



OPEN The shock of Awe experience to our soul is more directly on cognitive well-being than affective well-being

Yimiao Chen^{1,2}, Fawen Hu¹, Qianguo Xiao³✉ & Zhenhui Liu^{1,2}✉

Previous research has demonstrated that the experience of awe can alleviate negative emotions, such as stress related to life and career, consequently enhancing overall happiness. Drawing from the broaden-and-build theory of positive emotions, the mechanism through which awe mitigates stress and enhances happiness lies in its capacity to restructure an individual's original cognitive framework and foster a more open-minded approach to problem-solving. This, in turn, facilitates the cultivation of both physical and mental resources, including the enhancement of psychological resilience, thereby empowering individuals to better rebound from adversity and pressure. The study seeks to validate this perspective. In this study, 342 Chinese college students (awe group, pleasant group and neutral group) were investigated to test the effects of awe on cognitive well-being and affective well-being using a recall priming task paradigm. Results indicated that: (1) compared with pleasant and neutral groups, awe experience not only had a direct effect on cognitive well-being (life satisfaction), but it also had a significant indirect effect on cognitive well-being through a mediating variable – resilience. However, (2) awe experience had no direct effect on affective well-being (emotional balance), although the mediating effect of resilience was significant. This suggested that awe, as a transcendent positive experience, might have different effects or mechanism on individuals' cognition and emotion evaluation.

Keywords Awe experience, Cognitive flexibility, Cognitive structure, Adaptation, Emotional balance ability

Subjective well-being is a primary indicator for assessing individuals' physical and mental health. It encompasses emotional responses, satisfaction with various life domains, and an overall assessment of life satisfaction, which is manifested as kinds of spiritual and material experiences^{1,2}. Most scholars contend that subjective well-being is a broad category of phenomena and a multidimensional construct containing cognitive and emotional components. The cognitive component generally takes life satisfaction as an indicator to reflect an individual's overall assessment of life status, including work, family, health, financial status and self, while the emotional component often takes emotional balance as an indicator, reflecting an individual's capacity to balance positive and negative emotions^{3–7}, as negative emotions are not the opposite of positive emotions⁸. For instance, Bradburn⁹ emphasized that subjective well-being is the outcome of individuals' equilibrium between positive and negative emotions. Although the cognitive and emotional components of subjective well-being are two elements that cannot be completely independent, numerous studies have shown that they are two different components^{3,10–12} with different structures and functions^{13–15}. As previous empirical studies have found, people rely on their emotional experience to judge how satisfied they are with their lives¹⁶. These studies suggest that differences in the two dimensions of cognitive well-being and affective well-being should be distinguished and taken into account in the study of subjective well-being. At the same time, these studies suggest that different emotional stimuli may have different effects on cognitive well-being (e.g., overall life satisfaction) and affective well-being (e.g., emotional balance). For example, the effects of awe on cognitive well-being and emotional well-being differ according to age¹⁷.

¹College of Education, Honghe University, Mengzi, China. ²College of Psychology, Inner Mongolia Normal University, Hohhot, China. ³College of Management, Zunyi Medical University, Zunyi, China. ✉email: xiaoqianguo2008@163.com; liuzhenhui@uoh.edu.cn

Awe

Awe is a complex and profound emotional response characterized by feelings of wonder, admiration, and reverence, often in response to something vast, majestic, or beyond ordinary human comprehension¹⁸. It is commonly evoked by experiences in nature, art, spirituality, or majestic events. The awe state of the subjects were induced through watching awe-eliciting video (e.g., a 5-min montage of clips from the BBC's Planet Earth¹⁹), recalling awe-eliciting events or other narrative missions^{20,21} in many past investigations. Many scholars admitted that awe included negative factors based on threat such as fear^{19,22}, and there may be cultural differences between East and West about connotation of awe^{23,24}; however, whether the emotional experience by awe was positive or negative, its effect seems to be more positive on multiple aspects. Some studies have shown that awe has a positive promoting effect on people's physical and mental health and subjective well-being^{25–31}. For example, a recent study by Anderson, Monroy, & Keltner²⁸ found that arousing people's awe experience through outdoor activities (e.g., rapid drifting) predicted changes in an individual's well-being and stress-related symptoms one week later, and improved people's daily life satisfaction compared to general positive emotions.

Awe and cognitive well-being, affective well-being

Overall, the positive impact of awe on life satisfaction and happiness generally operates through the following psychological pathways: (1) Awe mitigates the influence of negative emotions such as life and work pressure, thereby enhancing life satisfaction and happiness^{25,32–35}. (2) Awe-inducing natural scenes and phenomena elicit unique emotional effects and behavioral inhibitory control effects^{20,31,36,37}, fostering traits such as the sense of small-self, humility, time perception, reduced aggression, mood improvement, and a pro-social orientation^{38–41}. (3) Awe experiences enhances the meaning of life^{27,42}, prompting individuals to pursue spiritual fulfillment over material pleasures^{21,30,31}. These shifts undoubtedly contribute to increased life satisfaction and happiness. Ke and Zhao et al.⁴³ have found that awe can reduce an individual's materialism level and weaken an individual's desire for money⁴⁴, reduce the need for possessions to enhance affective well-being⁴⁵. In addition, daily positive emotional experiences, such as awe, curiosity, and surprise, have been associated with lower levels of pro-inflammatory cytokines, of which awe emerges as the most significant predictor of lower levels pro-inflammatory cytokines, suggesting that positive emotional experiences not only make people feel better, but also, contributes to physical and mental health²⁹. In alignment with this, Monroy & Keltner⁴⁶ propose that awe encompasses five processes - neurophysiological shifts, diminished self-focus, heightened prosocial relationships, greater social integration, and a greater sense of meaning, all of which are beneficial for overall well-being.

The aforementioned psychological processes underscore the cognitive aspect of awe. We contend that existing studies have unveiled the transformative effect of awe, primarily evidenced by shifts in individuals' thinking styles and cognitive structure, characterized by increased flexibility and resilience in addressing life challenges, and adept problem-solving abilities, which would enhance individuals' emotional balance ability. This fosters an increase in positive emotional experiences and a decrease in negative emotional experiences, rather than positive emotions merely offsetting negative ones. Moreover, negative emotions are not the opposite of positive emotions⁸, but more sense of inner peace. According to the Dynamic Equilibrium Theory⁴⁷, individuals possess stable personality traits that contribute to a specific life pattern and an average level of happiness. When this normal life pattern is maintained, happiness tends to remain at a balanced level. Within the framework of traditional Chinese culture, awe is frequently linked to the Zhong-Yong thinking style, facilitating a global perspective that enables individuals to attain equilibrium between their internal and external environments⁴⁸, which is conducive to the balance of personal happiness, and emotional balance should be one of its concrete manifestations⁴⁹.

On the other hand, PA and NA are not simple binary relations. Studies have found that PA and NA are asymmetrical in terms of reactivity, duration, and cognitive engagement. To maintain a positive sense of well-being, one needs to balance more PA experience to compensate for each NA experience^{49,50}. At the same time, PA and NA are susceptible to efforts to manage or remedy these affective states⁵¹. However, attempting to counteract or compensate for negative emotional experiences by actively seeking more happiness contradicts the essence of happiness, as highlighted in the paradox of pursuing positive emotions⁵². Research suggests that the more individuals pursue positive emotions, the less happiness they may experience, and they could even risk damaging their physical and mental health^{53–55}. Moreover, this binary framework ignores the critical role of equanimity in happiness. Pan et al.⁵⁶ through seven systematic studies, combined with behavioral experiments, big data analysis and intervention studies, revealed the important role of awe in promoting a balanced state of mind by shifting one's temporal perspective on life events. It's shown that true happiness does not depend solely on an increase in positive emotions or a decrease in negative emotions, and that awe allows people to respond to emotional events with an balanced state of mind, regardless of their emotional valence, thereby improving mental health and well-being. Based on the above analysis, it's an interesting hypothesis that the experience of awe may have a more direct impact on cognitive well-being than affective well-being, given the asymmetrical nature of positive and negative affect. This could be an area for further research and exploration.

Awe, psychological resilience, and well-being

According to the broaden-and-build theory of positive emotions, positive emotions could broaden an individual's Novel thoughts, activities and relationships, and then build enduring personal resources (e.g., mindfulness, social support, resilience, skills.), thereby bringing long-term adaptive benefits (e.g., health, survival, fulfillment.) to the individual^{57–60}. And awe is regarded as a positive emotional experience of self-transcendence, an epistemic affection^{18,39,61}. It has a revolutionary effect, can transform the original cognitive structure, and subsequently construct new physical and mental resources for individuals, such as psychological resilience and hope. As a result, individuals hold different perspectives and attitudes towards the same matter, handle problems more peacefully, and ultimately obtain greater life satisfaction and happiness. A daily analysis conducted by Monroy

et al.³² revealed that individuals who experienced more awe on a daily basis reported lower stress levels, fewer physical health symptoms, and greater happiness. Due to their distinct cognitive effects, both awe and mindfulness also have been linked to psychological resilience in coping with stressors arising from the COVID-19 pandemic (a threatening situation), regardless of religious beliefs^{62–64}. These findings underscore the ability of individuals with high psychological resilience to adapt to changing environments. Hence, it is speculated that the positive impact of awe in alleviating individual and work-related pressures stems from its enhancement of psychological resilience, with psychological resilience plays an intermediary role between the two^{25,33}. Studies on awe and well-being have drawn similar conclusions. A short-term (four-week) follow-up study has found that resilience plays a mediating role between positive emotions and well-being. Individuals reported more personal growth goals and eudaimonic well-being in the awe condition compared with pleasant and neutral conditions³⁵. However, eudaimonic well-being is an assessment of an individual's quality of life based on the realization of individual potential. Suggestions have been made that evoking, experiencing, and reflecting on moments of awe through 'awe narratives' serves as a mindfulness technique that enhances individuals' resilience and positively affects their overall well-being⁶³. For example, improving resilience through awe practice has been shown to have positive career development effects⁶⁵. According to the functional (evolutionary) theory of emotion, awe can facilitate individuals in better coping with and adapting to their environment^{66,67}. Awe can confer selective advantages by fostering the ability to create and revise abstract mental representations of the world, enhancing the processing of new information in the environment, and bolstering cognitive flexibility (a core characteristic of psychological resilience)^{48,68–71}. And cognitive flexibility promotes individuals taking adaptive cognitive emotion regulation strategies to improve life satisfaction⁷². Based on the broaden-and-build theory of positive emotions and the related studies mentioned above, awe experience could enhance individuals' cognitive well-being and affective well-being by fostering psychological resources such as psychological resilience.

Method

Participants

This study was conducted in June 2023 with approval from the Ethics Committee of the university where the authors are affiliated. All procedures were conducted in accordance with the guidelines of the Declaration of Helsinki. And informed consent was obtained from the participants before starting the program. Nine classes were selected randomly from three universities in Sichuan, Inner Mongolia and Yunnan by convenience sampling. A total of 404 college students volunteered to participate in the present study for compensation. After excluding 62 invalid answers, there were 342 effective answers, representing a response rate of 84.7%. Of these, 117 were men and 225 were women; age ($M \pm SD$: 22.25 ± 1.15); no history of psychosis.

Measures

Resilience scale: The resilience subscale of the Positive Psychological Capital Scale, developed by Zhang Kuo⁷³, was used, in which seven items were set. For example, "when encountering setbacks, I can quickly recover." Respondents answered these items on a 7-point Likert-type scale ranging from 1 = "not at all" to 7 = "very much so." The students scoring higher were more likely to have higher level of resilience. The fit indexes were $\chi^2/df = 2.69$, NFI = 0.95, TLI = 0.92, CFI = 0.96, RMSEA = 0.07. The internal consistency coefficient α of the resilience subscale was 0.83.

Subjective well-being (SWB): The subjective well-being questionnaire was from the International College Survey (ICS)^{74,75}. The Life Satisfaction (LS)^{12,76}, subscale included 5 items, for example, "I am satisfied with my life." Respondents answered these items on a 7-point Likert-type scale ranging from 1 = "strongly disagree" to 7 = "strongly agree." The students scoring higher were more likely to have higher satisfaction with life. The Positive Affectivity (PA) subscale included 6 items: Enjoyment, wellness, uplifting, pride, gratitude, and love. The students scoring higher were more likely to have higher frequency and levels of positive emotional experience. The Negative Affectivity (NA) subscale included 8 items: Unpleasantness, sadness, anger, guilt, shame, worry, stress, and jealousy. Respondents answered these items on a 7-point Likert-type scale ranging from 1 = "almost no emotion" to 7 = "especially strong emotion." The students scoring higher were more likely to have higher frequency and levels of recent negative affectivity experience. The fit indexes were $\chi^2/df = 2.63$, NFI = 0.89, TLI = 0.91, CFI = 0.93, RMSEA = 0.07. The internal consistency coefficient α of the three subscales was 0.83, 0.79 and 0.81, respectively.

Procedure

Recall priming task. The participants were randomly assigned to three experimental conditions: Awe, pleasant, and neutral, under which they were each asked to recall a particular event²¹, as detailed as possible. A4 paper and pen were used to complete the recall task. A meta-analysis study showed that images, videos, autobiographical recall, and exposure to nature were effective in eliciting awe⁷⁷. The Awe group was asked: "Please try to recall a recently special experience during which you saw a particular panoramic view. Such as a sunset, a beautiful scene, or any other moment in nature, that you feel it deeply awe-inspiring." The Pleasant group was asked: "Please recall things that have made you feel very happy recently, such as watching movies with friends and receiving gifts that you like very much." Indicators under these two conditions included: "Now, try to immerse yourself in this experience, remember how you felt, and what life was like at the time." The Neutral group was asked: "Please remember the routine things you did yesterday, such as getting up and washing, cleaning rooms, washing clothes, taking class, etc., and please record them in a daily journal." At the end of the recollection, participants reported their current feelings (angry, joy, awe, sadness, excitement, calm, boredom, fear) and complete a 7-point self-rated scale (1- completely disagree, 7- completely agree).

Subsequently, they were asked to complete two scales: subjective well-being and resilience.

Dependent variables	Awe	Pleasant	Neutral	F	η^2
Awe	4.81 ± 1.93 ^a	2.56 ± 1.82 ^b	2.42 ± 1.79 ^b	59.74***	0.26
Joy	3.98 ± 2.01 ^a	4.54 ± 1.84 ^b	3.33 ± 1.64 ^a	12.40***	0.10
Excitement	3.67 ± 2.07 ^a	3.87 ± 2.06 ^a	2.75 ± 1.66 ^b	10.89***	0.09
Calm	3.43 ± 2.07 ^a	3.80 ± 1.93 ^a	4.34 ± 1.89 ^b	6.22**	0.04
Boredom	2.35 ± 1.61 ^a	2.69 ± 1.81 ^{ab}	2.99 ± 1.96 ^b	3.62*	0.02
Fear	2.29 ± 1.60 ^a	1.95 ± 1.49 ^{ab}	1.82 ± 1.51 ^b	3.05*	0.02
Angry	1.89 ± 1.63 ^a	1.80 ± 1.45 ^b	1.61 ± 1.13 ^c	1.17	0.007
Sadness	2.51 ± 1.81 ^a	2.02 ± 1.57 ^b	2.12 ± 1.69 ^c	2.74	0.016

Table 1. Descriptive statistics ($M \pm SD$) and difference analysis of eight types of emotions among emotional conditions. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Dependent variables	Awe	Joy	Excitement	Calm	Boredom	Fear	Angry	Sadness
Awe	1							
Joy	0.26**	1						
Excitement	0.34**	0.78**	1					
Calm	-0.08	-0.002	-0.13*	1				
Boredom	-0.07	-0.11*	-0.07	0.30**	1			
Fear	0.21**	-0.16**	-0.37**	-0.105	0.23**	1		
Angry	0.11**	-0.15**	-0.011	-0.083	0.11*	0.47**	1	
Sadness	0.17**	-0.20**	-0.029	-0.12*	0.23**	0.61**	0.47**	1

Table 2. Correlation analysis of eight types of emotions. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Elimination of invalid data: For the response to the recall task, the expert assessment method was used. Three investigators independently judged whether a participant was consistently considered to provide too simple a reply (including the situation of filling out with a “no” or blank) based on whether the subject has fully described the basic content of the event, and if such a participant was assessed to be unable to meet the requirements of emotional arousal, the data was excluded. A total of 62 participants’ data were excluded.

Common method bias test

In this study, psychological resilience, subjective well-being, and emotional experience levels were all measured using a 7-point scale. Therefore, the Harman single-factor method was employed to test common method bias in the survey data⁷⁸. The results showed that there were a total of four common factors with eigenvalues greater than 1, and the first common factor explained 27.23% of the total amount of variation, which was less than the critical criterion of 40%. This showed that common method bias was not severely weighted in the sample data.

Results

Emotion manipulation check

The independent variable was the emotional priming condition (awe, pleasant, neutral), and the dependent variable was the degree of experience of eight types of emotions, and a one-way analysis of variance was performed³¹ (Table 1). There were differences in the emotional priming conditions for awe, happiness, excitement, calmness, boredom, and fear, while the other two emotions did not show differences in priming conditions. The post hoc test using Tukey’s HSD showed that the awe group had significantly greater awe than the neutral and pleasant group, $p < 0.001$ for both, and the awe group had significantly greater fear than the neutral group, $p = 0.017$; the pleasant group had significantly greater joy than the pleasant and awe group, $p = 0.001$ and 0.022 for both; the neutral group had significantly greater calm than the pleasant and awe group, $p = 0.037$ and 0.001 for both, the neutral group significantly greater boredom than the awe group, $p = 0.008$, and the neutral group had significantly less excitement than the pleasant and awe group, $p < 0.001$ in both. There were no significant differences in the remaining pairwise comparisons with $p > 0.05$. There were no significant differences in the remaining pairwise comparisons, with p values greater than 0.05. In general, in one of the conditions of awe, pleasure and neutral, the corresponding emotional experience and accompanying emotions of the subjects were significantly greater than those in the other two conditions, indicating that the three recall tasks initiated the corresponding emotional experience of the subjects.

The correlation analysis among the eight emotions showed that (Table 2), there was a significant positive correlation between awe and pleasure, excitement, fear, angry and sadness, $p < 0.01$. There was a significant positive correlation between pleasure and excitement, $p < 0.01$, and a significant negative correlation between pleasure and boredom, fear, angry and sadness, $p < 0.01$. Calmness was positively correlated with boredom, $p < 0.01$, and negatively correlated with sadness, $p < 0.05$. Excitement was negatively correlated with calm and fear, $p < 0.05$. Boredom was positively correlated with fear, angry and sadness, $p < 0.05$. Fear was positively correlated

Dependent variables	Awe	Pleasant	Neutral	F	η^2
Resilience	4.33 ± 0.92 ^a	3.91 ± 0.83 ^{ab}	3.86 ± 0.89 ^b	9.59***	0.054
Positive affectivity	4.56 ± 1.06 ^a	4.34 ± 1.18 ^{ab}	4.11 ± 1.20 ^b	4.39*	0.025
Negative affectivity	3.02 ± 0.97 ^a	3.31 ± 1.09 ^b	3.21 ± 1.07 ^c	2.22	0.013
Life satisfaction	4.10 ± 0.95 ^a	3.60 ± 1.15 ^b	3.43 ± 1.17 ^b	11.40***	0.063
Emotional balance	1.54 ± 1.46 ^a	1.03 ± 1.64 ^b	0.90 ± 1.69 ^b	5.13**	0.029
Subjective well-being	5.64 ± 2.12 ^a	4.64 ± 2.27 ^b	4.33 ± 2.53 ^b	10.03***	0.056

Table 3. Descriptive statistics ($M \pm SD$) and difference analysis of resilience and well-being among emotional conditions. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Dependent variables	Resilience	Positive affectivity	Negative affectivity	Life satisfaction	Emotional balance	Subjective well-being
Resilience	1					
Positive affectivity	0.40**	1				
Negative affectivity	−0.45**	−0.07	1			
Life satisfaction	0.43**	0.45**	−0.23**	1		
Emotional balance	0.58**	0.76**	−0.70**	0.47**	1	
Subjective well-being	0.51**	0.58**	−0.37**	0.88**	0.65**	1

Table 4. Correlation analysis of resilience and well-being. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

with angry and sadness, $p < 0.01$. There was a significant positive correlation between angry and sadness, $p < 0.01$. There was no significant correlation between other variables, $p > 0.05$. The correlation analysis among the eight emotions further substantiates the efficacy of emotional manipulation.

The effect of Awe experience on resilience and subjective well-being

Emotional balance is the difference between positive and negative affectivity. A series of one-way ANOVAs were performed with resilience and each component of subjective well-being as dependent variables, and emotional priming conditions as independent variables, and the results showed that there were significant emotional differences in resilience, positive affectivity, and life satisfaction (Table 3).

The post hoc test using Tukey’s HSD showed that the resilience level of the awe group was significantly greater than that of the pleasant group and neutral group, $p < 0.01$ for both, and there was no significant difference between the pleasant and neutral group; the positive affectivity level of the awe group was significantly greater than that of neutral group, $p < 0.01$, and there was no significant difference between the pleasant and awe group, and between the pleasant and neutral group; the life satisfaction of the awe group was significantly greater than that of the pleasant and neutral group, $p < 0.01$, and there was no significant difference between the pleasant and neutral group; the emotional balance level of the awe group was significantly greater than that of the pleasant and neutral group, $p < 0.01$, and there was no significant difference between the pleasant and neutral group; the subjective well-being level of the awe group was significantly greater than that of the pleasant and neutral group, $p < 0.001$, and there was no significant difference between the pleasant and neutral group.

The correlation analysis between resilience and subjective well-being, as well as its various dimensions, reveals (Table 4) a significant positive correlation between mental toughness and positive emotions, life satisfaction, emotional balance, and subjective well-being ($p < 0.01$). Conversely, no significant correlation is observed between negative emotions and positive emotions ($p > 0.05$), while a significant positive correlation is evident among other variables ($p < 0.01$).

The mediating role of resilience in the effects of emotional events (awe, pleasant, and neutral conditions) on life satisfaction and emotional balance

Emotional priming conditions (awe, pleasant, and neutral conditions) were used as independent variables, resilience as mediating variables, and life satisfaction as dependent variables. We tested the proposed mediating effect using a bootstrapping procedure for mediator models recommended by Preacher and Hayes^{79,80}. We conducted this analysis with the PROCESS macro for SPSS⁸¹ using 10,000 bootstrap samples.

The overall mediation analysis results indicated a significant total effect, with $F(2, 339) = 11.40$, $p < 0.001$, suggesting that not all relative total effects were equal to zero. The analysis of direct effects yielded $F(2, 339) = 5.36$, $p < 0.01$, indicating that not all relative direct effects were zero as well. Furthermore, the 95% Bootstrap confidence interval for the overall indirect effect was [0.004, 0.041], which excludes zero, indicating that not all relative indirect effects are null.

In terms of the relative mediation analysis, the results were as follows: (1) The 95% Bootstrap confidence interval for the relative indirect effect between the awe group and the pleasure group was [0.08, 0.30], which does not include zero, indicating a significant mediation effect ($a1 = 0.46$, $b = 0.39$, $a1b = 0.18$). This implies that the awe group exhibited a higher level of resilience than the pleasure group ($a1 = 0.46$), which correspondingly contributed to an increase in life satisfaction ($b = 0.39$). The relative direct effect was also significant ($c'1 = 0.26$,

$p = 0.034$), indicating that after controlling for the indirect effect, the awe group reported higher life satisfaction than the pleasure group. Furthermore, the relative total effect was significant ($c1 = 0.44$, $p < 0.001$), with the effect size of the relative mediation effect being 41%.

(2) Using the neutral group as a reference, the 95% Bootstrap confidence interval for the relative indirect effect of the awe group compared to the neutral group was $[0.10, 0.33]$, which excludes zero, indicating a significant mediation effect ($a2 = 0.51$, $b = 0.39$, $a2b = 0.20$). This suggests that the awe group had a greater level of resilience than the neutral group ($a2 = 0.51$), leading to a corresponding increase in life satisfaction ($b = 0.39$). The relative direct effect was significant ($c'2 = 0.39$, $p = 0.001$), indicating that, after controlling for the indirect effect, the awe group had higher life satisfaction than the neutral group. Additionally, the relative total effect was significant ($c2 = 0.59$, $p < 0.001$), with an effect size for the relative mediation effect of 34%.

Emotional priming conditions (awe, pleasant, and neutral conditions) were used as independent variables, resilience as mediating variables, and emotional balance as dependent variables. The methods used were the same as above. The overall mediation analysis results indicated a significant total effect, with $F(2, 339) = 5.13$, $p < 0.01$, suggesting that not all relative total effects were equal to zero. The analysis of direct effects yielded $F(2, 339) = 0.44$, $p > 0.05$, indicating that both of relative direct effects were zero. Furthermore, the 95% Bootstrap confidence interval for the overall indirect effect was $[0.006, 0.058]$, which excludes zero, indicating that the two relative indirect effects were not both zero.

The results of the relative mediation analysis revealed the following: (1) Using the pleasure group as a reference, the 95% Bootstrap confidence interval for the relative indirect effect of the awe group compared to the pleasure group was $[0.13, 0.42]$, excluding zero, indicating a significant relative mediation effect ($a1 = 0.46$, $b = 0.57$, $a1b = 0.26$). This means that the awe group exhibited a higher level of resilience compared to the pleasure group ($a1 = 0.46$), and the emotion balance in the awe group also increased correspondingly ($b = 0.57$). The relative direct effect was significant ($c'1 = 0.05$, $p = 0.637$), suggesting that after controlling for the mediating effect, the emotion balance level in the awe group was higher than that in the pleasure group. The relative total effect was also significant ($c1 = 0.32$, $p = 0.016$), with the effect size of the relative mediation effect being 81%. (2) Using the neutral group as a reference, the 95% Bootstrap confidence interval for the relative indirect effect of the awe group compared to the neutral group was $[0.14, 0.46]$, excluding zero, indicating a significant relative mediation effect ($a2 = 0.51$, $b = 0.57$, $a2b = 0.29$). This suggests that the awe group had a higher level of resilience compared to the neutral group ($a2 = 0.51$), and the emotion balance in the awe group also correspondingly increased ($b = 0.57$). The relative direct effect was significant ($c'2 = 0.10$, $p = 0.348$), indicating that after controlling for the indirect effect, the emotion balance level in the awe group was higher than that in the neutral group. The relative total effect was significant ($c2 = 0.40$, $p = 0.003$), with the effect size of the relative mediation effect being 73%.

Discussion

Through the recall priming experiment, the present study found that awe experience had a direct effect on cognitive well-being (life satisfaction), as well as an indirect effect through resilience. This suggests that awe, as a self-transcending positive affectivity, cannot only directly promote positive shifts in cognitive function, such as reducing the need for cognitive closure⁷⁰, but also allow people to process new stimuli in the environment with a more open and non-judgmental attitude and affect the overall assessment of individuals' satisfaction with their lives. At the same time, the mediating effect of resilience also shows that awe experience can also help to broaden and build the psychological resources and cognitive flexibility of individuals, because cognitive flexibility is one of the main representations of resilience^{82,83}, which is reflected in the response process of individuals in the face of life stress events or adversity. From the perspective of evolutionary psychology, resilience is a psychological mechanism formed by people in the process of solving adaptive problems⁸⁴. One of its important features is meaning seeking⁸⁵. The shocking awe experience may actively expand and meet the individual's need for seeking meaning, increase the meaning of life by stimulating the pursuit of goals⁸⁶ and improve the individual's life satisfaction⁸⁷. According to the PERMA Model of Happiness⁸⁸, the pursuit of the meaning of life means that people are committed to some goal or activity that they think they are beyond themselves, and positive emotions (awe) are all essential elements of happiness in life. Consistent with the existing research conclusions, awe experience can improve the quality of individual resilience, which in turn promotes people's self-assessment of life satisfaction^{89–91}.

In addition, this study showed that life satisfaction was significantly greater in the awe condition compared to pleasant and neutral condition, and there was no significant difference between the pleasant and neutral conditions. This suggests that awe is a positive affectivity distinct from self-directed feelings such as pleasure. Based on the findings of this study, the explanation may relate to the different motivational orientations of these two emotions and their cognitive functions. Awe experiences are a form of transcendent emotional arousal, as opposed to self-directed emotional arousal, which serves to actively expand or transform cognitive perspectives and can foster a sense of connectedness, accommodation, and sacredness with a larger existence. These awe-related experiences could reduce an individual's level of materialism and desire for money^{43,44}. Joy, on the other hand, is conceptualized as a hyperarousal response to a reward^{92,93} and is an emotional experience characterized by self-orientation that focuses more on the actual "sense of acquisition" for the individual. Research has shown that pleasantness is associated with improvements in resources experienced, such as receiving a reward or obtaining something valuable⁹⁴. When individuals place greater importance on the acquisition and improvement of material goods or resources, their sense of well-being is often diminished⁹⁵. As mentioned above, awe promotes the practice of zhongyong thinking and balanced state of mind, and it may be associated with temporal distancing⁵⁶, concepts often associated with older people with rich life experiences, socioemotional selectivity theory (SST)⁹⁶, as people age, their motivation to pursue emotionally meaningful goals and activities increases, they view fame and wealth with a more open attitude, and they tend to be more peaceful, balanced, and impartial

when addressing life's challenges. These factors undoubtedly contribute to the cognitive aspects of an individual's experience of life satisfaction.

On the other hand, this study found that the awe experience had no direct effect on affective well-being, rather, it required the mediating role of resilience to exert its effect. This finding is consistent with previous research^{35,91,97–99}. Awe experience can stimulate an individual's higher level of resilience, and those with high resilience are more likely to experience and express positive affectivity¹⁰⁰, thereby improving their overall affective well-being⁹⁸. According to cognitive evaluation theory, how individuals interpret and evaluate their experiences influences their emotional responses¹⁰¹. When people experience awe, they may reframe their own challenges and stresses as insignificant in comparison to the awe experience. This cognitive shift can boost resilience, enabling individuals to better manage negative emotions and maintain positive emotions. This study showed that positive affectivity of in awe condition was significantly greater than that in the pleasant and neutral condition, and no significant difference was found between the pleasant and neutral conditions; there were no significant differences in negative affectivity across the three groups. Additionally, the results indicated that pleasant emotions did not directly or indirectly influence individuals' self-assessment of affective well-being through resilience. This may be related to the fact that awe elicits higher levels of positive experiences through resilience. The study performed by Rankin et al.¹⁰² indicated that awe experience was associated with greater positive affectivity and, to a lesser extent, lower negative affectivity and anxiety. Furthermore, this finding reiterates that awe, as a positive affectivity transcending self-orientation, appears to have a more powerful broaden-and-build function in eliciting positive feelings and transforming cognitive perspectives than self-oriented positive affectivity.

Furthermore, based on the two mediation models (Figs. 1 and 2), it can be observed that the effect of awe experience on cognitive well-being and affective well-being exhibited a disjunction, a significant direct effect on cognitive well-being but none on affective well-being. This may be related to differences in the connotations of cognitive well-being and affective well-being. When people assess their cognitive well-being, they tend to assess the overall and global nature of their living environment, whereas when assessing affective well-being, they more frequently report specific recent activities and events¹³, and compare and balance the advantages of positive and negative affectivity experiences. Research has shown that when negative information is deemed highly relevant to the self or important for other reasons, individuals in a positive mood may process this information more carefully and truthfully than those in a neutral mood. If our subjective well-being or self-worth falls below a certain threshold, we experience a hedonic debit that prompts us to act in ways that restore our emotions and enhances our self-esteem¹⁰³. This means that when assessing positive and negative feelings in specific recent activities or events, even individuals in a positive mood will take this negative information seriously, which requires additional cognitive and psychological resources. Therefore, such an assessment of affective well-being may demand greater positive resources and energy to compensate for or offset the negative effects caused by adverse experiences. As a result, awe, as a positive affectivity with "transformative effects", is also challenging to directly translate into improved affective well-being. This result can also be explained by the cognition-emotion processing system theory¹⁰⁴. The transformative effects of awe experience may be reflected through the cognitive cold processing system, achieving the goal of self-regulation, rather than eliciting rapid emotional responses. Therefore, there are differences in the effects of awe experience on CWB and AWB.

Of course, such results may also be related to the limitations of the experimental design. Because awe is not as readily apparent in everyday life as emotions such as anxiety, simply recalling a specific emotional event may

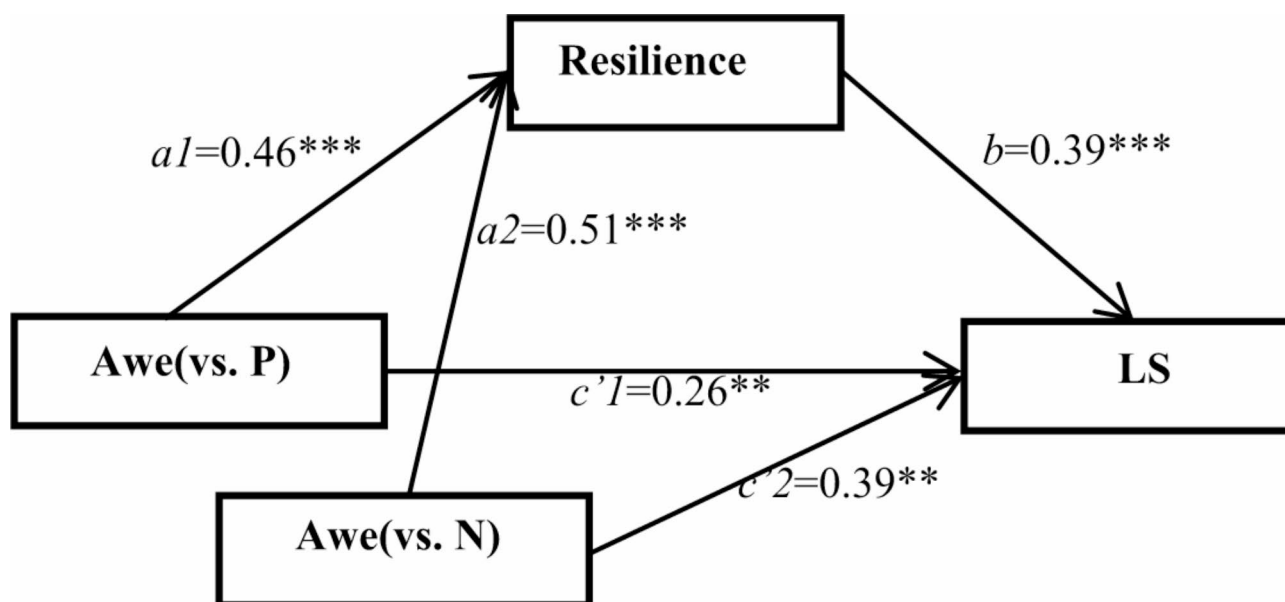


Fig. 1. The mediating effect model of resilience between emotional conditions and life satisfaction (LS). P = pleasant; N = neutral. Unstandardized coefficients are displayed. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

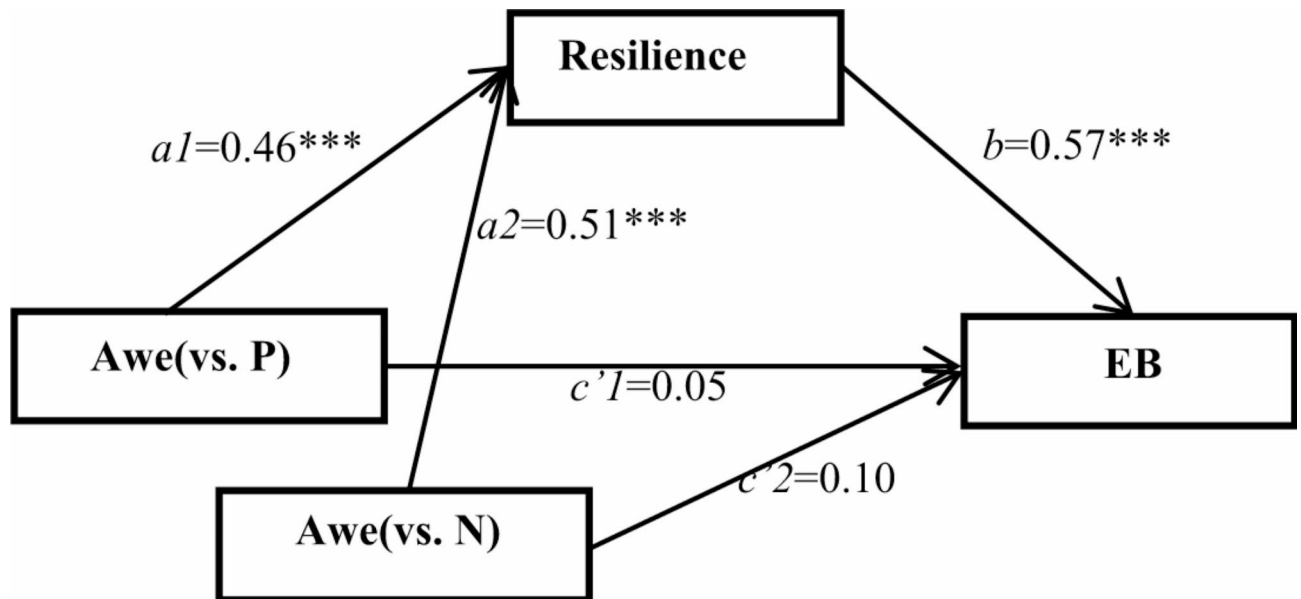


Fig. 2. The mediating effect model of resilience between emotional conditions and emotional balance (EB).

not induce sufficient awe. Fredrickson et al. found through mathematical modeling that people's wellness and prosperity can be significantly positively affected only when the ratio of positive to negative emotions reaches or exceeds 3:1³⁹. For this reason, further studies are needed to further improve the experimental paradigm and conditions, and to increase the arousal level of awe emotions so as to test the related hypotheses.

Limitations and future directions

There are still some limitations in this study that need to be examined in future studies. First, as always in psychological studies, only some highly educated younger students were enrolled to explain the world. However, as awe experiences increase with higher age, and the triggers might be differently connected with memories from their life. For example, Ebert et al.¹⁰⁵ proposed that in the same awe videos, the degree of awe experience of the elderly is significantly higher than that of the young, even for happy videos. In general, it is consistent with the theory of social emotional selection that the emotional responses of awe and joy caused by videos are related to the happiness of all age groups. In line with this, one study using a larger age range (18–89) suggested that age moderates the effect of awe on cognitive well-being, but not emotional well-being¹⁷. On the other hand, due to differences in personal attitudes, experiences, social resources, and health conditions, the elderly are still highly resilient and differ from young adulthood and early and middle adulthood. The mechanism of mental resilience at different ages is a change between dynamic and static balance^{106–109}. Two studies show that the selection of college students in this study has led to the results that there are still doubts about the personal developmental characteristics of awe and resilience, and future studies should further verify: In different age stages, whether there is a difference between the awe experience and the cognitive well-being and emotional well-being, and the stability of this difference, in addition, whether the mediating effect of psychological resilience is stable. Second, it would make more sense if further study could assesses frequency/duration of awe experiences over time or levels of dispositional awe (DPES)⁷¹ to predict subjective well-being and resilience. Most of the existing studies use cross-sectional studies to classify state awe and trait awe. The former, such as the use of video to induce awe¹⁹, has not been repeated to explore the depth and breadth of the impact of the experience on individuals. Even if the recall priming task²¹ is used, it only makes up some in the time dimension, but does not solve the fundamental problem; for the latter, whether there are differences in the connotation definition of awe trait in different cultures is limited by the research paradigm¹¹⁰, and the existing research cannot fully answer this question. Therefore, future studies should consider both state awe and dispositional awe, and adopt a combination of questionnaire measurement and behavioral experiments, and a combination of longitudinal and horizontal data to establish a more directional causal relationship model between awe, psychological resilience and well-being (cognitive well-being and emotional well-being).

Conclusions

This present study is intended to investigate the relationship between the awe experience and the cognitive and affective components of well-being, as well as the mediating role of resilience in it, by using a recall priming paradigm. The results suggested that awe experience can affect cognitive well-being both directly and indirectly through resilience, compared with the pleasant and neutral conditions. However, for affective well-being, awe experience only has a mediating effect of resilience. The implications of this study are that in the process of university education, incorporating the element of awe, constructing better physical and mental resources and optimizing mental models can help college students to deal with daily life and interpersonal problems wisely,

cope with the pressure from study and employment, and thus improve their physical and mental health, life satisfaction and happiness. Therefore, this study has certain psychological significance and practical value.

Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Received: 4 October 2024; Accepted: 20 March 2025

Published online: 27 March 2025

References

1. Diener, E. et al. Subjective well-being: three decades of progress. *Psychol. Bull.* **125**, 276–302 (1999).
2. Panaccio, A. & Vandenberghe, C. Perceived organizational support, organizational commitment and psychological well-being: A longitudinal study. *J. Vocat. Behav.* **75**, 224–236 (2009).
3. Andrews, F. M. & Withey, S. B. Developing measures of perceived life quality: results from several National surveys. *Soc. Indic. Res.* **1**, 1–26 (1974).
4. Arthaud-Day, M. L., Rode, J. C., Mooney, C. H. & Near, J. P. The subjective well-being construct: A test of its convergent, discriminant, and factorial validity. *Soc. Indic. Res.* **74**, 445–476 (2005).
5. Diener, E. Subjective well-being: the science of happiness and a proposal for a National index. *Am. Psychol.* **55**, 34–43 (2000).
6. Diener, E. Guidelines for National indicators of subjective well-being and ill-being. *Appl. Res. Qual. Life.* **7**, 397–404 (2006).
7. Diener, E. & Ryan, K. Subjective well-being: A general overview. *South African. J. Psychol.* **39**, 391–406 (2009).
8. Cacioppo, J. T. & Berntson, G. G. The affect system: architecture and operating characteristics. *Curr. Dir. Psychol. Sci.* **8**, 133–137 (1999).
9. Bradburn, N. M. *The Structure of Psychological well-being* (Aldine, 1969).
10. DeHaes, J. C., Pennink, B. J. W. & Welvaart, K. The distinction between affect and cognition. *Soc. Indic. Res.* **19**, 367–378 (1987).
11. Diener, E. Subjective well-being. *Psychol. Bull.* **95**, 542–575 (1984).
12. Pavot, W. & Diener, E. Review of the satisfaction with life scale. *Psychol. Assess.* **5**, 164–172 (1993).
13. Luhmann, M. et al. Time frames and the distinction between affective and cognitive well-being. *J. Res. Pers.* **46**, 431–441 (2012).
14. Schimmack, U. et al. The influence of environment and personality on the affective and cognitive component of subjective well-being. *Soc. Indic. Res.* **89**, 41–60 (2008).
15. Wiest, M. et al. Subjective well-being and mortality revisited: differential effects of cognitive and emotional facets of well-being on mortality. *Health Psychol.* **30**, 728–735 (2011).
16. Schwarz, N. & Clore, G. L. Mood, misattribution, and judgments of well-being: informative and directive functions of affective states. *J. Personal. Soc. Psychol.* **45**, 513–523 (1983).
17. Bernstein, L. & Patrick, J. Age moderates the effect of Awe on cognitive but not emotional Well-Being. *Innov. Aging.* **4**, 455 (2020).
18. Keltner, D. & Haidt, J. Approaching awe, a moral, spiritual, and aesthetic emotion. *Cogn. Emot.* **17**, 297–314 (2003).
19. Valdesolo, P. & Graham, J. Awe, uncertainty, and agency detection. *Psychol. Sci.* **25**, 170–178 (2014).
20. Li, J. et al. The effect of preceding Self-Control on prosocial behaviors: the moderating role of Awe. *Front. Psychol.* **10**, 682 (2019).
21. van Cappellen, P. & Saroglou, V. Awe activates religious and spiritual feelings and behavioral intentions. *Psychol. Relig. Spiritual.* **4**, 223–236 (2012).
22. Gordon, A. M. et al. The dark side of the sublime: distinguishing a threat-based variant of Awe. *J. Personal. Soc. Psychol.* **113**, 310–328 (2017).
23. Dong, R., Peng, K. P. & Yu, F. Positive emotion: Awe. *Adv. Psychol. Sci.* **21**, 1996–2005 (2013).
24. Nakayama, M. et al. Individual and cultural differences in predispositions to feel positive and negative aspects of Awe. *J. Cross-Cult. Psychol.* **51**, 771–793 (2020).
25. Bai, Y. et al. Awe, daily stress, and elevated life satisfaction. *J. Personal. Soc. Psychol.* **120**, 837–860 (2021).
26. Dong, R. & Ni, S. G. Openness to experience, extraversion, and subjective well-being among Chinese college students: the mediating role of dispositional Awe. *Psychol. Rep.* **1**, 1–26 (2019).
27. Zhao, H. et al. Why are people high in dispositional Awe happier? The roles of meaning in life and materialism. *Front. Psychol.* **10**, 1208 (2019).
28. Anderson, C. L., Monroy, M. & Keltner, D. Awe in nature heals: evidence from military veterans, at-risk youth, and college students. *Emotion* **18**, 1195–1202 (2018).
29. Stellar, J. E. et al. Positive affect and markers of inflammation: discrete positive emotions predict lower levels of inflammatory cytokines. *Emotion* **15**, 129–133 (2015).
30. Ye, T. & Dong, L. The experimental research on the influence of materialism and the emotion of Awe on life satisfaction and products preference. *Open. J. Social Sci.* **3**, 138–145 (2015).
31. Rudd, M. et al. Awe expands People's perception of time, alters decision making, and enhances well-being. *Psychol. Sci.* **23**, 1130–1136 (2012).
32. Monroy, M. et al. The influences of daily experiences of Awe on stress, somatic health, and well-being: A longitudinal study during COVID-19. *Sci. Rep.* **13**, 9336 (2023).
33. Atamba, C. Restorative effects of Awe on negative affect after receiving negative performance feedback. *J. Psychol. Afr.* **29**, 95–103 (2019).
34. Koh, A. H. Q. et al. The buffering effect of Awe on negative affect towards lost possessions. *J. Posit. Psychol.* **14**, 156–165 (2017).
35. Seaton, C. L. & Beaumont, S. L. Pursuing the good life: A short-term follow-up study of the role of positive/negative emotions and ego-resilience in personal goal striving and Eudaimonic well-being. *Motivation Emot.* **39**, 813–826 (2015).
36. Guan, F. et al. Neural basis of dispositional Awe. *Front. Behav. Neurosci.* **12**, 209 (2018).
37. Yang, Y. et al. Elicited Awe decreases aggression. *J. Pac. Rim Psychol.* **10**, e11 (2016).
38. Krakowiak, J. K. & Tana, U. *Psychological validity of awe and its influence on perception, decision-making, and wellbeing* (2019). <https://doi.org/10.13140/RG.2.2.13870.46403>
39. Stellar, J. E. et al. Self-transcendent emotions and their social functions: compassion, gratitude, and Awe bind Us to others through prosociality. *Emot. Rev.* **9**, 200–207 (2017).
40. Güsewell, A. & Ruch, W. Are there multiple channels through which we connect with beauty and excellence? *J. Posit. Psychol.* **7**, 516–529 (2012).
41. Joye, Y. & Bolderdijk, J. W. An exploratory study into the effects of extraordinary nature on emotions, mood, and prosociality. *Front. Psychol.* **5**, 1577 (2015).
42. Yuan, W. et al. How and when Awe improves meaning in life: the role of authentic-self pursuit and trait authenticity. *Emotion* **24**, 412–430 (2024).
43. Ke, J. H. & Zhao, N. Breaking the vicious cycle of materialism and loneliness: the moderator effect of Awe. *Psychology: Techniques Appl.* **8**, 129–139 (2020).

44. Jiang, L. et al. Awe weakens the desire for money. *J. Pac. Rim Psychol.* **12**, e4 (2018).
45. Christopher, A. N., Saliba, L. & Deadmarsh, E. J. Materialism and well-being: the mediating effect of locus of control. *Pers. Individ. Differ.* **46**, 682–686 (2009).
46. Monroy, M. & Keltner, D. Awe as a pathway to mental and physical health. *Perspect. Psychol. Sci.* **18**, 309–320 (2023).
47. Headley, B. & Wearing, A. Personality, life events, and subjective well-being: toward a dynamic equilibrium model. *J. Personal. Soc. Psychol.* **57**, 731–739 (1989).
48. Lin, R. M. et al. Honesty-humility and dispositional Awe in Confucian culture: the mediating role of Zhong-Yong thinking style. *Pers. Individ. Differ.* **167**, 110228 (2020).
49. Larsen, R. The contributions of positive and negative affect to emotional well-being. *Psihologijske Teme.* **18**, 247–266 (2009).
50. Larsen, R. J. & Prizmic, Z. Regulation of emotional well-being: overcoming the hedonic treadmill. In (eds Eid, M. & Larsen, R. J.) *The Science of Subjective Well-being* (258–289). Guilford Press (2008).
51. Chow, S. et al. Emotion as a thermostat: representing emotion regulation using a damped oscillator model. *Emotion* **5**, 208–225 (2005).
52. Ford, B. Q. & Mauss, I. B. The Paradoxical effects of pursuing positive emotion: when and why wanting to feel happy backfires. In (eds Gruber, J. & Moskowitz, J. T.) *Positive Emotion: Integrating the Light Sides and Dark Sides* (363–381). Oxford: Oxford University Press (2014).
53. Li, A. et al. The negative effect of pursuing positive emotion and its psychological mechanism. *Adv. Psychol. Sci.* **23**, 979–989 (2015).
54. Mauss, I. B. et al. The pursuit of happiness can be lonely. *Emotion* **12**, 908–912 (2012).
55. Mauss, I. B. et al. Can seeking happiness make people unhappy? Paradoxical effects of valuing happiness. *Emotion* **11**, 807–815 (2011).
56. Pan, X. et al. A balanced Mind: Awe fosters equanimity via Temporal distancing. *J. Personal. Soc. Psychol.* **127**, 1127–1145 (2024).
57. Fredrickson, B. L. What good are positive emotions? *Rev. Gen. Psychol.* **2**, 300–319 (1998).
58. Fredrickson, B. L. The role of positive emotions in positive psychology: the broaden-and-build theory of positive emotions. *Am. Psychol.* **56**, 218–226 (2001).
59. Fredrickson, B. L. The broaden-and-build theory of positive emotions. *Philosophical Trans. Royal Soc. B: Biol. Sci.* **359**, 1367–1377 (2004).
60. Fredrickson, B. L. & Cohn, M. A. Positive emotions. In (eds Lewis, M. et al.) *Handbook of Emotions* (3rd ed., 777–796). Guilford Press (2008).
61. Chirico, A., Yaden, D. B. & Awe A self-transcendent and sometimes transformative emotion. In (ed Lench, H. C.) *The Function of Emotions: when and why Emotions Help Us* (221–233). Springer International Publishing/Springer Nature (2018).
62. Braswell, J. M. & Prichard, E. C. Awe correlates with resilience to COVID-19 stressors independent of religiosity. *Psychol. Rep.* **332941231165240** <https://doi.org/10.1177/00332941231165240> (2023).
63. Thompson, J. & Awe Narratives A mindfulness practice to enhance resilience and Well-being. *Front. Psychol.* **13**, 840944 (2022).
64. Park, C. L. et al. Psychological resilience early in the COVID-19 pandemic: stressors, resources, and coping strategies in a National sample of Americans. *Am. Psychol.* **76**, 715–728 (2021).
65. Thompson, J. & Jensen, E. Hostage negotiator resilience: A phenomenological study of Awe. *Front. Psychol.* **14**, 1122447 (2023).
66. Lench, H. C. et al. A functionalist manifesto: Goal-related emotions from an evolutionary perspective. *Emot. Rev.* **7**, 90–98 (2015).
67. Lerner, J. S. & Keltner, D. Beyond Valence: toward a model of emotion-specific influences on judgment and choice. *Cogn. Emot.* **14**, 473–493 (2000).
68. Danvers, A. F. & Shiota, M. N. Going off script: effects of Awe on memory for script-typical and -irrelevant narrative detail. *Emotion* **17**, 938–952 (2017).
69. Shiota, M. N. et al. *The evolutionary perspective in positive emotion research*. In M. M. Tugade (Eds.), *Handbook of positive emotions* (pp. 44–59). Guilford Publications (2014).
70. Shiota, M. N. et al. The nature of Awe: elicitors, appraisals, and effects on self-concept. *Cognition Emot.* **21**, 944–963 (2007).
71. Shiota, M. N. et al. Positive emotion dispositions differentially associated with big five personality and attachment style. *J. Posit. Psychol.* **1**, 61–71 (2006).
72. Kaynak, H. et al. Your need for cognition, cognitive flexibility, and cognitive emotion regulation strategies matter! The path beyond a satisfied life. *J. Psychol.* **158**, 611–626 (2024).
73. Zhang, K. et al. Positive psychological capital: measurement and relationship with mental health. *Stud. Psychol. Behav.* **8**, 58–64 (2010).
74. Diener, E. et al. Similarity of the relations between marital status and subjective well-being across cultures. *J. Cross-Cult. Psychol.* **31**, 419–436 (2000).
75. Yan, B. & Zheng, X. Researches into relations among Social-support, Self-esteem and subjective Well-being of college students. *Psychol. Dev. Educ.* **22**, 60–64 (2006).
76. Vázquez, C. et al. Satisfaction with life scale in a representative sample of Spanish adults: validation and normative data. *Span. J. Psychol.* **16**, e82 (2013).
77. Pérez, K. A. et al. Experimental elicitations of Awe: A meta-analysis. *Cogn. Emot.* **37**, 18–33 (2023).
78. Podsakoff, P. M. et al. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *J. Appl. Psychol.* **88**, 879–903 (2003).
79. Preacher, K. J. & Hayes, A. F. SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behav. Res. Methods Instruments Computers.* **36**, 717–731 (2004).
80. Preacher, K. J. & Hayes, A. F. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav. Res. Methods.* **40**, 879–891 (2008).
81. Hayes, A. F. *Introduction To Mediation, Moderation, and Conditional Process Analysis: A regression-based Approach* (Guilford Press, 2013).
82. Zhang, C. et al. The effect of Awe on creativity: the mediating role of cognitive flexibility. *Chin. J. Social Psychol.* **16**, 153–176 (2020).
83. Wagnild, G. M. & Young, H. M. Development and psychometric evaluation of the resilience scale. *J. Nurs. Meas.* **1**, 165–178 (1993).
84. Yang, X. & Chen, X. From evolutionary psychology to explain resilience. *Psychol. Explor.* **29**, 18–21 (2009).
85. Coutu, D. L. How resilience works. *Harvard Business Rev.* **80**, 46–50 (2002).
86. Dai, Y., Jiang, T. & Miao, M. Uncovering the effects of Awe on meaning in life. *J. Happiness Stud.* **23**, 3517–3529 (2022).
87. Dong, X. & Geng, L. The role of mindfulness and meaning in life in adolescents' dispositional Awe and life satisfaction: the broaden-and-build theory perspective. *Curr. Psychol.* <https://doi.org/10.1007/s12144-022-03924-z> (2022).
88. Seligman, M. E. P. & Flourish A *Visionary New Understanding of Happiness and well-being* (Simon & Schuster, 2012).
89. Cohn, M. A. et al. Happiness unpacked: positive emotions increase life satisfaction by Building resilience. *Emotion* **9**, 361–368 (2009).
90. Fredrickson, B. L. et al. Open hearts build lives: positive emotions, induced through loving-kindness meditation, build consequential personal resources. *J. Personal. Soc. Psychol.* **95**, 1045–1062 (2008).
91. Wang, Y. & Wang, Z. H. Resilience of college students and the relations of resilience to positive emotion and to subjective Well-being. *Psychol. Dev. Educ.* **29**, 94–100 (2013).

92. Lazarus, R. S. *Emotion and Adaptation. Coping and Adaptation* (Oxford University Press, 1991).
93. Shaver, P. et al. Emotion knowledge: further exploration of a prototype approach. *J. Personal. Soc. Psychol.* **52**, 1061–1086 (1987).
94. Campos, B. et al. What is shared, what is different? Core relational themes and expressive displays of eight positive emotions. *Cognition Emot.* **27**, 37–52 (2012).
95. Kasser, T. et al. Changes in materialism, changes in psychological well-being: evidence from three longitudinal studies and an intervention experiment. *Motivation Emot.* **38**, 1–22 (2014).
96. Carstensen, L. L., Isaacowitz, D. M. & Charles, S. T. Taking time seriously: A theory of socioemotional selectivity. *Am. Psychol.* **54**, 165–181 (1999).
97. Block, J. & Kremen, A. M. IQ and ego-resiliency: conceptual and empirical connections and separateness. *J. Personality Social Psychol.* **70**, 349–361 (1996).
98. Lyu, M. S. et al. Daily emotional characteristics in individuals with different resilience levels: supplementary evidence from experience-sampling method (ESM). *Acta Physiol. Sinica.* **49**, 928–940 (2017).
99. Zautra, A. J. et al. Positive affect as a source of resilience for women in chronic pain. *J. Consulting Clin. Psychol.* **73**, 212–220 (2005).
100. Lei, M. et al. The mechanism of resilience: evidence from Trait-Resilient individuals. *Adv. Psychol. Sci.* **19**, 874–882 (2011).
101. Deci, E. L. & Ryan, R. M. *Intrinsic Motivation and Self-Determination in Human Behavior* (Plenum, 1985).
102. Rankin, K. et al. Awe-full uncertainty: easing discomfort during waiting periods. *J. Posit. Psychol.* **15**, 1–10 (2019).
103. Aspinwall, L. G. Rethinking the role of positive affect in self-regulation. *Motivation Emot.* **22**, 1–32 (1998).
104. Metcalfe, J. & Mischel, W. A hot/cool-system analysis of delay of gratification: dynamics of willpower. *Psychol. Rev.* **106**, 3–19 (1999).
105. Ebert, A. et al. Age differences in Awe among young, Middle-aged, and older adults: extensions of socioemotional selectivity theory. *Innov. Aging.* **5**, 772 (2021).
106. Lima, G. S. et al. Resilience in older people: A concept analysis. *Healthcare* **11**, 2491 (2023).
107. Angevaere, M. J. et al. Resilience in older persons: A systematic review of the conceptual literature. *Ageing Res. Rev.* **63**, 101144 (2020).
108. MacLeod, S. et al. The impact of resilience among older adults. *Geriatr. Nurs.* **37**, 266–272 (2016).
109. Ong, A. D. et al. Resilience comes of age: defining features in later adulthood. *J. Pers.* **77**, 1777–1804 (2009).
110. Bai, Y. et al. Awe, the diminished self, and collective engagement: universals and cultural variations in the small self. *J. Personal. Soc. Psychol.* **113**, 185–209 (2017).

Author contributions

Y.C. is the primary investigator of the study and provided comments and ideas and wrote the manuscript. F.H., Z.L., and Q.X. helped designed the study, and provided comments and ideas and helped polished the writing of the article.

Declarations

Competing interests

The authors declare no competing interests.

Additional information

Correspondence and requests for materials should be addressed to Q.X. or Z.L.

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