

## Research article

## Cognitive cost of empathizing with mothers and strangers by Chinese college students

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## ABSTRACT

**Background:** Empathy is a choice and the product of a dynamic decision process based on motivation. The value trade-off in empathy is object-specific and people are more likely to empathize with ingroup, especially empathize with whom we are particularly concerned. The mother is an integral part of the self-concept, but the status of the mother in the self-concept of the eastern and western subjects was different. Previous studies have shown that mother is integrated in self-concept and share the same motivational hierarchy with self in Chinese brain.

**Objectives:** The study's purpose is to investigate the empathic choice for mothers in Chinese culture and its regulatory mechanism.

**Methods:** Three experiments were conducted to investigate whether Chinese college students would choose to empathize with their mothers. Experiment 1 used the Empathy Selection Task to examine the empathic choices between mother-other and stranger-other conditions with two blocks of 50 trials, and used the NASA Task Load Index to evaluate the cognitive costs for each deck option presented; Experiment 2 induced a disagreeable emotional state and replicate the same conditions of the experiment 1; Experiment 3 induced an agreeable emotional state and replicate the same conditions of the experiment one.

**Results and conclusions:** The results showed that: (1) participants tended to avoid empathizing with their mothers and strangers for to the cognitive cost; (2) participants were more likely to choose empathy when the target was their mother rather than when the target was a stranger-other, due to the social reward; and (3) participants were more likely to opt to empathize with their mothers when positive emotions towards their mothers were primed. The results suggested that empathy is a choice and the product of a dynamic decision process based on motivation and the value trade-off in empathy is object-specific.

## 1. Introduction

Empathy is the ability to share and understand the thoughts and feelings of others (Decety and Cowell, 2014). The researchers argue that empathy consists of three distinct but interrelated processes: affective empathy (experience sharing), cognitive empathy (emotion Identification) and empathic concern (Weisz and Zaki, 2018). Empathy has many benefits which can drive cooperation, help and beneficial interaction with others (Preston, 2013), improve the attitude between groups (Vescio et al., 2003), increase the forgiveness and satisfaction of participants (Cornish et al., 2018), and drive prosocial behavior (Lei et al., 2020). Therefore, empathy is viewed as a highly valued and socially desirable trait, which is the cornerstone of human moral behavior (Ferguson et al., 2021; Cameron et al., 2022a).

In order to better adapt to the realistic needs, the current research focus of empathy has shifted from the structure and function of empathy

to the shaping and adjusting the empathy (). In recent years, researchers have argued that empathy is a choice and the product of a dynamic decision process based on motivation (Hughes and Zaki, 2015). The early appraisal and late appraisal models of empathy suggest that people integrate contextual information based on value and choose the manifestations of empathy (Vignemont and Singer, 2006). The evidence of electrophysiology and neurophysiology suggests that empathy not only has the intrinsic characteristics of sensibility, but also has a rational top-down cognitive regulation process (Fan and Han, 2008; Kogler et al., 2020). Heyes (2018) proposed the two-system model of empathy proposed by Heyes (2018) argues that empathy includes both bottom-up automatic process (System I) and top-down evaluation and control mechanism (System II), which lays the foundation for a top-down study of the adjustability of empathy. However, there is still a lack of research on the mechanism of empathy regulation under the theoretical

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framework. Furthermore, understanding how to modulate empathy from the top-down has positive guiding role for non-living entities such as artificial intelligence to achieve empathy (Cameron et al., 2017).

As for the adjustability of empathy, Cameron (2018) believes that people will weigh the costs and benefits of empathy, and then make different empathy according to the goal hierarchies. Cameron and collaborators (2020) propose a new framework that empathy can be chosen rather than compelled. They draw upon principles of cybernetic control, value-based choice, and constructionism to present a motivational account of empathy. They believe that empathy is the product of a dynamic decision process that iterates over time as people integrate competing goals and the process of empathizing itself reflects a value-based decision that occurs quickly and unconsciously over time as people assign subjective value to competing considerations. The central contribution of the framework is shifting attention from empathy per se to the motivations, goals, and values that decision-makers weighed during empathy-relevant situations (Cameron et al., 2017; Cameron, 2018; Cao et al., 2021). People essentially evaluate different goals based on subjective value (Berkman et al., 2017), which is an integration of various metrics (Hutcherson et al., 2015). Cameron et al. (2017) argue that there is a process of value accumulation for different goals in the process of empathy regulation. For example, when the target of empathy is their own children rather than strangers, people tend to choose empathy for the social reward. This suggests that the value trade-off in empathy is object-specific, manifested in significant differences in people's behavior toward self-other and ingroup-outgroup. Ingroup is considered to be close to the concept of "I" and provides more social value, so people are more likely to empathize with ingroup (Sierksma et al., 2015), especially empathize with whom we are particularly concerned.

The mother is an integral part of the self-concept, as well as the closest attachment in the process of individual growth. The status of the mother in the self-concept of the eastern and western subjects was different. Studies from individualistic culture have shown that the recall scores of the mother reference group in the United States are similar to those of the general semantic group, but significantly lower than that of the self-reference group (Baillet and Keenan, 1970). In the UK, the recall scores of the mother reference group in the United Kingdom are lower than that of the self-reference group (Tulving, 1999). The research results from collectivism culture show that there was no significant difference between Chinese people's memory performance of maternal reference and self-reference (Zhu Ying and Zhang Li, 2001); maternal reference is the boundary condition for retrieval-induced forgetting (Yang and Zhu, 2004); in the Han and Mosuo cultures, self-reference and maternal reference are the key factors that cause retrieval-induced forgetting (Wang et al., 2019). In the same Eastern Indian culture, Verma et al. (2021) found that mother-related information was processed equally well as self-related information. Many studies have compared the differences in the representation of mother and individual self in the brain, and found that both maternal processing and self-processing generally activated the medial prefrontal cortex (MPFC) (Heatherton et al., 2006), and the activation of MPFC did not differ between the two processing conditions for individuals in Chinese culture (Vanderwal et al., 2008), but Western subjects did not find significant activation of MPFC under the maternal reference. Electrophysiological studies have also found that mother-reference and self-reference had the same motivational hierarchy in medial frontal feedback-related negativity (FRN) in Chinese brain (Zhu et al., 2015). Compared with the contexts of un-reference and other-reference, the contexts of self-reference and mother-reference caused larger amplitudes in early posterior negativity (EPN) and late positive potential (LPP) and self-reference and mother-reference were consistent in face emotional processing, suggesting that mothers shares neural representations with the self (Ding et al., 2020). Cross-culture research on empathy has found 1) Iranian participants with interdependent cultural norms reported higher cognitive empathy than American participants with independent cultural norms (Parvaneh et al., 2018); 2) the correlation between empathy and attachment in Eastern

culture was significantly higher than that in Western culture (Xu et al., 2022). Recent research found that empathy among parents seemed to have positive benefits for children but negative costs for the parents, suggests that parents and their children could have different motives for sustaining or calibrating parental empathy (Manczak et al., 2016). Therefore, it is necessary to examine the empathic choice for mothers in Chinese culture and its regulatory mechanism, which not only provides evidence support for maternal self-reference effect, but also provides evidence support for the motivational choice view and the object specificity of empathy.

The researchers worked with different versions of the Empathy Selection Task to examine people's empathic choices. The Empathy Selection Task is a behavioral paradigm wherein people choose between completing an empathy task or a comparable non-empathic task. Over a series of trials, people are less likely to choose the empathy deck in the absence of acquired rewards (Cameron et al., 2019; Cameron and Inzlicht, 2020; Ferguson et al., 2020; Scheffer et al., 2021). More than that, participants report experiencing more mental demand, negative affect, and less self-efficacy when engaging in empathy than while completing an alternative task (Cameron et al., 2019, 2022; Cameron and Inzlicht, 2020; Ferguson et al., 2020). Effort is a cost of behavior and decision-making. Aversion and avoidance of high effort are universal principles of human behavior, but the potential value of effort has a significant incentive effect on individuals (Hart and Izquierdo, 2019). Different forms of incentives affect the cost-benefit trade-off of effort (Yee et al., 2021), and ultimately changing the effort. Value analysis determines when and how to strive (Cao et al., 2022). Only when the value of the goal is high enough, effort does not impede empathy, but instead transforms into the approaching motivation of potential value arousing people's empathy (Zaki, 2020). Ferguson and colleagues (2020) found that individuals were more willing to empathize with a self-nominated loved-other than a stranger, and they described empathizing with loved-others as less effortful than empathizing with strangers, though still more effortful than avoiding empathy altogether. However, when participants were asked to imagine that their loved-other was in distress, they were just as likely to opt-in to empathy with their loved-other as they were to opt-out of empathy all together. Therefore, based on the previous studies, three experiments were conducted to investigate Chinese people's empathic choices towards mothers by using Empathy Selection Task. The current study hypothesizes that 1) individuals may avoid empathy for their mothers and strangers due to cognitive costs; 2) individuals may choose to empathize with their mothers when the social reward of empathy for mothers is increased.

## 2. Experiment 1: Empathic choices for mother and stranger: the role of cognitive costs

### 2.1. Participants

Prior to the experiment, we conducted a priori sample size calculation by using the *simr* package in R (Green and MacLeod, 2015). With the same as Ferguson et al. (2020), assuming an alpha ( $\alpha$ ) of 0.05 and power of 0.84, the projected sample size needed to detect a parameter estimate of  $b = 0.33$  or larger was determined to be 50 participants in our completely within-subject design. In Experiment 1, we recruited 50 Chinese postgraduate students (37 females, 13 males,  $M$  age = 23.56,  $SD$  age = 1.34 years). All participants were right-handed, Mandarin Chinese speakers, had normal or corrected-to-normal vision, and did not have a history of any psychiatric or neurological disorders. All participants offered written informed consent to the study protocol, which was approved by the local ethics committee. After the experiment, the participants received modest monetary compensation.

### 2.2. Materials

100 pictures from the Chinese Affective Picture System (CAPS) were selected according to similar standards to Ferguson et al. (2020) (Bai

et al., 2005). The negative valence range of negative pictures was 3.50–3.90; the positive valence range of positive pictures was 6.00–6.50; the midpoint of CAPS was 5.60.

2.3. Procedure

2.3.1. Empathy selection task

The experimental program was written in prime 2.0 and presented by an ASUS computer with 17-inch LCD. Refer to the Feel-Self/Feel-Others version of Ferguson et al. (2020) and modify it slightly. The participants sat in front of the computer. At the beginning of each trial, a pair of card decks was shown on the screen and participants were instructed to choose one of the two decks. The labeled as “Feel-self” deck on the right was always red, which was the non-empathy deck. The deck labeled as “Feel-other (mother)” or “Feel-other (Xiaoming)” on the left was always blue, which was the empathy deck. Xiaoming was a stranger to all the participants.

After the choice, an emotional picture and an instruction were shown on the screen. Different cards correspond to different instructions. The instruction for the Feel-self deck was: “Look at the picture, and focus on the emotional reactions you are having to the picture. How are you feeling right now?” The instruction for the Feel-other deck (mother or Xiao Ming) was: “Look at the picture, and focus on the emotional reactions that mother or Xiao Ming is having to the picture. How is mother or Xiao Ming feeling right now?” Participants were asked to make emotional judgments according to the instructions by pressing one of two buttons (“F” or “J”) before moving on to the next trial.

There were two blocks of 50 trials of the Empathy Selection Task (100 trials total). The empathy target (i.e., stranger or mother) was randomly selected for each trial and the images were also presented randomly. The procedure of the Empathy Selection Task is shown in Figure 1. The total score of the Empathy Selection Task was calculated based on the number of trials in which participants chose “Feel-others.”

2.3.2. Post-task assessment

After completing the Empathy Selection Task, the participants answered the NASA Task Load Index (Hart and Staveland, 1988) to evaluate the cognitive costs for each deck option presented (i.e., three total: the “Feel-self” deck, the “Feel-other (stranger)” deck, and the “Feel-other (mother)” deck) on a 5-point scale (from 1 = very low to 5 = very high): “How mentally demanding was this deck?” “How hard did you have to work to accomplish your level of performance with this deck?”

“How successful were you in accomplishing what you were asked to do in this deck?” “How insecure, discouraged, irritated, stressed, and annoyed were you by this deck?” Consistent with prior work (Cameron et al., 2019), the first two questions correspond to effort, the third to efficacy, and the fourth to aversion.

2.3.3. Statistical analysis

All data were analyzed using IBM SPSS25.0. At first, we tested for empathy avoidance effect in different targets and estimates related to empathy choice within condition which were obtained from intercept values for two-level generalized linear models. In addition, we examined differences in three cognitive effort (effort, efficacy, and aversion) across decks.

2.4. Results and discussion

Empathic choice: Empathy avoidance effect was replicated both in the mother-other trials and stranger-other trials (mother-other:  $t(49) = -0.739, p = 0.464, 95\%CI = [-0.101, 0.470]$ ; stranger-other:  $t(49) = -2.274, p = 0.027, 95\%CI = [-0.152, -0.009]$ ). Participants were more likely to choose empathy with their mothers than with strangers, but the difference was marginal significant,  $t(49) = 1.915, p = 0.061, 95\%CI = [-0.132, 5.492]$ , Cohen's  $d = 0.271$ . The proportion of empathy choice is shown in Figure 2a.

NASA scale ratings: Table 1 displays the results for descriptive statistics in Experiments 1, 2 and 3. Reports of efficacy significantly differed by empathy target, (i.e., mother or stranger),  $t(49) = 3.974, p < 0.001, 95\%CI = [0.287, 0.873]$ , Cohen's  $d = 0.562$ ; participants reported lower efficacy ratings for empathic strangers than for empathic mothers. However, reports of effort ( $t(49) = -1.439, p = 0.156, 95\%CI = [-0.575, 0.951]$ , Cohen's  $d = 0.204$ ) and aversion ( $t(49) = -1.075, p = 0.288, 95\%CI = [-0.631, 0.191]$ , Cohen's  $d = -0.152$ ) did not differ by empathy target.

We next examined whether these differences in perceived cognitive costs across decks were associated with choosing empathy. As shown in Table 2, there was no consistent relationship for effort and aversion. Participants did choose empathy more when they felt more efficacious at it (mother:  $r = 0.48, p < 0.01$ ; stranger:  $r = 0.48, p < 0.01$ ). mothers than with strangers, but the difference was marginal significant, which was not completely consistent with the results of Ferguson et al. (2020) in Experiment 2b. Ferguson et al. (2020) found that the empathic choices of loved-other were significantly greater than those of stranger-other. The

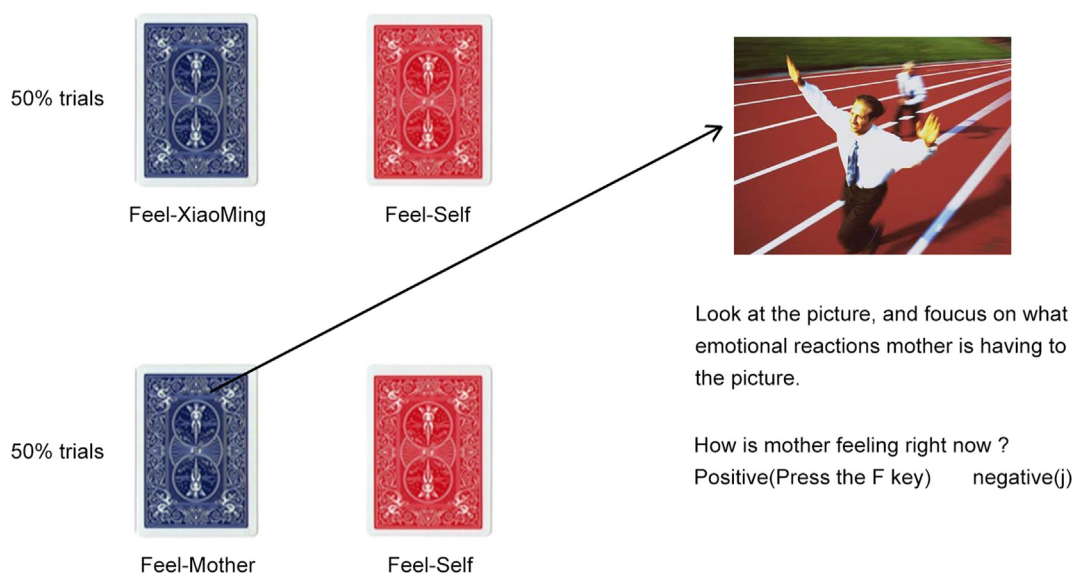


Figure 1. Visualization of the Empathy Selection Task trial procedure.

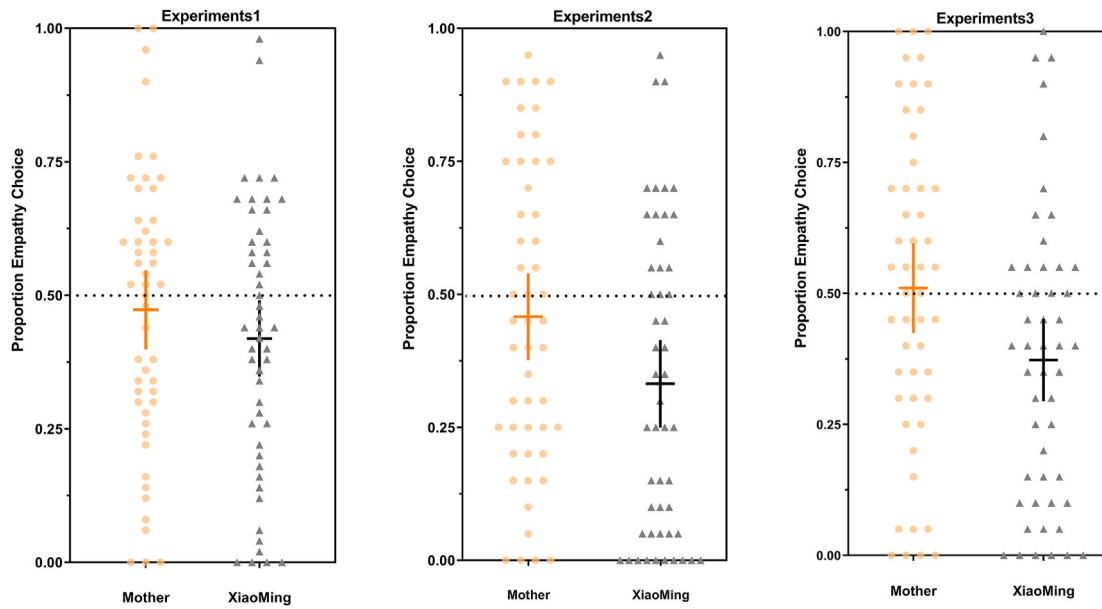


Figure 2. 2a: The proportion of empathy choice in experiments 1. 2b: The proportion of empathy choice in experiments 2. 2c: The proportion of empathy choice in experiments 3.

Table 1. NASA Task Load Index ratings by deck in Experiments 1–3.

Experiment	Condition	Effort Mean [95% CI]	Aversion Mean [95% CI]	Efficacy Mean [95% CI]
1	Empathy-Mother	2.78 [2.50,3.06]	2.44 [2.12,2.76]	3.54 [3.31,3.77]
	Empathy-Xiao Ming	3.02 [2.70,3.34]	2.68 [2.34,3.02]	2.96 [2.66,3.26]
	Non-Empathy	2.40 [2.09,2.71]	2.18 [1.83,2.53]	4.02 [3.79,4.25]
2	Empathy-Mother	3.29 [2.99,3.58]	2.92 [2.56,3.27]	3.22 [2.97,3.48]
	Empathy-Xiao Ming	3.13 [2.80,3.47]	3.06 [2.67,3.45]	2.41 [2.08,2.73]
	Non-Empathy	3.01 [2.73,3.29]	2.45 [2.19,2.70]	3.27 [3.02,3.51]
3	Empathy-Mother	2.88 [2.67,3.09]	2.74 [2.43,3.05]	3.20 [2.99,3.41]
	Empathy-Xiao Ming	3.07 [2.77,3.37]	2.78 [2.47,3.09]	2.86 [2.63,3.09]
	Non-Empathy	2.70 [2.52,2.88]	2.74 [2.42,3.06]	3.16 [2.93,3.39]

Table 2. Correlations of empathy choice with NASA Task Load Index Ratings.

Experiment	Effort		Aversion		Efficacy	
	r	p	r	p	r	p
1. Empathy vs. non-empathy						
Mother	-0.150	0.298	-0.107	0.458	0.481	<0.001
Stranger	-0.233	0.103	-0.226	0.115	0.480	<0.001
2. Empathy vs. non-empathy						
Mother	-0.146	0.312	-0.188	0.191	0.598	<0.001
Stranger	-0.171	0.236	-0.175	0.225	0.431	0.002
3. Empathy vs. non-empathy						
Mother	-0.202	0.159	-0.195	0.174	0.520	<0.001
Stranger	-0.251	0.079	-0.233	0.104	0.563	<0.001

differences might be due to three possible reasons. First, the difference might be related to the sequence of stimulus presentation. In Experiment 1, the order of stimulus presentation was completely random, while the order of stimulus presentation was balanced between empathy targets in experiment 2b of Ferguson et al. (2020). The order of presentation might affect the response bias of the participants, thus causing the difference in the selection results. Second, the difference might be related to the difference of the sample group. The participants in Experiment 1 were all graduate students. They had many common experiences with their mother in the process of individual growth and daily life, and they knew more about their mother's feelings rather than those of strangers, so they had more confidence in empathizing with their mothers (Preston, 2013). However, they lived in school and had relatively little contact with their parents, so they also had difficulty in empathizing with their mothers. Third, the consistent part of the results might be due to the number of trials. The large number of trials might have increased effort and reduced empathic efficacy.

Previous studies have shown that people are more empathetic to the suffering others, especially those who are vulnerable and in need (Preston, 2013), and the perception of other people's pain has been shown to motivate caring behavior (Batson, 2011). Therefore, in Experiment 2, participants' negative emotional experiences about their mothers were manipulated, and the number of trials was decreased in order to reduce the cognitive costs of empathy, so as to investigate the empathic choices for mother and stranger.

### 3. Experiment 2: Empathic choices for mother and stranger: the role of negative emotion and cognitive costs

#### 3.1. Participants

Similar to the prior sample size of Experiment 1, 50 Chinese college students participated (26 females, 24 males, M age = 22.82, SD age = 2.170). Other information related to the participants is the same as Experiment 1.

#### 3.2. Materials and procedure

##### 3.2.1. Materials

Forty images (20 negative images and 20 positive images) used in Experiment 1 were selected as the materials in Experiment 2.

### 3.2.2. Emotion manipulation

The method of emotional manipulation was similar to Ferguson et al. (2020).

Participants were asked to recall and write in a few sentences a time when their mother was very distressed and in need of help with no time limit. During the empathic selection task, participants were reminded twice of what they had written and asked "How concerned are you for your mother right now?" during the Empathy Selection Task (i.e., after the first 12 and 24 trials) so as to maintain their emotional empathy for their mothers. During these reminders, a 5-point Likert scale (1 = *not at all distressed*; 5 = *a great deal*) were used to evaluate participants' concerns. The result showed that the average scores of subjects on the five point Richter scale were 3.30, which suggested the emotional operation task was effective.

**Empathy Selection Task:** The task was similar to Experiment 1, with two differences: first, the writing task was added before the trial procedure and reminders were added twice throughout the Empathy Selection Task; and second, there were 40 trials in total (20 with the stranger as the empathy target, and 20 with their mother as the empathy target).

**Post-task assessment:** after completing the Empathy Selection Task, participants answered the NASA Task Load Index for cognitive load assessment, which was the same as experiment 1.

**Statistical analysis:** The statistical analysis was similar to that of Experiment 1.

### 3.3. Results and discussion

**Empathy choice:** The empathy avoidance effect was also replicated both in mother and stranger trials, (mother:  $t(49) = -1.035, p < 0.306$ , 95%CI = [-0.124, -0.040]; Xiaoming:  $t(49) = -4.107, p < 0.001$ , 95%CI = [-0.250, -0.086]. Participants were significantly more likely to empathize with their mothers than with strangers (Fig. 2b),  $t(49) = 4.634, p < 0.001$ , 95%CI = [1.427, 3.613], Cohen's  $d = 0.655$ .

**NASA scale ratings:** Descriptive statistics are presented in Table 1. In Experiment 2, the efficacy of empathy with mother was significantly higher than that of empathy with stranger,  $t(49) = 3.630, p = 0.001$ , 95%CI = [0.250, 0.870], Cohen's  $d = 0.513$ . However, reports of effort ( $t(49) = 0.518, p = 0.607$ , 95%CI = [-0.345, 0.585], Cohen's  $d = 0.073$ ) and aversion ( $t(49) = -0.599, p = 0.552$ , 95%CI = [-0.697, 0.377], Cohen's  $d = 0.085$ ) did not differ by empathy target.

We also examined the correlations of empathy choice with NASA Task Load Index ratings. As shown in Table 2, there was only a consistent relationship for efficacy. Participants did choose empathy more when they felt more efficacious at it (mother:  $r = 0.60, p < 0.01$ ; stranger:  $r = 0.43, p < 0.01$ ).

The results of Experiment 2 showed that the ratio of empathy choice for mothers (0.458) was significantly higher than that for strangers (0.332). There might be two reasons for this result. First, the negative emotional association with their mothers was primed, making the participants regard their mothers with a more negative emotion, which increased the cognitive costs of empathy-mother. The effort and aversion of empathy-mother were higher in Experiment 2 than in Experiment 1. Second, the writing task in Experiment 2 also increased the integration between participants and their mothers, which increased the personal pain in the process of empathy. Previous studies have found that people are more likely to integrate with their closer relations, especially mothers, in the context of empathy (Aron et al., 1991; Lee et al., 2017; Cialdini et al., 1997). The higher self-other integration made individuals fall into the dilemma of being unable to distinguish their own pain from others' pain, which increased the personal pain in the process of empathy (Krol and Bartz, 2021).

The results of Experiment 2 still showed the empathy avoidance effect towards their mothers, which is different from the results of Ferguson et al. (2020) in Experiment 2a. Ferguson et al. (2020) found that when the negative emotional association with the loved-other was primed and

the number of trials was reduced, the empathy avoidance effect on the loved-other disappeared and the participants showed the empathy approach effect. The reason for this difference might be due to the difference of the empathy target and the loved-other manipulation. In Experiment 2, the empathy target was the participant's mother, and only writing tasks were used to manipulate participants' emotions about their mothers. Participants were all the college students who had lived in school for a long time and seldom communicated with their mothers. Even if the negative emotional association with their mother was primed, participants were still reluctant to empathize with their mother. In the research of Ferguson et al. (2020), the empathy target was the loved-other, who might be parents, friends, or lovers of the participants. Additionally, they asked the participants to first list several reasons why their relationship with their loved-other was meaningful, important, and positive.

The results of Experiment 2 suggest that manipulating participants' negative information about their mother did not effectively offset the cognitive costs of displaying empathy towards their mother. This might be due to the fact that negative information recalled somehow has a negative effect on the participants' state. Empathy for positive and negative emotions has different functions, and studies have shown that empathy for positive emotions involves broader activation of brain regions than empathy for negative emotions (Taiwo et al., 2021). Positive empathy can strengthen social relations by increasing the perception of social intimacy and establishing relationship resources (Gable et al., 2006). Past studies have shown that imagining, recalling, observing, or learning from others' positive outcomes can trigger positive empathy (Devlin et al., 2014). Therefore, Experiment 3 explored the empathic choices for mother and stranger by manipulating participants' positive emotional experiences about their mothers.

## 4. Experiment 3: Empathic choices for mother and stranger: the role of positive emotion and cognitive costs

### 4.1. Participants

Similar to the prior sample size in Experiment 1, 50 Chinese college students participated (28 females, 22 males, M age = 19.14, SD age = 1.216). They did not participate in any other experiments. Other information related to the participants is the same as in Experiment 1.

### 4.2. Materials and procedure

**Emotion manipulation:** In Experiment 3, the emotional manipulation was the same as in Experiment 2, except that: (1) participants were asked to think and write down a time when their mother was very happy and successful; and (2) participants were reminded twice of the positive events written during the writing task and asked "How happy are you for your mother right now?" using a 5-point Likert scale (1 = *not at all happy*; 5 = *a great deal happy*) throughout the Empathy Selection Task. The result showed that the average scores of subjects on the five point Richter scale were 3.45, which suggested the emotional operation task was effective.

The materials, Empathy Selection Task, post-task assessment, and statistical analyses were the same as Experiment 2.

### 4.3. Results and discussion

**Empathy choice:** Participants in the stranger-other trials preferred to avoid empathy ( $t(49) = -3.250, p = 0.002$ , 95%CI = [-0.206, -0.485]). However, Participants showed choosing to approach rather than avoid empathy during the mother-other trials ( $t(49) = 0.235, p = 0.815$ , 95%CI = [-0.076, 0.096]), such that participants were no more likely to avoid the Feel-mother deck than they were the Feel-self deck. The participants' empathic choices ratio for mother (0.510) was significantly higher than that for stranger (0.373) (Fig. 2c),  $t(49) = 3.356, p = 0.002$ , 95%CI = [1.099, 4.381], Cohen's  $d = 0.475$ .

NASA scale ratings: Descriptive statistics are presented in Table 1. The efficacy of empathy with mother was significantly higher than that of empathy with stranger ( $t(49) = 2.621, p = 0.012, 95\%CI = [0.079, 0.601]$ , Cohen's  $d = 0.371$ ). However, participants reported more efficacy when the empathy target was mother ( $t(49) = 2.621, p = 0.012, 95\%CI = [0.079, 0.601]$ , Cohen's  $d = 0.371$ ). However, reports of effort ( $t(49) = -1.003, p = 0.321, 95\%CI = [-0.601, 0.201]$ , Cohen's  $d = 0.141$ ) and aversion ( $t(49) = -0.191, p = 0.850, 95\%CI = [-0.462, 0.382]$ , Cohen's  $d = -0.027$ ) did not differ by empathy target.

The correlations of empathy choice with the NASA Task Load Index ratings were also shown in Table 2 and indicated that felt efficacy at empathy was associated with choosing empathy more often (mother:  $r = 0.52, p < 0.01$ ; stranger:  $r = 0.56, p < 0.01$ ). Replicating Experiments 1 and 2, when participants felt that they were less successful at empathy, they were less likely to want to choose Feel-others.

Experiment 3 found that when the positive emotion about participants' mothers was primed, the empathy avoidance effect disappeared during the mother-other trials, the effort and aversion of empathy-mother decreased, and the efficacy of empathy-mother was similar. These results suggested that as the potential for social reward increased and cognitive costs decreased, participants might update their perceived (or subjective) value of engaging with empathy.

## 5. Discussion

The current study investigated the effects of cognitive costs and emotion on empathizing with mothers and strangers of Chinese college students by using the Empathy Selection Task similar to Ferguson et al. (2020). The results showed that when the target was their mother, individuals tended to avoid empathy in Experiments 1 and 2, and the empathy avoidance effect disappeared only when positive emotion about their mother was primed (Experiment 3). When the target was a stranger, the empathy avoidance effect was replicated in all three experiments, which were consistent with the results of previous studies (Cameron et al., 2019; Cameron and Inzlicht, 2020; Ferguson et al., 2020; Scheffer et al., 2021). The results support the concept of empathy motivation, that is, empathy is a motivated phenomenon. People tend to avoid empathy because empathy requires attention and cognitive effort (Schumann et al., 2014). People will choose empathy only when the rewards of empathy are large enough to offset the cognitive costs.

Previous studies have found that mothers are an integral part of self-concept in Chinese culture (Wang et al., 2019; Zhu and Zhang, 2002; Zhu et al., 2015; Ding et al., 2020). However, the results of Experiments 1 and 2 both showed the empathy avoidance effect when the target was the participant's mother. The differences might be due to four possible reasons. The first is that empathy-mother also results in more cognitive costs than non-empathy. Cognitive costs of empathy may derive in part from uncertainty about their mothers' experiences and the risk of making errors (Dunn et al., 2017), which may have driven participants to avoid empathy even if the target was their mother. The second is the characteristics of the participants who were undergraduates and postgraduates. They lived in school and had relatively little communication with their mothers. Therefore, they were unfamiliar with their mothers' emotions. After the study, 225 college students were investigated with the parent communication questionnaire. The results showed that about 80% of students reported that they were unwilling to communicate with parents due to the difficulty in understanding each other. The third is the Empathy Selection Task used in this study involved some amount of perspective-taking as participants needed to try to imagine another person's affective response to a picture. This paradigm might require a greater cognitive effort. Other studies have found that expectations of cognitive effort can play a role in how people make strategic task choices (Dunn et al., 2019), and perceptions of autonomy for task engagement predicts opportunity costs and subsequent felt effort (Rom et al., 2020). Fourth, when the purpose is to understand others, people's emotions need to be in synchronizing with others. Sometimes in order to protect one's

own healthy emotional state, people avoid or stay away from goals, and even avoid exposure to other people's negative emotions in order to maintain their own positive emotional state (Tamir and Ford, 2012).

Compared the differences of empathic mothers in Experiments 1, 2 and 3. The results showed that there was no significant difference in the empathic choice of mothers in the three experiments,  $F(2,147) = 0.448, p = 0.64$ . Meanwhile, compared with the results of Experiment 1, 2 and 3, the choice ratio of empathy-mother in Experiment 2 (0.458) was lower than that in Experiment 1 (0.473) and 3 (0.510). This suggests that positive emotions toward mothers affected empathic choices, but it do not achieve significance, which may mean that there is a ceiling effect in increasing empathic motivation. Future research can explore the existence of this ceiling effect and other details in combination with other rewards. In addition, the choice ratio of empathy-stranger in Experiment 1 (0.419), 2 (0.332) and 3 (0.373) was significant lower than that of empathy-mother. This suggests that positive (or negative) emotions toward mothers affected empathic choices. The choice ratio of empathy-others in Experiment 1 (0.419) was higher than that in experiment 2 (0.332) and 3 (0.373). The possible is that participants in experiment 1 were postgraduates, and participants in experiment 2 and 3 were undergraduates. Postgraduates are older and have better ability to regulate emotions than undergraduates. Empathy regulation is closely related to individual emotion regulation ability, which requires individuals to understand, predict and regulate their own and others' emotions (Zaki, 2020). People's need for emotional regulation is not limited to enhancing pleasant experiences or alleviating negative ones, but essentially emotions serve a specific purpose (Millgram et al., 2019; Tamir et al., 2020).

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By analyzing the cognitive load index and the correlations of empathy choice with NASA Task Load Index ratings of the three experiments, results suggested that participants rated the empathy deck as more effortful, aversive, and less efficacious than the non-empathy deck, and perceiving the empathy deck as less efficacious was associated with choosing the empathy deck less often, which largely replicated previous works (Cameron et al., 2019; Cameron and Inzlicht, 2020; Ferguson et al., 2020). However, it should be noted that the ratings of the cognitive load index were made after the empathy selection task, so it may be that participants provided those ratings as a way to justify their behavior on

the task (rather than truly representing their felt emotions during the task). Cameron et al. (2019; studies 9 and 10) manipulated the efficacy of empathy and found that self-efficacy during empathy trials might have a causal connection to empathy choice. In daily life, timely feedback during empathy may increase the sense of empathic efficacy, which in turn may increase empathic choice.

Social rewards can motivate empathy (Ferguson et al., 2020; Cao et al., 2021). Humans have an innate psychological need for relatedness (e.g., see Ryan and Deci, 2000). From an evolutionary perspective, empathizing with kin might confer survival benefits (e.g., see Preston and de Waal, 2002). Substantial evidence shows that people have a significant ingroup preference for empathy with others (Eres and Molenberghs, 2013), which may be because the social connection value brought by ingroups is far greater than short-term physical and mental fatigue. What's more, Inagaki (2018) has found that an increased sense of social connection reduces amygdala activity, which indicates that social connection is beneficial to the improvement of individual positive emotions and the reduction of negative emotions. In addition, the positive empathy can increase the perception of social intimacy and establish relationship resources (Gable et al., 2006). In Experiment 3, the priming of positive emotion about mother might increase the perception of social intimacy with the participant's mother and increase the social rewards of empathy-mother. Therefore, Experiment 3 found that the empathy avoidance effect disappeared during the mother-other trials.

Empathy is a choice and the product of a dynamic decision process based on motivation, empathy is the product of a dynamic decision process that iterates over time as people integrate competing goals and the process of empathizing itself reflects a value-based decision that occurs quickly and unconsciously over time as people assign subjective value to competing considerations.

## 6. Practical and educational implications

First, regarding empathy as an inspired phenomenon rather than an uncontrolled automatic occurrence, so we can change the empathy motivation to shape the empathy result, or choose when to approach empathy and when to avoid it, which introduces a layer of responsibility for how we interact with others and their willingness to empathize in a challenging environment (Zaki and Cikara, 2015). Second, empathy is a choice and the product of a dynamic decision process that iterates over time as people integrate competing goals and the process of empathizing itself reflects a value-based decision that occurs quickly and unconsciously over time as people assign subjective value to competing considerations. So we can increase empathy-induced prosocial actions by increasing the social value of empathy. Third, the value trade-off in empathy is object-specific and people are more likely to empathize with ingroup, especially empathize with whom we are particularly concerned, such as the mother. Therefore, it can enhance the intimate relationship with the empathic target and improve the empathy-induced prosocial behavior. Fourth, empathy regulation is closely related to individual emotion regulation ability (Zaki, 2020). People's need for emotional regulation is essentially emotions serve a specific purpose (Millgram et al., 2019; Tamir et al., 2020). Therefore, it is not only necessary to train skills such as perspective-picking or role-playing (Hodges and Klein, 2001) to improve the ability of empathy regulation, and people can effectively adjust their cognition according to the purpose to regulate empathy, and changing their own cognition can alleviate the negative effects of empathy (Tamir et al., 2019). Fifth, understanding how to modulate empathy from the top-down has positive guiding role for non-living entities such as artificial intelligence to achieve empathy (Cameron et al., 2020).

## 7. Limitations and prospects

First, the current study focuses on the impact of the experience of sharing empathic choices. Future research can establish the influence of

more empathetic attention-arousing situations on empathic choice (Zaki, 2020). Some cases challenge the general assumptions about empathy and prosociality. For example, in the process of aversion treatment or drug addiction, although individuals have the desire to help others improve their emotional state, they have to adopt some results that lead others to experience current negative emotions. In other words, individuals may want to promote the well-being of others, but this can sometimes be a source of negative influence on others. This highlights the empathic choices of a multi-dimensional space. Not all choices are to make the goal feel positive, or are consistent with the goal. These unusual types of empathy can be added to future research, which will help to reveal the whole picture of empathy.

Second, the participants in the current study were only college students and graduate students, which limit the generalizability of the results to people with different socio-economic and educational backgrounds. Some studies have shown that the effect of empathy training is affected by the type of population, which is more obvious after college students and health professionals receive training (van Berkouff and Malouff, 2016). There is a large individual difference in empathy (e.g. Davis, 1983; Stern and Cassidy, 2018). Future studies can expand the diversity of participants in empathy.

Third, we know our parents' kindness only when we raise children in Chinese culture. The participants in this study were independent and childless, and were less willing to understand their mothers' emotions. Future studies could examine whether parents are more likely to understand and empathize with their mothers. On the contrary, due to the immature development of language expression, parents mainly understand children through emotional signals. As children grow up, parents pay less attention to their children's emotions and find it harder to understand them, especially during adolescence. In the future, horizontal and longitudinal studies can be used to investigate the cognitive cost of parents' understanding of children's emotions and the changes in empathy choices during different periods, so as to reveal the influencing factors of parents' empathy motivation for children.

Fourth, the current study was carried out in a laboratory. Thus, it may have low external validity and applicability to everyday contexts. In the empathic choices task, social goals were presented without specific information and background, which may have increased the individual's sense of uncertainty and their cognitive efforts in the experiment. When there are no specific details to support empathy understanding, the results reflected by the Empathy Selection Task may be different from the results of social interactions in reality. Therefore, future studies should be conducted in a more realistic environment.

Finally, the empathic choice paradigm used choice rate as the evaluation index of empathic motivation. In addition, the cognitive cost of empathic choice was measured by a post-hoc justification of choices. Future studies can use ERP with higher temporal resolution to record the changes in executive control function of participants during empathic choice in real time, further elaborating on the internal mechanism of empathic motivation.

## 8. Conclusions

Normally, individuals tend to avoid being empathic towards their mother and stranger. When the social rewards of empathizing with their mothers were highlighted such as the priming of positive emotion about mother, the cognitive costs of being empathetic towards mothers were offset, and empathy-mother was selected. The current study suggests that empathy is a motivated phenomenon.

## Declarations

### Author contribution statement

Huijuan Li; Gaowei Wang; Entao Zhang; Hongqing Shi; Weijia Huang: Conceived and designed the experiments; Performed the experiments;

Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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#### Declaration of interest's statement

The authors declare no conflict of interest.

#### Data availability

The datasets generated for this study are available on request to the corresponding author.

#### Additional information

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