceived less entitativity compared to participants in the high group entitativity condition ($M = 7.01$, $SD = 1.90$), indicating that the manipulation of group entitativity was successful. The main effect of the task situation was significant, $F(1, 188) = 21.06$, $p < .001$, $\eta_p^2 = .100$, 95% CI [.030, .190]. Members in unfavorable situations ($M = 5.65$, $SD = 2.17$) perceived less entitativity than members in favorable situations ($M = 7.04$, $SD = 2.15$). The interaction between the task situation and entitativity was not significant, $F(1, 150) = 3.67$, $p = .057$, $\eta_p^2 = .020$, 95% CI [.000, .070].

Group Entitativity Moderated the Impact of the Task Situation on Group Identification

Two 2 (task situation: unfavorable vs. favorable) \times 2 (group entitativity: low vs. high) between-participant ANOVAs were conducted to assess the impact of the 2 independent variables on negative emotions and positive emotions. The results showed significant effects of group status on participants' emotions (please refer to Supplementary Materials Section 3.2 for more details). Therefore, we included emotions as control variables in subsequent analysis. A 2 (task situation: unfavorable vs. favorable) \times 2 (group entitativity: low vs. high) between-participant ANOVA was conducted to assess the impact of the 2 independent variables on group identification with positive emotions and negative emotions as covariates. The main effect of the task situation was significant, $F(1, 186) = 4.60$, $p = .033$, $\eta_p^2 = .020$, 95% CI [.000, .080]. Members in unfavorable situations ($M = 6.76$, $SD = 2.13$) reported lower group identification than members in favorable situations ($M = 7.82$, $SD = 1.89$), in accordance with the results of Study 1 and Study 2. Similarly, the main effect of group entitativity was significant, $F(1, 186) = 8.11$, $p = .005$, $\eta_p^2 = .040$, 95% CI [.000, .110]. Participants in the low group entitativity

condition ($M = 6.88$, $SD = 2.26$) had lower group identification compared to participants in the high group entitativity condition ($M = 7.70$, $SD = 1.78$).

The interaction between the task situation and group entitativity was significant, $F(1, 186) = 5.67$, $p = .018$, $\eta_p^2 = .030$, 95% CI [.000, .090]. Further simple effects analyses indicated that under conditions of low group entitativity, members in unfavorable situations ($M = 6.18$, $SD = 2.17$) had lower group identification than members in favorable situations ($M = 7.62$, $SD = 2.13$), $F(1, 186) = 10.86$, $p = .001$, $\eta_p^2 = .060$, 95% CI [.010, .130]. Conversely, under conditions of high group entitativity, there was no significant difference in group identification between members in unfavorable situations ($M = 7.38$, $SD = 1.92$) and those in favorable situations ($M = 8.02$, $SD = 1.59$), $F(1, 186) = .02$, $p = .904$, $\eta_p^2 < .001$, 95% CI [.000, .000]. Additionally, members in unfavorable situations reported significantly higher group identification when group entitativity was high ($M = 7.38$, $SD = 1.92$) compared to when it was low ($M = 6.18$, $SD = 2.17$), $F(1, 186) = 13.08$, $p < .001$, $\eta_p^2 = .070$, 95% CI [.010, .140]; while for members in favorable situations, there was no significant difference between these 2 conditions ($M = 7.62$, $SD = 2.13$ vs. $M = 8.02$, $SD = 1.59$), $F(1, 186) = .07$, $p = .798$, $\eta_p^2 < .001$, 95% CI [.000, .020]. These findings were in line with Study 2.

Group Entitativity Moderated the Impact of the Task Situation on Cooperative Behavior

According to previous research, when the score ratio between the easy and difficult tasks is 1:1, individuals tend to choose the easy task based on rational decision-making (Shenhav et al., 2017). However, when the ratio is 1:4, individuals are more driven by monetary rewards and tend to choose difficult tasks more often (Reddy et al., 2015). In order to better examine the extent to which participants from different groups are willing to exert effort for the group goal, we used the number of times the difficult task was chosen under the condition where the score ratio between the easy and difficult tasks was 1:2 as the dependent variable, with positive emotions and negative emotions as covariates, and conducted a 2 (task situation: unfavorable vs. favorable) \times 2 (group entitativity: low vs. high) between-participant ANOVA. The results of analyses using the number of times the difficult task was chosen under the condition that the score ratios were 1:1 and 1:4 are also provided in Supplementary Materials Section 4. According to the Central Limit Theorem, when the sample size reaches a certain level (commonly considered to be $n \geq 30$ as an empirical threshold), the distribution of the sample mean will approximate a normal distribution regardless of the shape of the population distribution, allowing for the use of parametric tests (Fischer, 2010; Zhang et al., 2023). Previous studies employing similar paradigms have also utilized ANOVA for data analysis (Chang et al., 2019; Treadway et al., 2009). The results indicated that the main effect of the task situation was not significant, $F(1, 186) = 3.26$, $p = .073$, $\eta_p^2 = .020$, 95% CI [.000, .070]. The main effect of group entitativity was significant, $F(1, 186) = 4.69$, $p = .032$, $\eta_p^2 = .030$, 95% CI [.000, .080]. Participants in the low group entitativity condition ($M = 6.17$, $SD = 5.20$) chose the difficult task less frequently than those in the high group entitativity condition ($M = 7.74$, $SD = 5.06$).

The interaction between task situation and entitativity was significant, $F(1, 186) =$

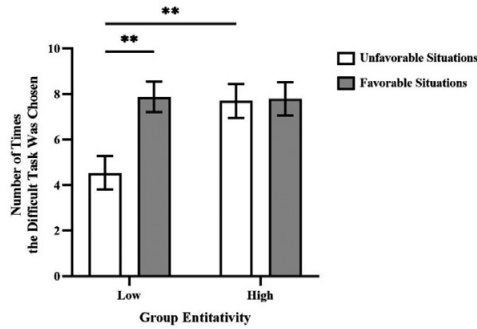


Fig. 5. Cooperative Behavior Among Members in Unfavorable and Favorable Situations in the Low and High Entitativity Conditions in Study 3

Note. Error bars represent standard error of means.

*** $p < .01$.

6.46, $p = .012$, $\eta_p^2 = .030$, 95% CI [.000, .100]. Simple effects analyses (Fig. 5) indicated that under the low group entitativity condition, members in unfavorable situations ($M = 4.54$, $SD = 5.23$) chose the difficult task less frequently than members in favorable situations ($M = 7.88$, $SD = 4.63$), $F(1, 186) = 9.98$, $p = .002$, $\eta_p^2 = .050$, 95% CI [.010, .120]. While under the high group entitativity condition, there was no significant difference in the times of choosing the difficult task between members in unfavorable situations ($M = 7.70$, $SD = 5.14$) and members in favorable situations ($M = 7.79$, $SD = 5.03$), $F(1, 186) = .22$, $p = .642$, $\eta_p^2 = .001$, 95% CI [.000, .030]. Members in unfavorable situations chose the difficult task less frequently when the group entitativity was low ($M = 4.54$, $SD = 5.23$) compared to when it was high ($M = 7.70$, $SD = 5.14$), $F(1, 186) = 10.67$, $p = .001$, $\eta_p^2 = .050$, 95% CI [.010, .130]. By contrast, for members in favorable situations, there was no significant difference in the times of choosing the difficult task between these 2 group entitativity conditions ($M = 7.88$, $SD = 4.63$ vs. $M = 7.79$, $SD = 5.03$), $F(1, 186) = .12$, $p = .732$, $\eta_p^2 < .001$, 95% CI [.000, .030]. These findings indicated that group entitativity significantly moderated the relationship between task situation and cooperative behavior.

We also modelled the numbers of times the difficult task was chosen using generalized linear mixed effects models (GLME; Camp et al., 2021; Dixon et al., 2020), assuming a Poisson distribution for the outcome variable. In this GLME model, task situation and group entitativity were the fixed effects, and participants were the random effects. Estimates, standard errors, z -values, and p -values are reported in Table 2. The interaction Task situation \times Group entitativity was significant ($B = -.64$, $p = .007$, 95% CI [-1.100, -.170]). Simple effects analyses indicated that under the low group entitativity condition, members in unfavorable situations ($M = 4.54$, $SD = 5.23$) chose the difficult task less frequently than members in favorable situations ($M = 7.88$, $SD = 4.63$), $t(94) = -3.38$, $p = .003$, 95% CI [-5.570, -1.200]. While under the high group entitativity condition, there was no significant difference in the number of times of choosing the difficult task between members in unfavorable situations ($M = 7.70$, $SD =$

Table 2. Coefficients From the Generalized Linear Mixed Effects Model Analysis

Fixed effect	B	SE	<i>t</i>	<i>p</i>	95% CI
Intercept	1.91	.35	5.50	< .001	[1.22, 2.59]
Positive emotions	0.08	.09	0.91	.363	[-0.09, 0.24]
Negative emotions	-0.07	.09	-0.80	.426	[-0.24, 0.10]
Task situation	0.08	.16	0.47	.636	[-0.24, 0.40]
Group entitativity	0.05	.15	0.33	.740	[-0.24, 0.34]
Task situation × Group entitativity	-0.64	.24	-2.71	.007	[-1.10, -0.17]

Note. SE = standard error. Task situation: 0 = unfavorable, 1 = favorable; Group entitativity: 0 = low, 1 = high.

5.14) and members in favorable situations ($M = 7.79$, $SD = 5.03$), $t(90) = -.03$, $p = .980$, 95% CI [-2.610, 2.550]. Members in unfavorable situations chose the difficult task less frequently when the group entitativity was low ($M = 4.54$, $SD = 5.23$) compared to when it was high ($M = 7.70$, $SD = 5.14$), $t(93) = -3.98$, $p < .001$, 95% CI [-7.170, -2.400]. For members in favorable situations, there was no significant difference in the number of times of choosing the difficult task between these 2 group entitativity conditions ($M = 7.88$, $SD = 4.63$ vs. $M = 7.79$, $SD = 5.03$), $t(91) = .29$, $p = .771$, 95% CI [-1.750, 2.350]. The results of the GLME model are consistent with those of the ANOVA. Group entitativity significantly moderated the effect of the task situation on cooperative behavior.

The Moderated Mediation Model: The Moderating Effect of Group Entitativity

The aforementioned results once again demonstrated the interactive effects of the task situation and group entitativity on group identification, and this interaction also extends to subsequent cooperative behavior. In line with Study 2, the moderated mediation model was tested using Model 8 of Conditional Process Analysis in PROCESS (Hayes, 2013). In this analysis, we employed the task situation as the independent variable, cooperative behavior as the dependent variable, group identification as the mediating variable, and group entitativity as the moderating variable. Additionally, positive emotions and negative emotions were included as covariates (Table 3). We also used Hayes' (2013) PROCESS Model 59 to enable a more comprehensive testing of moderation of the b-path (the relationship between the group identification and cooperation) and the direct path (the relationship between the task situation and cooperation) for an exploratory aim, as detailed in Supplementary Materials Section 2.

The interaction between the task situation and entitativity significantly predicted both cooperative behavior ($\beta = -.19$, $p = .012$, 95% CI [-.340, -.040]) and group identification ($\beta = -.17$, $p = .018$, 95% CI [-.310, -.030]; Equation 1 and Equation 2), which indicated that group entitativity moderated the impact of the task situation on group identification and cooperative behavior. After incorporating the mediating variable into the equation, group identification significantly and positively predicted cooperative

Table 3. Moderated Mediation Analysis of the Effect of Group Entitativity on Cooperative Behavior

Variables	Equation 1			Equation 2			Equation 3		
	(DV: Cooperative behavior)			(DV: Group identification)			(DV: Cooperative behavior)		
	β	SE	<i>t</i>	β	SE	<i>t</i>	β	SE	<i>t</i>
Positive emotion	.07	.08	0.94	.25	.07	3.35**	-.03	.07	-0.47
Negative emotion	-.07	.08	-0.87	-.11	.07	-1.45	-.02	.07	-0.29
Task situation	.14	.08	1.86	.16	.07	2.19*	.07	.07	1.03
Group entitativity	.16	.07	2.19*	.20	.07	2.87**	.07	.07	1.08
Task situation \times Group entitativity	-.19	.08	-2.54*	-.17	.07	-2.38*	-.12	.07	-1.68
Group identification							.44	.07	6.18***
R^2	.09			.18			.24		
<i>F</i>	3.47**			7.95***			9.83***		

Note. DV = dependent variable; SE = standard error; Task situation: 0 = unfavorable, 1 = favorable; Group entitativity: 0 = low, 1 = high.

* $p < .05$, ** $p < .01$, *** $p < .001$.

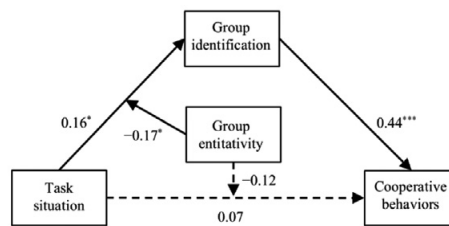


Fig. 6. Path Analysis of the Moderated Mediation Model

Note. Solid lines represent statistically significant paths.

* $p < .05$, *** $p < .001$.

behavior ($\beta = .44$, $p < .001$, 95% CI [.300, .580]), and the predictive effect of the interaction between the task situation and group entitativity decreased and was not significant ($\beta = -.12$, $p = .095$, 95% CI [-.250, .020]). This revealed that the moderating effect of group entitativity on the relationship between the task situation and cooperative behavior operated through the significant mediation of group identification. The moderated mediation model was supported (Fig. 6).

Further examination of the bootstrap 95% CI for the indirect effects (5,000 times) revealed that when group entitativity was low, the mediating effect of group identification was significant, with an indirect effect value of .14, 95% CI [.040, .250]. In contrast, when group entitativity was high, the mediating effect of group identification was not

significant, with an indirect effect value of $-.01$, 95% CI $[-.090, .070]$. This revealed that participants' group identification increased in favorable situations and subsequently related with an increase in cooperative behavior when group entitativity was low, whereas participants' group identification did not mediate the relationship between task situation and cooperative behavior when group entitativity was high.

DISCUSSION

Study 3 once again demonstrated the interactive effects of task situation and group entitativity on group identification. Specifically, members in unfavorable situations exhibited significantly lower group identification and cooperative behavior than members in favorable situations when group entitativity was low. Conversely, no significant differences were observed in group identification and cooperative behavior between members in unfavorable situations and those in favorable situations under conditions of high group entitativity. The moderated mediation model revealed that group entitativity moderated the impact of the task situation on participants' group identification, subsequently influencing cooperative behavior: for members in unfavorable situations, increasing group entitativity enhanced group identification and further promoted cooperation. However, for members in favorable situations, group entitativity did not impact group identification and cooperative behavior. These results confirmed Hypothesis 3.

GENERAL DISCUSSION

The present research examined the impact of the task situation and group entitativity on group identification and cooperative behavior. The results revealed that group entitativity moderated the effect of the task situation on group identification and cooperative behavior. Specifically, group identification among members in unfavorable situations was significantly lower than that among members in favorable situations under conditions of low group entitativity, with the need to belong mediating the relationship between task situation and group identification. In the high entitativity condition, group identification among members in unfavorable situations increased and was not significantly different from that of their counterparts in favorable situations. Similarly, members in unfavorable situations exhibited significantly less cooperative behavior than members in favorable situations when group entitativity was low. The relationship between task situation and cooperative behavior was mediated by group identification. In contrast, under conditions of high group entitativity, there was no significant difference in cooperative behavior between members in unfavorable situations and members in favorable situations. Additionally, members exhibited increased group identification and cooperation in unfavorable situations under conditions of high group entitativity compared to those under low group entitativity.

Groups assigned to unfavorable and neutral situations are at a lower status compared to those in favorable situations. Therefore, when participants are assigned to unfavorable

and neutral situations, they face challenges in maintaining their positive self-esteem and fulfilling the need to belong. This may be associated with lower levels of group identification in these two situations compared to favorable situations. According to SIT and RIM, people will proactively take remedial measures when group identity threatens their need to belong. Belongingness needs satisfaction is highly correlated with group entitativity. The higher the entitativity of a group, the more social support its members perceive, which satisfies their need to belong (Crawford & Salaman, 2012; McConnell et al., 2019). Studies 2 and 3 introduced group entitativity as a variable closely associated with the need to belong. By investigating the effect of the task situation on group identification through the need to belong, which was moderated by group entitativity, these experiments provided empirical evidence for SIT and RIM.

Prior research has explored the influence of personality traits and social contexts on group identification (Bradshaw & Muldoon, 2020; Poropat, 2009). In contrast, the present study introduced group entitativity from the perspective of group intrinsic characteristics and examined its impact on group identification. In line with SIT and RIM, group entitativity is highly connected with the fulfillment of the need to belong, and the satisfaction of this basic psychological need influences an individual's group identification (McConnell et al., 2019). Low entitativity groups fail to fulfill members' need to belong, which correlates with a lack of group identification. By contrast, high entitativity groups can satisfy members' need to belong and promote group identification by increasing members' sense of security and perceived social support (Dang et al., 2018). We conclude that when a group's entitativity increases and satisfies individuals' need to belong, members tend to have enhanced group identification, even if the group is in unfavorable situations. This suggests that the key to solidarity lies, to a certain extent, in increasing members' sense of security and perceived social support to fulfill their belonging needs. The results of this study also revealed that there was no significant difference in group identification among members in favorable situations under varying levels of group entitativity. This may be explained by the fact that members in favorable situations, who express higher belonging needs satisfaction, did not create an opportunity for entitativity to influence their group identification by fulfilling the need to belong.

Task situations and group entitativity not only impact group identification but also have a further influence on cooperative behavior. Currently, there are two theories explaining how group identification promotes cooperative behavior: the goal-transformation hypothesis and the goal-amplification hypothesis (de Cremer et al., 2008). The goal-transformation hypothesis states that enhancing group identification makes group members more focused on collective interests and, consequently, exhibit more cooperative behavior. On the other hand, the goal-amplification hypothesis posits that strengthening group identification leads group members to believe that other fellow members will cooperate with them, which in turn makes them more willing to engage in cooperative tasks, closely tied to the belief in reciprocity. Previous research has found that members in unfavorable situations, as opposed to those in favorable situations, tend to have higher beliefs in reciprocity (Miao et al., 2021). They highlight reciprocal relationships among members to increase their chances of obtaining social support and forming alliances, consequently satisfying

their need to belong. As a result, members in unfavorable situations, driven by the need to belong, may hold higher expectations of in-group reciprocity. When the need to belong among members in unfavorable situations is satisfied, they may experience an increase in group identification, which correlates with the belief that other members are likely to engage in cooperative behavior. This belief may, in turn, be related to their own demonstration of cooperative behavior. For members in favorable situations, increased perceived group entitativity does not align with enhanced cooperative behavior. This may be due to the fact that increased group entitativity does not correspond with heightened group identification in favorable situations, which may be associated with stable levels of cooperative behavior among members.

In the public goods game and the prisoner's dilemma game, commonly employed in prior studies (Gaertner et al., 2006), measures of cooperation behavior are based on individuals' token contributions. However, most cooperative interactions do not involve economic interests but rather encompass cognitive efforts invested by group members in daily life activities (McEllin & Michael, 2022), such as collaborative planning, playing with the band, and team sports. To address this gap, our study introduced an adapted cognitive effort task, a first in cooperative behavior research. This task facilitated the comprehension of trade-offs between individual costs and group benefits in group cooperation tasks. It quantified group members' cooperative performance based on cognitive effort, providing a novel approach to group cooperation research that better aligns with contemporary societal emphasis on teamwork and collaboration. In the current study, we employed the minimal group paradigm, which was considered a reliable and useful instrument to investigate group processes in a highly controlled environment (Hewstone et al., 2002; Otten, 2016; Spears & Otten, 2012). It is thought to strip away the complexity that makes established group distinctions, such as race and gender, so difficult to study (Otten, 2016; Spears & Otten, 2012; Tajfel et al., 1971). Many studies have confirmed that the mere categorization of individuals into arbitrary social categories is sufficient to influence members' cognition and behaviors (e.g., Dunham et al., 2011; McDonald et al., 2011), such as preferring to allocate more resources to their groups (Hong & Ratner, 2021). Real-world groups are typically formed through social, cultural, or economic ties and have long-standing histories, norms, and interdependence among members (Castano et al., 2002; Stuart et al., 2020). The dynamics within real-life groups are influenced by factors such as intergroup relationships, the same values, common ideas, and goals (Leach et al., 2008). These factors may contribute to more stable and complex group behaviors compared to minimal groups (Hong & Ratner, 2021). While the primary method for enhancing group entitativity applies to both minimal groups and real-world groups (Blondé & Falomir-Pichastor, 2021; Li et al., 2024), members of real-world groups may experience a greater sense of group entitativity compared to minimal groups (Pickett et al., 2002; Rutchick et al., 2008).

This study unveiled the potential mechanisms through which group entitativity and task situation influenced group identification and cooperative behavior. Previous research has investigated the effect of dispositions and specific contexts on group identification and cooperation. However, the current study took an intrinsic group characteristics

perspective, addressing the important but neglected question of how perceived group attributes influence members' psychological processes and behaviors. Additionally, it highlighted the crucial role of the need to belong in the formation of group identification and provided empirical evidence for SIT and RIM. These findings enriched our understanding of the process of group identification formation, facilitated the cross-disciplinary integration of relevant theories, and propelled further development of the research field. Practically speaking, our findings suggest that enhancing group entitativity is an effective strategy to increase group identification and foster cooperation in unfavorable situations. However, we do not advocate that higher entitativity is always better. The relationship between entitativity and identification may not be linear, and the optimal level of entitativity may vary depending on the specific context (Castano et al., 2003). Moreover, the impact of entitativity may vary across different stages of group development. Previous research suggests that increasing entitativity may be more crucial in the early stages of group formation, as most social groups tend to emphasize the entity-like qualities of the group during their initial phase (Brown & Wootton-Millward, 1993; Worchel et al., 1991).

There are still some limitations worthy of further exploration in future research. Firstly, the experimental design and analytical approach of the current study do not allow us to state a causal relationship between the need to belong and group identification. In future studies, we can simultaneously manipulate group identification and the need to belong to investigate the casual relationship between them (Miao et al., 2021). Moreover, future research could investigate the roles of the need to belong and group identification in the relationship between the task situation and cooperative behavior, to further validate and expand the results of Study 3. Secondly, although the minimal group paradigm is a reliable instrument, the generalizability of the minimal groups employed in the current study is limited. Future research should consider incorporating real-world groups to enhance the ecological validity of the findings.

In conclusion, the current research found that group entitativity can mitigate the negative impact of unfavorable situations on group identification and cooperative behavior. The mediated relationship between task situation and group identification through the need to belong was moderated by group entitativity. Group entitativity additionally moderated the relationship between task situation and cooperative behavior through the mediation of group identification.

AUTHOR'S CONTRIBUTION

W.R. contributed to the conceptualization, data curation, formal analysis, writing (original draft) and project administration; Y.W. contributed to the conceptualization, methodology, writing (review and editing), supervision, and funding acquisition. Q.W. contributed to the methodology, and writing (review and editing).

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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*(Manuscript received 9 July, 2024; Revision accepted 10 January, 2025;
Released online in J-STAGE as advance publication 30 March, 2026)*