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Individual differences in pain sensitivity predict the experience of unfairness

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Abstract

Pain has shaped our evolutionary history, and pain-free experiences are critical for our health. There are, however, enormous individual differences in pain sensitivity, and the psychological consequences of this heterogeneity are only poorly understood. Here, we investigated whether individual differences in pain sensitivity predicted the experience of unfairness. We found that the magnitude of pain sensitivity correlated with the extent to which participants experienced unfairness. This association was due to the shared human alarm system of unfairness and pain sensitivity. This finding may elucidate mechanisms for producing a new and positive cycle of a healthy experience between fairness and feeling pain-free.

Keywords

experience of unfairness, individual differences, pain sensitivity, pain threshold, pain tolerance

Introduction

Imagine putting your hand in very cold water until it feels unpleasant. This experience would contribute to the phenomenon of ‘pain’. There are enormous individual differences in self-reported pain among people, even with the same distress event. Available evidence indicates that these differences in pain ratings largely reflect individual variation in pain sensitivity, which is relatively stable across individuals (Nielsen et al., 2009). Understanding the consequences of individual differences in pain sensitivity may be crucial to the optimal design of health studies.

Now imagine that you are playing an ultimatum game (Güth et al., 1982) with an anonymous player. The rule is simply that the other player proposes how to allocate 10 monetary units between you both, and you just accept or reject whatever she/he shares with you. If you accept, the offer would be executed according to the proposed allocation; if you reject, you both get nothing. For instance, if the offer is that you would get 1 monetary unit, how would you react? Available evidence has repeatedly shown that some people often reject unfair offers and are even willing to get nothing in order to punish the proposer (Camerer, 2003). However, the sources of individual variation in responses to unfairness remain poorly understood.

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Here, we tested the idea that these two types of unpleasant experiences may be connected such that individual differences in pain sensitivity predicted unfairness, and we bridged the gap between these two major practical problems that have mostly been addressed independently. Our findings shed light on the psychological consequences (unfairness) of a relatively stable personal trait (pain sensitivity) and offered profound practical implications for health problems. By integrating literature within social psychology and health psychology, this research can contribute to a comprehensive understanding of the consequences of variation in pain sensitivity.

Consequences of individual differences in pain sensitivity

The conceptualization of pain sensitivity typically involves three different measures. Specifically, past experimental pain studies have focused on general measures of pain sensitivity, which include pain threshold and pain tolerance, and directly perceived pain intensity of the same experimental pain stimuli (Nielsen et al., 2009). Since there were no a priori reasons to assume that the heterogeneity in pain threshold (or pain intensity) but not in pain tolerance predicted unfairness (or vice versa), we predicted the pattern would emerge among all three of these measures.

Research has found that pain sensitivity can cause consequences outside of its directly physiological effects. For instance, a study demonstrated the existence of a shared sensitivity to physical and social pains (Dewall et al., 2010; Eisenberger et al., 2006). Similarly, a well-known pain killer (i.e. acetaminophen) was shown to effectively reduce both physical and social pains (Dewall et al., 2010). Additionally, neuroimaging studies showed that social pain shares neural underpinnings with physical pain (Eisenberger et al., 2003). Such similarities between physical distress and psychological unpleasantness are unified by a pain overlap theory (Eisenberger, 2012; Eisenberger and Lieberman, 2004; MacDonald and Leary, 2005; Riva et al., 2014), which posits that there is an overlap between different types of pain. Based on this pain overlap theory, as with social pain, the unpleasantness of unfairness (Lieberman and Eisenberger, 2008) may serve as another non-physical pain that is linked to pain because of shared sensitivity.

The shared sensitivity to pain and unfairness functions through a shared human alarm system, which is a psychological mechanism that detects and handles alarming situations. It is now well established that human alarm systems relate to both pain and unfairness. On one hand, it has been argued that being ostracized activates the human alarm system (Eisenberger and Lieberman, 2004). On the other hand, one study proved that presenting alarm-related stimuli activates the human alarm system and leads to more extreme judgements about subsequent justice-related events (Van den Bos et al., 2008). These observations show that both pain and unfairness may activate the same human alarm mechanism. Consequently, pain-sensitive individuals may consistently notice the cues of unfairness in a circumstance because of the activation of the human alarm system. The idea that shared sensitivity functions via the human alarm system provides a theoretical foundation for our hypothesis that heterogeneity in pain sensitivity predicts the experience of unfairness.

The experience of fairness is typically divided into three types. The first is distributive justice, which argues that the judgement of a result is determined by comparison with a reference (Adams, 1965). If the comparison results are the same, individuals will have a sense of fairness. The second is procedural fairness, which guarantees the fairness of results by controlling the process (Krawczyk, 2009; Thibaut and Walker, 1975). The third is interactional justice, which focuses on the quality of the interactional process (Bies and Moag, 1986; Greenberg, 1993). Through this understanding, it is reasonable to distinguish among the three types of unfairness to enhance the validity of our research.

In the current research, we explored whether individual differences in pain sensitivity predicted unfairness. To test the external validity in a real-world context, we conducted a pilot study involving blood withdrawal in a hospital (field study). To test the internal validity, we conducted three laboratory experiments (studies 1, 2 and 3). To consistently measure pain sensitivity, we used a well-validated scale when measuring participants' pain intensity, pain threshold and pain tolerance. To measure unfairness, we carefully designed scenarios to simulate real world and employed widely used ultimatum games to induce the experience of unfairness. Moreover, we tested whether the intensity of painful stimuli could serve as an alternate explanation for our findings (study 4). It is conceivable that stimulus intensity might affect both pain sensitivity and unfairness. To address this concern, we manipulated the stimulus intensity and measured pain sensitivity in one experiment to test whether the link between pain sensitivity and unfairness was due to situational factors, such as stimulus intensity.

Field study

A field study explored whether perceived pain intensity during a medical blood withdrawal predicted self-reported unfairness.

Method

Participants. In the field study, 57 students from Peking University (29 women, 28 men; M_{age} = 24.61 years, standard deviation (SD) = 3.05) participated in a routine medical examination. Eight additional participants participated but were excluded from the data analysis because of their incomplete participation. Informed consent was obtained according to procedures approved by the Committee for Protecting Human and Animal Subjects at our university.

Measures. Participants completed a medical blood withdrawal and the measure on unfairness. Participants were debriefed and thanked at the end.

Pain intensity measure. First, participants were instructed to become familiar with the 11-point numerical rating scale (NRS; 0 = *no pain*, 10 = *worst possible pain*) (Ferreira-Valente et al., 2011; Hartrick et al., 2003). Next, participants completed the blood withdrawal and then rated how much pain they felt during the process. The objective intensity of the pain stimulus was considered constant because both the pricking site on the skin and the performing nurse were consistent. However, the subjective experience of perceived pain varied according to participants' pain sensitivity. We reasoned that participants with higher pain sensitivity would rate the same stimulus more painful than those with lower pain sensitivity.

Unfairness measure. We measured participants' experience of unfairness using a 10-item scale, adapted from the Justice Sensitivity Inventory (Schmitt et al., 2010). More importantly, this scale has been successfully applied to the local participants (Wu et al., 2014). We averaged their responses to form our unfairness index (α = .85).

Control variables. We included reasonable external factors that might have affected both pain and unfairness, such as gender, age, unpleasant emotion or fear during the blood withdrawal, and the extent of hunger at the time of the blood withdrawal.

Results

We first tested the individual heterogeneity in pain intensity. There were large individual differences in the magnitudes of pain intensity (see Supplementary Materials Figure S1). The correlational analysis based on the entire sample of participants showed that individual differences in pain intensity predicted the experience of unfairness ($r(57) = .28$, $p < .05$). Therefore, the current field study established a direct relationship between pain intensity and unfairness in a real-world context.

Study 1

In the next three studies, we used laboratory studies to control for possible situational confounding factors. The design of our studies aimed to combine different paradigms to confirm our hypothesis that individual differences in pain sensitivity predicted the experience of unfairness. In study 1, we investigated whether pain sensitivity induced by a shock stimulation task predicted procedural unfairness measured with a well-validated unfairness scenario.

Method

Participants. In study 1, 50 students from Peking University (26 women, 24 men; M_{age} = 22.84 years, SD = 2.40) were eligible to participate. Five additional participants participated but were excluded from the data analysis because of equipment failure during experiment. Informed consent was obtained according to procedures approved by the Committee for Protecting Human and Animal Subjects at our university.

Measures. Participants first completed the pain threshold measure and then rated their responses to a procedural unfairness scenario (PUS). Following previous research (Chebat and Slusarczyk, 2005; Mikula et al., 1998), we operationalized the experience of unfairness as participants' emotional and cognitive responses to an unfairness scenario. Finally, participants were debriefed, thanked, and paid 15 RMB.

Pain threshold measure. On day 1, pain threshold was measured with shock pain (Lautenbacher and Rollman, 1993; Rollman and Harris, 1987). A Digitimer (Welwyn Garden City, UK) DS7A stimulator was used to simulate pain. A pair of electroencephalography (EEG) cap electrodes was placed on the dorsum of participants' nondominant hand. We followed the standardized procedure to assess pain threshold according to the NRS. The stimulus intensity that participants first perceived as painful was defined as their pain threshold. Participants with higher pain sensitivity showed lower pain thresholds.

Measure of procedural unfairness. On day 2, participants completed the PUS ratings. An independent pretest was conducted to assess the reliability of the PUS (see Supplementary Materials *Pretest for study 1*). The well-validated measure included the manipulation check, cognition and emotion items. The first item was used to confirm that participants read the scenario carefully. The second included the items, 'In this case, the degree of injustice or dislike or exclusion' (1 = *no*, 7 = *very*). The third included the items, 'In this case, the degree of angry or sad or disgust' (1 = *no*, 5 = *very*). The cognition and emotion items had a strong association ($r(50) = .75$, $p < .001$). The mean score of the cognition and emotion items was used as the procedural unfairness index.

Control variables. Participants responded to items assessing factors that might have affected their experience of pain or unfairness, such as gender, age, experiences with similar unfair scenarios, and experiences with unfair scenarios or not in the past two weeks.

Results

Participants showed large individual variation (see Supplementary Materials Figure S2).The correlation analysis confirmed that pain threshold was negatively associated with the unfairness index ($r(50) = -.47$, $p < .01$). This effect remained significant after we controlled for gender, age, experiences with similar unfair scenarios and experiences with unfair scenarios or not in the past 2 weeks ($r(44) = -.44$, $p < .01$). This was consistent with results of regression analysis (see Supplementary Materials Table S1). Thus, study 1 found that individual differences in pain threshold predicted the experience of procedural unfairness.

Study 2

We investigated whether pain tolerance induced by a cold pressor task (CPT) predicted interactional unfairness measured with a well-validated unfairness scenario.

Method

Participants. In study 2, 60 participants from the Normal University of Shanxi (41 women, 19 men; M_{age} = 23.03 years, SD = 5.69) provided informed consent and the study procedures were approved by the Committee for Protecting Human and Animal Subjects at our university.

Measures. First, participants were subjected to pain induced by the CPT. Next, they responded to an interactional unfairness scenario (IUS). Finally, participants were debriefed, thanked, and paid 10 RMB.

Pain tolerance measure. On day 1, participants completed the standard procedure of the CPT (Mitchell et al., 2004). Participants were asked to put their non-dominant hand in a bucket of ice water. To control for potential experimenter effects, the same experimenter always stood behind the participants while keeping time. Pain threshold was operationalized as the time at which participants first felt pain. Pain tolerance was defined as the time at which participants could not bear any more pain. We used the time difference between the time of pain tolerance and the time of pain threshold because pain tolerance was affected by pain threshold.[1] Moreover, the distribution of the pain tolerance (measured in seconds) was heavily righted-skewed. Therefore, we logged 10-transformed the time of pain tolerance in all analyses.

Measure of interactional unfairness. On day 2, participants completed the IUS ratings. An independent pretest was conducted to assess the reliability of the IUS (see Supplementary Materials *Pretest for study 2*). This well-validated measure included the manipulation check, cognition, and emotion items. The first item was to ensure that participants finished the measure successfully. The second included five items to measure the degree of politeness, respect, the adequacy and rationality of the information, and informed information. The third included three items to measure the degree of anger, sadness and disgust. The cognition and emotion items had a strong association ($r(60) = .42$, $p < .01$). The mean score of the cognition and emotion items was used as the procedural unfairness index.

Control variables. Participants responded to items assessing factors that might have affected their pain tolerance (e.g. attention, motivation and hungry) on day 1. They also rated items assessing factors that might have affected their experience of unfairness (e.g. have a flying experience or not, the frequency of flying in a plane, experiences with similar unfair scenarios, or experiencing unfair scenarios or not in the past 2 weeks) on day 2.

Results

The plotted figure showed large individual differences in the magnitudes of pain tolerance (see Supplementary Materials Figure S3). The results from the correlation analysis revealed that pain tolerance was negatively associated with the unfairness index ($r(60) = -.38$, $p < .01$). This effect held after we controlled for gender, age, experiences with flying or not, the frequency of taking the plane, experiences in similar unfair scenarios, and experiencing unfair scenarios or not in the past 2 weeks ($r(52) = -. 35$, $p = .01$). This was consistent with the results of the regression analysis (see Supplementary Materials Table S2). Therefore, study 2 showed that individual heterogeneity in pain tolerance predicted experiences of interactional unfairness.

Study 3

Study 3 employed a tourniquet pain paradigm to assess pain sensitivity and a widely used economic game to induce the experience of distributive unfairness. We predicted that pain sensitivity would predict unfairness, which was indicated by rejection rates and the point of indifference between the two options offered in the ultimatum game.

Method

Participants. In study 3, 51 students from the Normal University of Shanxi (28 women, 23 men; M_{age} = 19.43 years, SD = .70) provided their informed consent. The study procedures were approved by the Committee for Protecting Human and Animal Subjects at our university. In total, 63 participants were recruited, and 8 dropped out of the study because of computer programme failure during the experiment. Three were excluded because they did not pass the instruction check questions, which indicated that they did not understand the experimental instructions. One additional participant participated but was excluded from the data analysis because she/he accepted all the offers, which made it impossible to estimate the unbiased point of indifference for her/him with a logistic function.

Measures. We first measured pain threshold. Then, participants completed the ultimatum game. Finally, participants were debriefed, thanked and paid 10 RMB.

The game consisted of two types of players: the proposer and the responder. The proposer decided how to allocate given monetary units (e.g. 10), and then the responder either accepted or rejected. According to the rational agent assumption, participants would accept all offers greater than 0 (Henrich et al., 2001). However, participants often reject unfair offers (e.g. low offers). An aversion to unfairness has been proven to be the main reason (Nowak et al., 2000). Studies have found that participants with a higher sensitivity to unfairness reject more offers (Fetchenhauer and Huang, 2004). Thus, rejection rates are one main indicator of an individual's experience of unfairness. Additionally, the point of indifference, when a participant is equally likely to reject or accept an offer, also models the experience of unfairness (Kubota et al., 2013). We included the point of indifference as another unfairness index.

Pain threshold measure. On day 1, participants completed the measure of pain threshold. A Yuwell (Yuwell-Jiangsu Yuyue Medical Equipment & Supply Co., Ltd., JiangSu, China) pressure metre was used to stimulate pain. Participants were asked to lie down in bed, and then the experimenter attached the blood pressure cuff to their leg. Participants reported pain ratings using the NRS. Pain threshold was defined as the level of pressure that when participants first felt pain.

Measure of distributive unfairness. On day 2, participants completed the game. Participants were informed that we randomly selected 3 trials at the end of the experiment, and their decision in these three trials determined how much they were paid. This was actually a deceptive instruction to motivate participants to take the game seriously. Participants played 40 trials in the responder role.

Modelling rejection behaviour in the ultimatum game. To explore participants' experience of distributive unfairness and to estimate the amount required for participants to reject an offer, we fit the data by employing a logistic function

$$p(\text{accept}) = \frac{1}{1 + e^{-m(x-D)}}$$

In this function, the point of indifference (D) used a logistic regression to determine the amount at which a participant is equally likely to reject or accept a given offer. Since higher amounts are required for a player with higher sensitivity to unfairness to accept a given amount offered in the game, a higher D stands for a higher experience of unfairness.

Control variables. Participants responded to items assessing factors that might have affected their physical pain (e.g. fear and hunger) on day 1. They also rated items assessing factors that might have affected their unfairness experience on day 2, such as personal norm of reciprocity and the neuroticism scale from the Big Five personality inventory.

Results and discussions

Results. As in previous studies, there were large individual differences in the magnitudes of pain threshold (see Supplementary Materials Figure S4). We included two indicators (rejection rates and the point of indifference) to assess the experience of unfairness.

Rejection rates. The analysis confirmed that pain threshold was negatively associated with rejection rates ($r(51) = -.38$, $p < .01$; see Supplementary Materials Figure S4). This effect remained significant after we controlled for gender, age, personal norm of reciprocity and neuroticism ($r(45) = -.54$, $p < .001$). This was consistent with the results of the regression analysis (see Supplementary Materials Table S3).

Point of indifference. We found that pain threshold was negatively associated with this unfairness index ($r(51) = -.40$, $p < .01$; see Supplementary Materials Figure S5).[2] This effect held after we controlled for gender, age, personal norm of reciprocity and neuroticism ($r(45) = -.54$, $p < .001$). This was consistent with the results of the regression analysis (see Supplementary Materials Table S4).

Discussion. When we used the logistic function to estimate the point of indifference, one question deserved further discussion. Three participants' points of indifference exceeded 4 (i.e. the highest offer in the game), which made us speculate that these participants may have used specific strategies, such as rejecting them all at one specific point. To address this problem, we conducted an additional analysis in which we compared the results obtained after excluding these participants to the results obtained when they were included. The pattern of the results was consistent with the previous analysis that included these participants ($p < .05$). Thus, individual differences in pain threshold predicted two different measures of the experience of unfairness.

Together, the inclusion of perceived pain intensity of the same unpleasant event, pain threshold and pain tolerance provided different opportunities to confirm our hypothesis. The studies above provided convergent evidence that individual variation predicted unfairness. Despite the inclusion of possible control variables, however, one additional factor, the stimulus intensity, might also have affected the link between pain sensitivity and unfairness. We directly tested this issue in the next study.

Study 4

We reasoned that the shared alarm system functioned as the mechanism that linked pain sensitivity to unfairness. It was therefore possible that the stimulus intensity of pain activated the human alarm system. Moreover, the stronger stimulus intensity activated a stronger alarm system. That is, stimulus intensity may have served as a potential moderating variable that linked individual differences in pain sensitivity to the experience of unfairness.

Method

Participants. In study 4, 39 students from Peking University (25 women, 14 men; $M_{age} = 22.95$ years, $SD = 3.32$) were randomly assigned to experimental conditions. One additional participant participated but was excluded from the data analysis because of equipment failure during the experiment. Informed consent was obtained according to procedures approved by the Committee for Protecting Human and Animal Subjects at our university.

Experimental design and procedures. The study was a 2 (pain sensitivity: high pain sensitivity vs low pain sensitivity) × 2 (stimulus intensity: high stimulus intensity vs low stimulus intensity) mixed design with one within-subject factor. Participants' rejection rates were used as the dependent variable.

Pain sensitivity was measured with the shock pain paradigm, and the basic procedure was the same as the procedure in study 1. The electric current at level 3 according to the NRS was defined as the low stimulus intensity and level 7 was defined as the high stimulus intensity. Once the experiment started, a fixation was shown on the computer screen, and then participants were shocked. Then, participants completed the game. The game used similar parameters to those in study 3. The location of the rejection key, default acceptance key, the order of low/high pain intensity conditions and a number of other variables were counterbalanced across the experiment. Finally, participants were debriefed, thanked and paid 10 RMB.

Control variables. We included control variables that might have affected participants' rejection rates, such as demographic variables, justice sensitivity, personal norm of reciprocity and the neuroticism scale.

Results

To directly compare the groups between pain-sensitive individuals and pain-insensitive individuals, participants were divided into two groups according to the median number of pain sensitivity. A 2 (pain sensitivity) × 2 (stimulus intensity) repeated analysis of variance (ANOVA) on the rejection rates yielded an interaction effect ($F(1, 37) = 6.64$, $p < .05$, $\eta^2 = .15$; see Supplementary Materials Figure S6). In the high pain sensitivity condition, participants who were randomly assigned to the high stimulus intensity condition ($M = .61$, standard error (SE) = .06) rejected more offers than those in the low stimulus condition ($M = .49$, $SE = .06$, mean deviation (MD) = .26, $SE = .08$, $p < .01$); the effect was not significant in the low pain sensitivity condition ($MD = .11$, $SE = .08$, $p > .05$).

We conducted additional analyses to corroborate our central hypothesis using the hierarchical linear regression analyses (see Supplementary Analyses for study 4). The findings that stimulus intensity did not affect the link between pain sensitivity and unfairness supported our prediction that pain-sensitive individuals consistently experienced unfairness regardless of the pain they actually suffered.

General discussion

Although knowledge regarding pain sensitivity and experiences of unfairness is growing rapidly, very little is known about the relationship between them. This study found that individual variation in pain sensitivity predicted unfairness. The pattern emerged regardless of how pain sensitivity was measured (self-reported pain intensity of the same painful event, pain threshold and pain tolerance). Moreover, this association was due to the shared human alarm system of unfairness and pain sensitivity.

Pain-sensitive people may consistently experience unfairness

Our findings may be important precisely because they raise the possibility that pain-sensitive individuals may consistently experience unfairness. In comparison, past studies have focused on the unique quality of pain (Eisenberger, 2012) or unfairness (Brosnan and De Waal, 2014). Although we truly appreciate the attempts in the pain and unfairness literature to probe what makes the psychology of pain and unfairness different from the psychology of other constructs, we argue that this may have come at the expense of relatively neglecting for an overlap between them. An important implication of the findings here is that they suggest that they may share some similarities.

First, our finding illuminates a critical psychological experience (unfairness) related to a mainly physiological sensitivity (pain), thus providing solid evidence for the pain overlap theory. By linking social pain to unfairness, our work shows the connection between physical pain and non-physical pain perception. Past work has mainly shown that social pain overlaps with physical pain (Eisenberger, 2012; MacDonald and Leary, 2005). In the real world, however, people often experience a relatively mild yet more general unpleasant experience of unfairness (Lieberman and Eisenberger, 2008), especially with chronic pain (McParland et al., 2011). The current research suggests that pain-sensitive individuals may consistently experience unfairness. Second, the link between the heterogeneity of pain and unfairness may suggest an overlap in the evolutionary function of human alarm system (Brosnan and De Waal, 2014; Van den Bos et al., 2008).

Although it is tempting to assume that the pain and injustice constructs are unique, the shared human alarm system connects pain sensitivity to unfairness. Our conjecture is that they may sometimes have unique qualities at some level and that they may sometimes share a similar alarm function, especially in pain-sensitive individuals.

Practical implications for pain management and health

Our findings highlight the importance of the similarities between pain sensitivity and unfairness and have important implications for pain management and health, especially in crisis situations. In crisis, physical pain can eventually chip away at an individual's willingness to cope with pain. The experience of unfairness may further accentuate pain, entrapping individuals in a self-reinforcing negative loop.

How can the negative feedback be avoided? One possible solution is to find a way to build a new cycle of pain-free and fair experiences. Individuals experiencing pain not only need medical resources but also experience a sense of lacking control over their pain relief, and this lack of control increases pain (Chou et al., 2016). However, positive emotional states may reduce pain (Bushnell et al., 2013), and thus the experience of fairness may also reduce the pain experience. Together, developing a positive self-reinforcing loop of a healthy experience between freedom from pain and fairness may be a key step in coping with pain.

Alternative explanations

The studies reported in this article provided consistent evidence that individual differences in pain sensitivity predicted unfairness. Despite the consistency of these effects, however, two alternative explanations warrant further consideration.

A first possibility is bias in the use of the pain scale. From this perspective, individual differences in pain sensitivity do not reflect stable differences in actual pain but arise from differences in the way participants interpret the pain rating scales. First, the high stability and reliability of pain ratings across our studies and previous similar studies (Ferreira-Valente et al., 2011) argue against this measurement error as a major issue. Second, if participants have systematic biases in the way they use pain scales, these biases should increase correlations between ratings of different types of pain stimuli. However, the correlations between ratings of different types of experimental pain are very low (Janal et al., 1994). Thus, it appears that biases in scale use did not influence our participants' ratings, and our measures of pain threshold or pain tolerance were measuring actual individual differences of pain sensitivity.

Another possible explanation is whether our results are explained by confounding variables, such as attention or emotion-regulation strategies. We measured pain on day 1 and measured unfairness on day 2 (studies 1, 2 and 3) to control the possible situational factors that may have affected each other. Therefore, it seemed unlikely that physiological arousal, such as attention and saliency, had been affecting the next day's assessment of unfairness. Additionally, we directly ruled out the confounding factor of stimulus intensity in study 4. Moreover, if the current results could be explained in terms of emotion-regulation strategies, such as distraction, pain-insensitive individuals would have also shown a high number of experiences of unfairness. This was, however, not the case.

Conclusion

The present research bridges the gap between pain and unfairness that has mostly been addressed independently. Our results suggested that researchers should recognize the possible link between these two issues: pain-sensitive individuals may consistently experience unfairness regardless of the pain they actually suffered; thus, pain perpetuates itself. Once pain perpetuates itself to a chronic state, pain relief becomes a serious health issue because controlling pain becomes increasingly difficult. By showing that individual differences in pain sensitivity predict unfairness, the current findings offer an opportunity to short-circuit the negative-feedback loop by producing a new and positive cycle of a healthy experience between fairness and feeling pain-free.

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Notes

1. The pattern of the results remained significant ($p < .05$) if included the baseline time of pain threshold.
2. When estimating the point of indifference, one participant's slope was less than 0. This might have indicated that the participant did not pay attention to the experiment. The results were unchanged after excluding this participant.

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