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Pain as Social Glue: Shared Pain Increases Cooperation

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Abstract

Even though painful experiences are employed within social rituals across the world, little is known about the social effects of pain. We examined the possibility that painful experiences can promote cooperation within social groups. In Experiments 1 and 2, we induced pain by asking some participants to insert their hands in ice water and to perform leg squats. In Experiment 3, we induced pain by asking some participants to eat a hot chili pepper. Participants performed these tasks in small groups. We found evidence for a causal link: Sharing painful experiences with other people, compared with a no-pain control treatment, promoted trusting interpersonal relationships by increasing perceived bonding among strangers (Experiment 1) and increased cooperation in an economic game (Experiments 2 and 3). Our findings shed light on the social effects of pain, demonstrating that shared pain may be an important trigger for group formation.

Keywords

pain, group cohesion, bonding, cooperation, decision making, open data, open materials

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Painful experiences are an important component of social rituals in many cultures across the world. From secular initiation rites to religious practices, these rituals may include burning, scarifying, and other forms of mutilation (Whitehouse, 1996). Durkheim (1912/1995) argued that painful experiences function to promote cohesion and solidarity within groups. This accords with accounts of soldiers bonded together by the trauma of war (Elder & Clipp, 1989; Whitehouse, 2012) and of camaraderie promoted by shared pain within sporting contexts (Turner & Wainwright, 2003). No empirical evidence has been reported, however, for the proposition that bonding and cooperation are enhanced among people who share painful experiences. We tested the possibility that sharing the experience of pain with other people promotes interpersonal bonding and cooperation, aiming to provide evidence for a causal link.

In all three experiments reported here, each experimental session was conducted with a small group of participants. On the basis of past experience, we aimed to collect data from more than 30 participants in each condition. Data collection was stopped when this requirement was met. Some variation in sample size was caused by availability of participants, foreseeable exclusions, and group sizes.

Experiment 1

We first examined whether sharing a painful experience with other people in a small group might promote bonding more than sharing a similar but nonpainful social experience. We also measured affect and pain appraisal to examine whether any effects could be explained by these responses to pain.

Method

Fifty-four university students[1] (39 female, 15 male; mean age = 22.24 years) were paid \$10 (Australian) to participate

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and were randomly allocated to either a pain condition (n = 27) or a no-pain condition (n = 27). Group sizes ranged between 2 and 5, with a median of 4 (M = 3.65).

Pain was elicited through two separate performance tasks. The first involved an adapted cold pressor task (Walsh, Schoenfeld, Ramamurthy, & Hoffman, 1989). In the pain condition, participants submerged their hands in ice water (< 3 °C) for as long as possible. Participants in the no-pain condition completed the same task with room-temperature water (≥ 24 °C) for a fixed duration (90 s). In both conditions, participants were required to locate metal balls in the bottom of the water vessel and to place as many of them as possible into a small container affixed underwater. The sorting requirement ensured that in both conditions, participants felt there was a purpose to the task. In the second task, participants in the pain condition were asked to maintain an upright wall squat, with back straight and knees bent at 90°, for as long as possible. Participants in the no-pain condition were invited to balance on one leg for a fixed duration of 60 s and instructed to switch legs and use balance aids to avoid any tiredness. All groups of participants in both conditions were able to have a similar amount of interaction.

Next, participants completed the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988; positive affect: α = .90; negative affect: α = .73) and the Appraisal of Life Events Scale (ALES; Ferguson, Matthews, & Cox, 1999). Items on both measures were rated on a scale from 1 (*very slightly* or *not at all*) to 5 (*extremely*). The ALES is a primary appraisal that includes subscales for threat and challenge. Participants rated the degree to which their perception of the physical tasks was described by 12 adjectives (threat: "fearful," "worrying," "hostile," "threatening," "frightening," and "terrifying"; M = 1.25, SD = 0.47, α = .87; challenge: "enjoyable," "stimulating," "exciting," "exhilarating," "informative," and "challenging"; M = 2.52, SD = 0.89, α = .89).

Next, participants were asked to rate seven statements designed to measure their feeling of bonding to the other participants: "I feel a sense of solidarity with the other participants," "I feel connected to the other participants," "I feel part of this group of participants," "I feel a sense of loyalty to the other participants," "I feel I can trust the other participants," "I feel that the participants in this study have a lot in common," and "I feel like there is unity between the participants in this study." Ratings were made on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree; M* = 3.43, SD = 1.08, α = .91). Finally, participants rated the physical pain of the tasks by responding to an item gauging intensity ("How intense was the pain you experienced?"; 0 = *not at all painful*, 10 = *intensely painful*) and an item gauging unpleasantness ("How unpleasant was the pain you experienced?"; 0 = *not at all*, 10 = *the most intense bad feeling imaginable*; Price, McGrath, Rafii, & Buckingham, 1983).

Results

Manipulation checks revealed that reported pain intensity was higher in the pain condition (M = 6.07, SD = 1.99) than in the no-pain condition (M = 1.67, SD = 0.92), $t(52)$ = 10.41, p < .001. Reported unpleasantness was also greater in the pain condition (M = 6.00, SD = 1.96) than in the no-pain condition (M = 1.74, SD = 1.19), $t(52)$ = 9.63, p = .001. There were no significant differences between conditions in positive affect (pain condition: M = 3.05, SD = 0.82; no-pain condition: M = 2.80, SD = 0.83), $t(52)$ = 1.09, p = .283, or negative affect (pain condition: M = 1.34, SD = 0.45; no-pain condition: M = 1.27, SD = 0.37), $t(52)$ = 0.60, p = .554. Compared with the control tasks, the pain tasks were viewed as marginally more threatening (pain tasks: M = 1.36, SD = 0.58; control tasks: M = 1.11, SD = 0.30), $t(52)$ = 1.97, p = .054, but not more challenging (pain tasks: M = 2.67, SD = 0.87; control tasks: M = 2.37, SD = 0.91), $t(52)$ = 1.22, p = .227.

We predicted that participants who shared a painful experience, compared with those who shared a similar but nonpainful social experience, would feel more bonded together. A one-way analysis of variance (ANOVA) revealed that pain had a medium-sized effect on bonding, $F(1, 52)$ = 4.09, p = .048, d = 0.54 (see Fig. 1); participants in the pain condition reported higher bonding (M = 3.71, SD = 1.01, 95% confidence interval, or CI = [3.33, 4.09]) than did those in the no-pain condition (M = 3.14, SD = 1.09, 95% CI = [2.73, 3.55]).

This effect of pain remained when controlling for age (p = .048), gender (p = .052), and group size (p = .050). None of these variables were significantly correlated with experimental condition (ps > .136) or perceived bonding (ps > .925). To determine whether the marginal tendency for the pain tasks to be viewed as more threatening than the control tasks mediated the effect of pain on perceived bonding, we conducted a bootstrap analysis (Preacher & Hayes, 2008) using 5,000 resamples. The results of this analysis revealed that threat was not a significant mediator, indirect effect = −0.11, SE = 0.09, 95% CI = [−0.34, 0.03].

Experiment 2

Our first experiment found that sharing painful experiences (compared with sharing nonpainful experiences) increased perceived bonding among strangers, providing an important insight into how shared pain may promote trusting interpersonal relationships. In our next experiment, we examined whether these effects would extend

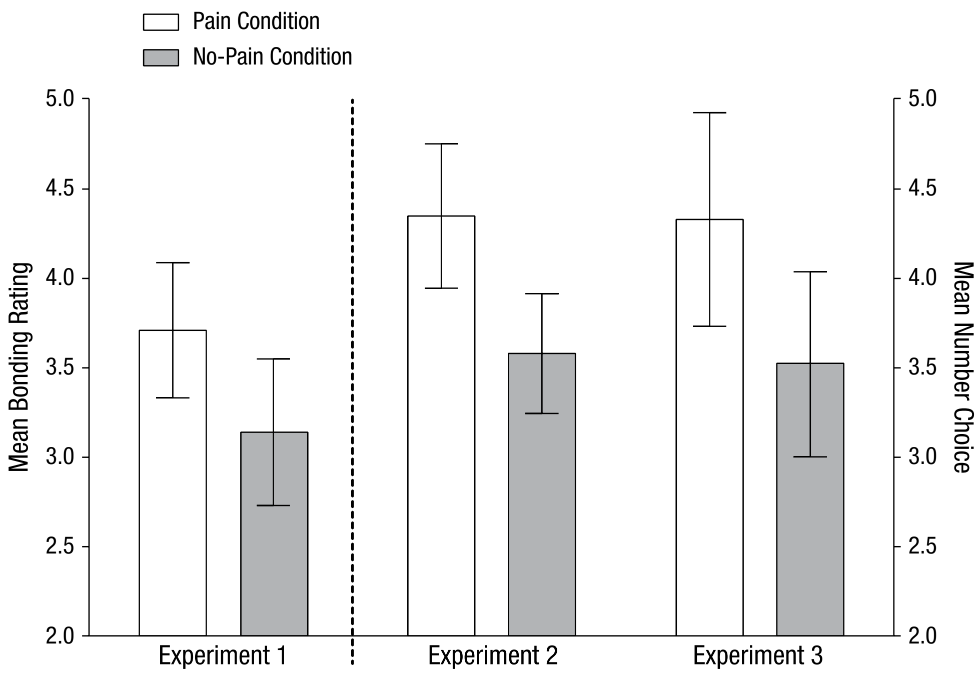

Fig. 1. Results for Experiments 1, 2, and 3. Mean bonding ratings in Experiment 1 (left *y*-axis) and mean number choices in Experiments 2 and 3 (right *y*-axis) as a function of condition. Error bars indicate 95% confidence intervals.

to cooperation. We predicted that sharing a painful experience (compared with sharing a nonpainful experience) would enhance cooperative behavior.

Method

Sixty-two university students[2] (47 female, 15 male; mean age = 21.87 years) were paid \$10 (plus game winnings) to participate and were randomly allocated to a pain condition (n = 34) or a no-pain condition (n = 28). Group sizes ranged from 2 to 6, with a median of 4 (M = 3.54).

As in Experiment 1, participants completed the pain or control tasks, the PANAS (positive affect: α = .90; negative affect: α = .73), and the ALES (perceived challenge: α = .87; perceived threat: α = .89). Next, the cooperation game was introduced as an ostensibly separate component of the experiment. Finally, as in Experiment 1, participants rated how much pain they had experienced during the physical tasks.

We used an economic-game paradigm to measure cooperation (Hirshleifer, 1983). This game was played in a group setting in which each participant could choose a number between 1 and 7. Choosing "7" could bring the highest payoff, but only if all other group members chose "7" also. When group members' choices differed, participants who chose lower numbers received higher payoffs than those who chose higher numbers (for the full payoff schedule, see Table 1). In essence, choosing "1" was the least cooperative option, because it ensured that the participant would receive a moderate payoff but minimized economic outcomes for the group. Choosing "7" was the most cooperative option because it maximized potential group outcomes, but the participant's own outcome was at risk if another group member defected. Participants played six trials of this game. To minimize iterative strategizing, we advised participants that their final payoff would be determined from a random trial. On each trial, participants chose numbers simultaneously. At the end of each trial, they were told the lowest number chosen and their earnings for that trial. Cooperation was indexed by averaging responses across all six trials; higher scores indicate more cooperative behavior.

Results

The pain manipulation was successful. Participants in the pain condition reported higher pain intensity (M = 6.09, SD = 2.12) than did those in the no-pain condition (M = 1.36, SD = 0.78), $t(58)$ = 11.19, p < .001. Likewise, participants in the pain condition reported greater unpleasantness (M = 6.16, SD = 2.01) than did those in the no-pain condition (M = 1.46, SD = 1.14), $t(58)$ = 10.95, p < .001. There were no significant differences between conditions in positive affect (pain condition: M = 2.76, SD = 0.99; no-pain condition: M = 2.65, SD = 0.91), $t(60)$ = 0.45, p = .710, or negative affect (pain condition: M = 1.21,

Table 1. Payoff Schedule for Experiments 2 and 3

Number chosen by participant	Lowest number chosen in the group						
	1	2	3	4	5	6	7
1	\$4.20	—	—	—	—	—	—
2	\$3.60	\$4.80	—	—	—	—	—
3	\$3.00	\$4.20	\$5.40	—	—	—	—
4	\$2.40	\$3.60	\$4.80	\$6.00	—	—	—
5	\$1.80	\$3.00	\$4.20	\$5.40	\$6.60	—	—
6	\$1.20	\$2.40	\$3.60	\$4.80	\$6.00	\$7.20	—
7	\$0.60	\$1.80	\$3.00	\$4.20	\$5.40	\$6.60	\$7.80

SD = 0.26; no-pain condition: M = 1.27, SD = 0.37), $t(60)$ = 0.33, p = .741. Compared with the control tasks, the pain tasks were not viewed as more threatening (pain tasks: M = 1.11, SD = 0.41; control tasks: M = 1.17, SD = 0.41), $t(57)$ = 0.59, p = .561, but they were viewed as marginally more challenging (pain tasks: M = 2.62, SD = 0.90; control tasks: M = 2.15, SD = 0.93), $t(52)$ = 1.94, p = .057.

We predicted that participants in the pain condition, compared with those in the no-pain condition, would engage in more cooperative behavior by selecting higher numbers in the game. An ANOVA revealed a medium- to large-sized effect of condition on cooperation, $F(1, 60)$ = 7.81, p = .007, d = 0.72; participants in the pain condition opted for higher numbers (M = 4.35, SD = 1.21, 95% CI = [3.95, 4.75]) than did those in the no-pain condition (M = 3.58, SD = 0.91, 95% CI = [3.25, 3.92]; see Figs. 1 and 2).

Age and gender were not significantly correlated with experimental condition or responses in the cooperation game (age: ps < .106; gender: ps < .101), and the effect of experimental condition on cooperation remained when we controlled for age (p = .005) and for gender (p = .012). Group size correlated significantly with experimental condition (r = −.31, p = .016) and with responses in the cooperation game (r = −.35, p = .005); nonetheless, the effect of experimental condition on cooperation remained when we controlled for group size (p = .042).

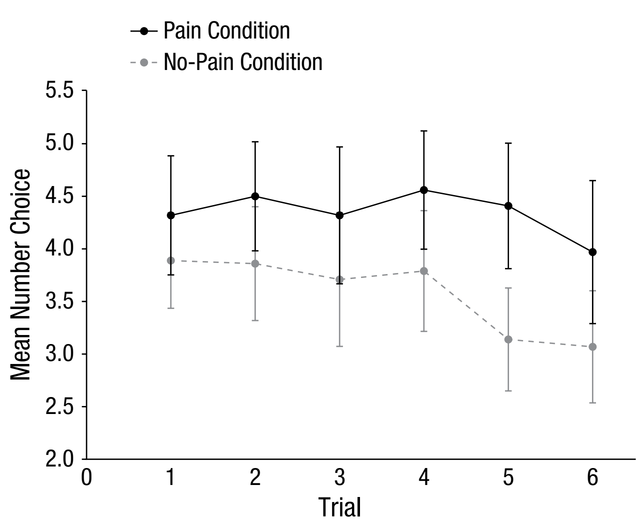

Fig. 2. Results for the cooperation game in Experiment 2. Mean number choice is graphed as a function of trial number and condition. Higher numbers indicate more cooperation. Error bars indicate 95% confidence intervals.

To determine whether the marginal tendency for the pain tasks to be viewed as more challenging than the control tasks mediated the effect of pain on cooperation, we conducted a bootstrap analysis using 5,000 resamples. The results of this analysis revealed that challenge was not a significant mediator, indirect effect = −0.01, SE = 0.08, 95% CI = [−0.02, 0.32].

Experiment 3

Our second experiment provided a behavioral demonstration that sharing painful experiences enhanced cooperation (compared with sharing nonpainful experiences). One potential criticism of our pain induction is that the physical tasks involved non-pain-related factors such as whether participants felt they performed well on the tasks. To better isolate the effects of pain on cooperation, we used a different type of pain induction—consumption of a hot chili pepper.

Method

Fifty-seven university students[3] (36 female, 21 male; mean age = 24.14 years) were paid \$10 (plus game winnings) to participate and were randomly allocated to a pain (n = 28) or no-pain (n = 29) condition. Group sizes ranged from 2 to 5, with a median of 2 (M = 2.84). Participants were recruited if they were prepared to potentially consume a hot chili pepper.

Participants first completed a pain task or a control task, which they were told was a consumer-preferences task. Participants in the pain condition were given one raw Bird's Eye chili (which is very hot) and instructed to eat as much as possible. Participants in the no-pain

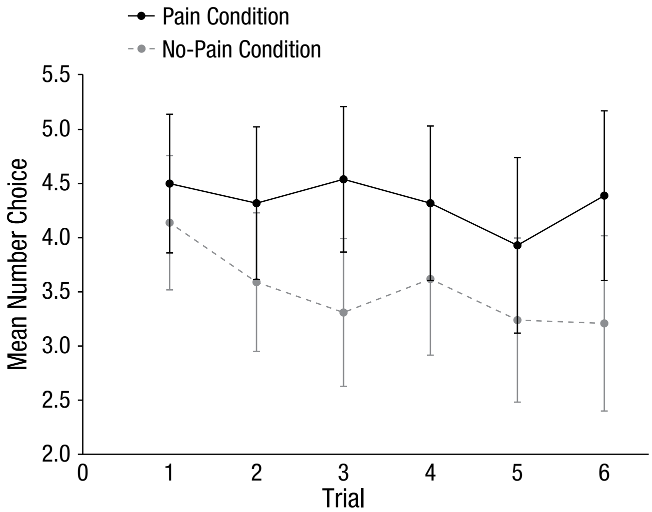

Fig. 3. Results for the cooperation game in Experiment 3. Mean number choice is graphed as a function of trial number and condition. Higher numbers indicate more cooperation. Error bars indicate 95% confidence intervals.

condition were given a hard candy (also known as a hard-boiled sweet). All participants were given 2 min to complete the task. Participants in the no-pain condition were instructed to hold the candy in their mouths rather than to chew it for the entire 2 min. Yogurt and water were provided as necessary in the pain condition.

After the consumer preferences task, participants completed the PANAS (positive affect: $\alpha = .90$; negative affect: $\alpha = .73$) and the ALES (perceived challenge: $\alpha = .87$; perceived threat: $\alpha = .89$). They next played the cooperation game, as in Experiment 2, and then rated the painfulness of the consumer preferences task. All groups of participants in both conditions were able to have a similar amount of interaction.

Results

Participants in the pain condition reported higher pain intensity ($M = 6.29$, $SD = 1.78$) than did participants in the no-pain condition ($M = 1.41$, $SD = 1.41$), $t(55) = 11.50$, $p < .001$. Participants in the pain condition also reported greater unpleasantness ($M = 5.96$, $SD = 1.81$) than did those in the no-pain condition ($M = 1.52$, $SD = 1.60$), $t(55) = 9.84$, $p < .001$. Independent-samples t tests revealed significant differences between the conditions in positive affect (pain condition: $M = 2.94$, $SD = 0.90$; no-pain condition: $M = 2.41$, $SD = 0.85$), $t(55) = 2.28$, $p = .027$, and negative affect (pain condition: $M = 1.75$, $SD = 0.51$; no-pain condition: $M = 1.25$, $SD = 0.37$), $t(55) = 4.29$, $p < .001$. Compared with the control task, the pain task was viewed as more threatening (pain task: $M = 2.20$, $SD = 0.93$; control task: $M = 1.26$, $SD = 0.55$), $t(53) = 4.62$, $p < .001$, and more challenging (pain task: $M = 2.99$, $SD = 0.52$; control task: $M = 1.97$, $SD = 0.82$), $t(53) = 5.44$, $p < .001$.

We predicted that participants in the pain condition, compared with those in the no-pain condition, would engage in more cooperative behavior by selecting higher numbers in the economic game. An ANOVA revealed a medium-sized effect of pain on cooperation, $F(1, 55) = 4.09$, $p = .048$, $d = 0.53$; participants in the pain condition chose higher numbers ($M = 4.33$, $SD = 1.62$, 95% CI = [3.81, 4.85]) than did those in the no-pain condition ($M = 3.52$, $SD = 1.42$, 95% CI = [2.92, 4.12]; see Figs. 1 and 3).

This effect of pain remained when we controlled for age ($p = .045$), gender ($p = .054$), and group size ($p = .050$). None of these variables was significantly correlated with experimental condition (ps > .694) or cooperation (age and group size: ps > .414; gender: $p = .068$).

To determine whether significant differences in affect and task perceptions mediated the effect of pain on cooperation, we conducted bootstrap analyses using 5,000 resamples. The results of these analyses revealed that neither positive affect (indirect effect = −0.01, $SE = 0.14$, 95% CI = [−0.21, 0.39]) nor negative affect (indirect effect = −0.01, $SE = 0.25$, 95% CI = [−0.58, 0.45]) significantly mediated the effect of pain on cooperation. Likewise, perceptions of the task as challenging (indirect effect = −0.01, $SE = 0.31$, 95% CI = [−0.22, 1.02]) or threatening (indirect effect = −0.01, $SE = 0.24$, 95% CI = [−0.36, 0.63]) were not significant mediators of the effect of pain on cooperation.

Because Experiments 2 and 3 focused on the same dependent variable, we collapsed the data across the experiments for a more powerful test of our key research question. An ANOVA revealed a medium-sized effect of pain on cooperation, $F(1, 117) = 11.10$, $p = .001$, $d = 0.61$; participants in the pain condition selected higher numbers ($M = 4.34$, $SD = 1.39$), 95% CI = [4.18, 4.51] (i.e., cooperated more) than did those in the no-pain condition ($M = 3.55$, $SD = 1.19$), 95% CI = [3.38, 3.72].

Discussion

Across three experiments, we found support for our hypothesis that shared pain promotes cooperation. Experiment 1 demonstrated that sharing pain promotes bonding among strangers. We then found evidence that shared pain enhances cooperative behavior, using the cold pressor task and leg squats or consumption of a hot chili pepper to induce pain (Experiments 2 and 3). None of these effects were explained by affective responses to pain or by appraisal of the painful tasks as challenging or threatening.

Our findings provide novel experimental evidence for the role of pain in promoting cooperation. This possibility has long been suggested by social theorists (e.g., Durkheim, 1912/1995). We argue that pain promotes cooperation because of its well-demonstrated capacity to capture attention and focus awareness on the immediate painful event (Craig, 2003, 2009; Eccleston & Crombez, 1999). Painful experiences are selected for attention over other competing demands, which makes painful events especially salient. Our interpretation aligns with the accounts of Whitehouse and his colleagues (Richert, Whitehouse, & Stewart, 2005; Whitehouse & Lanman, in press), who argued that dysphoric rituals prompt considerable reflection, which in turn generates richer representations of the episodes and their significance. When these experiences are shared, they not only make the events more salient but also enhance the salience of the other people who shared in those events. Sharing pain therefore is an especially powerful form of shared experience (cf. Campbell, 1958; Pinel, Long, Landau, Alexander, & Pyszczynski, 2006; Wiltermuth & Heath, 2009) that enhances the salience of the group and promotes bonding, solidarity, and, ultimately, cooperation.

Our findings make several novel contributions to the literature. First, our studies focused on personal performance or consumer preference in a context in which no prior group memberships or identities were salient. Therefore, the enhanced bonding and cooperation that we observed emerged from the experience of pain rather than from the experience of pain for the group (i.e., which would increase the symbolic value of group membership; Aronson & Mills, 1959; Olivola & Shafir, 2013). Our research thus goes beyond work focusing on costly behaviors and group commitment (Henrich, 2009; Xygalatas et al., 2013) or the influence of preestablished social identities on cooperation (Kramer & Brewer, 1984; van Vugt & Hart, 2004). Second, in our studies, participants were exposed to functionally similar tasks (common fates) in the pain and no-pain conditions, and the tasks varied only in how painful they were; thus our findings extend beyond explanations based on common fate (e.g., Brewer & Kramer, 1986; Campbell, 1958) and place the burden of explanation on qualities related to pain. Third, we focused on what happens after pain, rather than before pain, thus going beyond work focusing on the role of fear or anxiety related to future pain (e.g., Schachter, 1959). Finally, although we did not empirically demonstrate a mechanism for the effects we observed, our design did allow us to rule out alternative explanations, showing that merely sharing painful experiences with other people promotes cooperation.

Our findings afford new insight into the ways in which pain interacts with human sociality. Evolved responses to pain serve to generate social support (e.g., Hadjistavropoulos et al., 2011); when shared, however, pain may promote higher-order effects such as bonding and group formation. Pain, it seems, has the capacity to act as social glue, building cooperation within novel social collectives.

Author Contributions

B. Bastian and J. Jetten developed the study concept and designed the studies. L. J. Ferris assisted with data collection. B. Bastian and L. J. Ferris analyzed the data and prepared the draft manuscript. J. Jetten and L. J. Ferris provided critical revisions. All authors approved the final version of the manuscript for submission.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Open Practices

All data and materials have been made publicly available via Open Science Framework and can be accessed at http://osf.io/9k3sw. The complete Open Practices Disclosure for this article can be found at http://pss.sagepub.com/content/by/supplemental-data. This article has received badges for Open Data and Open Materials. More information about the Open Practices badges can be found at https://osf.io/tvyxz/wiki/view/ and http://pss.sagepub.com/content/25/1/3.full.

Notes

1. Of the 58 participants in the original sample, 4 were excluded: One had insight into the study's aims, 1 reported high levels of pain in the control condition (> 3 *SD* above the mean), and 2 presumably did not experience group rapport because of their overt annoyance at a group member's loud sneezing.
2. Of the 69 participants in the original sample, 7 were excluded: Five had preexisting friendships with other members of their group, and 1 misunderstood the instructions for the game.
3. Of the 71 participants in the original sample, 14 were excluded: Eleven had preexisting friendships with members of their group (these participants were identified early in the experimental session and were marked for exclusion, but they were allowed to complete the procedure in the control condition so that they could receive payment), 2 verbally communicated a strategy at the beginning of the game, and 1 misunderstood the instructions for the game.

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