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ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rpos20

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To cite this article: Li Luo, Rong Zou, Dong Yang & Jiajin Yuan (2023) Awe experience triggered by fighting against COVID-19 promotes prosociality through increased feeling of connectedness and empathy, The Journal of Positive Psychology, 18:6, 866-882, DOI: 10.1080/17439760.2022.2131607

To link to this article: https://doi.org/10.1080/17439760.2022.2131607

THE JOURNAL OF POSITIVE PSYCHOLOGY
2023, VOL. 18, NO. 6, 866–882
https://doi.org/10.1080/17439760.2022.2131607

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RESEARCH ARTICLE

Awe experience triggered by fighting against COVID-19 promotes prosociality through increased feeling of connectedness and empathy

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ABSTRACT

The promoter of prosocial behavior in fighting against the COVID-19 pandemic needs to be examined. Here, we examined the effect of experienced awe through cross-sectional (Study 1), a 3-wave longitudinal (Study 2) and experimental (Study 3–4) approaches. Study 1 showed that dispositional awe positively predicted one's prosocial behavior in the pandemic ($N = 1281$). Study 2 ($N = 332$) observed that experienced awe predicted higher prosociality, and this relationship was serially mediated by connectedness and empathy. Study 3 ($N = 153$) and 4 ($N = 156$) confirmed that elicited awe, compared to that of amusement and neutrality, promoted multiple types of prosociality (Study 3) and willingness of blood donation (Study 4) via serial mediation of connectedness and empathy. These findings suggest that the experience of awe increases one's connectedness to the world, which in turn enhances empathic concern and prosociality in pandemic fighting.

ARTICLE HISTORY
Received 22 December 2021
Revised 1 September 2022
Accepted 14 September 2022

KEYWORDS
Awe; prosociality; connectedness; empathy; COVID-19

Introduction

The COVID-19 pandemic leads to a massive, unprecedented challenge to human life. Prosocial behavior, which is defined as people's engagement into helping behavior that benefits others, such as self-sacrifice, donating, cooperation, and sharing (Eisenberg et al., 2010), plays a crucial role in fighting against the pandemic (Bavel et al., 2020). On the contrary, self-centered behavior may aggravate the spread of the pandemics. During the pandemic, self-centeredness would lead individuals to engage in unethical behavior, such as hoarding of products and profiteering (Sobirova, 2020), and decreasing helping behavior and cooperation with public health guidelines (Barragan et al., 2021).

Awe refers to an emotion when individuals encounter vast and powerful stimuli that are beyond their own understanding (Keltner & Haidt, 2003). As a collective emotion (Bai et al., 2017), awe enables individuals to fold into collaborative social groups and engage in collective action (Bai et al., 2021). A body of research has found that awe is a key promoter to prosocial actions, such that people experiencing awe are generous to help others in need (Piff et al., 2015; Prade & Saroglou, 2016; Rudd et al., 2012) and exhibit less aggressive motivation (Yang et al., 2016).

However, can awe improve prosociality in the fighting against the COVID-19? Currently, few studies have tested this proposition. More importantly, the mechanisms supporting the association of awe and prosocial behavior need elucidation. As mentioned, awe is characterized by appraisals of facing vast stimuli, and thus, accompanies the feeling of small self and the need to accommodate new experience (Keltner & Haidt, 2003). Studies showed that awe induced by perceptually vast stimuli promotes prosocial behavior, in part due to its ability to elevate the sense of small self (Piff et al., 2015). However, this account has not received consistent supporting evidences. For example, Yang et al. (2016) did not find the pathway from awe to aggression or to helping behaviors via the sense of small self, when awe induction was not restricted to vast natural scenes. In real life, scenarios that elicit awe may not be limited to natural scenes. Keltner and Haidt (2003) have pointed out that awe-inspiring events are diverse, including physical, social, and cognitive elicitors. Previous studies mainly used physical elicitor to induce awe, such as nature. However, approximately half of awe experiences in our life arise in response to other-focused appraisals (Bai et al., 2017; Shiota et al., 2007), which is the social elicitor of awe.

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/17439760.2022.2131607

In the present study, social awe-inspiring elicitors, such as respectable and touching examples during fighting against COVID-19 pandemic, were used. Firstly, social awe-inspiring elicitors may be more accessible during the pandemic than natural awe elicitors. Due to pandemic prevention policies, people may have less exposure to nature during the pandemic. In addition, frequent media report of pandemic-related events made social awe-inspiring elicitors more accessible and vivid. Secondly, social awe-inspiring situations may elicit awe in a way distinct from that elicited by the perception of greater stimuli than oneself. Specifically, natural scenarios, with fearful beauty and sublime magic, may be more likely to conquer the individual to promote their sense of small self (Pearce et al., 2017). By contrast, the feeling of awe induced by social stimuli requires an extended representation of oneself as situated within a society(Xu et al., 2005), which may involve higher levels of cognition (Sun et al., 2021). These evidences imply a distinct pathway in the association of social awe (in fighting against COVID-19) and prosociality, as compared to that when awe is elicited by vast natural scenes.

Moreover, studies have confirmed that awe helps individuals to connect themselves to the world, see themselves and the world in a way not hindered by the boundaries of one's ego identity (Stellar et al., 2017; Van Cappellen & Rimé, 2014). Specifically, the sense of connectedness means the feelings of unity with society, nature, humanity, and even with the universe beyond one's self feature (Yaden et al., 2016, 2019). When experiencing the feeling of awe, individuals are more likely to experience a heightened sense of connectedness with others and the world (Bonner & Friedman, 2011; Van Cappellen & Saroglou, 2012; Yaden et al., 2016, 2019) and even generate an overview effect by broadening their own boundaries (Yaden et al., 2016). There is converging evidence that both social and natural connectedness could promote prosociality. Study on adults indicates that perception of high levels of social connectedness significantly enhances one's helping behaviors (Vingerhoets et al., 2016). Even for the infants, when they were asked to bounce to music in synchrony with the experimenter to establish a social bond, this synchronicity encouraged them to help the experimenter (Cirelli et al., 2014). In addition, social connectedness can also reduce anomie behaviors (Özbay & Özcan, 2006). Natural connectedness can increase prosocial behavior. Prior study has discovered that the stronger the sense of connectedness with nature, the more likely participants endorse prosocial attitudes or engage in collective behaviors (Rosa et al., 2018). Accordingly, we hypothesize that the feeling of awe may increase prosociality via increased sense of connectedness, when awe is elicited by scenes of pandemic fighting.

Furthermore, studies also find that social connectedness (Cwir et al., 2011) and nature connectedness (Fido & Richardson, 2019) can positively predict empathy, an other-oriented prosocial affect including compassion, sympathy and tenderness (Batson et al., 1983). Empathy for others' sufferings was higher (Cialdini et al., 1997; Masten et al., 2011; Meyer et al., 2013), when subjects perceived higher levels of connectedness or self-integration with others; On the contrary, emphasizing the distinction between self and others may weaken empathy (Huang, 2012). Evidence from physiological and brain mechanism research also suggests that social connectedness could promote empathy (Cwir et al., 2011; Meyer et al., 2013). It was found that when watching others being rejected in a social exclusion game, participants feeling more involved with others had higher activation of brain areas associated with empathy (e. g. dACC and insula; Meyer et al., 2013). In addition, Fido and Richardson (2019) showed that individuals with a high sense of natural connectedness scored higher on empathy to others and lower on coldness and ruthlessness. In the field of clinical practice, individuals also increased their empathy through human-animal bond training (P M Wilson, 2014). Therefore, connectedness may also promote empathy, and the two variables may jointly subserve the promoting effects of awe on prosociality.

Across four studies, we investigated whether awe can increase prosociality in the context of COVID-19 pandemic. Furthermore, we explored the cognitive mechanism underlying the link from the perspective of connectedness and empathy. We hypothesized that awe could lead to greater prosociality related to fighting against the pandemic, via the mediators of connectedness and empathy. In Study 1, we tested whether dispositional awe promoted people to conduct real prosocial behavior in the COVID-19 pandemic by a cross-sectional survey. In Study 2, we used a longitudinal study (through a 3-wave measurement) to investigate the prediction and psychological mechanism of awe on prosociality in the COVID-19 pandemic. Using a recalling and writing task to induce emotion, Study 3 used an experimental approach to further examine the effects and mechanism of induced awe (vs. amusement and neutrality) on prosociality. Finally, Study 4 explored whether awe can increase the willingness to donate blood in response to acute blood shortage for medical transfusions in the COVID-19 pandemic. In addition, an investigation has found that over 85% of awe experiences in daily life are positive (Gordon et al., 2017). The mainstream research of awe focuses on the effects of positive-valenced awe (Bonner & Friedman,

2011; Shiota et al., 2007). Therefore, in Studies 3 and 4, we induced the feeling of awe with positive valence, following previous work.

Study 1

Method[1]

Participants

We used random sampling to recruit students from XXX university to participate in the study, and asked them to invite their classmates or families to participate through the snowball sampling method. The subjects received credits for completing the survey or inviting others to fill in the questionnaires. To ensure the validity of data, we informed the subjects in advance that they could obtain credits after researchers examined the validity of the data. 1305 participants from XXX took part in the online study. The data of 24 were removed from further analysis due to 1), contradictory answers on whether to donate (the answer = yes) and the donation amount (the answer = 0; N = 4), 2), donation amount beyond 3 standard deviation (N = 18) or incorrect age (N = 2). Therefore, the available data was 1281 (N_{female} = 880). The age ranged from 16 to 71, with an average age of 23.05 ± 7.86 years. 392 (30.60%) of them were from urban and 889 (69.40%) were from rural areas. Additionally, the educational level of the participants ranged from the junior middle school or below to graduate student.

Materials

Dispositional awe. The dispositional awe was assessed by the awe sub-scale in Dispositional Positive Emotion Scale (DPES-awe; Shiota et al., 2006). The DPES is a well-validated questionnaire that measures individuals' dispositional tendencies to experience seven distinct positive emotions: love, compassion, joy, pride, amusement, contentment, and awe. We only measured awe according to the purpose of the study. There were 6 items, such as '*I often feel awe*'. Participants responded to each item on a scale ranging from 1 (strongly disagree) to 7 (strongly agree). Higher score indicates individuals experiencing the emotion more often. Cronbach's alpha of the scale was 0.91.

Prosocial behavior. Four questions were used to measure prosocial behavior in fighting against COVID-19 pandemic. That is, 'Did you act as a volunteer to support fighting the COVID-19 pandemic?', 'Did you donate materials?', 'Did you donate money?', and 'How much did you donate?'. The first three questions are answered binarily (yes or no), and the last one is to fill in the blank.

Data analysis

We used logistic regression analysis to examine the effects of dispositional awe on binary yes–no questions, and used curvilinear regression to investigate the relationship between dispositional awe and the amount of monetary donation in SPSS 23.0 (SPSS Inc, Chicago, IL, USA). We controlled the demographic variables, including age, gender, education level, and area.

Results

There were 501 (39.11%), 285 (22.25%), and 827 (64.56%) participants who reported that they had been a volunteer, donated materials, and donated money respectively to support fighting against COVID-19 pandemic, and the range of monetary donation was from RMB 1 ¥ to 2000 ¥ (M = 114.73, SD = 254.35) who really donated money (N = 827).

The results of logistic regression showed that dispositional awe could positively predict whether participants acted as a volunteer (β = .12, *Wald* (1) = 5.07, p = .024) or donated materials (β = .18, *Wald* (1) = 8.01, p = .005), but did not significantly predict whether they donated money (β = .07, *Wald* (1) = 1.62, p = .203). Because the amount of monetary donation distributed abnormally (Shapiro – Wilk test (1281) = .47, $p < .001$), we used logarithmic estimation in curvilinear regression to explore the relationship between dispositional awe and monetary donation. The result showed that individuals with higher dispositional awe tended to donate more money (β = .10, t (1) = 3.55, $p < .001$).

Summary

Study 1 primarily examined the association between awe and real-life prosocial behavior during the COVID-19 pandemic, and the results supported the hypothesis that awe was positively linked with real-life prosocial behavior. Moreover, the participants in our study ranged widely in educational level and age, illustrating the generalization of the results. However, this is only a correlational study, which constrains the interpretability. Therefore, in Studies 2 to 4, we used longitudinal and experimental studies to investigate the influence and mechanisms of awe on prosocial tendency.

Study 2

Methods

Participants

A total of 340 college students from XXX University completed three waves of the survey online, and 8

were deleted because their scores on prosociality were over three standard deviations. The mean age of the participants was 20.37 years (*SD* = 1.14; range = 18–24), and 194 (58.43%) were female.

Materials and procedure

Wave 1 was conducted on 2 June 2020, and Wave 3 was on July 2. The interval between two consecutive waves was 15 days. At Wave 1, participants completed scales including the experience of awe during the pandemic, connectedness, empathy, and prosociality, as well as demographic information. Through Wave 2 and 3, they completed the same scales except for demographic data.

The experience of awe. The experience of awe during COVID-19 pandemic was assessed by four questions: 'In general, how often did you feel awe?', 'How often did you feel awe for medical workers', 'How often did you feel awe for the life?', 'How often did you feel awe for the nature?'. Participants were asked to rate how frequently they experienced awe during COVID-19 pandemic using a 5-point scale ranging from 1 (never) to 5 (always). Higher scores indicated experiencing awe more often during the pandemic. Cronbach's alphas of the scale were between .85 to .86.

Connectedness. The Inclusion of Other in the Self Scale (Aron et al., 1992; Van Mulukom et al., 2020) was used to measure the sense of connectedness. It is a pictorial scale measured through a choice of increasingly overlapping circles. In the current study, individuals responded on the scale to measure their experienced connectedness felt to humanity and the world, respectively. The pictures were accompanied by the following instructions (taking humanity as an example): 'Which of the following picture is the best to represent how you perceive your relationship to humanity'. The scores ranged from 1 (no overlap) to 7 (full overlap). The mean of the two items served as the index of connectedness.

Empathy. Empathy for the patients infected by the virus was assessed by the Empathy Concern Scale (Batson et al., 1983), including 6 adjective words, sympathetic, moved, compassionate, warm, softhearted, and tender. The items were rated on a 7-point scale (1 = not at all; 7 = extremely), assessing how much the participants experienced these feelings on those infected by the virus. Cronbach's alphas of empathy were between .89 to .95.

Prosociality. Prosociality was assessed by two items, 'How willing are you to be a volunteer to support our country fighting against the COVID-19', and 'How willing are you to donate materials?'. Participants answered the questions from 1 (not at all) to 7 (very much). The mean of the two items served as the index of prosociality.

Data analysis

Descriptive statistics were conducted in SPSS 23.0, and path analysis was estimated in AMOS 23.0 (SPSS Inc, Chicago, IL, USA).

Results

We analyzed common method variance (CMV) for each wave using unmeasured latent method construct (ULMC) approach (Podsakoff et al., 2012). A confirmatory factor analysis was done firstly (Model 1), and then a first-order method factor was added in which the measures can load on both this factor and their own theoretical factor (Model 2). Results showed that the fitting indexes of Model 1 and Model 2 were satisfactory both in Wave 1 and Wave 2, but the fit index of Model 2 with method factor were not significantly improved. In addition, Changes of CFIs (0–0.01) and TLIs (−0.06–0) between the two models in Wave 1 and Wave 2 were both less than 0.1, and those of RMSEAs (0–0.03) and RSEAs (−0.01–0.02) were less than 0.05. The fitting of the Model 2 with method factor even decreased in Wave 3. All these suggested that CMV was not a major problem in the current study.

Descriptive statistics and correlations

The results of descriptive statistics showed that there was little mean change for the variables over time. The experience of awe during the pandemic was significantly correlated with prosociality, connectedness and empathy. Descriptive statistics and correlations among the variables are shown in Table 1.

Longitudinal models

A cross-lagged structural equation model (SEM) and a parametric bootstrap procedure with 5,000 replications were used to calculate 95% bias-corrected CIs for the indirect effects by the parameters and standard errors. The model was evaluated using the χ^2 statistic and approximate fit indices. And P_M, the percentage of mediating effect in the total effect, was used as the effect size of mediation effect (Preacher & Kelley, 2011). We included awe as an input variable, connectedness and empathy as mediators, and prosociality as the outcome variable. In the current study, the input, mediators, and outcome variable were all longitudinal variables,

Table 1. Descriptive statistics and Pearson correlations for variables.

Variables	*M*± *SD*	1	2	3	4	5	6	7	8	9	10	11	12
1. Awe (Wave 1)	4.17 ± .62	1											
2. Connectedness (Wave1)	4.84 ± 1.26	.24***	1										
3. Empathy concern (Wave1)	5.49 ± .95	.43***	.23***	1									
4. Prosociality(Wave1)	6.26 ± .72	.28***	.24***	.26***	1								
5. Awe (Wave 2)	4.11 ± .61	.66***	.22***	.43***	.31***	1							
6. Connectedness (Wave2)	4.76 ± 1.36	.28***	.66***	.21***	.19***	.33***	1						
7. Empathy concern (Wave2)	5.36 ± .94	.43***	.25***	.63***	.38***	.58***	.29***	1					
8. Prosociality (Wave2)	6.20 ± .95	.32***	.19***	.20***	.56***	.41***	.26***	.34***	1				
9. Awe (Wave 3)	4.14 ± .64	.54***	.23***	.39***	.34***	.64***	.33***	.51***	.40***	1			
10. Connectedness (Wave3)	4.73 ± 1.38	.24***	.62***	.23***	.22***	.29***	.74***	.28***	.26***	.38***	1		
11. Empathy concern (Wave3)	5.34 ± 1.10	.38***	.26***	.53***	.33***	.48***	.26***	.71***	.27***	.58***	.26***	1	
12. Prosociality (Wave3)	6.24 ± .81	.31***	.23***	.24***	.56***	.34***	.28***	.39**	.56***	.43***	.30***	.40***	1

Note: *$p < .05$, **$p < .01$, ***$p < .001$ (the same below).

measured from Wave 1 to Wave 3. The model fitting is satisfactory (X^2 (30) = 112.11, $p < .001$, *CFI* = .96, *NFI* = .94, *TLI* = 0.91, *GFI* = .95, *RMSEM* = .09). The cross-lagged panel model was shown in Figure 1.

Results showed that the experience of awe was associated with increased prosociality from Wave 1 to Wave 3 (total effect = .12, 95% CI [.01, .23], $p = .033$), and with increased connectedness (a = .11; 95% CI [.02, .20], $p = .015$) and empathy (c = .22; 95% CI [.12, .33], $p < .001$) from Wave 1 to Wave 2. Empathy positively predicted prosociality from Wave 2 to Wave 3 (d = .17; 95% CI [.07, .27], $p < .001$). Meanwhile, the feeling of connectedness was positively correlated with empathy in Wave 2 (e = .12; 95% CI [.03, .21], $p = .008$). The indirect effect of awe on prosociality was significant through increased empathy alone (mediation effect = c * d = .04; 95% CI [.01, .07], $p = .006$, $P_M = 33.33\%$). Moreover, the pathway from awe to prosociality via serial mediation of connectedness and empathy was significant (mediation effect = a * e * d = .002; 95% CI [.001, .01], $p < .001$, $P_M = 1.67\%$). The inclusion of two mediators reduced the direct path coefficient between awe and prosociality from .12 to .07 (95% CI [−.04, .19], $p = .214$). These results indicated that connectedness

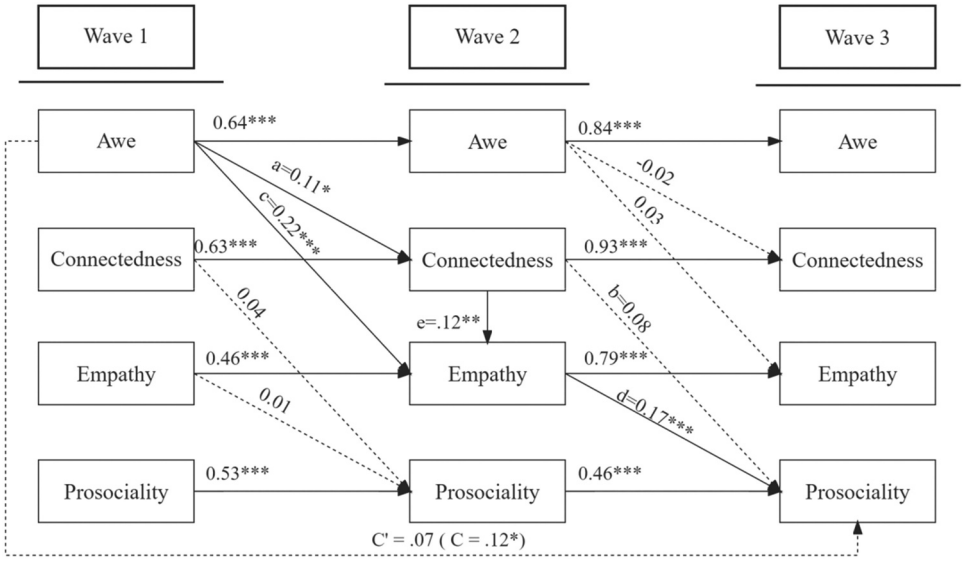

Figure 1. Cross-lagged panel mediation model for the effect of awe on prosociality. All path coefficients were standardized, and dashed lines denoted insignificant paths (the same as below). Residuals were not shown.

and empathy serially mediated awe's promotion effect on prosociality related to fighting the pandemic.

Summary

In this longitudinal study, we tested the relationship between the experience of awe during the COVID-19 and prosociality, and explored its mechanism. It was found that awe was positively related to long-term increases in prosociality, measured by more willing to be a volunteer and to donate money to support fighting against COVID-19. Our results also indicated that connectedness and empathy serially mediated awe's promotion effect on prosociality. Despite the use of a longitudinal study, we should still be cautious to infer the causality, because longitudinal design is essentially a variation of correlational study that independent variables were not manipulated. To replicate these findings, study 3–4 used an experimental method to investigate the effects of induced awe on prosociality and its cognitive mechanisms.

On the other hand, COVID-19 leads to difficulties of pandemic control in many countries. Prior studies have established an intergroup bias that in-group person is evaluated more favorably than out-group individual, which can impede prosociality to the out-group individual (Hewstone et al., 2002; Luo et al., 2018). Therefore, we are also interested in whether the experience of awe may increase prosociality to out-group. If yes, we will further explore its mechanism by testing whether the experience of awe leads people to transcend the boundaries of ethnic identity to enhance the sense of connectedness and empathy, which consequently enhances prosociality to out-group.

Study 3

Methods

Participants

We conducted a priori power analysis using G*Power (Faul et al., 2007) to calculate the required sample size, with effect size set at .28, power set at .80, and α = .05 (Jiang et al., 2018). The necessary sample size was 126. Data were collected during the outbreak of COVID-19 pandemic and 153 undergraduates were recruited from XXX University in XXX (N_{awe} = 49; $N_{amusement}$ = 54; $N_{neutral}$ = 50). There were 83 females (N_{awe} = 29, $N_{amusement}$ = 29, $N_{neutral}$ = 27) and there was no significant difference in gender composition across the three conditions, X^2 (2) = .38, p = .826. The mean age was 19.76 years (SD = 1.24; range = 17–24).

Materials and procedure

The experiment was carried in a separate room. After obtaining verbal consent, participants were randomly assigned to one of the three emotional conditions, awe, amusement and neutrality. Amusement is chosen as the comparison because it is a positive emotion and can also be induced by an incongruity between one's expectations and experience, like awe (Piff et al., 2015).

Firstly, participants reported the extent to which they currently experienced each of seven emotions on a 7-point scale ('anger', 'disgust', 'awe', 'sadness', 'fear', 'happiness', and 'amusement'; 1 = not at all, 7 = very strong) as the baseline (Piff et al., 2015). The reason for measuring so many emotions was to keep participants from guessing the purpose of the experiment. Then, they were asked to recall and write about an experience in which they felt the target emotion during the COVID-19 pandemic. Participants in each condition read the specific instruction as below.

Awe: 'Please try to think about a particular and positive moment during the pandemic that made you feel awe, such as medical workers persevere in fighting in tough situations regardless of their own health, and immerse yourself in it.'

Amusement: 'Please try to think about a particular moment during the pandemic that made you feel amused, such as a joke or funny situation at which you laugh with family or friends, and immerse yourself in it.'

Neutrality: 'Please try to think about a typical day's routine during the pandemic, such as taking physical exercise.'

In all conditions, the instruction ended with the following sentence: 'After thinking about it well, please write down no less than ten sentences on the paper to describe it and your feelings in detail, as if you are experiencing it again'. After recalling and writing, participants rated their emotions again and the valence of the recalling (1 = very negative; 7 = very positive) as the manipulation check, and then completed the questions about connectedness, empathy, and prosociality.

Connectedness. Connectedness was assessed by 10 items. Five items were developed by Yaden et al. (2019), 'I had the sense of being connected to everything', 'I felt a sense of communion with all living things', 'I experienced a sense of oneness with all things', 'I felt closely connected to humanity', and 'I had a sense of complete connectedness'. The other 5 items were developed for this study ('I think I belong to a larger entity', 'Human beings is a whole', 'Human beings should not fight against each other', 'Human beings is a community with a shared future', 'Human beings is intimately connected to all living things'). Participants reported their experience on a 7-point scale (1-*not at all*, 7-*very much*).

Higher score indicates higher experience of connectedness. Cronbach's alpha of connectedness scale was .83.

Empathy. The measure of empathy was the same as it in study 2. We measured the empathic concern for the patients infected with the virus in China and foreign countries respectively. Cronbach's alphas for in -group and out-group were .90 and .94 respectively.

Prosociality. All the questions were related to fighting against COVID-19. To the in -group, there were 4 items: 'How willing are you to be a volunteer to support our country fighting against the COVID-19', 'How willing are you to donate materials?', 'How willing are you to donate money?', and 'How much money do you want to donate from RMB 0 to 100 ¥'. To the out-group, there were 8 items. The first four questions were: 'How willing are you to cooperate with foreign countries to fight against the COVID-19?', 'How willing are you to donate materials to support foreign countries?', 'How willing are you to donate money to support foreign countries?', and 'How much money do you want to donate to help foreign countries from RMB 0 to 100 ¥?'. The last four questions are the same, but they are for Japan. We choose Japan because Chinese teenagers' stereotype toward Japanese are negative (Zhang et al., 2013). Each question was answered via a 7-point scale ranging from 1 (not at all) to 7 (very much), except for the question of how much to donate.

Small self. Previous studies have shown that the sense of small self mediated the link between awe and prosocial behavior (Piff et al., 2015; Yang et al., 2016). Hence, we assessed small self to control its effect in testing the mediation of connectedness and empathy between awe and prosociality. It was measured by two questions, 'I feel relatively small' and 'I feel insignificant' (Piff et al., 2015), using a 7-point Likert scale, ranging from 1 (not at all) to 7 (very much). Cronbach's alpha was .82.

Additionally, we collected the dispositional awe assessed by DPES-awe (Shiota et al., 2006), dispositional empathy assessed by Interpersonal Reactivity Index (IRI; Davis, 1983), prosocial tendencies assessed by Prosocial Tendencies Measure (PTM; Carlo & Randall, 2002), and social desirability assessed by Marlowe-Crowne Social Desirability Scale (MCSD; Crowne & Marlowe, 1960), as the extraneous variables. Analyses suggested that there were no significant differences among the three groups in terms of these variables (*ps* > .272).

Results

Manipulation check

We used MANOVA to examine whether our manipulations were effective (see Table 3.1 of Supplementary Materials). The pre-test showed that there were no differences among three conditions in terms of the self-reported emotions: 'anger', 'disgust', 'awe', 'sadness', 'fear', 'happiness', and 'amusement', *ps* ≥ .196. The post-test showed that participants in the awe condition experienced stronger feeling of awe than did those in the amusement (M = 2.83, SD = 2.03; 95% CI [1.86, 3.41]) and neutral (M = 2.32, SD = 1.32; 95% CI [2.35, 3.94]) conditions, F (2, 150) = 53.92, p < .001, η^2 = .42. In turn, participants in the amusement condition (M = 4.22, SD = 1.81) experienced a stronger feeling of amusement than did those in the awe (M = 1.04, SD = .29; 95% CI [2.53, 3.83]) and neutral (M = 1.68, SD = 1.45; 95% CI [1.89, 3.19]) conditions, F (2, 150) = 79.15, p < .001, η^2 = .51. Moreover, participants in the awe condition experienced a stronger feeling of awe than feeling of amusement, F (1, 48) = 497.72, p < .001, η^2 = .91, 95% CI [4.03, 4.83], while participants in the amusement condition experienced a stronger feeling of amusement than feeling of awe, F (1, 53) = 14.05, p < .001, η^2 = .21, 95% CI [0.65, 2.13]. In addition, awe induction was coupled by increased feeling of sadness (but not other emotions), while amusement induction was linked with increased feeling of happiness (but not other emotions; see Table 3.1 of the Supplementary Materials), consistent with relevant prior reports (Negami, 2016). Analysis for valence indicated no significant difference between awe (M = 6.17, SD = .93) and amusement conditions (M = 5.83, SD = 1.01), p = .14; 95% CI mean difference [−.21, .87], whereas both groups rated more positive than the neutral group (M = 4.52, SD = 1.33; *ps* < .001; 95% CI mean differences [1.11, 2.19] and [0.78, 1.86] for awe and amusement groups respectively). These results suggested that emotional manipulation was successful across the conditions.

The effects of awe on connectedness, empathy and prosociality

To control for the effect of other variables (disgust, happiness, sadness, dispositional awe, dispositional empathy, prosocial tendencies, social desirability) on dependent variables, we used Multivariate Analysis of Covariance (MANCOVA) to examine the effects of emotion on connectedness, empathy, and prosociality. MANCOVA requires that the covariates should be significantly correlated with the dependent variables, and the interaction effect between covariates and the independent variables should be insignificant, that is, the assumption of homogeneity of regression (Field, 2018). Therefore, we first performed Pearson correlation analysis between the seven control variables and connectedness, empathy, and prosociality (see Table 3.2 of Supplementary Materials). It was found that disgust

was not significantly correlated with the dependent variables (*ps* > .09). By respectively constructing the interaction between independent variable (emotion) and the other six control variables to test the homogeneity of regression, it was indicated that dispositional awe, dispositional empathy, and prosocial tendency had no significant interaction with emotion manipulation (see Table 3.3 of Supplementary Materials).

Then, we conducted MANCOVA, including one independent variable (emotion), 10 dependent variables (connectedness, empathy, and prosociality), and 3 covariates (dispositional awe, dispositional empathy, and prosocial tendency). Bonferroni method was used for post hoc pairwise comparisons (Bland & Altman, 1997). Results indicated that emotion had a significant effect on connectedness (F (2, 147) = 7.20, $p < 0.001$, $\eta^2 = 0.09$). Participants in the awe condition experienced higher level of connectedness than did those in the amusement and neutral conditions (*ps* < .01). Awe increased prosociality to in- and out-group (ps < .05), but not willingness to donate money for in-group (F (2, 147) = 2.61, $p = 0.077$, $\eta^2 = 0.03$) or empathy for in- and out-group (*ps* > .576), compared with amusement and neutrality. Those results appear in PANEL A (the results of connectedness), B (the results of in-group) and C (the results of out-group) of Figure 2. The details are presented in Table 3.4 of the Supplementary Materials.

Mediation analysis

As shown above, awe led to significant increases in the sense of connectedness and prosociality, irrespective of receiver group membership. Also, connectedness was positively associated with all the indicators of prosociality, *rs* > .27, *ps* < .001. Awe didn't increase empathy, but both groups' empathy was positively correlated with connectedness (*rs* > .51, *ps* < .001) and their prosociality measures (*rs* > .19, *ps* < .018), respectively. Hence, we performed two mediation analyses by AMOS 23.0 to test whether connectedness and empathy mediated the link between awe and prosociality to in- and out-groups respectively, using a parametric bootstrap procedure with 5000 replications and 95% bias-corrected CIs to calculate the indirect effects.

The mediation analysis for prosociality to in-group

The mediation model included one predictor variable (emotion, coded as awe = 2, neutral = −1, amusement = −1), two mediators (connectedness and empathy), one outcome (prosociality), and one control variable (small self). The model fitting coefficients were acceptable (X^2 (15) = 21.19, $p = .131$, *CFI* = .99, *NFI* = .95, *TLI* = .97, *GFI* = .97, *RMSEM* = .05). The total effect ($\beta = .29$, 95% CI [.15, .42], $p = .001$) and the direct effect ($\beta = .20$, 95% CI [.08, .34], $p = .003$) from awe to prosociality were significant. There was a significant indirect effect of awe on prosociality through serial mediation of connectedness and empathy (mediation effect = .08, 95% CI [.04, .16], $p < .001$, $P_M = 27.58\%$), but not through small self (mediation effect = .01, 95% CI [−.01, .04], $p = .259$), connectedness alone (mediation effect = .04, 95% CI [−.01, .11], $p = .125$), or empathy alone (mediation effect = −.04, 95% CI [−.12, .03], $p = .25$). The results suggested that the promoting effect of awe on prosociality was partially due to the strengthened sense of connectedness, which then enhanced individuals' empathy and prosociality serially (see PANEL D of Figure 2 for the model).

The mediation analysis for prosociality to out-group

The model fitting coefficients were acceptable (X^2 (16) = 31.79, $p = .011$, *CFI* = .98, *NFI* = .96, *TLI* = .96, *GFI* = .95, *RMSEM* = .08). The total effect ($\beta = .29$, 95% CI [.16, .41], $p < .001$) and direct effect ($\beta = .19$, 95% CI [.04, .18], $p = .002$) between awe and prosociality were significant. The indirect effects of awe on prosociality via connectedness alone (mediation effect = .06, 95% CI [.01, .13], $p = .01$, $P_M = 20.69\%$) and via serial mediation of connectedness and empathy (mediation effect = .06, 95% CI [.03, .12], $p < .001$, $P_M = 20.69\%$) were both significant. The mediation effect of small self (mediation effect = .01, 95% CI [−.01, .03], $p = .229$) or empathy alone (mediation effect = −.03, 95% CI [−.09, .03], $p = .283$) was insignificant (as illustrated in PANEL E of Figure 2).

Summary

This study used experimental approach to investigate the influence of awe on prosociality and its cognitive pathways. A recalling and writing task was used to induce awe and other emotions. Also, we manipulated receiver identity to be either in-group (China) or out-group (foreign countries and Japan) to explore whether the awe effects on prosociality and its cognitive mechanisms differ as a function of receiver identity. It was found that compared to amusement and neutrality, awe increased connectedness and prosociality to both in- and out-groups. Mediation analyses indicated significant serial mediation effects of connectedness and empathy in the awe effects on prosociality. It is worth noting that, the link between awe and out-group prosociality is also mediated by the sense of connectedness alone.

In Study 1–3, prosociality was measured by voluntary behaviors of donating materials and money. However, there are other types, such as blood donation which is

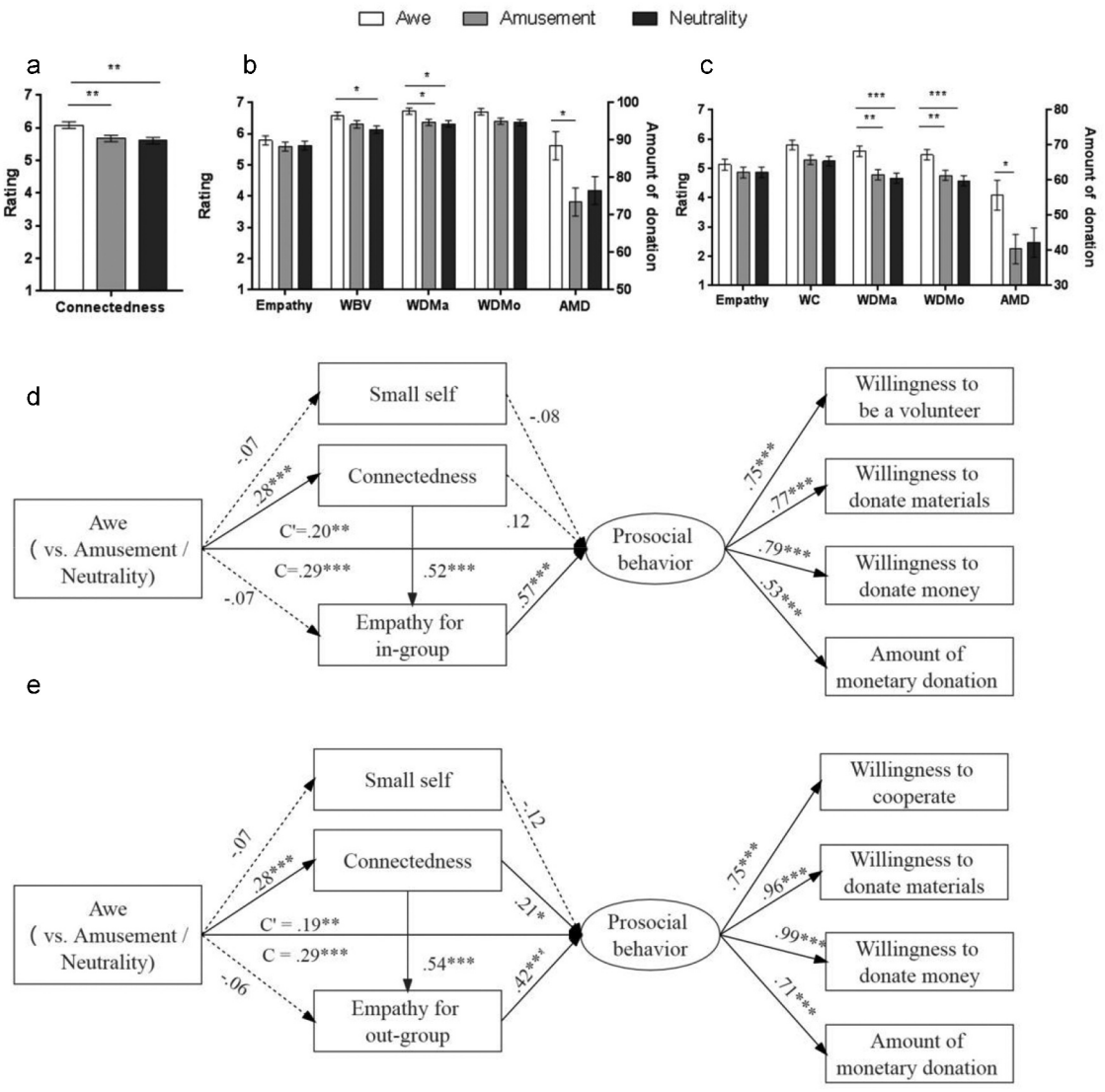

Figure 2. The effects of emotion on measures in Study 3. PANEL A shows the means and comparisons of connectedness among different conditions after recalling. PANEL B-C denote the measures of empathy and prosociality to in-group (PANEL B) and out-group (PANEL C) varying as the function of emotion. Error bars represent standard errors. PANEL D-E are the multiple mediation models from awe to in-group prosociality (PANEL D) and out-group prosociality (PANEL E) through connectedness and empathy respectively. Prosociality was treated as a latent variable in the models. As the amount of monetary donation was scored differently from the other questions, data were standardized. Confirmatory factor analysis was performed on the standardized data of the four prosociality measures. Goodness-of-fit indexes were X^2 (1) = 3.79, p = .079 for in-group prosociality and were X^2 (2) = 2.13, p = .345 for out-group prosociality. WBV – willingness to be a volunteer; WDMa – willingness to donate materials; WDMo – willingness to donate money; AMD – amount of monetary donation, WC – willingness of cooperation.

very different from the donation assessed above. On the one hand, people would report some negative effects produced by blood donation, including fatigue, diminished physical capacity, vertigo/dizziness, freezing, thirst, hunger, headache, numbness in an arm, and fear of needles (Nilsson Sojka & Sojka, 2003). On the other hand, evidence from medical research showed that blood donation may pose health risk of reduced haemoglobin, immunological parameters, iron in blood, and blood pressure to donors (Cançado et al., 2001; Casiglia et al., 1996). Moreover, the number of volunteers donating blood dropped during the COVID-19. And medical institutions faced the challenge of insufficient blood collection and supply due to restricted face to face communications (Riley et al., 2021). Therefore, in Study 4, we aimed to investigate whether awe promotes

individuals' willingness to donate blood and the roles of connectedness and empathy in this association.

Study 4

Method

Participants

158 college students participated in the experiment. Two participants were excluded from data analysis as they did not follow the experimental procedures, leaving 156 valid cases (N_{awe} = 52; $N_{amusement}$ = 53; $N_{neutral}$ = 51). There were 90 females (N_{awe} = 29, $N_{amusement}$ = 29, $N_{neutral}$ = 32) and there was no significant difference in gender composition across the three groups, X^2 (2) = .68, p = .408. The mean age was 20.21 years (SD = 1.20; range from 17 to 24).

Materials and procedure

The experimental procedure, group assignment, small self and behavioral measures in Study 4 were the same as those in Study 3 (in-group), except that connectedness measure was the same as it in Study 2 and the measures of empathy and prosociality were adapted to fit the situation of blood donation. Specifically, prosociality was assessed by two questions: 'how willing are you to donate blood', and 'how willing are you to register on the blood donation website (https://www.china-xianxue.com/) to inform you to donate blood?'. Empathy was assessed by Empathic Concern Scale (Batson et al., 1983) with the guideline 'When a patient needs blood transfusion, to what extent do you have the following feelings?'. Also, the three groups (awe, amusement and neutral) scored similarly in dispositional awe, dispositional empathy, social desirability, and trait prosocial tendencies (*ps* > .077).

Results

Manipulation check

The MANOVA showed similar emotional pre-test across groups, *ps* > .279. However, to the emotional post-test, participants reported a stronger feeling of awe (M = 5.88, SD = 1.35) in the awe condition than did those in the amusement (M = 2.36, SD = 1.88; 95% CI [2.75, 4.30]) and neutral (M = 2.33, SD = 1.65; 95% CI [2.77, 4.34]) conditions, F (2, 153) = 80.05, p < .001, η^2 = .51. In turn, participants in the amusement condition (M = 5.32, SD = 1.37) experienced a stronger feeling of amusement than did those in the awe (M = 1.44, SD = 1.24; 95% CI [3.19, 4.56]) and neutral (M = 2.49, SD = 1.70; 95% CI [2.14, 3.52]) conditions, F (2, 153) = 100.83, p < .001, η^2 = .57. Moreover, participants in the awe condition experienced a stronger feeling of awe than feeling of amusement, F (1, 51) = 283.16, p < .001, η^2 = .85, 95% CI [3.91, 4.97], while participants in the amusement condition experienced a stronger feeling of amusement than feeling of awe, F (1, 52) = 86.39, p < .001, η^2 = .62, 95% CI [2.32, 3.60]. In addition, awe induction was coupled by increased feeling of sadness but not other emotions, while amusement induction was linked with increased feeling of happiness (but not other emotions, see Table 4.1 of the Supplementary Material), similar to those of Study 3. Moreover, Analysis for valence indicated no significant difference between awe (M = 5.69, SD = 1.42) and amusement (M = 5.43, SD = 1.18) conditions, p = 1.00, whereas both groups' valence was more positive than that of the neutral group (M = 4.20, SD = 1.69; *ps* < .001; 95% CI [0.81, 2.18] for awe and [0.55, 1.92] for amusement group, respectively). Hence, our emotional manipulation was valid for each condition.

The influence of awe on connectedness, empathy, and willingness of blood donation

MANCOVA was also used to test the effect of emotion on dependent variables. Pearson correlation analysis found that disgust and happiness were insignificantly correlated with connectedness, empathy, and willingness of blood donation (*ps* > .076). We also test the interaction effect between the independent variable (emotion) and the other 5 control variables (dispositional awe, dispositional empathy, prosocial tendency, social desirability, and post-test of sadness) to test the homogeneity of regression. Results showed that the interaction effect was insignificant. Details were presented in the Table 4.2 and 4.3 of the Supplementary Materials.

Therefore, we conducted MANCOVA including one independent variable (emotion), four dependent variables (connectedness, empathy, and two prosociality indexes), and five covariates (dispositional awe, dispositional empathy, prosocial tendency, social desirability, and post-test of sadness). Bonferroni method for post hoc pairwise comparisons was also used. The results indicated a significant emotion effect on connectedness (F (2, 148) = 3.76, p = .026, η^2 = .05) and willingness of blood donation (F (2, 148) = 4.16, p = .017, η^2 = .05), but not on empathy for those who need blood transfusions (F (2, 148) = 0.42, p = .67, η^2 = .01) or willingness to register online (F (2, 148) = 1.18, p = .131, η^2 = .02). Post hoc pairwise comparisons showed that awe increased the sense of connectedness and willingness to donate blood, compared with neutrality (see PANEL A of Figure 3). Table 4.4 in the Supplementary Materials presented the details.

Mediation analysis

As indicated above, awe promoted the sense of connectedness and willingness of blood donation. In addition, correlation analyses found that connectedness was positively associated with empathy and the two indexes of prosociality, *rs* > .28, *ps* <.001. Also, empathy was positively associated with the two prosociality measures (*rs* >.23, *ps* <.004). The mediation analysis method was the same as that in Study 3.

The results firstly showed a satisfactory model fitting ($X^2(5) = 4.17$, $p = .525$, $CFI = 1.00$, $NFI = .97$, $TLI = 1.00$, $GFI = .99$, $RMSEM < .001$). Moreover, the total effect from awe to blood donation was significant ($\beta = .24$, 95% CI [.05, .38], $p = .018$), and the direct effect was not significant ($\beta = .16$, 95% CI [−.01, .31], $p = .071$). As for the indirect effects, the mediation of connectedness alone (mediation effect = .08, 95% CI [.02, .17], $p = .01$, $P_M = 33.33\%$) and the serial mediation of connectedness and empathy (mediation effect = .03, 95% CI [.01, .08], $p < .001$, $P_M = 12.50\%$) were both significant. By contrast, the mediation of small self (mediation effect = −.01, 95% CI [−.07, .01], $p = .247$) and that of empathy alone (mediation effect = −.02, 95% CI [−.08, .03], $p = .390$) were insignificant. These results confirmed that awe increased the sense of connectedness, which in turn promoted one's empathy and willingness of blood donation serially (see PANEL B of Figure 3).

Summary

Using willingness of blood donation as the measure of prosociality, Study 4 explored whether awe promoted the willingness to donate blood and whether connectedness and empathy accounted for the relationship. The findings confirmed that individuals were more prosocial in the awe than in the amusement and neutral conditions. Also, the mediation of connectedness alone and the serial mediation of connectedness and empathy accounted for the promoting effect of awe on prosociality, similar to those observed in Study 3.

General discussion

Previous studies often used perceptually vast natural scenes (e.g., towering trees) to induce awe and explored its effect on ethical decision-making, generosity, prosocial value and helping behaviors (Rudd et al., 2012; Van Cappellen & Saroglou, 2012). Using this approach, several studies found the sense of small self mediated the awe's promoting effect on prosocial behavior (Piff et al., 2015; Yang et al., 2016). However, in the context of global fighting against COVID-19 pandemic, to date there is no study exploring potential effects of awe induction on prosociality and its mechanism. To fix this gap, the present study explored, the impact of feeling of

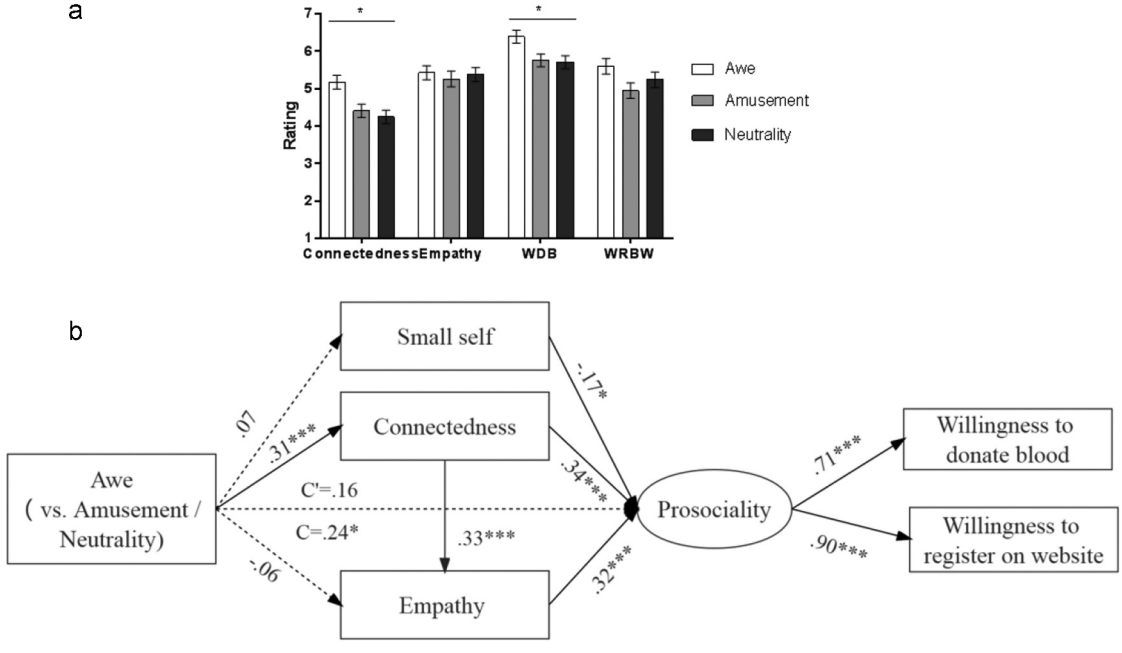

Figure 3. The effects of emotion on measures in Study 4. PANEL A shows the means and comparisons of measures as the function of emotion. Error bars represent standard errors. PANEL B is the multiple mediation model from awe to blood donation via connectedness and empathy. WDB – willingness to donate blood; WRBW – willingness to register online.

awe on prosociality and its cognitive paths in the context of global fighting against COVID-19 pandemic.

Four studies, using different approaches, have consistently confirmed that the feeling of awe is associated with increased prosociality in COVID-19 control. Though previous studies have established an intergroup bias (Luo et al., 2018), we still observed an awe-induced prosociality to out-group. This is consistent with prior findings that elicitation of moral-elevating emotion reduced prejudice towards out-group members (Lai et al., 2014), and that induction of awe can reduce aggression and increase helping behavior (Prade & Saroglou, 2016; Yang et al., 2016). Moreover, the feeling of awe also increased people's willingness to donate blood despite potential health risk to themselves. In sum, all these results indicate that awe is a robust factor to trigger a wide range of prosociality during COVID-19 control via expanding one's feeling of connectedness and empathy serially.

We did not observe a mediating role of small self, but instead observed a consistent serial mediation of connectedness and empathy across Study 2 to Study 4. This effect was still robust after isolating the potential effect of small self. Also, the validity of this effect is independent of research design (longitudinal survey or experimental study), the measure of awe experience (experience report or narrative recall), the measure of connectedness (Self-Other Integration Scale, or self-compiled connectedness questionnaire), how prosociality was measured, and receiver group membership (own or foreign country). It is worth noting that most of prior studies observing a mediating role of small self used physical elicitors (Piff et al., 2015; Yang et al., 2016). When participants were required to recall a natural scene that caused them to feel awe, Piff et al. (2015) found that small self mediated the relationship between awe and prosocial behavior. However, when the recalling content was not restricted, Yang et al. (2016) didn't repeat this result. By contrast, the same authors did observe a mediating role of small self in the effects of awe experience on prosocial and aggressive behavior, when awe was elicited via watching panoramic views of polar scenes and oceans of Planet Earth.

Scenes of others engaging in selfless fighting against COVID-19 elicit awe in a way distinct from that elicited by perception of greater stimuli than oneself. It may inspire reverence for medical workers, trigger overall concerns for the fate of humans, and accommodate new appraisals for the meanings of life. Meanwhile, the experience of awe evoked by touching events in public emergency can reshape people's social memory (Yan & Yan, 2017), which leads to the transformation of self-representation and makes the social self-identity more prominent. Therefore, social awe would be more likely to trigger other cognitive component instead of small self, to further influence the subsequent decision making. Consistent with this inference, it has been shown that awe can reduce individuals' focus on their own interests by directing them towards something more universal and important than what they normally care about (Jiang et al., 2018; Thrash & Elliot, 2004). Specifically, awe inspires individuals to connect themselves with the outside world beyond the boundaries of race, skin color, and country (Van Cappellen & Rimé, 2014; Yaden et al., 2016), which promotes their concerns for the welfare of others and consequently engages in more prosocial behavior (Bai et al., 2017, 2021; Piff et al., 2015). This might account for our consistent observation that increased connectedness and empathic feeling serially mediate the effects of awe on prosociality. Recently, Van Mulukom et al. (2020) observed a significant mediation model indicating that awe elicited by recent use of serotonergic psychedelic drugs was associated with increased feeling of connectedness and empathic drive, which in turn was associated with decreased levels of maladaptive narcissism personality features, lending further support to the current findings.

It is worth noting that empathy alone instead of connectedness mediates the association between awe and prosociality in the longitudinal survey (Study 2), but not in Study 3 and 4. Study 3 and 4 used a recalling and writing task to elicit awe via experiment manipulation; whereas Study 2 measured awe through the COVID-19 pandemic experience using an observational approach. Therefore, the awe experience measured in Study 2 resembles a stable, trait-like feeling of awe in the context of pandemic experience (15 days or longer) while experimentally elicited awe across Study 3 and 4 was state-like, which was specific to contexts subjects recalled and wrote, such as scenarios of medical workers fighting against the COVID-19. Empathy is defined by some researchers as an ability to understand the behavior of others, to experience their feelings, and to express that understanding to them (Lam et al., 2011). According to hedonic adaptation theory, frequent exposure to an environment that enhances a particular emotion is conducive to the accumulation of that emotion (Armenta et al., 2014), which would have accumulated psychological effects brought by such emotion to lead to attitudinal and behavioral changes (Erickson et al., 2018). As an intellectual, higher-order or even effortful attribute (Halpern, 2003), empathy may require training (Srivastava & Das, 2016). That is, a long-term awe intervention would increase empathy. There is evidence that elevated daily experience of awe is coupled by increased levels of affective empathic drive (Van Mulukom et al.,

2020). On the contrary, it is not easy for state awe to enhance empathy instantly, which leads to the insignificant mediating effect of empathy in study 3 and 4. Therefore, individuals who frequently experience the emotion of awe during the pandemic may be more empathic, but this is not the case for state, situational awe.

The sense of connectedness alone mediates the effect of awe on prosociality in Study 3–4. Feelings as Information Theory (Schwarz, 2012) suggests that individuals usually take their own feelings as a source of information, and different emotions can provide different information. Feelings as the source of information would affect judgments and decisions. The sense of connectedness is the main feeling brought by awe (Bonner & Friedman, 2011). Studies have shown that the awe triggers intense feeling of connectedness (Stellar et al., 2017; Yaden et al., 2016). Both connectedness with society or nature can promote one's prosociality in many forms (Cwir et al., 2011; Meyer et al., 2013; Rosa et al., 2018; Pear M. Wilson, 2014). Moreover, we also found that connectedness was more important for the out-group than in-group, because awe not only connected individuals to the world, but also produced an overview effect by broadening one's own boundaries (Yaden et al., 2016). Previous work also indicated that connectedness to out-group could increase interest in out-group's culture and decrease implicit bias (Brannon & Walton, 2013). Therefore, the sense of connectedness is more likely to mediate the association between awe and prosociality to out-group.

The present study has potential practical implications. Schneider (2009) believes that awe plays an important role in the healthy development of individual and society. Study found that emphasizing self-interest, e. g. personal freedom, would make collective action harder, which was detrimental to the pandemic prevention or crisis management (Chen et al., 2021). The results of our study suggest that raising the feeling of awe for life, nature, and others has the effect of promoting the sense of being connected and empathic in the face of crisis, which motivates people to cooperate and join the fight against the crisis more voluntarily; Moreover, awe elicited by fighting against the pandemic makes individuals transcend their own identity boundaries, which encourages helping behavior to other races in disaster (not just their own).

Several limitations require further attention. First, the results of the present study were only limited to positive awe. The valence of awe can be positive or negative (Gordon et al., 2017; Piff et al., 2015). However, we only elicited positive awe in the present study. It is unknown whether the results could be generalized to the negative or threatening awe, which needs further study. Also, considering that the elicitors of awe were various (Keltner & Haidt, 2003), whether physical or cognitive awe can promote prosociality through connectedness and empathy should be clarified in the future. Third, the experience of awe was just induced by recalling task in the present work, which may lead to demand characteristic because the instruction includes words related to the measure of interest, such as awe (Liang et al., 2015). Therefore, multiple inducing methods, e.g., listening song or watching videos or pictures, should be used for awe induction to confirm the convergence validity of the results. Meanwhile, though awe can be typically assessed with single item using a Likert-type scale (Hendricks, 2018) and we have measured it not only after but also before the recalling task to ensure the success of emotion manipulation, standardized scale should be developed to test the level of state awe. In addition, many participants in the current study recalled the selfless dedication of medical staff during awe elicitation. Though Schneider (2017) posits that the experience of being emotionally touched is an important way to awe induction, this may elicit other experiences, such as elevation. Stellar et al. (2017) holds that awe is an self-transcendent emotion that may include the experience of elevation. Nonetheless, it is also necessary for future studies to design a comparison condition of elevation, in order to isolate the unique effect of awe on prosociality. Fourth, the sense of connectedness and empathy are not sole mediators between awe and prosociality, as the direct effect of awe on prosociality is still significant (Study 3). Hence, there may be other interpretation pathways requiring future studies to ascertain. Moreover, currently little is known about the neurophysiological mechanism subserving this effect. Identifying these mechanisms would help to construct a full-pictured theoretical model explaining the links between awe and prosociality. Lastly, intervention studies targeting at the enhancement of trait-awe and its effects on mental health are still lacking. Currently, only one study used intervention approach and observed that old men who took awe-walk reported greater awe experience, less daily distress, and more prosocial emotions over time (Sturm et al., 2020). It is unclear whether other intervention methods, such as mindfulness training (Waller et al., 2021) or daily diary writing, may produce similar effects, especially to those with low levels of awe experience. Waller et al. (2021) found that participants who experienced a 360°video-guided meditation, primarily involving a mindful breathing exercise, increased the feeling of awe. Emmons and McCullough (2003) found that writing task was a valid method to enhance other positive emotion (e.g., gratitude). Therefore, whether

mindfulness training or daily diary writing can effectively elevate awe in the long term needs exploration, which is essential to mental health education and psychological therapy practices.

Conclusion

This present investigation reveals the role of awe in promoting prosociality and its psychological mechanism during COVID-19 pandemic. The feeling of awe enhances one's sense of connectedness with society and the world, which, on the one hand, promotes a line of prosociality including material donation, monetary donation, cooperation and blood donation. On the other hand, awe-inspired feeling of connectedness also promotes one's empathic concerns for other people, which in turn promotes prosociality in multiple levels, whether they belong to one's own or foreign countries. These results suggest that the feeling of awe can increase prosociality via enhancing the sense of connectedness and empathic concerns for others, particularly in pandemics requiring global cooperation (Bavel et al., 2020).

Note

1 The four studies reported in this article have been approved by the internal ethics committee of XXX in XXX University (Protocol number:H20081, The neural mechanism of the influence of awe on prosocial behavior). Before the participants took part in the study, they were informed that the study was voluntary and they were free to withdraw at any time. They were also promised confidentiality of the data.

All data and analysis code have been made publicly available via The Open Science Framework repository, named data and script about awe and prosocial behavior, and can be accessed at https://osf.io/rfyt5/.

Acknowledgments

We are grateful to Chen, Shengdong, Yang Ying, Mao Jixuan, Gao Wei and Chen Yongqiang for their valuable comments in programming the experiments and for proofreading the manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the National Natural Science Foundation of China (grant number NSFC31971018, 31671164; JiaJin Yuan) and Humanity and Social Science Youth Foundation of Ministry of Education (grant number 17XJC190004; Li Luo).

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Data availability statement

The data described in this article are openly available in the Open Science Framework at https://osf.io/rfyt5/.

Open Scholarship

This article has earned the Center for Open Science badges for Open Data and Open Materials through Open Practices Disclosure. The data and materials are openly accessible at https://osf.io/rfyt5/.

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