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Study of the Effects of Interpersonal Distance and Cognitive Load on Pain Empathy

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Abstract

Numerous studies have shown that pain empathy receives the influence of multiple factors. The present study combined two influencing factors, interpersonal distance and cognitive load, to investigate the effect of their interaction on pain empathy. The study used a mixed 2 (interpersonal distance: friends, strangers) × 2 (cognitive load: high load, low load) × 2 (pain pictures: pain, non-pain) design and measured subjects' empathy levels using an evaluation of donation behavior. Subjects with higher levels of empathy (pain scores) were predicted to donate a greater amount.

Keywords

Empathy; Pain empathy; Interpersonal distance; Cognitive load.

1. Preface

The predecessor of empathy is the German word Einflung, a concept introduced by the German scholar Robert Fischauer. Later psychologist Tiechener proposed the English word empathy and gave the definition: "a process of humanizing an object, of feeling ourselves inside something else [1].

Kohlor interpreted empathy in terms of cognitive psychology, arguing that empathy is the understanding of another person's emotions, rather than sharing them with others (1929). Mead highlighted the ability to role pick, suggesting that this ability is to recognize how others evaluate the world (1934). Rogers' person-centered theory argues that a very important tool in the psychotherapeutic process is part of the counselor's attitude toward the visitor [2]. The concept of empathy is widely used in various fields of psychological research. In the field of social psychology research, empathy has also attracted the attention of scholars. In social psychology, empathy is defined as an individual's emotional response to what others feel or will feel in a given situation based on an understanding of their emotional state [3]. Davis suggested that greater empathic feelings are associated with heightened concern for others'[4]. Decety & Meyer proposed that empathy can trigger pro-social behavior and that it facilitates moral reasoning [5]. In our daily life, we usually use "empathy" to describe a concept which means that we personally experience the feelings of others.

Pain empathy is a type of empathy that refers to an individual's perception, judgment, and emotional response to another person's pain [6], or "empathy" for another person's pain. Pain empathy can be classified according to different types, which can be divided into empathy for others' physical pain and empathy for others' psychological pain.

In the following, previous studies related to the field of pain empathy will be presented, and the factors that influence pain empathy can be divided into two aspects: internal and external. In terms of internal factors, it has been argued that emotional mimicry and screening mechanisms in the human brain affect the level of pain empathy [7]. Meanwhile, some scholars also believe that cognitive load also affects pain empathy, and cognitive load affects the early processing stage of pain empathy [8]. As for the external factors, many scholars have also made studies.

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Some scholars believe that situational factors are an important influencing factor, and people in different states of mind will have different levels of pain empathy [9]. On the other hand, some scholars have conducted research in terms of interpersonal distance, suggesting that different interpersonal distances of pain sufferers also affect the pain experienced by empathizers, e.g., we are more likely to experience the pain of a friend compared to a stranger [10].

Many scholars have investigated the brain mechanisms involved in pain empathy as well as developed theoretical models. Pain empathy can be considered as two parts: the first part is bottom-up processing, which is automatically triggered by emotion sharing; the second part is top-down processing, which is an executive control component regulated by the prefrontal cortex. Current studies on the brain mechanisms of pain empathy mostly use the event-related potential (ERP) technique, which exploits its event correlation and high temporal accuracy to explore the EEG activity of pain empathy under different time courses.

Among many previous studies, it is known that subjects' performance of pain empathy is easily influenced by other factors, such as the quality of the material, presentation perspective, and attentional bias [11]. Therefore, the present study attempted to measure the "true" empathy of the subjects by measuring their own behavior.

2. Research Hypothesis

Imagine a scenario where your friend is cooking and cutting vegetables, and suddenly his finger is accidentally cut by a knife and bleeds, and when you see such a scene, you also put yourself in his shoes and experience his pain. Many previous studies in the field of pain empathy have shown that the closer the social relationship between the person in pain and the empath, such as friends and lovers, the more we are able to experience the pain of others. At the same time, if you are completing a complex task, such as homework or a work report, and then your friend rushes into your room with an injured finger, how would you feel in the face of your friend's pain? Some researchers have proposed the Load Theory, which suggests that distracting stimuli receive more attentional resources and are therefore better processed under conditions of high cognitive load compared to low cognitive load [12]. This may mean that we are more likely to feel the pain of others if we are in a state of full attention.

In our daily lives, we often come across fundraising messages through different channels, usually for some friends or relatives who are seriously ill and need donations, or for some charities that appeal for donations to help some disadvantaged people. Often this will trigger our empathy, compared to self- reported scores, the action itself can also represent the degree of empathy to some extent, and the degree of empathy will often be reflected in the amount of donations. Do we donate more or less because the person is our friend or a stranger, because we are busy at work or have nothing to do at the moment?

3. Experiment Design

A mixed design of 2 (interpersonal distance: friend, stranger) × 2 (cognitive load: high load, low load) × 2 (pain picture: pain, non-pain) was used for the experiment. Subjects were asked to provide a 1-inch bareheaded photograph of a same-sex friend before participating in the experiment, and to ensure the intimacy of this friend with the subject, it was required that this same-sex friend should have been in relationship with the subject for at least 6 months. Also, in addition to the friend initiation condition, the corresponding stranger initiation condition, the stranger's face picture, was used for the Chinese calm emotion face picture [13]. To control for extraneous variables, it was before the test that each subject was asked to select a picture from the picture library that matched the facial attractiveness, arousal, and validity of their same-sex

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friend as the stranger picture priming stimulus. Once the buddies and selected strangers provided by the subjects were collected, the two faces were modified using Photoshop software to either a pain or non-pain condition, i.e., a needle inserted into the face or a cotton swab pressed on the face, for four conditions (pain friend, non-pain friend, pain stranger, and non-pain stranger).

In terms of cognitive load, using the memorized number string task, subjects were asked to memorize number strings for a limited period of time. The length of the number string for the high cognitive load condition was 8 and for the low cognitive load condition was 3. The number strings that the subjects had to memorize in the experiment were randomly generated by the experimental procedure.

In terms of pain judgment, subjects were presented with pain pictures and non-pain pictures, with the pain picture being a needle inserted into the face and the non-pain picture being a face stick pressed on the face. Subjects were asked to rate the pain level of the pain subject using a 10-point scale (0 for no pain at all and 9 for pain limit). Example of pain and non-pain pictures are shown below.

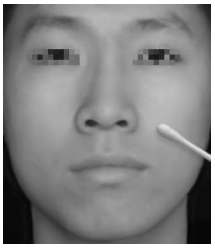

Figure 1. Example of non-pain

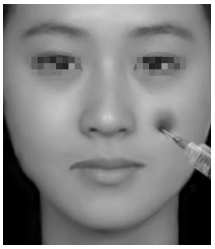

Figure 2. Example of pain

4. Experiment Procedures

Subjects were asked to sit in front of the screen and keep their attention on the gaze point "+".

After the subject read the instruction, he or she pressed the random key to start, first presenting the "+" for 500 ms, followed by a string of numbers for 4000 ms. Then after an empty screen with an interval of 500-800 ms, the pain picture was presented for 1000 ms. Subsequently, an empty screen was presented for 500-800 ms, and the subject was asked to rate the pain picture just presented the pain level was evaluated by pressing the keyboard 0-9 to represent the pain level from low to high. At the end of the selection, two different sets of number strings were presented on the screen, and the subject was asked to select the option that was consistent with the number string he had just memorized, pressing "F" for the left side and "J" for the right side. After the selection, the experiment will end and the next experiment will start after an interval of 500-800ms. The experiment has 8 blocks, each block has 10 trials, eight conditions are presented randomly, the number of equal appearances, a total of 80 trials. The specific experimental procedure is shown in Figure 3.

Figure 3. The specific experimental procedure

At the end of the test, subjects were required to fill out the empathy scale: the IRI (Interpersonal Response Indicator Inventory) [14].

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This study attempts to measure whether the subject's pain empathy affects his behavior by measuring the subject's donation behavior (e.g., the higher the pain score, the greater the donation amount). At the end of all trial sessions, the following instructional phrase is presented on the screen.

In this experiment, you experience the pain of others to varying degrees, and in life, firefighters serving the city and its citizens often encounter more painful situations than in the experiment, such as being cut by sharp objects, burned by flames, hit by heavy objects and other dangerous situations, which may leave them disabled or even sacrificed.

In this experiment you are paid 100 RMB (10 RMB bills of 10 RMB denomination) and you can choose to keep the money or donate part of it to Guangdong Fire Control Aid Foundation, which is a government public fund to provide medical coverage for firefighters. If you choose to donate, please put the appropriate amount in an envelope and give it to the experiment staff, after which you will receive a gift as a token of appreciation.

5. Conclusion

The present experiment is expected to support the former friend-initiated effect [10], i.e., higher levels of empathy for friends; and also supports higher levels of empathy in the high cognitive load Condition [8]. It is worth discussing that under the interaction of these two, the present study expected that empathy levels would be influenced by more cognitive load conditions from within individuals, i.e., the effect of interpersonal distance would be limited, and the specific results need to be supported by actual experimental data. As for whether the evocation of empathy would have on the actual behavior change of the subjects, this study will explore the correlation between IRI scores and the actual donation amount of the subjects, predicting that subjects who report higher IRI scores will donate more amount.

The present study sought to explore how the interaction of two conditions (interpersonal distance, cognitive load) affects pain empathy in real-life situations where external influences are often varied and complex, rather than appearing singularly. And specific behavioral measures are included in addition to the self-report to estimate the effect of experimental manipulation on subjects' empathy levels, which is more relevant to real-life situations.

This study has further implications for in-depth exploration, for example, the current research field of pain empathy mostly uses ERP methods to measure subjects' brain activity and assess subjects' early and late components during the experiment, which is very valuable for research. At the same time, the experimental materials can be further selected from dynamic videos, actors, virtual reality and other techniques to simulate real situations instead of static, single materials like pictures.

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