Shared Adversity, Stronger Alliance: Shared Negative Emotional Experiences Promote Cooperative Behavior

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Abstract

Four experiments investigated whether and how jointly experiencing the same negative emotional events, compared to individually experiencing negative emotional events, promotes cooperation between individuals. Experiments 1–3 respectively employed a lottery task and Raven's Progressive Matrices task to manipulate negative emotional events, and used a public goods game task to measure cooperative behavior. The results indicated that jointly experiencing the same negative emotional events, compared to individually experiencing negative emotional events, promoted cooperative behavior between individuals. Experiment 2 examined the underlying mechanism by measuring need for belonging, social connection, and in-group identification, while Experiment 3 manipulated need for belonging. The results demonstrated that cooperative behavior among joint experiencers was driven by need for belonging, whereas social connection and in-group identification were insufficient to explain this phenomenon. Experiment 4 further clarified that the promotion of cooperation between individuals was due to "jointly experiencing the same negative emotional events" rather than "jointly experiencing negative emotions" by manipulating whether individuals jointly experienced "same" versus "different" negative emotional events. The findings are beneficial for explaining the formation of small groups and offer implications for group and social management.

Full Text

Co-Experiencing Adversity, Forging Alliance: How Shared Negative Emotional Events Promote Cooperative Behavior

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Abstract

Four experiments investigated whether and how co-experiencing the same negative emotional events, compared with experiencing negative emotional events alone, promotes cooperation between individuals. Experiments 1–3 manipulated negative emotional events using a lottery task and Raven's Progressive Matrices task, and measured cooperative behavior through a public goods game. The results demonstrated that co-experiencing the same negative emotional events enhanced cooperation compared with experiencing negative emotional events alone. Experiment 2 measured need for belonging, social connection, and in-group identification, while Experiment 3 manipulated need for belonging to examine the underlying mechanisms. The findings revealed that cooperation between co-experiencers is driven by need for belonging, whereas social connection and in-group identification cannot adequately explain this phenomenon. Experiment 4 further clarified that the promotion of cooperation stems from "co-experiencing the *same* negative emotional events" rather than merely "co-experiencing negative emotions"by manipulating whether individuals co-experienced "same"versus "different" negative emotional events. These results contribute to understanding small group formation and offer insights for group and social management.

Keywords: co-experience; negative emotional events; cooperation; need for belonging

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1. Introduction

Cooperation plays an indispensable role in human survival and development. As highly social beings, humans form stronger collectives through cooperation to address existential threats (Henrich & Henrich, 2006; Valdesolo & Desteno, 2011). In societal development, cooperation helps resolve social conflicts, stimulates creativity, and enhances task performance and productivity (Xie et al., 2013; Newman-Norlund et al., 2007). Extensive research has examined how emotional events influence cooperative behavior. The prevailing view suggests that positive emotional experiences increase cooperation (Dou et al., 2018; Dorfman et al., 2014), whereas negative emotional experiences decrease cooperation and may even increase aggression (Almagor & Ehrlich, 1990; Denson et al., 2011; Verona et al., 2002). However, this research has primarily focused on individuals experiencing emotional events in isolation, neglecting the impact of co-experiencing emotional events with others.

In reality, individuals not only experience emotional events alone but also frequently share such experiences with others (Betts & Hinsz, 2013). Whether

losing a loved one, experiencing natural disasters such as earthquakes, failing exams, receiving criticism, or facing social exclusion, people often have co-experiencers. Like threads woven into fabric, shared experiences intertwine throughout daily life, being both common and crucial (Haj-Mohamadi et al., 2018). Given that previous research demonstrates the destructive impact of negative emotional events on interpersonal relationships and cooperation (Denson et al., 2011; Twenge, Baumeister, et al., 2007; Verona et al., 2002), the present research focuses specifically on how co-experiencing negative emotional events influences cooperation. This investigation is warranted not only because such experiences are ubiquitous in daily life, but also because it addresses two important theoretical questions: (1) Does co-experiencing the same negative emotional event affect individual behavior differently than experiencing negative emotional events alone, such as by reducing cooperation between co-experiencers? (2) How does co-experiencing the same negative emotional event influence psychological and cognitive processes that subsequently affect cooperative behavior? This research aims to answer these questions through a series of experiments.

1.1 Co-Experience and Cooperative Behavior

Co-experience is broadly defined as two or more individuals or groups participating in the same event. Although previous research has not directly examined whether co-experiencing negative emotional events promotes cooperation compared with experiencing them alone, several lines of indirect evidence support this possibility. Studies on synchronous activities have found that synchronous body movement (Reddish et al., 2013), rocking in unison (Valdesolo et al., 2010), and tapping to the same rhythm (Valdesolo & Desteno, 2011) all promote cooperation. While synchronous activities represent a form of co-experience, such research does not emphasize the emotional nature of these events (Wiltermuth & Heath, 2009).

Recent research has examined how co-experiencing physical pain influences cooperation. Bastian et al. (2014) induced physical pain by having participants immerse their hands in ice water while performing squats (Experiment 1) or consume spicy foods (Experiment 2), finding that individuals who co-experienced physical pain cooperated more than those who co-experienced non-painful conditions. Wang et al. (2019) investigated how co-experiencing physical pain affects brain activity during cooperation among female college students, revealing that shared pain enhanced interpersonal neural synchronization during cooperative tasks. However, because these studies focused on whether and how co-experiencing pain versus non-pain influences cooperation, they address fundamentally different questions than the present research, which examines whether co-experiencing emotional events promotes cooperation compared with experiencing them alone.

Everyday experience suggests that "shared adversity" serves as an important interpersonal bonding agent. Consistent with this, retrospective studies indicate that co-experiencing negative emotional events increases intimacy between

co-experiencers. Turner and Wainwright (2003) found that ballet dancers who repeatedly experienced injuries during training—particularly those who shared the experience of being unable to perform due to injury—developed closer relationships. Whitehouse et al. (2014) discovered that soldiers who witnessed comrades' deaths together in the Vietnam War maintained stronger friendships; similarly, Libyan war veterans who shared more anxiety-inducing experiences during combat reported stronger social bonds. Based on this evidence, we hypothesize that co-experiencing the same negative emotional events, compared with experiencing negative emotional events alone, may promote cooperation between individuals.

1.2 Mechanisms Through Which Co-Experiencing Negative Emotional Events Promotes Cooperation

How does co-experiencing negative emotional events promote cooperation? Drawing on previous research, this study examines three potential mechanisms: need for belonging, social connection, and in-group identification. These concepts are related yet distinct. Need for belonging represents the fundamental human motivation to establish and maintain positive interpersonal relationships, guiding cognition, emotion, and behavior (Baumeister & Leary, 1995). As a fundamental motive, need for belonging encompasses various submotives (or subtypes), such as social comparison, seeking emotional support, establishing positive stimulation, and reducing negative affect through social contact. Social bond refers to the degree of intimacy established between individuals or groups (Baumeister & Leary, 1995). While related to the emotional support and positive stimulation components of need for belonging, social bond differs in that need for belonging represents the *desire* for relationships (a motive), whereas social bond reflects the *perception* of intimacy (Baumeister & Leary, 1995). In-group identification refers to individuals' recognition of their membership in a particular social group (Ellemers et al., 1999).

Previous research shows that individuals with high need for belonging tend to seek common group identities (De Cremer & Leonardelli, 2003), and that need for belonging can be satisfied through identification with common groups (Hornsey & Jetten, 2004). The present research aims to clarify whether co-experiencing negative emotional events promotes cooperation through need for belonging, social connection, or in-group identification. In other words, does co-experiencing negative emotional events increase cooperation by enhancing individuals' need to seek belonging from others (whether for establishing positive relationships, obtaining emotional support, or engaging in social comparison), by increasing intimacy between co-experiencers (social connection), or by leading individuals to perceive themselves and co-experiencers as the same type of people (in-group identification)?

1.2.1 Co-Experiencing Negative Emotional Events and Need for Belonging From an evolutionary psychology perspective, individuals facing ex-

ternal threats typically experience strong need for belonging. Because individual strength is limited, people seek mutual support to better cope with threats, enhance survival chances, and pass on their genes (Gintis et al., 2003; Higgins, 2008). Need for belonging represents one of the most fundamental human needs for establishing and maintaining positive interpersonal connections (Baumeister & Leary, 1995; Maslow, 1943). Rao et al. (2011) examined cooperation among victims and non-victims following the 2008 Wenchuan earthquake, finding that victims exhibited higher cooperative tendencies than non-victims, with more severe victimization predicting stronger cooperation. Based on these findings, Rao et al. (2011) proposed that disadvantage promotes cooperation, possibly because the natural threat of the earthquake increased need for belonging, thereby enhancing cooperation. Moreover, not only actual threats but also imagined threats can activate need for belonging. Maner et al. (2007) created three experimental conditions: one in which participants imagined "dying alone" (relational threat), one imagining stable marriages and friendships (future belonging), and a control condition (non-relational threat). Results showed that participants in the "dying alone" condition, compared with the other two conditions, demonstrated stronger desire to connect with others and integrate into groups. Previous research also indicates that negative emotional events are pervasive and can rapidly undermine physical and mental health (e.g., Schwarz, 2010; Yiend, 2010), thus eliciting strong need for belonging (Gintis et al., 2003; Higgins, 2008).

Although experiencing negative emotional events activates need for belonging, this need is specifically directed. Research shows that people do not indiscriminately seek belonging from anyone; rather, they seek belonging only from those likely to accept them or with whom they can potentially establish relationships (Maner et al., 2007). Schachter' s (1959) classic research on need for belonging amply demonstrates this point. Schachter (1959) found that people awaiting electric shocks preferred to wait with others rather than alone. However, these participants were not willing to wait with just anyone; they preferred to wait specifically with others who were also about to receive shocks. As Schachter (1959) noted, "Misery doesn' t love just any kind of company; it loves only miserable company" (p. 24). Similarly, individuals experiencing negative emotional events are more likely to seek belonging from co-experiencers (rather than from unrelated others or those who caused the negative event). This is because co-experiencing the same negative emotional event places individuals and their co-experiencers in the same predicament; they "know" that the other also desires relationship formation to satisfy need for belonging, leading them to draw closer and seek mutual support. This perspective aligns with Allport' s (1954) view: "For most victims of discrimination···their own suffering helps them understand and empathize with other victims' feelings. They may think: 'Those people are victims, I am also a victim; better to stand with them than against them' " (pp. 154–155).

Strong need for belonging may drive individuals to exhibit cooperative or other prosocial behaviors. Baumeister and Leary (1995) noted that need for belong-

ing reflects the desire to establish relationships, while cooperation represents a behavioral expression of that desire. De Cremer and Leonardelli (2003) found that individuals with high need for belonging invested more in public goods games, demonstrating greater cooperation. Maner et al. (2007) found that socially excluded individuals (whose need for belonging was threatened), compared with accepted or neutral individuals, showed greater tendency to make new friends (by joining friendship activities), chose to work with others rather than alone, and gave more positive evaluations and higher rewards to others (excluding those who rejected them). Based on this evidence, we hypothesize that co-experiencing negative emotional events may promote cooperation between co-experiencers by increasing need for belonging directed toward them.

1.2.2 Co-Experiencing Negative Emotional Events and Social Connection Research on co-experience and common fate indicates that individuals tend to establish social connections with others who share similar emotional experiences (Nakayachi & Ozaki, 2014; Turner & Wainwright, 2003). For example, co-experiencing natural disasters or terrorist attacks increases social bonds among survivors; co-experiencing war strengthens social bonds among soldiers (Bauwens & Tosone, 2010; Boulanger, 2013; Cohen et al., 2015; Whitehouse et al., 2014). Boothby et al. (2016) found that participants who ate chocolate together (a shared experience) reported stronger social connections. Individuals with stronger social connections may cooperate more due to mutual liking and trust (Balliet & Van Lange, 2013). Based on this evidence, one might hypothesize that individuals who co-experience emotional events (including negative ones) would develop stronger social connections and thus exhibit greater cooperation than those who experience events alone.

However, two lines of evidence suggest that co-experiencing negative emotional events may not necessarily forge strong social connections. First, extensive research shows that people stigmatize and distance themselves from individuals or groups in disadvantaged positions (e.g., people with disabilities, hepatitis patients, ethnic minorities) (Pescosolido et al., 2013; Vaughan & Hansen, 2004). Second, evidence indicates that people prefer to connect with advantaged individuals to enhance their own status (Dijkstra et al., 2010) or learn from them (Harris et al., 2008). Given that during co-experiencing negative emotional events, companions are also in a disadvantaged position, individuals (the negative event experiencers) may develop negative attitudes toward them. This could reduce rather than enhance social connections between co-experiencers, consequently decreasing cooperation.

Based on this conflicting evidence, we remain uncertain whether social connection serves as the underlying mechanism through which co-experiencing negative emotional events increases cooperation. Nevertheless, this study aims to investigate this potential mechanism.

1.2.3 Co-Experiencing Negative Emotional Events and In-Group Identification Social Identity Theory posits that "social identity is that part of an individual' s self-concept which derives from his knowledge of his membership of a social group (or groups) together with the value and emotional significance attached to that membership" (Tajfel, 1974, p. 69). When a particular social identity becomes salient, individuals exaggerate differences between categories while minimizing differences within categories, creating clear distinctions between in-groups and out-groups. Based on this social categorization, individuals develop identification with their in-group, leading to in-group favoritism and out-group derogation in behavior and attitudes (Everett et al., 2015; Hewstone et al., 2002). Building on Social Identity Theory, Turner et al. (1987) proposed Self-Categorization Theory, which suggests that people automatically categorize themselves and others into in-groups or out-groups based on various cues, even trivial ones, thereby forming different group memberships. Clearly, co-experience represents a significant and salient social cue. Based on this, one might hypothesize that individuals could use this cue to categorize themselves and co-experiencers as the same type of people, generating in-group preference and exhibiting higher cooperation.

Despite this possibility, some evidence suggests that individuals may not necessarily form group identification with co-experiencers when sharing negative emotional events. A fundamental principle of Social Identity Theory is that "individuals strive to maintain or enhance their self-esteem and develop a positive self-concept" (Tajfel & Turner, 1986, p. 16). Based on this principle, Tajfel and Turner (1986) deduced that: (1) individuals attempt to achieve and maintain positive social identity; (2) when social identity is unsatisfactory, individuals either leave their current group to join a more positive one or strive to make their current social identity more positive. Consistent with this principle, previous research shows that members of low-status groups exhibit less in-group identification than members of high-status groups (Ellemers et al., 2010; Ellemers et al., 1990; Sachdev & Bourhis, 1987). Specifically, when individuals co-experience negative emotional events with others, they may not form in-group identification with co-experiencers because both parties are in disadvantaged positions, making it difficult to obtain positive social identity or enhance self-esteem from each other. In other words, individuals sharing negative emotional events may be less likely to develop in-group identification.

Based on this conflicting evidence, we also remain uncertain whether in-group identification explains why co-experiencing negative emotional events increases cooperation between co-experiencers. Nevertheless, this study aims to investigate this potential mechanism.

In summary, this research uses four experiments to examine whether and how co-experiencing the same negative emotional events increases cooperation between individuals. The present research focuses on "failure" as a common type of negative emotional event. Specifically, Experiment 1 uses a lottery task, while

Experiments 2 and 3 use Raven' s Progressive Matrices to manipulate negative emotional events; all three experiments measure cooperation through a public goods game. Additionally, Experiments 2 and 3 examine three potential psychological mechanisms through which co-experiencing negative emotional events might increase cooperation. Experiment 4 further investigates individuals' cooperative intentions when they co-experience "same" versus "different" negative emotional events.

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2. Experiment 1: The Effect of Co-Experiencing Failure on Cooperation

2.1 Method

2.1.1 Participants We determined the sample size based on previous relevant literature (Bastian et al., 2014; Maner et al., 2007)[1]. Since these studies included approximately 30 participants per condition, we planned for 30 participants per group. The study aimed to recruit 120 participants, and we successfully recruited 120 participants. Two participants identified the experimental purpose (one each in the co-experience success and alone-experience success conditions), and their data were excluded from statistical analysis. The final sample included 118 participants (94 female, mean age = 18.32 $\pm$ 0.73 years). The distribution across conditions was: co-experience failure (n = 36), co-experience success (n = 29), alone-experience failure (n = 27), and alone-experience success (n = 26). We conducted a sensitivity power analysis for the primary ANOVA (a 2 (experience type: co-experience/alone-experience) $\times$ 2 (emotional event type: failure/success) analysis with cooperation as the dependent variable), assuming $\alpha = .05$ and power = 0.80. Results indicated that with the current sample size, we could detect a minimum effect size of f = 0.26 for all effects (main effects and interaction), representing a medium-to-large effect ($0.25 < f < 0.40$).

2.1.2 Procedure To conceal the experimental purpose, participants were told this was a study on investment decision-making. Two unacquainted participants completed the experiment simultaneously. First, they simultaneously performed a real lottery task to manipulate emotional event type (positive vs. negative). Specifically, each participant drew a ball from an opaque box containing 10 yellow balls and 10 white balls (identical in size, shape, and material). Drawing a yellow ball yielded 20 RMB cash, while drawing a white ball yielded 0 RMB. This created a 2 (experience type: co-experience vs. alone-experience) $\times$ 2 (emotional event type: success vs. failure) design with four conditions: both participants drew yellow balls and each received 20 RMB (co-experience success); both drew white balls and each received 0 RMB (co-experience failure); one drew yellow (20 RMB) while the other drew white (0 RMB), representing alone-experience success and alone-experience failure conditions, respectively. Because the lottery outcomes were genuinely random, participant numbers across the four condi-

tions were not exactly equal.

Subsequently, participants completed a public goods game (Cremer & Vugt, 1999). Each participant received 50 tokens and could invest any amount into a public goods box based on their preference. If the sum of both participants' investments $\geq$ 70 tokens, the total would be multiplied by 1.4 and then divided equally between them. Each participant' s final earnings would be their remaining tokens plus their share from the public box. If the total investment $<$ 70 tokens, all invested tokens would be lost, and participants would keep only their remaining tokens. Participants were told there would be only one round of investment, and their final tokens would be converted to cash as experimental compensation. They were instructed to consider their investment decision carefully and were not allowed to communicate during the task.

[1]In Bastian et al.'s (2014) research, Experiments 1, 2, and 3 included 54, 62, and 57 participants, respectively, assigned to two conditions (approximately 30 per condition). In Maner et al.' s (2007) research, Experiment 1 had 56 participants divided into three groups, and Experiment 2 had 34 participants divided into three groups.

To verify the effectiveness of the emotional event manipulation, participants completed the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) after making their investment. Finally, participants guessed the experimental purpose, received compensation, and were informed they could contact the experimenter if they experienced negative effects or had questions.

2.2 Results

2.2.1 Manipulation Check of Emotional Events The 10 positive affect items (Cronbach' s $\alpha = 0.87$) and 10 negative affect items (Cronbach' s $\alpha = 0.88$) from the PANAS were averaged to create positive and negative affect scores, respectively. Results showed that participants who experienced failure reported significantly lower positive affect ($M = 2.89$, $SD = 0.60$) than those who experienced success ($M = 3.39$, $SD = 0.56$), $t(116) = 4.63$, $p < 0.001$, $d = 0.86$. However, negative affect scores did not differ significantly between success ($M = 1.73$, $SD = 0.60$) and failure conditions ($M = 1.55$, $SD = 0.53$), $t(116) = 1.77$, $p = 0.08$, $d = 0.32$. These results indicate that the lottery task partially manipulated emotional events.

2.2.2 Cooperative Behavior A 2 (experience type: co-experience/alone-experience) $\times$ 2 (emotional event type: failure/success) ANCOVA was conducted with tokens invested as the dependent variable and gender as a covariate.[2] Results revealed no significant main effect of experience type, $F(1, 113) = 0.80$, $p = 0.37$; $BF_{10} = 0.26$, indicating moderate evidence supporting the null hypothesis (H_0).[3] The main effect of emotional event type was also non-significant, $F(1, 113) = 2.31$, $p = 0.13$; $BF_{10} = 0.35$, indicating weak evidence for H_0. However, the interaction between experience type and emotional event

type was significant, $F(1, 113) = 4.21$, $p = 0.04$, $^{2} = 0.04$. See Figure 1 [Figure 1: see original paper].

Further analysis revealed that cooperation in the co-experience failure condition was marginally higher than in the alone-experience failure condition, $t(61) = 1.72$, $p = 0.09$, $d = 0.42$; $BF_{10} = 0.90$, indicating weak evidence for H_0. Cooperation did not differ significantly between co-experience success and alone-experience success conditions, $t(53) = -1.02$, $p = 0.31$; $BF_{10} = 0.42$, indicating weak evidence for H_0. These results suggest that co-experiencing failure tended to increase cooperation compared with experiencing failure alone.

[2]Given that traditional NHST with $p > 0.05$ does not constitute evidence for the null hypothesis (H_0), we conducted Bayesian factor analyses using JASP software for effects with $p > 0.05$ on our core dependent variable—cooperative behavior (for detailed methods and inferential standards, see Hu et al., 2018). Experiments 2–4 used the same analytical approach.

[3]The original text appears to have a typographical error here ("= -1.29, $p > 0.05$") which seems disconnected from the context. We have omitted this fragment as it appears to be an artifact.

Figure 1. Investment amounts (M ± SE) across experience types and event types.

2.3 Discussion

Experiment 1 found that co-experiencing negative emotional events tended to promote cooperation compared with experiencing them alone, though the result did not reach statistical significance. This partially supports our hypothesis. The non-significant result may stem from inadequate manipulation of emotional events: First, the manipulation check using PANAS indicated that the lottery task did not effectively induce negative emotions (participants in the failure condition reported significantly lower positive affect than those in the success condition, but negative affect scores did not differ between conditions). This may be because winning or losing in a lottery is inherently random, and losing may not elicit strong negative emotions. Second, because the task involved money, it may have interfered with the dependent variable (investment amounts), creating confounds. Given these limitations, Experiment 2 will use a new non-monetary task (Raven' s Progressive Matrices) to manipulate emotional events, which previous research has shown effectively induces negative emotions (Cai & Yang, 2003; Zhang & Tian, 2005).

Although Experiment 1 partially supported our hypothesis, two questions remained unanswered: First, Experiment 1 could not determine whether the results reflected increased cooperation in the co-experience failure condition or decreased cooperation in the alone-experience failure condition (where one participant failed while the other succeeded). In other words, the results might be due to failed participants' unwillingness to cooperate with successful par-

ticipants. Second, how exactly does co-experiencing negative emotional events promote cooperation? To address these issues, Experiment 2 introduces a new control condition (where participants experience failure while their partner experiences neither success nor failure) to test whether co-experiencing failure genuinely increases cooperation. Additionally, we measured need for belonging, social connection, and in-group identification to explore the underlying psychological mechanisms.

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3. Experiment 2: The Mediating Role of Need for Belonging

3.1 Method

3.1.1 Pretest We used Raven' s Progressive Matrices to manipulate negative emotional events. To verify the effectiveness of this manipulation, we recruited 32 undergraduate students (15 female, mean age = 18.28 ± 0.52 years) for a pretest. Specifically, we selected 13 difficult items from the Raven' s Standard Progressive Matrices to create a new test. Participants were told that this test effectively measured college students' intelligence and abilities and could predict their future achievement and happiness. They were instructed to complete the test as quickly and accurately as possible (each item presented for 23 seconds on computer). After the test, participants received false feedback to manipulate failure: "You completed 13 items, with only 3 correct answers, scoring 3 points. Unfortunately, you failed this test!" We then used a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree) to measure perceived failure ("I feel I succeeded," "I feel I failed") and emotions (happy, pleased, proud, sad, upset, disappointed).

Results showed that participants' perceived failure (M = 3.66, SD = 1.78) was significantly higher than perceived success (M = 2.63, SD = 1.10), t(31) = 2.78, p = 0.009, d = 0.70. Averaging the three negative emotion items ($\alpha = 0.88$) and three positive emotion items ($\alpha = 0.87$) and conducting paired-samples t-tests revealed that participants experienced significantly higher negative affect (M = 3.89, SD = 1.45) than positive affect (M = 2.99, SD = 1.29), t(31) = 2.10, p = 0.046, d = 0.65. Thus, the Raven' s Progressive Matrices task effectively manipulated negative emotional events.

3.1.2 Participants Experiment 2 recruited 98 participants. Thirty-two were assigned to the co-experience failure condition, 33 to the alone-experience failure condition, and 33 served as partners for alone-experience failure participants (unrelated others whose data were not collected). Three participants identified the experimental purpose (one in co-experience failure, two in alone-experience failure) and were excluded. The final sample included 62 participants (31 female, mean age = 18.15 ± 0.47 years), with 31 in each condition. A sensitivity power analysis for the t-test on cooperative behavior (assuming $\alpha = 0.05$, power =

0.80) indicated that the current sample could detect a minimum effect size of d = 0.72, representing a medium-to-large effect (0.50 < d < 0.80).

3.1.3 Materials **Need for Belonging Scale (NTBS; Leary et al., 2013).** This scale includes 8 items, such as "I would like to be able to turn to the other person (the person I play the investment game with) when I need help." Participants used a visual analogue scale (VAS) to mark an "X" on a 10 cm line according to their true state (0 = not at all, 10 = very much).

Social Connection Questionnaire (adapted from Bastian et al., 2014; Boothby et al., 2016; Sedikides et al., 1999). This questionnaire includes 5 items, such as "How close do you feel to the other person (the person you play the investment game with)?" using the same 10 cm VAS.

In-Group Identification Questionnaire (Leach et al., 2008). This questionnaire includes 3 items, such as "How similar do you think the other person (the person you play the investment game with) is to you?" using the same 10 cm VAS.

3.1.4 Procedure Two unacquainted participants completed the experiment simultaneously. First, both completed the Raven' s Progressive Matrices task (as in the pretest). In the co-experience failure condition, participants were told they had failed the task and that the other participant had also failed, and that they would now complete an investment task together. In the alone-experience failure condition, participants were told they had failed and would complete an investment task with another participant (they were not told whether this participant had taken the Raven's test). Participants then completed the public goods game together. Specifically, each received 50 tokens and could invest any amount into a public box. If the total investment $\geq$ 70 tokens, the sum would be multiplied by 1.5 and divided equally. Final earnings consisted of remaining tokens plus the equal share from the public box.[4] As in Experiment 1, participants considered their investment individually without communication. After investing, participants completed the Need for Belonging Scale, Social Connection Questionnaire, and In-Group Identification Questionnaire.

Finally, we checked whether participants identified the experimental purpose, explained that the Raven' s test results were manipulated rather than their actual performance (to study reactions to failure), ensured participants would not be negatively affected, and obtained consent to use their data (all agreed). Participants were compensated, asked to maintain confidentiality about the manipulation, and informed they could contact experimenters with questions or concerns.

[4]The text appears to have a formatting issue here. The complete rule is: If total investment $\geq$ 70 tokens, the sum is multiplied by 1.5 and divided equally. Participants' final earnings are their remaining tokens plus their equal share.

3.2 Results

3.2.1 Cooperative Behavior This experiment used a simplified public goods game (Bowen, 1943). An independent-samples t-test revealed that participants in the co-experience failure condition invested significantly more tokens (M = 64.35, SD = 19.29) than those in the alone-experience failure condition (M = 51.77, SD = 18.70), t(60) = 2.61, p = 0.01, d = 0.68.

3.2.2 Mediation Analysis Descriptive statistics and correlations among variables are presented in Table 1 . Correlation analysis revealed that experience type was significantly positively correlated only with need for belonging and cooperation. Need for belonging, social connection, in-group identification, and cooperation were all significantly positively correlated with each other.

Table 1. Descriptive statistics and correlations among variables

Averaging the Need for Belonging Scale items (Cronbach' s $\alpha = 0.72$) revealed that participants in the co-experience failure condition reported significantly higher need for belonging (M = 6.16, SD = 1.42) than those in the alone-experience failure condition (M = 5.35, SD = 1.28), t(60) = 2.44, p = 0.02, d = 0.60. Social connection (Cronbach' s $\alpha = 0.91$) did not differ between conditions, t(60) = 1.54, p = 0.13, nor did in-group identification (Cronbach' s $\alpha = 0.74$), t(60) = 1.18, p = 0.24.

We used bias-corrected bootstrap methods to test mediation with multiple parallel mediators (Preacher & Hayes, 2008). With 5,000 samples and 95% confidence intervals (95% CI), we assessed indirect effects of the independent variable (experience type) on the dependent variable (cooperation) through mediators (need for belonging, social connection, and in-group identification). If a 95% CI does not include 0, the indirect effect is significant.

All variables were standardized. Regression results for each path are shown in Figure 2 [Figure 2: see original paper].

Figure 2. Mediation analysis of the relationship between experience type and cooperative behavior

Note: **p ≤ 0.01; *p ≤ 0.05

Results showed that the combined indirect effect of the three mediators was significant ($\beta = 5.15$, 95% CI = [0.89, 10.45]). Among the three indirect paths, need for belonging showed a significant mediation effect ($\beta = 3.19$, 95% CI = [0.40, 8.28]), while social connection ($\beta = 1.78$, 95% CI = [-0.30, 6.51]) and in-group identification ($\beta = 0.18$, 95% CI = [-0.97, 2.85]) did not (see Table 2). These results indicate that need for belonging mediates the relationship between experience type and cooperative behavior, whereas social connection and in-group identification do not.

Table 2. Bootstrap results for mediation analysis

3.3 Discussion

Experiment 2 used Raven' s Progressive Matrices to manipulate negative emotional events and introduced a new alone-experience condition as a control group. The findings further support Experiment 1: co-experiencing failure promoted cooperation compared with experiencing failure alone. Moreover, need for belonging mediated the relationship between co-experiencing negative events and cooperative behavior, while social connection and in-group identification did not. These results support the hypothesis that co-experiencing negative emotional events promotes cooperation by increasing need for belonging.

However, because mediation analysis can only infer causal relationships from covariation or correlations rather than directly establishing causality (Wen & Ye, 2014; Spencer et al., 2005; Zhao et al., 2010), Experiment 3 manipulated need for belonging to further test its effect on increased cooperation between co-experiencers.

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4. Experiment 3: Manipulating Need for Belonging

4.1 Method

4.1.1 Participants This experiment recruited 96 undergraduate students (50 female, mean age = 18.26 ± 0.71 years). Thirty-two participants were assigned to each of three conditions: co-experience failure—belonging satisfied, co-experience failure—belonging control, and alone-experience failure. A sensitivity power analysis for the one-way ANOVA on cooperative behavior (assuming $\alpha = 0.05$, power = 0.80) indicated that the current sample could detect a minimum effect size of f = 0.32, representing a medium-to-large effect ($0.25 < f < 0.40$).

4.1.2 Procedure Two unacquainted participants completed the experiment simultaneously. Negative emotional events were manipulated using Raven' s Progressive Matrices (as in Experiment 2). In the co-experience failure—belonging satisfied condition, we manipulated need for belonging satisfaction. Following previous research (e.g., Twenge, Zhang, et al., 2007), participants spent one minute thinking about their favorite friend and why they liked them, then wrote a detailed description for three minutes. They were then told the other participant had also failed the test, and both would complete the investment task (public goods game, as in Experiment 2). In the co-experience failure—belonging control condition, after experiencing failure, participants spent one minute thinking about the route from their dormitory to the laboratory and wrote a detailed description for three minutes. They were then told the other participant had also failed and would complete the investment task together. In the alone-experience failure condition, after experiencing failure, participants were told they had failed and would complete an investment task with another participant (they were not told whether this participant had taken the Raven' s

test). Afterward, we checked whether participants identified the experimental purpose, explained the manipulation, ensured no harm, and obtained consent to use their data.

4.2 Results

A one-way ANOVA with experimental condition (co-experience failure—belonging control, co-experience failure—belonging satisfied, alone-experience failure) as the independent variable and investment amount in the public goods game as the dependent variable revealed significant differences across conditions, $F(2, 93) = 4.81$, $p = 0.01$, $^{2} = 0.09$. See Figure 3 [Figure 3: see original paper]. Post-hoc tests showed that investment in the co-experience failure—belonging control condition ($M = 68.56$, $SD = 24.44$) was significantly higher than in both the co-experience failure—belonging satisfied ($M = 52.37$, $SD = 21.35$) and alone-experience failure conditions ($M = 52.17$, $SD = 26.70$), $ps < 0.01$. Investment did not differ between the co-experience failure—belonging satisfied and alone-experience failure conditions, $p = 0.97$; $BF_{10} = 0.26$, indicating moderate evidence supporting H_0.

Figure 3. Investment amounts ($M \pm SE$) across experimental conditions

4.3 Discussion

These results show that co-experiencing failure increased cooperation compared with experiencing failure alone, replicating Experiment 2' s findings. However, once need for belonging was satisfied, participants who co-experienced failure no longer exhibited greater cooperation toward their co-experiencers. In other words, co-experiencing negative emotional events promotes cooperation by increasing individuals' need for belonging directed toward co-experiencers. While Experiments 1–3 demonstrated that co-experiencing negative emotional events promotes cooperation, they could not determine whether this effect resulted from "co-experiencing the *same* negative emotional events" or simply from "co-experiencing negative emotions." Experiment 4 addresses this question by comparing co-experiencing the same negative emotional event, co-experiencing different negative emotional events, and experiencing negative emotional events alone.

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5. Experiment 4: Same Versus Different Negative Emotional Events

5.1 Method

5.1.1 Participants Using G*Power (Faul et al., 2007), we calculated that for a one-way ANOVA with three levels, assuming $\alpha = 0.05$, medium effect size ($f = 0.25$), and power = 0.80, a minimum total sample of 159 participants was required. We recruited 210 college students (70 per condition). One participant

had incomplete emotion ratings, one had incomplete demographic information, and 34 had participated in similar experiments, leaving a final sample of 174 participants (102 female, mean age = 18.28 ± 0.52 years): co-experience same negative emotional event (n = 62), co-experience different negative emotional event (n = 57), and alone-experience negative emotional event (n = 55). A sensitivity power analysis for the one-way ANOVA on cooperative intention (assuming $\alpha = 0.05$, power = 0.80) indicated that the current sample could detect a minimum effect size of f = 0.24, representing a medium effect.

5.1.2 Procedure We manipulated negative emotional events (failure) using a story scenario. Participants read: "Imagine you really want to pursue graduate studies after college. You've chosen your ideal school and major and worked very hard preparing for the entrance exam, feeling confident. However, due to poor performance, you failed the exam and lost your chance at your dream school and major!" Participants then rated their emotional state: "How would you feel at this moment?" using six emotion items (happy, pleased, proud, sad, upset, disappointed) on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree).

To manipulate the three experimental conditions, participants were told: "If at this moment, you need to complete a task with a stranger. [You learn that this student also just failed the graduate entrance exam due to poor performance.] [You learn that this student just broke up with their boyfriend/girlfriend and experienced a romantic breakup.] How willing would you be to cooperate with this student to complete the task?" The bracketed statements represent the co-experience same negative emotional event (hereafter "same experience") and co-experience different negative emotional event (hereafter "different experience") manipulations, respectively; the alone-experience condition contained no such statement. Participants rated their willingness to cooperate on a 7-point Likert scale (1 = very unwilling, 7 = very willing). Finally, participants completed demographic information and indicated whether they had participated in similar experiments.

5.2 Results

Averaging the three negative emotion items ($\alpha = 0.93$) and three positive emotion items ($\alpha = 0.92$) and conducting paired-samples t-tests revealed that participants experienced significantly higher negative affect (M = 5.52, SD = 1.40) than positive affect (M = 1.66, SD = 1.14), t(173) = -22.09, $p < 0.001$, d = 3.02, confirming effective manipulation of negative emotional events. Additionally, perceived negative affect did not differ across the three conditions, F(2, 171) = 0.22, p = 0.80; $BF_{10} = 0.07$, indicating strong evidence supporting H_0.

A one-way ANOVA with experimental condition as the independent variable and willingness to cooperate as the dependent variable revealed significant differences across conditions, F(2, 171) = 6.97, p = 0.001, $^{2} = 0.08$. See Figure 4 [Figure 4: see original paper]. Post-hoc tests showed that willingness to cooperate in the

same experience condition (M = 4.68, SD = 1.43) was significantly higher than in both the different experience (M = 4.05, SD = 1.41) and alone-experience conditions (M = 3.69, SD = 1.51), ps < 0.05. Cooperation willingness did not differ between different experience and alone-experience conditions, p = 0.19; $BF_{10} = 0.43$, indicating weak evidence supporting H_0.

Figure 4. Willingness to cooperate (M ± SE) across experimental conditions

5.3 Discussion

Experiment 4 results show that although negative affect did not differ between co-experience same and co-experience different negative emotional event conditions, participants in the co-experience same condition reported higher willingness to cooperate than those in both the co-experience different and alone-experience conditions. This suggests that co-experiencing negative emotional events promotes cooperation primarily because individuals experienced the *same* negative emotional event, not merely because they co-experienced negative emotions.

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6. General Discussion

6.1 Co-Experiencing Negative Emotional Events Promotes Cooperation

Four experiments investigated whether co-experiencing the same negative emotional events, compared with experiencing them alone, increases cooperation. Experiments 1-3 manipulated negative emotional events using a lottery task (Experiment 1) and Raven' s Progressive Matrices (Experiments 2 and 3), measuring cooperation through public goods games. Experiment 1 showed that co-experiencing negative emotional events tended to increase cooperation compared with experiencing them alone, though not significantly. Experiments 2 and 3 consistently demonstrated that co-experiencing the same negative emotional events significantly promoted cooperation. Experiment 4 used story scenarios to manipulate co-experiencing "same" versus "different" negative emotional events and alone-experience conditions, measuring cooperation intentions. Results showed that only participants who co-experienced the *same* negative emotional event reported higher cooperation intentions compared with those who experienced different negative events or experienced negative events alone. These findings align with previous research showing that synchronous activities increase cooperation (Valdesolo et al., 2010; Wiltermuth & Heath, 2009; Woolley & Fishbach, 2017) and that co-experiencing physical pain increases cooperation (Bastian et al., 2014; Wang et al., 2019).

Furthermore, our results are consistent with research on intergroup co-experience. Studies show that sharing disadvantaged status increases positive attitudes between stigmatized groups (Cortland et al., 2017; Craig & Richeson,

2012). For example, Craig and Richeson (2012) found that Latinx and Asian Americans who experienced racial discrimination showed more positive attitudes toward other groups sharing similar discrimination experiences. Cortland et al. (2017) found that inducing disadvantaged experiences among Black participants increased their support for same-sex marriage among gay individuals, another disadvantaged group. Overall, this research enriches and extends the literature on co-experience.

6.2 Underlying Mechanisms

This research also examined mechanisms through which co-experiencing negative emotional events increases cooperation. Experiment 2 measured three potential mediators: need for belonging, social connection, and in-group identification. Mediation analysis revealed that only need for belonging mediated the relationship. Building on this, Experiment 3 manipulated need for belonging, showing that co-experiencing failure increased cooperation compared with experiencing failure alone, but this effect disappeared when need for belonging was satisfied. These results support need for belonging as the mechanism driving increased cooperation between co-experiencers.

Notably, although our focus was on comparing co-experiencing versus alone-experiencing negative emotional events, Experiment 1' s 2 (experience type) $\times$ 2 (emotional event type) design also allowed us to examine co-experiencing positive emotional events. Results showed that co-experiencing positive events did not increase cooperation compared with experiencing them alone, consistent with our need-for-belonging hypothesis: co-experiencing positive events does not threaten need for belonging, so individuals do not exhibit higher cooperation to satisfy this need. Experiment 4 further demonstrated that the cooperation-promoting effect stems from "co-experiencing the *same* negative emotional events" rather than merely "co-experiencing negative emotions."

We did not find social connection to be a mechanism, which seems inconsistent with previous research. Wiltermuth and Heath (2009) found that synchronous activities (coordinated singing or synchronized dancing) increased cooperation by strengthening social bonds among group members. This discrepancy may arise because synchronous activities and co-experiencing failure represent different types of "co-experience."First, as previously discussed, synchronous activities do not emphasize emotional valence. Second, although co-experience may increase social connection, negative emotions resulting from negative events may undermine this connection (Denson et al., 2011). Additionally, our results show that co-experiencing negative emotional events did not increase in-group identification among co-experiencers. This aligns with Social Identity Theory (Tajfel & Turner, 1986), which posits that people seek positive social identities and identify with high-status groups to maintain and enhance self-esteem. In other words, people are unwilling to seek identity validation from others in disadvantaged positions (such as co-experiencers of failure). This result also aligns with Craig and Richeson (2014), who found that inducing shared experiences of rejec-

tion among Latinx Americans and gay individuals did not increase but rather decreased identification between the two groups. Thus, our research rules out in-group identification as a mechanism.

Overall, our investigation of mechanisms reveals an intriguing phenomenon: co-experiencing negative emotional events increases cooperation, but this cooperation is not driven by mutual liking and trust (social connection) or perceiving each other as the same type of people (in-group identification). Instead, it is motivated by need for belonging.

6.3 Limitations and Future Directions

First, this research examined only one type of co-experience. In reality, different types of co-experience exist: one where individuals co-experience negative events as a collective or group (e.g., entire team losing a game, entire group facing discrimination, entire nation losing a war), where individuals share negative events as "group members" (Hornsey et al., 2003; Smith et al., 2012); another where individuals co-experience negative events as separate individuals (e.g., one student fails an exam, another student also fails; one person loses a job, another is also fired; one person experiences romantic breakup, their friend also experiences breakup). Some research has examined the first type, such as Smith et al. (2012), who found that experiencing rejection as a group (vs. alone) intensified perceived unfairness. Our research focused on the second type at the individual level, examining whether co-experiencing negative events promotes cooperation between two individuals. Future research could compare these two types of co-experience.

Second, although Experiment 3 manipulated "belonging satisfaction," we did not verify the manipulation' s effectiveness. Nevertheless, previous research has demonstrated this manipulation' s validity (e.g., McConnell et al., 2011; Twenge, Zhang, et al., 2007), and our results align with Experiment 2' s mediation findings, providing confidence that need for belonging is indeed a key factor promoting cooperation between co-experiencers.

Third, Experiments 1–3 did not conduct a priori power analysis but sampled approximately 30 participants per condition based on previous studies. Post-hoc sensitivity analyses showed that although these experiments did not fully meet recommended sample sizes, they could detect medium effect sizes. More importantly, Experiment 4 conducted a priori power analysis and recruited a sufficient sample to detect medium effects, replicating Experiments 1–3' s results. Thus, we believe our findings regarding co-experience promoting cooperation demonstrate good robustness.

Finally, previous research shows that social value orientation is an important individual factor affecting cooperation: prosocial individuals cooperate more, while pro-self individuals prioritize self-interest (Liu & Hao, 2011; Wang & Chen, 2011). Future research could examine whether individual characteristics such as social value orientation moderate the relationship between co-experiencing

negative emotional events and cooperation.

6.4 Conclusions and Implications

Based on four experiments, this research concludes that co-experiencing the same negative emotional events, compared with experiencing them alone, promotes cooperation between individuals. These findings help explain small group formation: individuals who share failure experiences in academics, job seeking, romance, or interpersonal relationships tend to cooperate and seek mutual support. Second, because co-experiencing negative events serves as interpersonal glue (increasing cooperation), allowing team members to share negative emotional experiences (e.g., failure) may be beneficial rather than harmful for team building. More broadly, our findings provide experimental evidence for ancient adages such as "adversity strengthens a nation," demonstrating that people become more cooperative and reciprocal in the face of disaster.

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English Abstract

Cooperation plays an essential role in the development and survival of humans. Previous research suggests that experiencing negative emotional events typically decreases cooperation. Yet the research has primarily focused on experiencing negative emotional events alone. People living in a social environment often co-experience negative emotional events with others. Less understood is the impact of co-experiencing the same negative events on interpersonal cooperation. The present research hypothesized that (1) co-experiencing the same negative emotional events (i.e., failure) increases cooperation between co-experiencers compared with experiencing negative emotional events alone; (2) the need to belong mediates the relationship between those co-experiencing negative emotional events and their cooperation.

Four experiments were conducted to examine the two hypotheses. In Experiments 1–3, negative emotional events were manipulated either by failing in a lottery (Experiment 1) or in the Raven' s Standard Progressive Matrices (Experiments 2 and 3), and cooperation was measured by a public goods game. The results of the three experiments showed that co-experiencing a negative emotional event promoted cooperation between the co-experiencers compared

with experiencing the negative emotional event alone. Furthermore, to examine the underlying mechanism of this effect, three possible mediator variables —the need to belong, social bonds, and common in-group identity—were also measured in Experiment 2. The results showed that the need to belong, but not social bonds or common in-group identity, mediated the relationship between co-experiencing a negative emotional event (i.e., failure) and the promoted cooperation. In Experiment 3, the need to belong was manipulated rather than measured to further examine its effect on the increased cooperation between the co-experiencers. The results showed that when the need to belong was satisfied, the participants who co-experienced the negative emotional event did not behave more cooperatively than when they experienced the emotional event alone.

Experiment 4 investigated whether people would be more willing to cooperate when they co-experienced the same negative emotional events compared with when they experienced different negative emotional events or when they experienced the negative emotional events alone. The results showed that only the participants who co-experienced the same negative emotional event, but not those who co-experienced a different negative emotional event, were more likely to cooperate than when they experienced the emotional event alone. The implication of the present findings on the formation of small groups and enhancing group cohesion was discussed.

Key Words: co-experience; negative emotional events; cooperation; the need for belonging

Note: Figure translations are in progress. See original paper for figures.