



# Study on the Influence of Ingroup and Outgroup Perspective on Empathy for Pain in Self-Involvement Situation

Yuran Yang, Qian Wang<sup>(✉)</sup>, and Siying Zhu

Tianhua College Shanghai Normal University, Shanghai, China  
414791142@qq.com

**Abstract.** The study used the pain empathy paradigm to investigate the level of pain empathy in situations with or without self-involvement. The researcher randomly selects 30 representative subjects. The experiment implements  $2$  (situation: self-involvement situation group, no self-involvement situation group)  $\times 2$  (Group position: inner group, outside group)  $\times 2$  (the picture stimulus type: pain, non-pain) three-factor hybrid experimental design. The e-prime procedure was used to take the subject's pain intensity score as the dependent variable. Pain intensity was significantly higher in the inner group than in the outgroup position ( $p < 0.001$ ). In the inner group standpoint, subjects with a self-involvement situation had higher pain empathy levels than subjects without the self-involvement group ( $p < 0.001$ ). In the self-involvement situation, the subjects were significantly different in the level of pain.

**Keywords:** empathy for Pain · in-group · out- group · self-involve

## 1 Introduction

The empathy for pain refers to an individual's perception, judgement and emotional response to the pain of others [1]. When seeing another person's finger is cut, one would also feel the pain. "Having the same feeling" of others' pain is the empathy for pain, which is a psychological phenomenon closely related to our daily life and affects social activities. Previous studies found that pain empathy is affected by numerous factors, such as the moral evaluation of the pain sufferer [2], gender and age of the observer [3], and the observer's own personality traits, with one ERP research finding lower levels of pain empathy in violent offenders than in the general population [4]. In addition to this, the relationship between the observer and the pain sufferer also has a bearing on it, for example, individuals in the friend priming condition had significantly higher levels of pain empathy than those in the stranger-initiated condition [5].

An in-group is any group in which an individual is identified as being a member to regularly lives, works, or participates in activities [6]. Generally, in-group members are in a friendly relationship with each other, while often holding an outward hostility to the members of out-group [7, 8]. Cross-cultural studies have shown that observers develop higher levels of pain empathy for the sufferers in their group, which is called ingroup effect [9–11].

Self-involvement is a psychological state in which an individual's "vicarious" feeling arouses him or her stronger responses to a situation or stimulus as being more active in the performance of an event [12]. An individual shows high level of self-involvement if with stronger correlation and similarity to the group members [13]. The available research has shown that the presence of self-involvement can influence people's attitudes toward events, for instance, individuals develop stronger moral sense when there is a self-involvement situation [14]. Individuals with self-involvement shows significantly higher level of pain empathy than those without. Self-involvement also makes difference in the pain empathy intensity of one individual. A person produces stronger and more accurate empathy with self-involvement [12]. By reviewing the current studies on the effects of pain empathy, we found that there is no direct discussion on how in-group and out-group respectively affect pain empathy with the presence of self-involvement. Individual's different positions in in- and out-group lead to a favoritism for physiological pain of the in-group members. In other words, in-group favoritism exists with pain empathy [15], while self-involvement situations can cause more pain empathy in individuals, which affects their judgments of painful stimulus as well as the generation of pain empathy [16]. Does self-involvement situation affect pain empathy in in-group? Does the effect exist in out-group? Then what are the effects? To answer the questions, this study investigated the influences both of in-group and out-group on subjects' pain empathy levels with or without self-involvement situation. The discussion and research over this topic will enhance our understanding of the factors that influence people's attitudes toward events and the importance of pain empathy in daily lives. More knowledge of this field can encourage prosocial behaviors and better interpersonal relationships, contributing to a more stable society.

## 2 Research Subjects and Methodology

### 2.1 Research Subjects

Software G\*power 3.1.9.2 was adopted with medium effect size ( $f = 0.25$ ), statistical power of 0.80 and  $\alpha$  value of 0.05. For a significant within-group effects and interactions to be tested in  $2 \times 2 \times 2$  three-way repeated measures ANOVA (with two factors repeated), at least 28 subjects were required.

By following the Voluntary Principles, 30 adult were randomly selected as subjects. Among them, 15 were in the group with self-involvement situation, including 7 males and 8 females, aged  $34.9 \pm 6.6$  on average. The rest of subjects were in the group without self-involvement, including 6 males and 9 females, aged  $34 \pm 7.7$  on average. The gender and age between the two groups was statistically non-significant (all  $P > 0.05$ ). All subjects were physically healthy and had no color blindness. All subjects participated in psychological study of this type for the first time. Before getting start, the subjects were informed of the experimental task and gave their informed consent, and received remuneration after completing the task.

### 2.2 Experiment Design

The experiment designed a  $2$  (situation: with self-involvement situation, without self-involvement situation)  $\times 2$  (group position: in-group, out-group)  $\times 2$  (picture stimulus

type: pain, non-pain) three-way mixed model. Group position and the picture stimulus type were within-subject variables. The presence or absence of self-involvement was between-subject variable. The dependent variable was the level of pain empathy, with pain scale rating and reaction time to the pictures as the indicator which were automatically recorded by the E-prime procedure.

## 2.3 Experiment Tools and Materials

### The Priming Task of Self-involvement Situation

The self-involvement group was asked to imagine that they had caused the pain shown in the picture, while the non-self-involvement group was not asked to do so. To prime the self-involvement group: subjects were asked to tell themselves, “I caused him/her injured in the picture” and to imagine the scene of the harm in the picture taking place when seeing the pain stimulus picture [16].

### Pain and Non-pain Stimulus Pictures Preparation

In this experiment, pictures of scenes with pain and without pain were taken as the stimulus materials. With reference to the photos taken by other researchers [17], 35 pairs of pain and non-pain stimulus pictures were shot in common daily life scenarios without any ambiguity, and each pair were placed aside with each other (as shown in Fig. 1). Fifty-six college students were randomly selected to rate the intensity of pain induced by the 35 pairs of pain stimulus and non-pain stimulus pictures on a 9-point scale (1 point means not painful at all and 9 point for very painful). The data collected from this experiment were processed by SPSS 22.0 for analysis. Results: the differences in pain intensity were particularly significant ( $P < 0.001$ ), where the pain intensity stimulated by the pain pictures ( $\bar{x} = 6.91, s = 0.54$ ) was significantly higher than that of the non-pain stimulus pictures ( $\bar{x} = 1.50, s = 0.19$ ). Thus, the pictures of pain stimulus and non-pain stimulus could be used as stimulus materials for the actual experiment.

Finally, 33 pairs of pain stimulus and non-pain stimulus pictures were selected based on the results of pain scale rating. All selected pictures were of the same size of 9 cm  $\times$  6.76 cm and 100 pixels/inch. Then, a copy of those selected pictures were marked with the words “red personality” and “green personality” at the lower right corner of the images. Therefore, another 66 pictures of pain and non-pain stimulus with the marks of “red personality” and “green personality” were prepared, and thus a total of 132 pictures (as shown in Figs. 2 and 3) ready for the test.



**Fig. 1.** An Example of Non-pain Stimulus Picture and Pain Stimulus Picture



**Fig. 2.** An Example of Non-pain and PAIN Stimulus Picture Marked “Green Personality”



**Fig. 3.** An Example of Non-pain and pain Stimulus Picture Marked “Red Personality”

### Minimal Group Paradigm - MBTI Personality Test

In this experiment, the group positions of the subjects were classified according to their personalities (introversion/extroversion). “Introversion” was defined as “red personality” and “extroversion” as “green personality”. For the subjects in the “red personality” group, the “red personality” was their in-group, and the “green personality” as their out-group, vice versa [15].

Questionnaire and personality type were presented prior to the experimental procedure. The MBTI personality questionnaire was adopted to determine the introvert and extrovert subjects so as to apply minimal group paradigm to the subjects.

## 2.4 Experiment Procedure

1. Introduce subjects to the experimental setting and invite them to fill out informed consent.
2. Subjects were randomly classified into a group with self-involvement situation and one without.
3. The classical task procedure of minimal group paradigm was used to manipulate the group positions of in- and out-groups. Subjects were asked to complete a personality questionnaire. Based on the questionnaire results for either introversion or extroversion, the shared personality between the subject and other group members evoke an in-group favoritism effect.
4. Subjects completed the task procedure of pain scale rating. The pain empathy paradigm was applied to assess the pain empathy of the subjects in both groups. In the assessment, subjects were asked to rate the pain occurring in pain and non-pain stimulus pictures, with the judgement reaction time and pain intensity rating as indicators of pain empathy.
5. After the experiment completed, the subjects were asked if they understand the experiment objective, and then the researchers expressed their appreciation and paid remuneration to the subjects. The whole experiment lasted 20–30 min.

**Table 1.** Pain Intensity Rating of Subjects in the Two Groups Under Different Conditions ( $\bar{x} \pm s$ )

<i>Self-involvement</i>	<i>Stimulus type</i>	<i>Group position</i>	<i>Pain intensity scores</i>
With self-involvement	Pain		
		In-group	$7.32 \pm 0.98$
		Out-group	$5.65 \pm 0.92$
	Non-pain		
		In-group	$1.66 \pm 0.73$
		Out-group	$1.42 \pm 0.61$
Without self-involvement	Pain		
		In-group	$5.65 \pm 0.92$
		Out-group	$4.50 \pm 0.84$
	Non-pain		
		In-group	$1.30 \pm 0.40$
		Out-group	$1.40 \pm 0.52$

## 2.5 Statistical Methodology

This experiment use SPSS 22.0 to process the data collected for descriptive statistics and three-way repeated measures ANOVA. ANOVA was used to verify whether main effects occurs over pain intensity rating and reaction time when variables, including picture stimulus types, group positions, and self-involvement situation, change. Additionally, whether interaction effects between the two indicators and the three factors.

## 3 Results

### 3.1 Descriptive Statistics

Subjects in the two groups, with and without self-involvement, rated pain intensity over different picture stimulus types (pain and non-pain), and the descriptive statistics of the result are shown in Table 1.

### 3.2 Main Effects and Interaction Effects

In terms of pain intensity scores, the results of the repeated measures ANOVA are shown in Table 2.

The results from Table 2 indicate an extremely significant main effect of stimulus type ( $F = 670.79^{***}$ ,  $P = 0.000 < 0.001$ ), with subjects rating pain intensity remarkably higher for pain stimulus than for non-pain stimulus. The main effect of group position was significant, ( $F = 47.08^*$ ,  $P = 0.000 < 0.01$ ), indicating that subjects had an extremely significant influence on ratings of pain intensity for in- and out-groups, with significantly

**Table 2.** The Main Effect of Self-Involvement Situation \* Stimulus Type \* Group Perspective and the Interaction Effect Between the Three Factors

<i>Independent variable</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Self-involvement (with or without)	13.69	1	13.69	10.33**	0.003
Stimulus type (pain - non-pain)	531.06	1	531.06	670.79***	0.000
Group perspective (in-group-out-group)	22.34	1	22.34	47.08***	0.000
Stimulus type * with or without self-involvement	7.10	1	7.10	8.97**	0.006
Group position * with or without self-involvement	3.51	1	3.51	7.40*	0.011
Stimulus type * Group position	19.06	1	19.06	37.70***	0.000
Stimulus type * Group position * with or without self-involvement	0.87	1	0.87	1.73	0.199

Note: \*\*\* indicates an extremely significant difference at the 0.001 level, \*\* indicates a highly significant difference at the 0.01 level, and \* indicates a significant difference at the 0.05 level

higher pain intensity for in-groups than for out-groups. The main effect of whether self-involvement situation exists was highly significant, ( $F = 10.33^{**}$ ,  $P = 0.003 < 0.01$ ), indicating that subjects with self-involvement rated the pain intensity of the stimulus significantly higher than without.

The interaction effect between stimulus type and presence/absence of self-involvement was highly significant, ( $F = 8.97^{**}$ ,  $P = 0.006 < 0.01$ ). The group position and presence/absence of self-involvement witnessed significant interaction effect ( $F = 7.40^{*}$ ,  $P = 0.011$ ,  $0.01 < P < 0.05$ ). The stimulus type and group position interaction was extremely significant, ( $F = 37.70^{**}$ ,  $P = 0.000$ ,  $P < 0.001$ ), indicating a significant interaction between stimulus type and group position over pain intensity scores.

The interaction among the three factors, stimulus type, group position, and presence/absence of self-involvement, was insignificant ( $F = 1.73$ ,  $P = 0.199 > 0.05$ ), therefore it is of no statistical significance.

### 3.3 Simple Effect

Simple effect analysis was applied on the basis of the highly significant interaction effect of stimulus type \* the presence/absence of self-involvement situation. The results showed that: 1. When the stimulus type was pain stimulus pictures, the subjects' pain intensity scores were significantly higher in the self-involvement situation than not in the self-involvement situation ( $P < 0.01$ ); 2. When the stimulus type was non-pain stimulus pictures, there was no significant difference in the subjects' pain intensity scores with and without self-involvement ( $P > 0.05$ ). That is, subjects showed higher pain empathy for the pain picture stimulus with self-involvement than without self-involvement.

The interaction effect between group position \* presence/absence self-involvement situation was significant and simple effect analysis was conducted. The results showed

that: (1) when the group position was in-group, the subjects with self-involvement rated pain intensity significantly higher than those without self-involvement ( $P < 0.001$ ); (2) when the group position was out-group, there was no significant difference between the subjects' pain intensity scores with and without self-involvement ( $P > 0.05$ ), where the subjects' pain intensity scores in a self-involvement situation were higher than those not in a self-involvement situation. That is, presence/absence of self-involvement affects the subjects' pain empathy rating at the in-group position, and the subjects' pain empathy is stronger in a self-involvement situation than not in a self-involvement situation.

The interaction effect of group position \* stimulus type was extremely significant. A further simple effects analysis indicates that: (1) when the stimulus type was a pain stimulus, there was an extremely significant difference in pain intensity scores between the in-group position and the out-group position ( $P < 0.001$ ), as indicated by the significantly higher pain intensity scores when the person in the pictures was an in-group member than an out-group member. (2) when the stimulus type was a non-pain stimulus, the subjects' pain intensity scores showed insignificant difference between to an in-group member in picture and an out-group one ( $P > 0.05$ ). That is, in-group and out-group positions affect subjects' pain empathy level, i.e., their pain empathy level is higher for in-group member than for out-group.

## 4 Discussion

This study discusses how in-group or out-group position affects pain empathy in a self-involvement situation by implementing a pain judgment task. The results show a significant influence of stimulus type on pain empathy, indicating a significant difference between the pain stimulus and non-pain stimulus pictures used in this study, which meets the experiment requirements. By using the materials prepared under the preparation standards, the experiment got the consistent results with that of the standards authors [17]. Specifically, subjects both in the self-involvement group and non-self-involvement group rated significantly higher pain intensity for pain stimulus than for non-pain stimulus, which indicates that pain stimulus pictures can be distinguished from non-pain stimulus pictures in describing pain scenes. This confirms the validity of the materials prepared for this experiment.

According to the result, group position shows significant main effect over pain empathy, indicating that subjects' pain intensity rating to in-group members is remarkably different from the rating to out-group ones. In other words, subjects rated pain intensity higher for the in-group member than for the out-group member regardless of the presence or absence of self-involvement. In terms of reaction time, subjects took longer reaction time at in-group position than at the out-group one, indicating that individuals tend to pay more attention and take longer time to think about the members of the same group. The results confirm that pain empathy has a "favoritism", which is in line with the findings of Li et al. in 2017. This "favoritism" of pain empathy is a reflection of human in-group favoritism, a phenomenon that can be explained by social identity theory. According to the theory, people show more care, empathy, and sensitivity to in-group members than to out-group members. The results of this study are consistent with the previous finding that pain sufferer arouses subject's more pain empathy if they are in the same group [15].

In this study, according to their personality, the subjects were divided into introverted group and extroverted group. People tend to build and strengthen their psychological connection with the group in which they are identified as members. The more similarities a person shared with their group members, the more likely he or she feels as “one of them”. This feeling makes people more sensitive to their in-group members, and more easily detect and perceive the pain suffered by those members, resulting in a higher level of empathy. The empathy for pain suffered by one’s in-group members will also be intensified when it is compared with the pain of out-group members [8].

In this study, the self-involved subjects were asked to imagine that they caused the injury of the person in the picture and “simulate” how they “hurt” the person in their mind. The results show that, for both in-group and out-group stimulus, self-involved subjects rated the pain intensity of higher than non-self-involved subjects. This result is consistent with the findings of Huang et al. in 2018, which showed that individuals in self-involvement situations have a higher degree of accurate empathy for others in pain, in other words, have stronger empathy for pain. Because of self-involvement situation, individual bring his or her strong similarity and relatedness to events into the experimental situation, actively involving their past experiences to the current situation as a link between the two. Previous research found that the more people involves their individual responsibility into the situation, the stronger accurate empathy they express to the pain sufferer. Empathy to different pain sufferers also show stronger discrepancy as emotional involvement grows.

Both self-involved and non-self-involved subjects show higher levels of pain empathy at the in-group position than at the out-group position. In the self-involvement situation, there was a significant difference in subjects’ pain empathy intensity between at in-group position and at out-group, i.e., self-involved subjects had a higher level of pain empathy for the in-group than for the out-group, as evidenced by subjects’ higher pain ratings for pain pictures. Regarding this findings, we can find examples in daily life. If a person has a high level of relevance to an event, then he or she tends to think more about that event. Additionally, group position also affects one’s judgment. In a self-involvement situation, subjects hold a greater level of pain empathy for their in-group members than for the out-group ones. Self-involved individuals also have a stronger empathy for their in-group members due to their more thoughts on the members’ pain.

## 5 Conclusions

This study investigates how stimulus type, the presence/absence of self-involvement and group position affect pain empathy from the perspective of subjects’ behavioral response, so there’s certain limitations in the research methodology. In the following research, bigger sample size and more variables are recommended. In terms of research methodology, ERP and eye movement technologies can be used in studies of pain empathy, enabling further discussions on more factors affecting pain empathy and how they affect the cognitive neural mechanisms of pain empathy. It is expected to uncover how they influence pain empathy from the neuroscience perspective.



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