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Solitude capacity and emotional experience in Chinese college students: The suppression effect of emotion regulation

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Abstract: Although numerous findings show that people experience both positive and negative experiences with regards to solitude, the relationship between solitude capacity and emotional experience remains unclear. The current study investigated the extent to which emotion regulation may play a suppressive role in the relationship between solitude capacity and emotional experience. Questionnaires on solitude capacity, emotion regulation, and emotional experience were completed by a sample of Chinese college students ($n = 844$; 432 females; $\text{Mean}_{\text{age}} = 19.79$ years, $SD = 1.43$ years). The results of the indirect effect test showed that cognitive reappraisal suppresses the prediction of solitude capacity on positive emotions, while the solitude capacity prediction of negative emotions was suppressed by both cognitive reappraisal and expressive suppression. This suggests that solitude capacity does not predict emotional experience directly, but instead is realized through an antagonistic system consisting of adaptive and nonadaptive emotion regulation strategies. These findings provide cross-sectional empirical support for the ecological niche hypothesis of solitude, and are of theoretical significance in clarifying the role of internal mechanisms of solitude capacity on the human emotional experience.

Keywords: solitude capacity; emotion regulation; emotional experience; suppression effect

Introduction

Philosopher Schopenhauer once stated, "To be alone is the fate of all great minds." Solitude, as an indication of human maturity and inner peace (Lian et al., 2023), has been advocated for and practiced by numerous eminent historical figures. Wang Wei, a renowned poet from the Tang Dynasty (618 to 907 A.D.) in China, wrote in his poem "终南别业(My Retreat at Mount Zhongnan)" that "兴来每独往, 胜事空自知" ("When the mood comes, I go alone to the mountains, and I alone know the delightful things"). Legend has it that Goujian, king of the Chinese Kingdom of Yue during the Spring and Autumn Period (770 to 476 B.C.), spent close to 10 years in solitude contemplating his next conquests. However, in contemporary times, many studies have associated solitude with psychological distress or negative emotions (e.g., Larson et al., 1990; Lian et al., 2023; Lian et al., 2021), with claims that solitude experienced during adolescence will inevitably affect one's physical and mental health adversely (Goosby et al., 2013). And yet, studies have also shown the importance of solitude in enhancing one's short-term emotional renewal (Larson, 1990) and psychological adaptability (Larson & Lee, 1996; Long & Averill, 2003; Long et al., 2003). There is emerging consensus that solitude may help individuals evaluate adverse situations more positively, providing them with a greater sense of control of their situation (Lian et al., 2023; Li et al., 2023), and thereby alleviating the effects of stress on their mental health (Larson & Lee, 1996; Wu & Chen, 2006).

The benefits of solitude can vary across one's lifespan, and when people are younger and more gregarious (Roberts et al., 2006), they may find solitude to be unrewarding. However, this can vary across cultures. Eastern collectivistic societies place more emphasis on interdependence and group attachment (Greenfield et al., 2006) and young people in these cultures have been found to be less likely to tolerate solitude compared to those in Western individualistic societies (Lian et al., 2023). This means that enriching the empirical evidence regarding the experience of solitude in different cultural contexts is essential. Therefore, this study aimed to explore the relationship between solitude capacity and emotional experience among Chinese young adults in relation to their emotion regulation.

Solitude Capacity and Emotional Experience

As an independent orthogonal structure of positive and negative emotions (Watson et al., 1988; Zhao et al., 2020), emotional experience vary by the forms and connotations of solitude. Specifically, involuntary solitude, as the situations in which one desires to be with others but is forced to be alone, is often associated with negative emotional experiences such as loneliness and isolation (Larson & Lee, 1996; Lian et al., 2023). Whereas constructed solitude, a state of solitude that the individual autonomously and voluntarily chooses, is often accompanied by numerous positive emotional experiences such as deepened self-understanding, enhanced self-recovery, and creativity (Larson & Lee, 1996; Lian et al., 2023). As for solitude preference-the extent to which individuals seek to be alone (Jiang & Zhao, 2017), was reported to be significantly associated with a decrease in positive affection (Jiang & Zhao, 2017) and an increase in loneliness, depression, and social anxiety (e.g., Liu et al., 2015; Zhang et al., 2024) in Chinese cultural context. The correspondence between constructed solitude, involuntary solitude, solitude preference, and emotional experience seems clear, but things get more complicated regarding solitude capacity.

Solitude capacity has developed from the concept of constructed solitude (Lian et al., 2021), and reflects one's ability to utilize solitude to deal with stress or experience

self-renewal (Larson & Lee, 1996). Individuals with a higher level of solitude capacity can benefit more from solitude as they have better psychological adaptability (Detrixhe, 2011) and increased sense of control, happiness, relaxation, freedom, and optimism (Lian et al., 2021). Whereas those with a lower level of solitude capacity tend to distract themselves when alone by engaging in irrelevant activities, and are therefore less able to release negative emotions and address the problems they are facing (Larson & Lee, 1996). As such, it seems likely that solitude capacity can positively predict one's positive emotions, as well as negatively predict one's negative emotions. However, contradictions exist in research results. Some studies have found a significant positive correlation between solitude capacity and psychological distress (Lian et al., 2023, 2021), while others have found significant negative correlations between solitude capacity and major depression (Lin et al., 2020), loneliness (Li et al., 2023), and physical and mental health (Wu & Chen, 2006). Meanwhile, Jiang and Zhao (2017) found no significant correlation between solitude capacity and positive affection. It can be seen that although solitude capacity is closely related to emotional experience, its prediction of emotional experience is obscure and not directly carried out.

The Suppressing Role of Emotion Regulation

Emotion regulation refers to the process of managing one's own emotions (Gross, 2015), which is a basic ability in maintaining one's own mental health and well-being (Yao et al., 2022). Gross (1998) proposed five emotion regulation strategies: situation selection, situation modification, attention deployment, cognitive reappraisal (cognitive change), and expressive suppression (modulation of responses); however, cognitive reappraisal and expressive suppression are the most common (Zhao et al., 2020). Cognitive reappraisal refers to the process of cognitively reinterpreting emotional events to change one's emotional responses. Expressive suppression, on the other hand, refers to the process of altering one's emotional response by actively suppressing emotional expression (Zhao et al., 2020). Reappraisal, as an antecedent-focused strategy, generally occurs before emotional reactions take place, meaning it can effectively change the track of one's subsequent emotional development; suppression, as a response-focused strategy, usually occurs after one has experienced an emotional response, and is therefore more effective in modifying behaviors that are predisposed to emotional responses (Gross & John, 2003).

Typically, cognitive reappraisal is associated with an increase in positive emotions (Kelley et al., 2019; Gross & John, 2003) and a decrease in negative emotions (Schafer et al., 2017; Troy et al., 2013), and thereby be considered to be an adaptive emotion regulation strategy, whereas expressive suppression is associated with the increase of negative emotions (Gross & John, 2003; Guo et al., 2023; Schafer et al., 2017) and thereby be considered to be a non-adaptive emotion regulation strategy (Schafer et al., 2017; Zhang et al., 2020), and together they constitute an antagonistic system of emotion regulation. While the antagonistic effect of cognitive reappraisal and expressive suppression in emotion regulation is not absolute, and may vary by cultures (see Yeung & Fung, 2012; Yuan et al., 2014).

Conceivably, it would be safe to assume that the prediction of solitude capacity on emotional experience is likely achieved through emotion regulation. Firstly, according to the comparative model of the benefits and costs of solitude from the lifespan development perspective (Haidabieke et al., 2024), the costs and benefits of solitude coexist across one's developmental lifespan, but the performances of the two vary at different ages. In addition, the ecological niche hypothesis of solitude (Larson et al., 1982, p. 40) also holds that individuals can experience either positive or negative emotions while alone, and that this may be determined by the characteristics of individuals, such as age-related capabilities (Long & Averill, 2003). Considering that emotion regulation is not only related to an individual's age (Nakagawa et al., 2017; Wang et al., 2021) but also an important variable that determines one's specific emotional experience (Gross & John, 2003; Schafer et al., 2017). Therefore, emotion regulation may be one of the factors determining how solitude capacity predicts emotional experience. Secondly, emotion regulation may function as an antagonistic system between solitude capacity and emotional experience. Specifically, when the two sides of this antagonistic system produce the same effect, their regulating impacts on the relationship between solitude capacity and emotional experience possibly counteract one another, manifesting as a failure of solitude capacity to predict emotional experience. Additionally, when the effects of these two parts of the system are not synchronized, solitude capacity will draw upon the dominant side of the antagonistic system to demonstrate predictive effects on specific emotional experiences.

Nonetheless, most of the existing research on solitude is based on Western cultural samples (Haidabieke et al., 2024; Lian et al., 2023), while it is essential to pay attention to solitude in collectivism society in order to arouse people's consciousness of seeking solitude and promoting self-harmony (Lian et al., 2023). In addition, the few empirical studies looking at Eastern cultural contexts have focused more on the relationship between solitude capacity and internalizing or externalizing behavior problems (e.g., Li et al., 2023; Lian et al., 2021, 2023; Lin et al., 2020; Yang et al., 2020), while little attention has been paid to the relationship between solitude capacity and emotional experience. Therefore, it is necessary to clarify the relationship mechanism between solitude capacity and emotional experience in the Eastern cultural background.

The Present Study

This study aimed to explore the relationship between solitude capacity and emotional experience with cognitive reappraisal and expressive suppression in Chinese culture. Namely, to test the suppression effects of cognitive reappraisal and expressive suppression in the relationship between solitude capacity and emotional experience. In consideration of our literature review, we proposed the following conceptual model (see Figure 1) and related hypotheses:

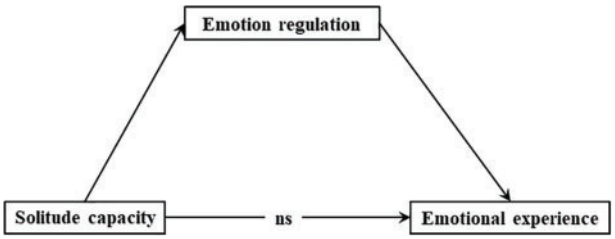

Figure 1. The conceptual model (ns: $p > 0.05$)

Hypothesis 1a: Solitude capacity is not significantly correlated with either positive or negative emotions, but is positively correlated with both cognitive reappraisal and expressive suppression.

Hypothesis 1b: Cognitive reappraisal is positively correlated with positive emotions, but negatively correlated with negative emotions; and expressive suppression is positively correlated with negative emotions.

Hypothesis 2: The relationship between solitude capacity and positive emotions is suppressed by cognitive reappraisal.

Hypothesis 3: The relationship between solitude capacity and negative emotions is suppressed by both cognitive reappraisal and expressive suppression.

Method

Participants and setting

The participants in this study were 844 Chinese college students (432 females; mean age = 19.79; *SD* = 1.43 years). Of these, 208 were only children, and 309 of the students came from towns or cities. In terms of their year of study, 327 were freshmen, 224 were sophomores, 198 were juniors, and 95 were seniors or higher. With regards to their studies, 258 were liberal arts students, 392 were science students, 128 were engineering students, and 66 were other majors.

Measures

Solitude capacity

Solitude capacity was measured using the Chinese version of the Capacity to be Alone Scale, which was developed by Larson and Lee (1996) and revised by Wu and Chen (2006). This questionnaire comprises 20 items assessing two dimensions: solitary comfort (comprising 10 items; e.g., "I enjoy being by myself") and solitary coping (comprising 10 items; e.g., "Being alone is not healing for me"). Each item is rated using a five-point Likert-type scale ranging from 1 ("very untrue of me") to 5 ("very true of me"); the higher the total score, the higher the respondent's level of solitude capacity. In the current sample, the Cronbach's α coefficient for scores from this measure was 0.84.

Emotion regulation

Emotion regulation was measured using the 10 items Chinese version of the Emotion Regulation Scale developed by Gross and John (2003) and revised by Wang et al. (2007). This scale measures two emotion regulation strategies: cognitive reappraisal (comprising six items; e.g., "When I want to feel less negative emotion (such as sadness or anger), I change what I'm thinking about") and expressive suppression (comprising four items; e.g., "When I am feeling positive emotions, I am careful not to express them"). Each item is rated using a seven-point Likert-type scale ranging from 1 ("total disagree") to 7 ("totally agree"), and the scale has been shown to have good reliability and validity. The reliabilities of the cognitive reappraisal subscale, the expressive suppression subscale, and the total questionnaire obtained in this sample were 0.85, 0.69, and 0.77, respectively.

Emotional experience

Emotional experience was measured using the Chinese version of the Positive and Negative Affect Schedule developed by Watson et al. (1988) and translated by Huang et al. (2003). This questionnaire is made up of 20 words that describe emotions, with respondents asked to report on their positive (comprising 10 items; e.g., "Enthusiastic") and negative (comprising 10 items; e.g., "Scared") emotional experiences during the previous one to two weeks. Each item is rated using a five-point Likert-type scale ranging from 1 ("very slightly or not at all") to 5 ("extremely"). In the current sample, the Cronbach's α coefficients for scores for positive emotions, negative emotions, and the total questionnaire were 0.86, 0.88, and 0.82, respectively.

Procedure

The Medical Ethics Committee of the Affiliated Hospital of Yan'an University approved the study (approval code YAA-No5-20230805). All participants consented to the study and accessed the questionnaire on the Wenjuanxing platform by following a link or QR code sent via Wechat or QQ social software. They were assured that their participation in the survey was voluntary and anonymous. Participants received 2 RMB (approximately US$ 0.28) as a token of appreciation after they had completed the questionnaire.

Data analysis

This study tested for the suppression effect utilizing a mediation analysis process (Liu et al., 2021) in PROCESS v 3.4 plugin in SPSS 22.0 software.

Process plug-in. The PROCESS plugin is based on the Bootstrap program and has been proven to be superior to Sobel's indirect effect test and traditional step-by-step indirect effect testing in terms of statistical test power (Hayes, 2015). The criterion for determining whether an indirect effect is significant is whether the 95% confidence interval of the corresponding regression coefficient includes 0. If it does not include 0, then the indirect effect is significant; otherwise, the indirect effect is not significant. In this test, we first converted the raw scores of all variables into Z-scores and then included them in Model 4 of the PROCESS v 3.4 program for suppression (mediating) effect analysis. Considering that gender and home region were somewhat correlated with the main variables of interest in this study (see Table 1), gender and home region were used as covariates for statistical control in the suppression effect analysis.

Table 1. Pearson correlation analysis and descriptive statistics of the main variables ($n = 844$)

	1	2	3	4	5	6	7	8	9
1. Gender [a]	1.00								
2. Age [b]	−0.08*	1.00							
3. Only child status [c]	0.17**	0.03	1.00						
4. Home region [d]	−0.07*	0.06	0.30**	1.00					
5. Solitude capacity	0.12**	−0.04	0.03	−0.02	1.00				
6. Cognitive reappraisal	0.13**	−0.03	0.03	−0.03	0.22**	1.00			
7. Expressive suppression	−0.09*	−0.01	−0.06	−0.07*	0.18**	0.18**	1.00		
8. Positive emotions	−0.05	−0.05	−0.01	0.02	0.05	0.32**	0.02	1.00	
9. Negative emotions	0.02	0.05	−0.04	−0.01	−0.06	−0.24**	0.16**	−0.01	1.00
M	0.51	19.79	0.75	0.63	64.79	26.97	14.84	29.71	22.27
SD	0.50	1.43	0.43	0.48	10.04	5.33	3.67	6.06	6.52

Notes. a: Male = 0, Female = 1; b: $n = 839$; c: Yes = 0, No = 1; d: Urban = 0, Rural = 1; *$p < 0.05$, **$p < 0.01$.

Common method variance test

We controlled possible common method biases through anonymous distribution and privacy protection commitments. Harman univariate analysis was used to evaluate the severity of common method bias. That is, all questionnaire items related to the research variables were integrated into a common factor for model fitting. The results indicated that the data did not fit the model well, $\chi^2/df = 11.518$, SRMR (standardized root mean squared residual) = 0.157, RMSEA (root mean square error of approximation) = 0.112, CFI (comparative fit index) = 0.243, TLI (Tucker-Lewis index) = 0.211, indicating that there was no serious common method bias in this measurement.Considering that using 40% of the empirical critical point as the criterion for measuring common method bias has been increasingly questioned by more and more scholars, we referred to the research method of Zeng et al. (2025).

Results

Descriptive analysis of variables of interest

As Table 1 shows, solitude capacity was positively correlated with cognitive reappraisal and expressive suppression; cognitive reappraisal was positively correlated with expressive suppression and positive emotions but was negatively correlated with negative emotions; and expressive suppression was positively correlated with negative emotions.

Suppression Analysis

Multiple linear regression results of the suppression effect test of emotion regulation between solitude capacity and positive emotions

As indicated by Table 2, solitude capacity significantly positively predicted cognitive reappraisal and expressive suppression, and cognitive reappraisal significantly positively predicted positive emotions.

Table 2. Multiple linear regression results of the suppression effect test of emotion regulation between solitude capacity and positive emotions ($n = 844$)

Regression equation		Significance of regression coefficient						Overall fit index			
Result variable	Predictors	*β*	*SE*	*t*	*p*	95% CI		*R*	R^2	*F*	*p*
						Lower	Upper				
Positive emotions	Gender	−0.05	0.03	−1.50	0.133	−0.12	0.02	0.08	0.01	1.60	0.188
	Home region	0.01	0.03	0.41	0.684	−0.05	0.08				
	Solitude capacity	0.06	0.03	1.69	0.091	−0.01	0.13				
Cognitive reappraisal	Gender	0.10	0.03	3.05	0.002	0.04	0.17	0.24	0.06	17.10	<0.001
	Home region	−0.02	0.03	−0.60	0.547	−0.09	0.05				
	Solitude capacity	0.20	0.03	5.99	<0.001	0.14	0.27				
Expressive suppression	Gender	−0.12	0.03	−3.40	0.001	−0.18	−0.05	0.22	0.05	14.52	<0.001
	Home region	−0.07	0.03	−2.11	0.035	−0.14	−0.01				
	Solitude capacity	0.19	0.03	5.66	<0.001	0.13	0.26				
Positive emotions	Gender	−0.09	0.03	−2.80	0.005	−0.16	−0.03	0.33	0.11	21.09	<0.001
	Home region	0.02	0.03	0.53	0.597	−0.05	0.08				
	Solitude capacity	−0.0002	0.03	−0.01	0.994	−0.07	0.07				
	Cognitive reappraisal	0.34	0.03	10.00	<0.001	0.27	0.41				
	Expressive suppression	−0.05	0.03	−1.50	0.134	−0.12	0.02				

Notes. Results are based on 5000 bootstrap samples; CI: Confidence interval.

Table 3. Multiple linear regression results of the suppression effect test of emotion regulation between solitude capacity and negative emotions ($n = 844$)

Regression equation		Significance of regression coefficient						Overall fit index			
Result variable	Predictors	*β*	*SE*	*t*	*p*	95% CI		*R*	R^2	*F*	*p*
						Lower	Upper				
Negative emotions	Gender	0.03	0.03	0.86	0.391	−0.04	0.10	0.07	0.004	1.19	0.313
	Home region	−0.01	0.03	−0.32	0.752	−0.08	0.06				
	Solitude capacity	−0.06	0.03	−1.74	0.082	−0.13	0.01				
Cognitive reappraisal	Gender	0.10	0.03	3.05	0.002	0.04	0.17	0.24	0.06	17.10	<0.001
	Home region	−0.02	0.03	−0.60	0.547	−0.09	0.05				
	Solitude capacity	0.20	0.03	5.99	<0.001	0.14	0.27				
Expressive suppression	Gender	−0.12	0.03	−3.40	0.001	−0.18	−0.05	0.22	0.05	14.52	<0.001
	Home region	−0.07	0.03	−2.11	0.035	−0.14	−0.01				
	Solitude capacity	0.19	0.03	5.66	<0.001	0.13	0.26				
Negative emotions	Gender	0.09	0.03	2.56	0.011	0.02	0.15	0.33	0.11	20.76	<0.001
	Home region	−0.0003	0.03	−0.01	0.992	−0.06	0.06				
	Solitude capacity	−0.05	0.03	−1.39	0.165	−0.11	0.02				
	Cognitive reappraisal	−0.28	0.03	−8.31	<0.001	−0.35	−0.22				
	Expressive suppression	0.23	0.03	6.77	<0.001	0.16	0.30				

Notes. Results are based on 5000 bootstrap samples; CI: Confidence interval.

Table 4. Suppression effects of each sub-model and the overall model

Outcome variable	Path	Ratio (%)	Effect	*SE*	95% CI	
					Lower	Upper
Positive emotions	Total indirect effect	100.00%	0.059	0.015	0.030	0.089
	Path 1: SC→REA→PE	116.95%	0.069	0.014	0.042	0.097
	Path 2: SC→SUP→PE	−16.95%	−0.010	0.008	−0.027	0.003
Negative emotions	Total indirect effect	21.67%	−0.013	0.018	−0.049	0.021
	Path 1: SC→REA→NE	95.00%	−0.057	0.013	−0.084	−0.034
	Path 2: SC→SUP→NE	−73.33%	0.044	0.013	0.021	0.071

Notes. CI: Confidence interval; SC = Solitude capacity; REA = Cognitive reappraisal; SUP = Expression suppression; PE = Positive emotions; NE = Negative emotions.

Multiple linear regression results of the suppression effect test of emotion regulation between solitude capacity and negative emotions

As indicated by Table 3, solitude capacity significantly positively predicted both cognitive reappraisal and expressive suppression; cognitive reappraisal significantly negatively predicted negative emotions, and expressive suppression significantly positively predicted negative emotions.

Results of the suppression effect test of emotion regulation between solitude capacity and emotional experience

As indicated by Table 4, the 95% confidence intervals of the indirect effects of cognitive reappraisal between solitude capacity and both positive and negative emotions, as well as the indirect effect of expressive suppression between solitude capacity and negative emotions, did not include 0, indicating that the indirect effects of cognitive reappraisal between solitude capacity and both positive and negative emotions, as well as the indirect effect of expressive suppression between solitude capacity and negative emotions, are significant.

However, the direct and total effects of solitude capacity on both positive and negative emotions were not significant (see Figure 2). Following the suggestion of Liu et al. (2021), when the total effect is not significant and the indirect effect is significant in the mediation model analysis, the indirect effect should be interpreted as a suppression effect, which explains why the independent variable cannot predict the dependent variable rather than clarifying how the independent variable predicts (affects) the dependent variable. Thus, in this study, cognitive reappraisal suppressed the predictive effect of solitude capacity on positive emotions, and both cognitive reappraisal and expressive suppression suppressed the predictive effect of solitude capacity on negative emotions.

Discussion

First, we found that solitude capacity was not correlated with either positive or negative emotions, but was significantly positively correlated with both cognitive reappraisal and expressive suppression (Hypothesis 1a was supported). Although solitude capacity is considered to be a positive psychological, emotional, and behavioral

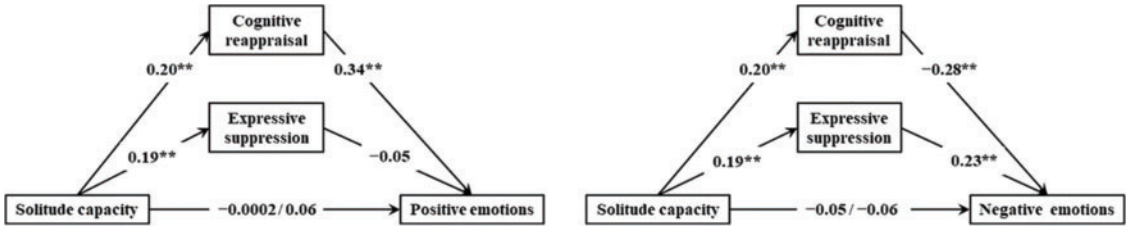

Figure 2. Suppression model path coefficient diagram (**$p < 0.01$)

factor (Li et al., 2023), considering that solitude is not encouraged by Chinese collectivist society (Jiang & Zhao, 2017; Lian et al., 2023), the emotional utility of solitude capacity is likely to be neutral for Chinese college students. In addition, cognitive reappraisal is generally considered to be a typical adaptive emotion regulation strategy, and expressive suppression is considered to be a typical non-adaptive emotion regulation strategy (Schafer et al., 2017; Zhang et al., 2020). As each other's opposites, the two constitute an antagonistic system of emotion regulation. However, the lack of social communication in solitude (Campbell & Ross, 2022) allows individuals with high solitude capacity less opportunity to express and share their emotions with others, providing them with the possibility to develop expression suppression strategies. Nonetheless, the positive utility of solitude in adjusting and renewing one's mental state, self-perception, and self-evaluation, and the opportunity for individuals to reconstruct their emotional homeostasis (Lian et al., 2023) means that cognitive reappraisal is in active development in individuals with high solitude capacity. However, the suppression of self-expression may be derived from the Chinese collectivist society's emphasis on emotional restraint to maintain interpersonal and social harmony (Mauss & Butler, 2010; Xu et al., 2021), while the reconstruction of mental state may come from the traditional Chinese culture's praise of dialectical "yin-yang" thinking of there being "good in bad, and bad in good". This implies that adaptive and non-adaptive emotion regulation strategies develop in parallel in individuals with high solitude capacity, and they may use both adaptive and non-adaptive emotion regulation strategies as their usual or default choices.

In addition, we found that cognitive reappraisal showed a significant positive correlation with positive emotions and a significant negative correlation with negative emotions; meanwhile, expressive suppression was positively correlated with negative emotions (Hypothesis 1b was supported). These findings are consistent with previous findings that cognitive reappraisal is associated with an increase in positive emotions (Kelley et al., 2019; Gross & John, 2003) and a decrease in negative emotions (Schafer et al., 2017; Troy et al., 2013), while expressive suppression is significantly positively correlated with the increase of negative emotions (Gross & John, 2003; Guo et al., 2023; Schafer et al., 2017). As for the relationship between cognitive reappraisal and expressive suppression, although some studies have found a significant negative correlation between them (Wong & Fielding, 2013), the present study found a significant positive correlation between them, which is consistent with some studies of Eastern cultures (e.g., Nakagawa et al., 2017; Tian et al., 2023; Yin et al., 2022). East Asian collectivist culture places a greater emphasis on emotional restraint (Mauss & Butler, 2010; Xu et al., 2021), and expressive suppression has been shown to reduce laboratory-induced negative emotions to some extent (Xu et al., 2021; Yeung & Fung, 2012; Yuan et al., 2014). Therefore, consistent with cognitive reappraisal, expressive suppression may have an adaptive aspect in Eastern culture.

Second, we found that the predictive effect of solitude capacity on positive emotions was suppressed by cognitive reappraisal but not by expressive suppression (Hypothesis 2 was supported). This confirms our hypothesis that, just like being in the company of others, solitude also has both positive and negative effects on an individual's well-being and social-psychological function (Coplan & Bowker, 2014; Coplan et al., 2018; Lay et al., 2018); furthermore, whether it has a positive or negative effect may depend on the age-related capabilities of the particular individual (Long & Averill, 2003). Specifically, emotion regulation, as a process through which individuals exert influence on the occurrence, experience, and expression of emotions (Gross, 1998), is not only closely related to individual development (Schafer et al., 2017) but also significantly correlated with one's age (Nakagawa et al., 2017), particularly when it comes to cognitive reappraisal, as significant differences have been found in this among juveniles, youths, middle-aged, and elderly people (Wang et al., 2021). Meanwhile, cognitive reappraisal is also an important mediating mechanism for positive emotions (Nakagawa et al., 2017). Therefore, cognitive reappraisal, as an adaptive emotion regulation strategy (Schafer et al., 2017; Zhang et al., 2020), is likely to be an important factor determining the positive impact of solitude on one's individual happiness and social-psychological function. With regards to this study specifically, our findings imply that the prediction of the solitude capacity on one's positive emotions is manifested with the help of cognitive reappraisal, that is, cognitive reappraisal has a suppression effect on the relationship between solitude capacity and positive emotions. As for expressive suppression, although it is often considered to be a maladaptive emotion regulation strategy (Schafer et al., 2017; Zhang et al., 2020) and has been reported to be more associated with increased negative emotions (e.g., Gross & John, 2003; Guo et al., 2023; Schafer et al., 2017), its adaptability in Eastern culture (e.g., Yeung & Fung, 2012; Yuan et al., 2014) and the independent orthogonal structure between positive and negative emotions (Watson et al., 1988; Zhao et al., 2020)

make it impossible for expressive suppression to have a significant suppressing role between solitude capacity and positive emotions.

Finally, we found that the predictive effect of solitude capacity on negative emotions was suppressed by both cognitive reappraisal and expressive suppression (Hypothesis 3 was supported). This is consistent with the comparative model of the costs and benefits of solitude from a lifelong developmental perspective (Haidabieke et al., 2024) and the ecological niche viewpoint of solitude (Larson et al., 1982), which states that solitude is like a double-edged sword and has the potential to have both positive and negative effects on one's psychological functioning. Whether this effect is positive or negative depends on one's own ability to create emotions (Long et al., 2003), such as through emotion regulation strategies. Specifically, the role of emotion regulation may be antagonistic, in which the emotional effects caused by one side of the antagonistic system are offset by the other side. As previously mentioned, in Chinese collectivist society, solitude capacity develops in parallel with the adaptive and non-adaptive emotion regulation strategies that constitute this antagonistic system. Moreover, cognitive reappraisal is associated with a decrease in negative emotions (Schafer et al., 2017; Troy et al., 2013; Wu et al., 2019), while expressive suppression is associated with an increase in negative emotions (Gross & John, 2003; Guo et al., 2023; Schafer et al., 2017). Therefore, the positive effect of expressive suppression in the relationship between solitude capacity and negative emotions may be offset by the negative effect of cognitive reappraisal, diminishing the predictive effect of solitude capacity on negative emotions.

Implications, Limitations, and Future Directions

The current study investigated the role of emotion regulation (i.e., cognitive reappraisal and expressive suppression) in the relationship between solitude capacity and emotional experience and found that the prediction of solitude capacity on positive emotions was suppressed by cognitive reappraisal, whereas the prediction of solitude capacity on negative emotions was co-suppressed by cognitive reappraisal and expressive suppression.

These findings have theoretical significance as they not only reveal the relationship mechanism between solitude capacity and emotional experience, but also support the ecological niche view of solitude while providing empirical evidence for the comparative model of the costs and benefits of solitude. Furthermore, our results also have guiding significance for helping individuals with high solitude capacity to better maintain positive emotional experiences when alone. Specifically, by consciously developing and cultivating their own positive emotion creation capital through self-compassion, psychological resilience, etc., those with high solitude capacity can synergistically promote their adaptive emotion regulation strategies (primarily cognitive reappraisal) to take advantage of the antagonistic system of emotion regulation.

There are nonetheless some limitations to this study. First, the present study followed a cross-sectional design, which does not effectively reveal causal relationships between study variables. A longitudinal tracking design should be adopted in future studies to further confirm the conclusions of this study. Second, the data of this study was collected during a lockdown phase of the COVID-19 pandemic, and the subjects were college students. Therefore, the ecological validity of the research conclusion still needs to be verified further to expand the generalizability of our results. Third, the data for this study was obtained through an online survey, which helped ensure that the survey was completed voluntarily, anonymously, and without geographic restrictions, however, this also means that there could be some sampling bias in the survey data. Therefore, subsequent research should verify the conclusions of this study by adopting completely randomized stratified sampling. Fourth, in addition to emotion regulation, the ability of solitude capacity to predict emotional experience may also be suppressed by other individual variables such as psychological resilience, self-compassion, or self-criticism. Therefore, subsequent studies should further explore and expand upon the relationship mechanism between solitude capacity and emotional experience. Finally, due to the limited available existing literature, this study has cited evidence regarding solitude several times to support the concept of solitude capacity, which is desirable in literature citations, however, the specific connotations of these two concepts are different. Therefore, follow-up research should strengthen its relevant research on solitude capacity to further enrich the research evidence.

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Availability of Data and Materials: The data presented in this study will be made available upon reasonable request.

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