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Positive valence ≠ positive effect: impact of positive meta-stereotypes on the cognitive performance

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ABSTRACT

The aim of this study was to examine how positive meta-stereotypes impacted cognitive performance among disadvantaged groups and the mediating effect of negative emotions. In Experiments 1 and 2, Chinese migrant children and rural college students were randomly allocated to the positive meta-stereotype, negative meta-stereotype, or a non-meta-stereotype activation group to examine positive meta-stereotypes' effect on creativity and working memory performance. Both experiments revealed that positive meta-stereotypes had a choking under-pressure effect on cognitive performance, and negative emotions may act as significant mediators between meta-stereotypes and cognitive performance. The choking under pressure effect may occur under positive meta-stereotypes, necessitating more clarification on meta-stereotypes' negative effects.

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Choking under pressure; cognitive performance; negative meta-stereotypes; positive meta-stereotypes

Meta-stereotypes are the beliefs held by ingroup members regarding the stereotypes from outgroup members (Vorauer et al., 1998), whereas stereotypes are relatively fixed beliefs or expectations held by people about members of a group (Fiske et al., 2002), including other-stereotypes (e.g., individuals' beliefs about the other person's outgroup) and self-stereotypes (e.g., individuals' beliefs about the ingroup). Meta-stereotypes are distinct from stereotypes (Hogg & Turner, 1987) in that meta-stereotypes include a relational component: Meta-stereotypes refer to individuals' beliefs about how an ingroup is viewed by an outgroup, rather than to individuals' own personal beliefs about the ingroup. Among other differences, meta-stereotypes seem apt to be comparatively negative in terms of content. For example, Vorauer et al. (1998) compared the relationship between meta-stereotypes (White Canadians hold the beliefs about how White Canadians are viewed by Aboriginal Canadians), other-stereotypes (White Canadians hold the beliefs of Aboriginal Canadians) and self-stereotypes (White Canadians hold the beliefs of White Canadians), found that the relationship between meta-stereotype and other-stereotype was weaker, and there was also a significant difference between meta-stereotypes and self-stereotypes, with meta-stereotypes being more negative than self-stereotypes.

Among meta-stereotypes, there are negative, neutral, or positive ones (Anseel, 2011). If the ingroup members believe that the outgroup sees the ingroup positively, the meta-stereotypes about ingroup will be positive, otherwise, negative. A meta-stereotype will be activated when a person feels being evaluated by an outgroup (Vorauer et al., 1998, 2000), an outgroup is more powerful, or an outgroup perspective is adopted (Lammers et al., 2008). Past research suggests that members of disadvantaged groups are more concerned with how the ingroup is perceived by the outgroups than members of advantaged groups (Lammers et al., 2008). Meta-stereotype activation of the disadvantaged groups can lead to guilt and awareness about the unreasonable status (Crocker et al., 1998). Therefore,

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disadvantaged group members are more vulnerable to meta-stereotypes (Lammers et al., 2008; Zhang et al., 2016). Previous researchers emphasized negative meta-stereotype effects (C. K. Owuamalam & Zagefka, 2011; C. Owuamalam & Zagefka, 2014; Méndez et al., 2007; Sigleman & Tuch, 1997; Sun et al., 2015). It was found that the expectation of being rejected or being negatively evaluated after the activation of negative meta-stereotypes induced a range of negative emotions (e.g., intergroup anxiety) and led to decreased cognitive processing efficiency (Huang et al., 2019; Li et al., 2021). According to the stereotype threat model, the activation of negative stereotypes of minority groups (e.g., females, older adults, and homosexuals) can trigger anxiety. Minority groups are afraid to confirm others' negative expectations of the ingroup, which would interfere with their performance in the stereotype-related domain (Steele & Aronson, 1995). Similar to stereotype threat effects, negative meta-stereotype activation has deleterious effects on cognitive performance, which is called meta-stereotype threat (Sun et al., 2015).

However, few explore the effects of positive meta-stereotypes on cognition (C. K. Owuamalam & Zagefka, 2011; Vázquez et al., 2016), and none have manipulated positive meta-stereotypes of the disadvantaged groups so far. Therefore, two experimental studies were conducted to address this gap by considering the effects of positive meta-stereotypes on cognitive performance between Chinese migrant and urban children, and Chinese rural and urban college students from the point of view of disadvantaged groups (i.e., migrant children and rural college students). An additional aim was to test the mediating process driving the effects of positive meta-stereotypes.

Positive meta-stereotypes and cognitive performance

Research on positive meta-stereotypes, compared to negative meta-stereotypes, is less numerous, and focuses mainly on intergroup emotions and attitudes. For example, C. K. Owuamalam and Zagefka (2011) found that when positive meta-stereotypes were activated, female university students showed an increase in group identification with females. To date, the purpose of few studies to examine the effects of positive meta-stereotypes on cognitive processing. Past research has suggested that disadvantaged group members are more vulnerable to meta-stereotypes (Lammers et al., 2008; Zhang et al., 2016).

In the field of stereotype research, researchers found that individuals' performance on the task could be facilitated by activating positive stereotypes (Armenta, 2010; Shih et al., 1999). Concerning this phenomenon, Shih et al. (2012) developed the concept of stereotype boost, which refers to positive outcomes from the activation of positive stereotypes. Based on the ideomotor process (Dijksterhuis & Bargh, 2001; Wheeler & Petty, 2001), Armenta (2010) proposed that the stereotype boost resulted from an ideomotor process in which the mere thought of an action, even if only at a non-conscious level, increases the tendency to engage in that action. However, Krendl et al. (2012) found that most previous studies related to positive stereotypes were explored under conditions of no mass pressure, whereas the reality is that many individuals are subject to expectations and attention from the surrounding people in a real context, and this expectation and attention can be stressful for the individual. Thereupon, Krendl et al. (2012) demonstrated that choking under pressure can explain the negative effect of positive stereotype activation by different experiment conditions.

"Choking under pressure" suggests that individuals will choke under pressure in the face of positive meta-stereotypes (Fowler & Gasiorek, 2021; Vázquez et al., 2016). An individual may experience performance pressure when aware that the outgroup has high expectations for the individual's performance (Baumeister, 1984; Krendl et al., 2012; Tagler, 2012). As a result, individuals may choke and perform poorly. Thus, although positive meta-stereotypes contain positive traits, people do not always return positive evaluations to the outgroup. Similar to stereotype threat, positive meta-stereotype activation may create performance pressure that is disruptive to performance. In the field of stereotype research, the choking under pressure effect (CUPE) was the first to explain the phenomenon that positive stereotypes did not always appear to boost performance (Beilock & Carr, 2001; Cheryan & Bodenhausen, 2000). For example, females and males both performed worse in a positive

stereotype activation condition than those in a non-stereotype condition (Dardenne et al., 2007; Smith & Johnson, 2006).

Choking is particularly likely to occur when high expectations are accompanied by self-focus (Lewis & Linder, 1997) or the explicit monitoring of performance behaviors (Beilock & Carr, 2001). One source of high-performance expectations is positive meta-stereotypes. In particular, researchers have found that low-status groups tend to have more negative meta-stereotypes, while high-status groups tend to have more positive meta-stereotypes (He, 2010; Vorauer et al., 1998). Thus, compared with high-status groups, low-status groups may have more difficulties in retrieving positive meta-stereotypes (Vázquez et al., 2016).

Negative emotions as a mediator

When the ingroup holds a belief of being viewed negatively by outgroup members, negative emotions are likely to be elicited. For example, some researchers have identified certain negative emotions (e.g., fear and anxiety) as a typical consequence of negative meta-stereotype activation (C. K. Owuamalam, Tarrant et al., 2013; Sun et al., 2015). Nevertheless, much less has been done on the impact of positive meta-stereotypes on emotion. According to the CUPE (Vázquez et al., 2016), positive meta-stereotype activation can lead individuals to fulfil high expectations of the outgroup, which will induce negative experiences like feelings of stress.

Based on the dual competition model and cognitive flexibility theory (Pessoa, 2009), studies show that negative emotions implicitly increased the control of attentional resources and suppressed the flexibility and speed of information processing (Fredrickson & Branigan, 2005; Rowe et al., 2007). As such, individuals may use more cognitive resources when experiencing negative emotions to ensure the completion of ongoing tasks and prevent possible harm caused by emotions such as anxiety, grief, and fear. Thus, negative emotions result in cognitive consumption, leading to the dispersion of cognitive resources and the suppression of cognitive processing. Similarly, according to the mood as an input model (Martin & Stoner, 1996) and feelings as information theory (Schwarz, 2012), negative emotions contain information about danger and uneasiness in the environment. Such emotions may foster a systematic processing style that is characterized by bottom-up processing, attention to the details at hand, and limited creativity.

The above literature shows that there is a close relationship between positive meta-stereotypes, negative emotions, and cognitive performance. Specifically, the activation of positive meta-stereotypes in disadvantaged groups could lead to increased levels of negative emotions and reduced cognitive performance. Negative emotions can influence cognitive performance. To understand the exact relationships between the three variables, some guidance was adopted from previous studies. For example, stereotype activation had a direct effect on task correctness and speed, and also indirectly affected the efficiency of cognitive processing through emotions such as anxiety and anger (Schmader et al., 2008). Sun et al. (2015) found that intergroup anxiety mediated the relationship between negative meta-stereotype activation and working memory. Therefore, the activation of positive meta-stereotypes in disadvantaged groups may produce negative emotions, which will adversely affect cognitive performance.

Overview of the studies

Despite advances in meta-stereotype research, there are questions that require further clarification. First, there is limited knowledge about the emotional and cognitive effects as well as the underlying psychological mechanism of positive meta-stereotypes activation. Second, most studies on positive meta-stereotypes did not have a control group (C. K. Owuamalam & Zagefka, 2011; Fowler & Gasiorek, 2021), but only made comparisons between positive and negative meta-stereotype activation groups. Such a research design can only indicate that the effects of meta-stereotypes vary in degree, but not in direction. That is, both positive and

negative meta-stereotype activation groups possibly have a negative (or positive) effect compared to a non-meta-stereotype activation group. The inclusion of the control condition served to ensure that the eventual effects of positive meta-stereotypes are a function of positive meta-stereotypes, rather than a deterioration of the negative meta-stereotypes on interaction expectations. Third, with regard to Vezzali (2017), the positive effect of meta-stereotypes activation was found in high-status groups. However, in addition to the valence of meta-stereotypes, the social status may play a decisive role in the effects of positive meta-stereotypes. Therefore, two experiments manipulating the meta-stereotypes of disadvantaged groups by setting two control conditions (a negative meta-stereotype activation group and a non-meta-stereotype activation group) to investigate the effect of positive meta-stereotypes on the cognitive performance and negative emotions of disadvantaged groups, and the role of negative emotions in the relationship between positive meta-stereotypes and cognitive performance. Cognitive processing, especially working memory processing, is closely related to the efficiency of current information processing and affects an individual's creativity, learning ability, reasoning ability, problem-solving ability, etc. Thus, working memory and its closely related creativity are considered indicators of cognitive processing in the current experiments.

In Experiment 1, the valence of meta-stereotypes was manipulated and the effects of positive meta-stereotypes on creativity among migrant children (the disadvantaged group) were tested.

In Experiment 2, the positive meta-stereotype was manipulated again by including a meta-stereotype activation examination. In this study, rural college students (the disadvantaged group) were recruited to be examined in terms of working memory under positive meta-stereotype activation.

Experiment 1

Migrant children are one of the typically disadvantaged groups in urban schools (Huang et al., 2019; Sun et al., 2015; Zou, 2012), defined as children aged 6 to 18 years who live temporarily with parents or guardians in the inflow area for more than six months (Yuan et al., 2010). Meta-stereotypes are prevalent among migrant children, yet the effects of meta-stereotypes on cognitive performance have not been thoroughly studied (Sun et al., 2015; Zou, 2012). Beilock and Carr (2001) suggest that cognitive tasks may differ in terms of the susceptibilities to performance pressure. Specifically, researchers suggest that tasks that require large amounts of information are stored in working memory, as well as more complex and procedural cognitive tasks (such as difficult mathematics exams) are more vulnerable to the CUPE (Beilock & Carr, 2005). Creativity refers to the ability to generate novel and meaningful ideas or products that can be accepted by a particular social culture (Plucker et al., 2004). As a complex and advanced cognitive ability, the creativity performance level is influenced by various factors, such as motivation (Amabile, 1985), emotion (Lofy, 2013), and pressure (Markus & Oldham, 2006). It follows then that creativity is an appropriate cognitive task to detect the CUPE.

The main aim was to test whether positive meta-stereotypes of migrant children have negative effects on creativity. Negative emotion as a potential mediator was tested between participants. An experimental paradigm was used to activate meta-stereotypes to describe the outgroup's impression of the participants' ingroup. After participants were led to believe an outgroup individual showing positive/negative/neutral expectations in intergroup contact, a measure of negative emotion and creativity was conducted. Two control groups were also included where participants were not in either the non-meta-stereotype activation or negative meta-stereotype activation groups.

The first hypothesis proposes that positive meta-stereotype activation should decrease the creativity level and choke under pressure on creativity in positive meta-stereotype activation should be found.

And the second hypothesis posits that negative emotion could mediate the relationship between positive meta-stereotypes and creativity. Therefore, activating positive meta-stereotypes should confirm negative expectations to a greater extent, and negative emotion would decrease the creativity level.

Method

Participants

A total of 188 migrant, Han ethnic children (111 males and 77 females) from Shanghai, China participated in this study. The children had parents or guardians who temporarily resided in Shanghai for more than one year. The mean age was 12.40 years (range = 11–16 years, $SD = .89$). A power analysis was conducted for a one-way three-level ANOVA to determine the sample size. A statistically significant medium effect with $f = .25$ and $p = .050$ will require at least 60 participants in each group (i.e., 180 participants in total) to guarantee an 85% statistical power (Faul et al., 2009).

Procedures and materials

A single-factor between-subjects experimental design was adopted in Experiment 1. There were 65 children in the positive meta-stereotype activation (PMSA) group, 62 in the negative meta-stereotype activation (NMSA) group, and 61 in the non-meta-stereotype activation (non-MSA) group. Each participant was involved in only one of the three groups. Before the experiment, the informed consent forms from the school leaders and participants were obtained. This study was approved by the China Academic Ethics Committee. The independent variable was whether meta-stereotypes were activated or not (PMSA, NMSA, or the non-MSA group, respectively). The dependent variable was the creativity score.

Two schools in Shanghai were selected for the survey, in which group measurement was conducted while taking a class as a unit and was led by a trained graduate student in psychology and a class teacher. Random allocation of groups was done at the individual level. Each participant was informed of the confidentiality and experiment rules. The migrant children and the urban children were asked to fill in the questionnaire related to meta-stereotypes and stereotypes respectively. All children were allowed to raise hands to ask the leader any questions, but no discussions were allowed. Migrant children were randomly assigned to one of the three groups, answered open-ended questions according to the instructions in each situation, and were asked to remain in their imagined group environment. All participants were tested in groups of 20, and four experimenters were master's students in psychology.

Activation of meta-stereotypes was adapted from the classical experimental paradigm which has been successfully used in prior research (Branscombe, 1998; C. K. Owuamalam & Zagefka, 2011), and was found to be effective with migrant children (Huang et al., 2019).

Different instructions were used to manipulate different meta-stereotype activation groups. For the PMSA/NMSA group, the instructions were as follows: "As a rural-to-urban migrant child, what positive/negative impressions do you think urban children (Shanghai students) might have of migrant children? Please use as many adjectives or as many of your own experiences as possible to describe these impressions." For the non-MSA group, the instruction was "What's your opinion on the current development of technology? Please use as many adjectives or as many of your own experiences as possible to describe these impressions." The last sentence in the instruction, based on a similar thought listing task by Cacioppo and Petty (1981), was included to enhance the salience of the meta-stereotype activation. Subsequently, participants completed the emotional self-rating scale and creativity test. Before the creativity test, participants were instructed as follows: "The following is a creativity test. You should complete the items within 20 minutes. You are expected to provide answers that are as extensive, flexible, and unique as possible. Please try not to stop thinking ahead, because if you spend more time thinking, you'll probably have more and better answers."

During the 20-minute creativity test, participants were asked to rate the valence of three typical positive/negative meta-stereotype words regarding migrant children and three neutral words after each question to ensure their focus on the task. These typical positive/negative meta-stereotype words were from the survey by Zou (2012). The negative meta-stereotype words were surliness, rube, and dreary, and the positive meta-stereotype words were sincerity, respect, and kindness. The neutral

words (i.e., combination, age, and angle) were from the Chinese Affective Words System (Y. N. Wang et al., 2008).

Next, participants completed a demographics questionnaire related to their age and household registration. Finally, participants were thanked and carefully debriefed about the aim of the study.

Emotional self-rating scale

A self-rating scale was used to measure participants' negative emotions (anxiety, sadness, fear, and anger) and a positive emotion (happiness),1[1] which was adapted from Diener et al. (1995) and applied in previous studies (D. Wang, 2018). The CUPE was mainly examined on negative emotions. Participants were asked to make responses based on their current emotions. Cronbach's α was .82 for the Emotional Self-Rating Scale.

Three dimensions of creativity test

A creativity test (Lu et al., 2002) and the Torrance Tests of Creative Thinking were used. The test has been shown to be appropriate for Chinese junior high school students (Lu et al., 2002). It includes three questions (i.e., give a title to a short article, imagine with a simple picture, and write the possible use of an object), and each of the answers is evaluated in three dimensions: originality, flexibility, and fluency, with a score, generated respectively in each dimension. The fluency score reflects the number of answers, where each title or each use of an object is given a point. The flexibility score reflects the number of answer categories, where each category is given a point for a title or use of an object (e.g., cloth can be used to make clothes, curtains, and tablecloths). The originality score reflects the novelty of the answers, where the answer is rarely mentioned by other participants (i.e., less than 5% of the participants mentioned the answer). Before scoring the creativity test, four experimenters were trained by a psychology professor to fully grasp the scoring criteria and reached a scoring consistency beyond 95%, which ensures the standardization of the instruction and procedures. Inter-rater reliability ranged from .94 to 1.0, indicating that the creativity scores were reliable. The overall creativity score is the sum of the three standardized scores.

Results

All data were recorded and processed using SPSS Statistics 26.0. All variable scores were converted to standard scores. The chi-square test or ANOVA showed that there was no significant difference in gender distribution ($\chi^2 = .34$, $p = .844$) or age ($F = .20$, $p = .815$) among the three groups.

Differences in negative emotions and creativity

The results of the differences in negative emotions and creativity among the three groups are shown in Table 1. Results showed a significant main effect of meta-stereotype activation on anxiety, $F = 5.87$, $p = .003$. The PMSA and NMSA groups did not differ significantly, $p = .708$. Participants in the

Table 1. ANOVA results for negative emotions and creativity among three groups (M; SD).

	Non-MSA Group ($n = 61$)	PMSA Group ($n = 65$)	NMSA Group ($n = 62$)	F	η^2 (Cohen's f)
Anxiety	1.66 (.12)	2.22 (.14)	2.29 (.17)	5.87**	.06 (.25)
Sadness	1.43 (.11)	1.98 (.13)	2.23 (.15)	9.73***	.10 (.32)
Anger	1.57 (.12)	1.60 (.11)	2.02 (.16)	3.48*	.04 (.19)
Fear	1.28 (.08)	1.63 (.12)	1.95 (.17)	6.57**	.07 (.27)
Negative emotion	1.48 (.54)	1.86 (.72)	2.12 (1.14)	8.98***	.09 (.31)
Fluency	.76 (.31)	−.69 (.16)	−.27 (.25)	9.12***	.09 (.31)
Flexibility	.54 (.32)	−.42 (.19)	−.76 (.23)	7.32***	.07 (.28)
Originality	.58 (.29)	−.28 (.17)	−.41 (.17)	6.02**	.61 (.26)
Overall Creativity	1.88 (.72)	−1.39 (.36)	−1.44 (.53)	11.88***	.11 (.36)

*$p < .05$, **$p < .005$, ***$p < .001$, the same as below.

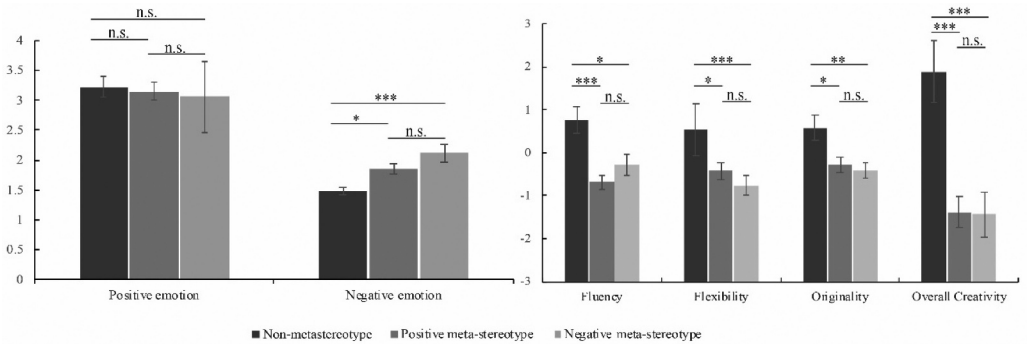

Figure 1. Comparison of all variables among different groups.

non-MSA group had significantly lower anxiety than those in the PMSA group ($p = .006$) and NMSA group ($p = .002$). Similar results were found in the effect of meta-stereotype activation on sadness, fear, and anger.

Results also showed a significant main effect of meta-stereotype activation on negative emotions, $F = 8.98$, $p < .001$, $\eta_p^2 = .09$. Meta-stereotype activation had a significant effect on all dimensions of creativity and overall creativity, $F_{\text{fluency}} = 9.12$, $F_{\text{flexibility}} = 7.32$, $F_{\text{originality}} = 6.02$, $F_{\text{overall Creativity}} = 11.88$, $ps < .05$. The pairwise comparison (t-test with Bonferroni adjustment; see Figure 1) showed that the PMSA and NMSA group did not differ significantly, $ps > .10$. However, compared with the non-MSA group, both meta-stereotype groups showed significantly more negative emotions and significantly less creativity, $ps < .05$.

Regression and the test of mediation

Mediation analyses were performed using the PROCESS version 4.1 macro for SPSS (Hayes, 2013). Five thousand samples for bias-corrected bootstrap confidence intervals were chosen. If the 95% confidence interval does not contain 0, the mediating effect is statistically significant (Hayes, 2013). Since the independent variable was a multi-categorical variable (i.e., group), this variable was dummy coded into two variables, representing the comparison between the non-MSA and PMSA group and the comparison between the non-MSA and NMSA group, and age was included as a covariate in the mediation model.

Figure 2 shows the results of the mediation test. The total effect of the meta-stereotype activation on creativity was significant, $F(2, 185) = 10.84$, $p < .001$, and the regression results showed that both positive and negative meta-stereotype activation had a significantly negative effect on creativity, $ps < .001$.

After controlling the effect of emotion, the direct effect of meta-stereotypes remained significant, $F(4, 183) = 11.19$, $p < .001$, and the regression results showed that both positive ($B = -.58$, $SE = .16$) and negative ($B = -.52$, $SE = .17$) meta-stereotypes had a significantly negative effect on creativity, $ps < .01$. For the indirect effect, negative emotions had a significant mediating effect on the effect of positive and negative meta-stereotypes for both PMSA and NMSA groups, the indirect effect of positive meta-stereotype activation on creativity through negative emotion was significant ($B = -.12$, 95% CI [−.21, −.04]), and the indirect effect of negative meta-stereotype activation on creativity through negative emotion was significant ($B = -.20$, 95% CI [−.32, −.09]). These results showed that negative emotion partially mediated the relationships between meta-stereotypes and creativity.

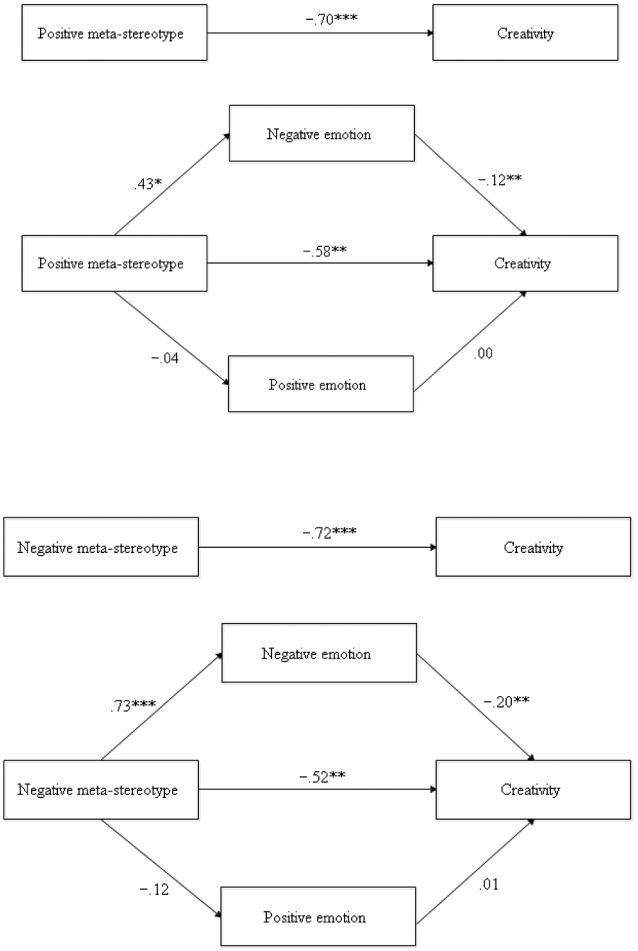

Figure 2. Pathway of the mediating effect of negative emotion between positive and negative meta-stereotypes and creativity.

Discussion

The aim of Experiment 1 was to investigate the effects of positive meta-stereotypes on creativity and negative emotions in migrant children. The results confirmed the hypotheses, showing that positive meta-stereotypes had a negative effect on creativity (Hypothesis 1) and the negative emotion acted as a partial mediator in the relationship between positive meta-stereotypes and creativity (Hypothesis 2).

Surprisingly, since no differences in negative emotions and creativity were shown between positive and negative meta-stereotype activation, positive meta-stereotypes may have a negative effect on an individual's cognition and emotion. In line with previous studies, negative meta-stereotypes contribute to more anxiety and a threatening effect on cognitive performance (Sun et al., 2015; Van Leeuwen et al., 2014). It is suggested that the positive meta-stereotype leads to decreased creativity performance due to the CUPE. "Pressure" can result from an evaluative audience, punishments, rewards, competition, and when the performance domain is viewed as self-relevant (Baumeister & Showers, 1986). Therefore, in the current study, positive meta stereotypes activation engendered feelings of threat. With a feeling of being compared to urban children in this threatening situation, individuals tend to experience negative emotions, including anxiety and anger (C. K. Owuamalam, Issmer, et al., 2013; Voyles et al., 2014). In terms of cognitive resources, migrant children were asked to complete a creative task under the meta-stereotype-activated situation. The activation of positive meta-stereotypes forces

children to monitor their own behavior, which highly occupies one's attention and cognitive resources, and then leads to poor creativity performance (C. Owuamalam & Zagefka, 2014).

Negative emotions, as aroused by meta-stereotypes, showed a significant mediating effect on the relationships between positive meta-stereotypes and creativity. With negative emotions, an individual may think that the environment is questionable or problematic. As such, individuals must reduce the scope of their cognitive processes and undertake a defensive response to carefully assess the environment (Schwarz, 2012). Less dependence on the original knowledge structure may inhibit the divergence of thought and harm creative activities (George & Zhou, 2002).

Experiment 2

Results from Experiment 1 showed that activating positive meta-stereotypes decreased creativity, suggesting that positive meta-stereotypes had a CUPE. It is worth noting that although the experimental activation paradigm of meta-stereotypes employed in the present study has been widely used and demonstrated effective (C. K. Owuamalam & Zagefka, 2011; Fowler & Gasiorek, 2020), it would provide more direct evidence for the validity of this experimental paradigm if the corresponding activation check could be done. The findings in Experiment 1 provided further motivation for this question. In Experiment 2, the effect of working memory after positive meta-stereotype with the activation check was examined. Working memory is a cognitive mechanism that temporarily processes and stores a limited amount of information (Baddeley, 1992). It is an important component of the creative process (Orth et al., 2019) since working memory has the function of suppressing the interference of irrelevant information, keeping new information highly active, and considering multiple ideas at the same time to produce more novel solutions (Zabelina et al., 2019). Thus, working memory is appropriate to obtain evidence for the CUPE of positive meta-stereotypes.

Theory of mind (ToM) acknowledges that people can understand the personal mental activities and those of others (e.g., beliefs and emotions) and predict the behavior of others (Premack & Woodruff, 1978; Wellman, 2014). In the process of using ToM, individuals from each age group show differences, for example, adults are better able to understand the mental state of others like children (Baron-Cohen et al., 1997). Rural college students are adults in school, who meanwhile act as one of the generally disadvantaged groups in urban college schools. Researchers have found that outgroups tend to have negative stereotypes of rural college students, such as that rural college students are unhygienic, possess poor expressive skills, and lack self-confidence. Outgroups also hold positive stereotypes, such as that rural college students are independent and hardworking (Meng, 2013; Yu, 2010). At the same time, researchers have also found that rural college students have negative meta-stereotypes (e.g., indecisive, untidy) and few positive meta-stereotypes (Meng, 2013). On the basis of Experiment 1, for deeper exploration, Experiment 2 would focus on the positive meta-stereotypes of rural college students, examining whether positive meta-stereotypes have negative effects on working memory and the mediating effect of negative emotions. Therefore, the first hypothesis proposes that positive meta-stereotype activation will decrease the working memory. And the second hypothesis posits that negative emotion will act as a mediator between positive meta-stereotypes and working memory.

Method

Participants

A total of 125 college students of Han ethnicity from China participated in the study. After excluding 17 participants with invalid data (e.g., incomplete questionnaire, accuracy exceeding three standard deviations), the sample is 108 (12 males and 96 females), with 36 in each condition. The mean age was 19.79 years (range = 19–22 years, $SD = 1.22$). A statistically significant medium effect with an f of .25 and an α of .05 requires approximately 108 participants to attain 80% power.

Procedures and materials

3 (activation groups: PMSA, NMSA, and non-MSA group) × 3 (task levels: low, medium, and high difficulty) between-subjects design was adopted in Experiment 2. The dependent variable was the accuracy and reaction time in the N-back test. Having been informed of consent, participants were assigned randomly to one of the three groups (PMSA, NMSA, or the non-MSA group). The meta-stereotype activation was similar to Experiment 1. The PMSA group was asked to list four positive impressions that college students thought the outgroup had attributed to the ingroup. The NMSA group was asked to list four negative impressions that college students thought the outgroup had attributed to the ingroup. The non-MSA group was asked to list four opinions about the current development of science and technology. After finishing the positive meta-stereotype activation, participants immediately completed the meta-stereotype activation check, which measured the general opinion of the ingroup students toward the outgroup students on a 7-point scale, ranging from 1 (*negative*) to 7 (*positive*), according to Matera et al. (2015). Next, participants took approximately 15 minutes to complete the N-back task. Three black solid pictures were selected for this task: triangles, circles, and squares. The dimensions of each image on the screen were approximately 6.5 cm in width and 6.5 cm in height and sustained 187 by 308 pixels. In the 0-back task, participants were required to press "A" upon seeing a triangle and press "L" for the rest of pictures including circles and squares. In the 1-back task, participants were instructed to decide whether the current image is the same as the previously displayed image, while in the 2-back task, participants were asked to decide whether the current image is the same as the two previously displayed images. If the two pictures are the same, press "A," if not, press "L." Participants were instructed to respond as quickly as possible. In the processing of a task, instructions are presented on a computer screen. Then the practice experiment was carried out, and the formal experiment was conducted after participants fully understood the experimental requirements. In a trial, a 500 ms fixation point was presented, then the stimulus was presented at 500 ms, and the judgment time was 2, 000 ms.

Emotional self-rating scale

The same emotional rating scale as in Experiment 1 was used.[2]

N-back test

The N-back task was used as a measure of working memory performance (Cai et al., 2011; Gkalitsiou & Byrd, 2021). In order to measure working memory, three different levels of difficulty were incorporated, including 0-back, 1-back, and 2-back. The 0-back included 32 trials, the 1-back included 33 trials, and the 2-back included 34 trials. Participants were instructed to identify whether triangles or circles and squares in the 0-back task, and decide whether each presented image was the same as the image 1-, or 2- trials back in the 1-back and 2-back task.

Results

All data were recorded and processed using SPSS Statistics 26.0. All variable scores were converted to standard scores. The chi-square test or ANOVA showed that there was a significant difference in gender distribution ($\chi^2 = 7.31$, $p = .026$), but no significant difference in age ($F = 1.29$, $p = .278$) among the three groups.

Activation check

The activation check was entered into the ANOVA. The results were significantly different across the activation groups, $F(2, 105) = 31.46$, $p < .001$, $\eta_p^2 = .38$. The item score in the non-MSA group ($M = 4.42$, $SE = .14$) was lower than that in the PMSA group ($M = 5.36$, $SE = .15$) and was higher than that in the NMSA group ($M = 3.64$, $SE = .17$). This suggested that the experimental activation was effective.

Differences in negative emotion

The main effect of activation groups in the negative emotion was significant, $F(2, 105) = 3.23$, $p = .044$, $\eta_p^2 = .06$. The negative emotions of the non-MSA group ($M = 1.42$, $SE = .08$) and PMSA group ($M = 1.40$, $SE = .10$) were lower than that in the NMSA group ($M = 1.73$, $SE = .13$). The negative emotions of the non-MSA and PMSA groups were not significantly different, $p = .849$.

Differences in N-back performance

The performance in the N-back test was submitted to a repeated measures ANOVA. For accuracy, the analysis revealed a main effect of activation groups, $F(2, 105) = 4.61$, $p = .012$, $\eta_p^2 = .08$, with higher accuracy in the non-MSA group ($M = .86$, $SE = .01$) than that in the PMSA group ($M = .82$, $SE = .01$), $p = .011$, 95% CI [.01, .07], and NMSA group ($M = .82$, $SE = .01$), $p = .009$, 95% CI [.01, .07]. The performance of the NMSA and PMSA groups were not significantly different, $p = .925$.

The main effect of task levels was also significant, $F(2, 210) = 285.26$, $p < .001$, $\eta_p^2 = .73$. The accuracy at the low difficulty level ($M = .96$, $SE = .01$) was higher than that at both medium ($M = .89$, $SE = .01$), 95% CI [.05, .08], and high difficulty levels ($M = .66$, $SE = .01$), 95% CI [.28, .34]. The accuracy in the medium difficulty level was higher than that in high difficulty level, 95% CI [.21, .27].

The interaction between activation groups and task levels was significant, $F(4, 210) = 3.28$, $p = .012$, $\eta_p^2 = .06$. The simple effect analysis showed that the accuracy of the non-MSA group ($M = .72$, $SE = .03$) was higher than that in the PMSA group ($M = .61$, $SE = .03$), 95% CI [.03, .17], and NMSA group ($M = .64$, $SE = .03$), 95% CI [.01, .15], at the high difficulty level. There was no significant difference at other levels.

The analysis of the reaction time (RT) revealed that the effect of activation groups was significant, $F(2, 105) = 5.28$, $p = .007$, $\eta_p^2 = .09$, with higher RT in the NMSA group ($M = 727.87$, $SE = 19.95$) than that in the PMSA group ($M = 640.37$, $SE = 19.95$), $p = .002$, 95% CI [31.55, 143.45], and non-MSA group ($M = 660.41$, $SE = 19.95$), $p = .019$, 95% CI [11.50, 123.40].

The main effect of task levels was significant, $F(2, 210) = 140.24$, $p < .001$, $\eta_p^2 = .57$. RT at the low difficulty level ($M = 494.21$, $SE = 9.94$) was shorter than that at both medium difficulty level ($M = 724.02$, $SE = 12.13$), 95% CI [207.93, 251.69], and high difficulty level ($M = 810.42$, $SE = 23.09$), 95% CI [269.04, 363.39]. RT at the medium difficulty level was lower than that at the high difficulty level, 95% CI [44.11, 128.70]. The interaction between activation groups and task levels was not significant, $F(4, 210) = 1.32$, $p = .266$.

Regression and the test of mediation

Mediation analyses were performed using the PROCESS version 4.1 macro for SPSS (Hayes, 2013). Five thousand samples for bias-corrected bootstrap confidence intervals were chosen. If the 95% confidence interval does not contain 0, then the mediating effect is statistically significant (Hayes, 2013). Gender and age were included as a covariate in the mediation model.

The effect of the meta-stereotype activation was significant; the results showed $F(3, 104) = 3.18$, $p = .027$. The regression results showed that both positive and negative meta-stereotype activation had a significantly negative effect on working memory at high-difficulty levels. For the indirect effect, it was found that negative emotion (95% CI [−.37, .06]) was insignificant.

Discussion

Activating positive meta-stereotypes decreased working memory, especially in terms of accuracy at the high-difficulty condition. The occurrence of the CUPE was limited to the more demanding task with higher cognitive load in the N-back task (2-back). There was no significant difference in task

performance in these three groups under the 0- and 1-back tasks. This suggested that positive and negative meta-stereotype activation (compared to the no-MSA group) did not affect working memory processing when the need for monitoring, updating, and storing in working memory was low. These results verified the conditions of the CUPE on cognitive tasks, which demonstrated that cognitive but complex tasks and tasks that require large amounts of information to be stored in working memory were more vulnerable to the CUPE (Beilock & Carr, 2005).

However, unlike the findings in Experiment 1, negative emotion did not mediate the relationship between positive/negative meta-stereotypes and working memory. The reason might be that in the case of high task difficulty (2-back), the complex task itself consumes a large number of cognitive resources, squeezing the cognitive resources occupied by negative emotions, and resulting in the decline of the effect of negative emotions.

General discussion

Two experimental studies were conducted and showed that activating positive meta-stereotypes had a negative effect on cognitive performance in both experiments. Notably, the meta-stereotype activation check led us to conclude that this effect was due to enhancing the effects of positive meta-stereotype activation rather than suppressing the effects of negative meta-stereotypes (Experiment 2).

Interestingly, positive meta-stereotypes did not achieve positive effects. Considering that meta-stereotype valance has specific functions for in groups, it was found that positive meta-stereotypes may also have negatively impacted an individual's cognition and emotion. Furthermore, negative emotions were followed by positive meta-stereotype activation. Thus, it suggested that the positive meta-stereotype group experienced a lower cognitive performance due to the CUPE. Many researchers have hypothesized that such pressure is disruptive, at least in part, because it leads to excessive attention directed toward the self (i.e., self-consciousness), which may result in slower performance, hesitation, and excessive worry (Krendl et al., 2012). When positive meta-stereotypes of disadvantaged groups were activated, the ingroup members felt high expectations from the outgroup and increased stress, which result in the CUPE and poor performance.

Another interesting result was that positive meta-stereotypes induced negative emotions. The negative emotions stimulated by positive and negative meta-stereotypes showed a significant mediating effect on the relationship between positive and negative meta-stereotypes and creativity (Experiment 1). However, negative emotions could not mediate positive and negative meta-stereotypes and working memory (Experiment 2). Consistency occurs between an individual's emotions and memory (Blaney, 1986), which means that emotion has a significant impact on the process of storage, transformation, and information combination. When an individual experiences negative emotions, information, and memories similar to the current emotional state are more easily evoked. Therefore, on the one hand, individuals may lack confidence in their cognitive abilities, leading to decreased resilience in executing cognitive tasks. On the other hand, negative emotions may interfere with individuals' working memory. Studies have shown that working memory plays an important role in complex cognitive tasks. Individuals with a high working memory capacity can integrate existing knowledge and effectively suppress irrelevant information, which is necessary for creative behaviors. However, individuals with negative emotions have a reduced diversity of information and narrow cognitive background, which causes the simplification of memory material interpretation and organization. Accordingly, individuals cannot recompose ideas from multiple perspectives, which reduced the possibility of connecting different elements or achieving diversity (Y. Wang, 2011). Additionally, negative emotions have a detrimental effect on individuals' executive control functions. Such emotions may occupy limited attention resources and increase the activity of the amygdala. This process can affect individuals' central executive system function, prompting the consumption of cognitive resources that are essential to cognitive performance (Miller & Bichsel, 2004).

The working memory restriction theory of anxiety (Eysenck, 1979) suggests that individuals exposed to threatening stimuli tend to devote cognitive resources to anxious states, thereby

inhibiting corresponding mental flexibility (Gawda & Szepietowska, 2016). Negative emotions related to a threat can cause individuals to have regurgitated thinking (Curci et al., 2013). Such resource investment and interference with thinking severely affect cognitive processes required for creativity, such as working memory (Orth et al., 2019). Compared to migrant children, rural college students have a higher maturity level to regulate emotions, especially in complex tasks, where individuals should spend more cognitive resources on negative emotions, and decrease the effects of negative emotions. Thus, when positive meta-stereotypes of rural college students were activated, negative emotions could not serve as a mediator. Future research should focus on the CUPE of positive meta-stereotypes among disadvantaged groups, for example, migrant children, who are vulnerable to negative evaluation by outgroups and need to consider more nuanced targeted interventions.

Some study limitations deserve further exploration. First, although migrant children and rural college students are typically disadvantaged groups in China (Huang et al., 2019; Sun et al., 2015), the current results are greatly significant for understanding the positive meta-stereotype activation effect in disadvantaged groups. Future studies should examine if other social groups have the same adaptation mechanism. Second, as a meta-cognition of group relations, the content of meta-stereotypes varies according to the relationship between ingroups and outgroups. The current study focused on the low-status group. Future studies could investigate the effects of positive and negative meta-stereotypes among high-status groups. Third, group identification and self-consciousness should be considered as moderators of the CUPE (Tagler, 2012), and differences in internal mechanisms between meta-stereotype threat and the CUPE of positive meta-stereotypes need clarification. Additionally, it would be important to figure out how to reduce the negative effect of positive and negative meta-stereotypes among low-status groups.

Notes

1. In Experiment 1, a positive emotion (happiness) was adopted as a supplement and support to examine the choking under pressure effect. Items were responded to on a five-point Likert scale ranging from 1 (not at all) to 5 (very much). The results showed that there was no a significant main effect for meta-stereotype activation on positive emotions, $F = .24$, $p = .785$.
2. In Experiment 2, the analysis revealed a main effect of activation groups in the positive emotion [$F(2, 105) = 4.93$, $p = .009$, $\eta p2 = .09$], and positive emotion in the non-MSA group ($M = 3.50$, $SE = .17$) is higher than that in the PMSA group ($M = 3.00$, $SE = .17$) and NMSA group ($M = 2.75$, $SE = .17$).

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Data availability statement

The data and materials described in this article are openly available in the Open Science Framework at https://osf.io/5nvba.

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