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Title: Mediating Function of Awe from Collective Threat to Self-transcendental Values and
Eudaimonia

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Abstract

How do people react to collective threats such as natural disasters or the COVID-19 pandemic? One consequence of such catastrophic events is the emotional impact on those who feel threat without actual harm as well as those who experienced direct harm. The current study demonstrated that such threat enhances self-transcendent values that further leads to general well-being, mediated by the emotion of awe. Two surveys were conducted immediately after a severe typhoon hit Japan (Study 1) and during the early phases of the COVID-19 spread in Japan (Study 2). Predisposition to feel negative awe predicted participants' attention to both collective threat events, which led to an affirmation of self-transcendent values and general well-being. Furthermore, when participants were asked to recall a collective threat (vs. control event), they felt more awe which led to more engaged meaning making during the event, in turn predicting their affirmation of self-transcendent values.

Keywords: collective threat, self-transcendence, awe, eudaimonia, well-being

Declarations

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Conflicts of interest/Competing interests

The authors declare no conflicts of interest/competing interests

Ethics approval

The protocol of the study was approved by a local ethics committee at Kyoto University.

Consent to participate

All participants gave informed consent to participate in the study.

Consent for publication

All participants gave informed consent to publish the data including public access to raw data.

Preregistration

No reported study has been preregistered.

Availability of data and material

Threat to Eudaimonia

Raw data are available at <https://osf.io/38g2s/>. Material is available at <https://osf.io/29uqn/>. See the readMe.txt file in <https://osf.io/dwrtk/> for the overview of the available material, data, and analysis code.

Code availability

Analysis code is available at <https://osf.io/dwrtk/>

Authors' contributions

MN and YU conceived the original idea. MN and YU created the materials. MN collected and analyzed the data. MN and YU wrote the manuscript. All authors approved the final version of the draft.

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Introduction

Psychological consequences of collective threat have been targets of scientific investigation (Bonanno et al., 2010; Cohn et al., 2004; Garcia & Rimé, 2019; Gelfand et al., 2011; Mancini et al., 2016; Mercer et al., 2012; Miura et al., 2015; Smith et al., 2018). On the one hand, catastrophic events usually have a negative impact such as post-traumatic experiences through the emotion of horror (Taylor & Uchida, 2019). On the other hand, other evidence suggested a seemingly paradoxical consequence, that is, feeling the threat of disaster (but not directly victimized/afflicted by the disaster) *increased* eudemonic happiness instead, where collective threat not only evoked hedonically negative emotions, but increased eudaimonia through reevaluation of meaning in life (Uchida et al., 2014; see also Mancini et al., 2016; Triplett et al., 2012). However, the process of how collective threat leads to eudaimonic well-being is still unclear. In addition, since severe collective threat is relatively rare, empirical tests for the effect of collective threat is lacking. The current study empirically demonstrated that threat enhances self-transcendent eudaimonic well-being, in response to both a natural disaster and the virus pandemic, as previous literature would suggest. We further clarified the role of the emotion of awe (Keltner & Haidt, 2003) and illustrated the bridge between threat and eudaimonic happiness.

Collective Threat, Self-Transcendence, and Eudaimonic Well-being

How does well-being change after experiencing collective threat? Uchida et al. (2014) conducted a survey before and after the Great Eastern Japan earthquake in 2011, which caused a tsunami and accident at a nuclear power plant. The survey was conducted on those who did not experience direct harm nor harm to relatives, friends and acquaintances. Compared to pre-earthquake ratings, those who were thinking about the earthquake reported higher levels of temporal negative emotion (see also Hamamura & Chan, 2020; Miura et al., 2015) but also higher levels of general well-being than those who were not thinking about the earthquake. While this result may seem counterintuitive at first glance, it is possible that after feeling threatened, people become aware of the value of the things that surround them, which enhances their general well-being. Based on bottom-up observations, Uchida et al., (2014) identified a set of self-transcendent values that was (re-)affirmed after the earthquake. The values were clustered around social and prosocial themes from intimate relations to societal values, such as connection to family, friends and local community, becoming aware of transcendent values in the society, and compassion towards vulnerable people (especially victims). Affirmation of these other-oriented (i.e., self-transcendent) values was accompanied with humble and self-diminishing re-evaluations of what they already have, together with acceptance of the difficulties they face (for the sake of victims). Therefore, this set of self-transcendent values seem to relate to and increase aspects of eudaimonic well-being.

Other line of evidence suggested that social relatedness is an important source of eudaimonic well-being (Hitokoto & Uchida, 2014; Ryan et al., 2008; Ryff & Singer, 2008). Affirmation of values itself could work as a buffer against the threat (Heine et al., 2006) or could increase eudaimonic and hedonic well-being (Nelson et al., 2014). When prosocial behavior was triggered by the affirmation of self-transcendent values (Li et al., 2013; Oishi et al., 2017;

Uchida et al., 2014), well-being would increase (Hui, 2022; Lyubomirsky & Layous, 2013).

Thus, combining empirical observations of responses to collective threat and theoretical considerations from well-being literature, we draw a path from collective threat to self-transcendence and eudaimonia.

Awe and Collective Threat

Independent from the above line of research, we explore the emotion of “awe” as a potential mediator that strengthens the path from threat to eudaimonia. Awe is characterized by the appraisals of vastness and need for accommodation (Keltner & Haidt, 2003). Past research suggested that elicitors of awe can come from a wide domain, including beautiful nature scenes which are vast and magnificent, or powerful leaders (i.e., evoking social vastness) who inspire with their charisma. These elicitors necessitate accommodating the external stimuli into one’s worldview, such as the beauty of nature beyond one’s expectation and the charisma of a leader which inspires novel perspectives. The need for accommodation evoked by awe induces a meaning making process, where people alter their worldview and value system to reduce the discrepancy between their pre-existing worldview and the ongoing event (Heine et al., 2006; Hirschberger, 2018; Park, 2010). Although previous research typically studied positive elicitors such as the beauty of nature (e.g., Rudd et al., 2012; Shiota et al., 2006, 2007; Stellar et al., 2017, 2018), the valence of the experience is theoretically assumed to vary (Keltner & Haidt, 2003) between positive and negative (Gordon et al., 2017; Guan, Chen, et al., 2019; Guan, Zhao, et al., 2019; Muto, 2016; Nakayama et al., 2020; Piff et al., 2015; Rivera et al., 2020; Sawada & Nomura, 2020; Takano & Nomura, 2020).

The collective threat of natural disasters and the Covid19 pandemic are some of the most likely targets of such negative variants of awe (i.e., threatening awe), as people perceive vastness (power of nature) when witnessing the large-scale impact of the disaster/pandemic. Individuals have trait-like tendency to feel negative as well as positive awe (Nakayama et al., 2020) which explains the individual difference in perceptions of collective threat. Thus, individuals who tend to feel negative awe would think more about (i.e., pay more attention to) the collective threat.

Once attended, such an event would also spur on changes in people's worldview, to cope with daily life which would be affected by the threatening event. This would further evoke a meaning making process to understand “why” such a threat occurred and “how” to adjust to such changes, during which people adapt their worldviews alongside these changes. Such a meaning making process changes not only the epistemological worldview (Gottlieb et al., 2018; McPhetres, 2019; Valdesolo et al., 2016, 2017; Valdesolo & Graham, 2014), but also one's core values (e.g., Saroglou et al., 2008). Self-transcendent values are likely to be affirmed by awe (Stellar et al., 2017), which could explain why collective *threat* can increase eudaimonic *well-being*.

Awe and Self-transcendent Values

Empirical research has shown that positive variants of awe are associated with self-diminishment, which is an antecedent of humility (or acceptance of own limitations) and facilitates prosocial behavior because the self is perceived to be small vis-à-vis the vastness of the awe elicitor (Bai et al., 2017; Guan, Chen, et al., 2019; Piff et al., 2015; Prade & Saroglou, 2016; Stellar et al., 2018). Positive awe was also shown to help people psychologically cope with lost possessions (Koh et al., 2019). Furthermore, related to our current investigation, negative

variants of awe also evoke self-diminishment and prosocial behaviors (Guan, Chen, et al., 2019; Piff et al., 2015).

Awe and Well-being

It is no wonder why positive variants of awe are associated with well-being (Gordon et al., 2017; Rivera et al., 2020; Rudd et al., 2012), but it seems controversial whether negative variants of awe are associated with well-being. Indeed, previous studies suggested that negative variants of awe were not associated with well-being in general (Gordon et al., 2017; Nakayama et al., 2020; Rivera et al., 2020). However, while negative variants of awe might not enhance temporal feelings of pleasantness (i.e., hedonic well-being), it could enhance commitment to self-transcendent values and eventually eudaimonic well-being as well, rather than hedonic well-being as discussed above (Uchida et al., 2014).

The Current Study

The current study tested the mediating role of awe from collective threat to eudaimonia. We tested our predictions by asking about experiences of two different types of collective threat, natural disaster (typhoon) and COVID-19 pandemic, respectively in Studies 1 and 2. We combined correlational individual difference analysis and experimental emotion induction analysis within one survey. The following specific hypotheses were tested (Figures 1 and 2).

Hypothesis 1: If events with collective threat are awe eliciting, then those who tend to feel negative awe (Muto, 2016; Nakayama et al., 2020) would think more about (i.e., pay more attention to) the collective threat which would lead to an affirmation of self-transcendent values. As such, the positive indirect effect of dispositional negative awe on general well-being would

be mediated by thinking about collective threat and self-transcendent values (Figure 1; bold lines).

Hypothesis 2: If the positive indirect effect via self-transcendent values is separated out, the direct effect of dispositional negative awe on general well-being would be negative (Figure 1; grey lines), since threat-based awe typically has shown no or negative effect on happiness (Gordon et al., 2017; Nakayama et al., 2020; Rivera et al., 2020).

Although a correlational approach is suitable for examining individual differences, it does not provide evidence for causality. To overcome this limitation, we asked participants to recall the collective threat event (or control event) to induce the target emotion. We measured the extent of feeling awe, successful meaning making during the recalled event, and self-transcendent values after emotion manipulation. We tested the following Hypothesis 3 (Figure 2; regular black line) by emotion induction. If the events with collective threat are awe-eliciting, those who recalled the event would feel more awe than those who recalled control events. The intensity of awe would positively predict successful meaning making; successful meaning making would positively predict self-transcendent values. Combining the above paths, we predicted that the positive indirect effect of condition (collective threat vs. control) on self-transcendent values would be mediated by awe and successful meaning making.

Figure 1 Conceptual model for individual difference

Hypotheses are displayed as H1 and H2 with the predicted directionality of the association.

The bold line indicates H1, the grey line indicates H2. As the model only illustrates the main hypotheses, the absence of prediction paths does not necessitate a predicted lack of association.

Figure 2 Conceptual model for experimental induction of awe.

Hypotheses (H2 and H3) are displayed with the predicted directionality of the association.

Grey line indicates H2 and black line indicates H3. As the model only demonstrates the main

hypotheses, the absence of prediction paths does not necessitate a predicted lack of association.

Study 1

Study 1 examined a severe typhoon in Japan as an elicitor of collective threat.

Method

Reiwa 1 East Japan Typhoon (Collective Threat Condition)

Reiwa 1 East Japan Typhoon, also known as typhoon Higibis, was a severe typhoon that hit the Eastern part (Tokai, Koushin, and Kanto area, mostly within 250km from central Tokyo) of Japan from October 6 to October 13, 2019 (Japan Meteorological Agency, 2019). The Japanese government designated it as a Disaster of Extreme Severity (激甚災害; Seirei Dai 142 Gou, 2019) and as a Specific Extraordinary Disaster (特定非常災害; Seirei Dai 129 Gou, 2019).

Immediately after the typhoon subsided into an extratropical cyclone at noon October 13 (Japan Meteorological Agency, 2019), the survey was conducted online. All responses were collected by the end of October 14. Those who participated in Study 1 are assumed to have received no severe consequence from the typhoon because they could respond to the survey immediately after the typhoon. For more contextual information, see Supplementary Material “Reiwa 1 East Japan Typhoon (Study 1, Collective Threat Condition)”.

Workplace Bullying among Elementary School Teachers (Control Condition)

To control for the attention to a negative event in general, we included the news of workplace bullying among elementary school teachers. Around the survey period, it turned out that teachers in an elementary school in Hyogo prefecture bullied another teacher (e.g., pouring hot curry into

the victim's eyes). This news was widely covered by media in October 2019 and onwards. We assumed that the event elicited negative emotions such as anger, disgust, and horror among many Japanese especially because it happened among elementary school teachers. For more contextual information, see Supplementary Material "Workplace bullying among Elementary School Teachers (Study 1, Control Condition)".

Participants

We recruited 425 Japanese participants via a Japanese crowdsourcing site Lancers (<https://www.lancers.jp>). They were paid 250 JPY for completing the survey. Among them, 13 participants accessed the survey page but did not complete the survey and were not included in the analysis. There were 224 participants who identified themselves as male, 186 as female, and 2 as neither. Mean ($\pm$ SD) age was 41 ($\pm$ 9.9). There were nine students, 185 full-time workers, 37 part-time workers, 68 housewives/househusbands, 41 unemployed, and 72 outside those categories. There were 227 unmarried, 164 married, 30 divorced/widowed, and one with undefined marital status. All prefectures but Akita and Shimane had at least one participant (see Supplementary Codes for more detailed information). Participants were randomly assigned to either collective threat ($n = 210$, i.e., “typhoon”) or control ($n = 201$, i.e., “bullying”) conditions.

For sample size, in this and the next study, we aimed to collect 400 participants (200 for each condition). The targeted sample size had .80 power to detect correlations with $r > .14$ and to detect between-condition difference with $d > .28$. Recruitment was terminated after 400 participants completed the survey.

Procedure

Once participants accessed the survey page, they had to provide informed consent to proceed. They rated individual difference measures, including dispositional positive awe (Shiota et al., 2006) and dispositional negative awe (Muto, 2016, modified by Nakayama et al., 2020). Then, they were asked about their frequency of thinking about recent public events (i.e., typhoon, bullying, and rugby world cup). After responding to the frequency questions, they were randomly assigned to either the collective threat or control condition. In each condition, participants were asked to recall and write about the target event (i.e., typhoon in the collective

threat condition or bullying among elementary school teachers in the control condition). They were also asked to retrospectively rate their emotions and meaning making during the event. After the emotion induction, they rated self-transcendent values together with other items from Uchida et al. (2014) and general well-being (Inglehart, 1997) as measures for their current state. Following this procedure, to buffer against the induced (potentially) negative emotion, they were presented with an image of a (cute) puppy in a cup, which received the most positive rating in a normative stimulus set by Kurdi et al. (2017). To boost the positive emotion, they were also asked to write about the image. The survey ended after participants completed demographic questions.

In typical research practice, experimental studies are performed separately from correlational studies to avoid potential confounds. However, the current study targeted relatively rare ecological events (i.e., a severe typhoon in Study 1 and COVID-19 in Study 2). The sample size would be reduced if we separated the studies for each methodology. Hence, we measured individual differences and tested the effect of experimental manipulation simultaneously. We minimized potential confounding factors between individual differences and experimental manipulation, by (1) measuring individual differences that could be the antecedents of our current hypotheses (i.e., dispositional awe scales and frequency of thinking about recent public events) before the experimental manipulation, (2) randomly assigning participants to either experimental condition so that the individual difference is orthogonal to experimental manipulation, and (3) including individual differences as control variables when we analyze the effect of experimental manipulation.

Materials

Dispositional Awe Scales. For the dispositional negative awe scale, we used a modified version of the awe subscale in Trait Respect-Related Emotion Scale (Muto, 2016, modified by Nakayama et al., 2020; $\alpha = .77$ and $.75$, respectively for Studies 1 and 2). The scale measures individual tendency to feel negatively appraised awe (e.g., “I often feel that people and the nature around me have large presences that make me realize my own limitations.” and “I often feel that things like myself are tiny compared to the vastness of space and nature.”, see Nakayama et al. 2020 for more detailed discussion). We also measured dispositional positive awe (see Supplementary Materials “Hypothesis regarding dispositional positive awe”, for hypotheses regarding this measure). We used the awe subscale in Dispositional Positive Emotion Scale (Shiota et al., 2006; Japanese version; $\alpha = .74$ and $.72$, respectively for Studies 1 and 2). The scale measures individual tendency to feel positively appraised awe (e.g., “I have many opportunities to see the beauty of nature.” and “I seek out experiences that challenge my understanding.”). A seven-point Likert scale (from 1. Strongly disagree to 7. Strongly agree) was used. The dispositional positive awe scale was used as a control variable in the main analyses reported below.

Frequency of Thinking about Recent Public Events. All participants were asked how often they had been thinking about each of the three public events using five-point scales (1. Not thinking at all to 5. Always thinking). Typhoon was included as a target event to measure the attention to collective threat. To control for the attention to negative and positive events in general, we included bullying among elementary school teachers (negative event) and the Rugby World Cup 2019, which was held in Japan around the survey period (positive event).

Emotion Induction. To induce awe or control for negative emotions, participants were asked to remember and write about either of the target events. The target events were Reiwa 1 East Japan Typhoon, which was called 台風 19 号 (19th typhoon) by the general public at that time, and bullying among elementary school teachers, respectively for collective threat and control conditions. If participants were assigned to the collective threat condition but they had responded to the frequency question with “Not thinking (about the typhoon) at all”, then they were asked to remember and write about an episode when they felt the threat of nature. If participants were assigned to the control condition but they had responded to the frequency question with “Not thinking (about the bullying) at all”, then they were asked to remember and write about an episode when they felt anger, disgust, and/or horror towards a public event.

Emotion Rating. After writing about the event, participants were asked to rate the emotions and appraisals they experienced during the event. A seven-point Likert scale (from 1. Strongly disagree to 7. Strongly agree) was used.

Awe-Related Items. Awe-related items included Japanese words “畏怖/*ifu*”, “畏敬/*ikei*”, and “畏（かしこ）まる気持ち/*kashikomarukimochi*” ($\alpha = .81$ and $.85$, respectively for Studies 1 and 2). Nakayama and Uchida (2020) analyzed a Japanese corpus and demonstrated that these Japanese words/phrases collectively have comparable meanings to the one theorized by Keltner and Haidt (2003) (i.e., the emotion toward vast targets that requires accommodation of worldview) with a negative connotation.

Awe-Related Negative Emotions. The items were “fearful”, “nervous”, and “anxious” ($\alpha = .83$ and $.88$, respectively for Studies 1 and 2), because these emotions are based on negative appraisals of upcoming and uncertain events.

High-Arousal Negative (HAN) Emotions. The items were “angry”, “disgusting”, and “horror” ($\alpha = .87$ and $.83$, respectively for Studies 1 and 2), which were expected to be higher in the control condition.

Low-Arousal Negative (LAN) Emotions. The items were “sad”, “depressed”, and “hopeless” ($\alpha = .75$ and $.80$, respectively for Studies 1 and 2).

High-Arousal Positive (HAP) Emotions. The items were “elated”, “excited”, and “euphonic” ($\alpha = .72$ and $.79$, respectively for Studies 1 and 2).

Low-Arousal Positive (LAP) Emotions. The items were “calm”, “peaceful”, and “relaxed” ($\alpha = .75$ and $.82$, respectively for Studies 1 and 2).

Meaning Making. The items included “I sensed that this experience was going to be meaningful to me”, “I sensed that my view of myself may be changing”, “I sensed that my view of the world may be changing”, “I came to realize something”, and “I was inspired to do something” ($\alpha = .84$ and $.85$, respectively for Studies 1 and 2). Nakayama et al. (2020, Study 1) asked Japanese participants to recall awe or control experiences and to rate a large pool of awe-related appraisal items. Principle component analysis extracted the meaning making-related component as the primary component. For the current study, the five items were selected if they had high loadings on the principal component and if they thematically related to meaning making. Some wordings were slightly modified to measure an ongoing event rather than retrospective appraisals of a remote event.

Self-transcendent values. Five self-transcendent values items were adopted from Uchida et al. (2014) with slight modifications ($\alpha = .75$ and $.68$, respectively for Studies 1 and 2). The items were “My ordinary everyday life is important to me and makes me feel happy”, “I want to treasure my connections with my local community”, “In order to make society better, I need to

come together with everyone and act”, “I want to treasure my connections with family and friends”, and “If I consider people who are facing greater difficulties than I am, I accept the inevitability of needing to endure some degree of difficulty myself”. For completeness, two items (e.g., “I place more value on gaining fulfillment in my job or school”) were adapted from Uchida et al. (2014) to measure valuation of individual effort ($r = .55$ and $.56$, respectively for Studies 1 and 2) that might be another source of meaning, three additional items were also adapted but will not be reported because they showed low consistency. A seven-point Likert scale (from 1. Strongly disagree to 7. Strongly agree) was used.

General well-being. General well-being was measured with one question: “To what extent are you happy?” (0 = very unhappy, 10 = very happy; Inglehart, 1997).

Analysis strategy

Since the current study targeted ecological events, pre-registration was impractical as the survey was time-sensitive and it was virtually impossible to pre-register the analysis plan with sufficient details and plausible justifications for the predictions. We took an alternative approach to reduce the researcher’s degrees of freedom regarding analyzing the data, by performing a multiverse analysis (Steegen et al., 2016). In a multiverse analysis, researchers perform a set of, rather than one pre-registered, analyses (e.g., with different exclusion criterion and with different choices of control variables) covering a reasonably wide range of plausible (i.e., multiverse of) analyses. When reporting the multiverse analysis, there is little opportunity for the researchers to cherry pick the results. In addition, there are different but equally justifiable choices in data analysis each of which may have different reasons for justifications (Silberzahn et al., 2018). Registering and performing arbitrary one of them would not reveal the accurate and entire

picture of the pattern of the results (Oberauer & Lewandowsky, 2019). Therefore, a multiverse analysis is as good as or even better than pre-registration. Since the rigor (i.e., reporting all analyses) is likely to trade-off with informativeness (i.e., most analyses might show the similar pattern of the results), we report the simplest and most straightforward analysis as a main analysis. Nonetheless, we checked whether the results were robust to specific choices of the analysis and preprocessing. Any deviating patterns from the main result are reported and discussed in Supplementary Materials “robustness of the results”. The full detail of analysis with associated data and codes are available at <https://osf.io/dwrtk/>.

Results

Individual difference measures

Correlation among measures. Simple correlations among the individual difference measures are displayed in Table 1.

Table 1 Correlation coefficients of individual difference measures in Study1

	1	2	3	4	5	6	7	8
1 Dispositional negative awe	-	.35***	.16***	.14**	-.01	.21***	.13**	-.10
2 Dispositional positive awe	n = 412	-	.17***	.18***	.04	.25***	.29***	.14**
3 Thinking about typhoon	n = 412	n = 412	-	.29***	.24***	.31***	.24***	.12*
4 Thinking about bullying	n = 412	n = 412	n = 412	-	.21***	.29***	.27***	.19***
5 Thinking about rugby	n = 412	n = 412	n = 412	n = 412	-	.23***	.15**	.17***
6 Self-transcendent values	n = 410	n = 410	n = 410	n = 410	n = 410	-	.52***	.41***
7 Valuation of individual effort	n = 411	n = 411	n = 411	n = 411	n = 411	n = 409	-	.28***
8 General well-being	n = 412	n = 412	n = 412	n = 412	n = 412	n = 410	n = 411	-

*: $p < .05$ **: $p < .01$ ***: $p < .001$

Mediation Analysis. The conceptual model in Figure 1 was implemented into a structure equation model using the lavaan package in R (Rosseel, 2012) to test Hypotheses 1 and 2. Figure 3 displays the model and estimated path coefficients. Figure 3 also displays the estimated indirect effect and their confidence intervals using the adjusted bootstrap percentile (BCa) method. For full detail of the estimated model, see Table S-1.

To control for non-specific attention to public events, the frequency of thinking about bullying and the rugby world cup were included as covariates, which are omitted in Figure 3 and Table S-1.

Hypothesis 1 was supported by the significant positive indirect effect of dispositional negative awe on self-transcendent values via thinking about typhoon ($0.031, p = 0.032, 95\% \text{ CI } [0.003, 0.060]$; Figure 3).

Hypothesis 2 was supported by the positive indirect effect of dispositional negative awe on general well-being via self-transcendent values ($0.059, p = 0.009, 95\% \text{ CI } [0.015, 0.104]$; Figure 3) in contrast to the negative direct effect ($-0.228, p = 1.29\text{E-}06, 95\% \text{ CI } [-0.320, -0.136]$; Figure 3).

Indirect Effect for Hypothesis 1

Dispositional Negative Awe → Thinking about Typhoon → Self-Transcendent Values
= 0.031, $p = 0.032$, 95% CI [0.003, 0.060]

Indirect Effect for Hypothesis 2

Dispositional Negative Awe → Self-Transcendent Values → General Well-being
= 0.059, $p = 0.009$, 95% CI [0.015, 0.104]

Direct Effect for Hypothesis 2

Dispositional Negative Awe → General Well-being
= -0.228, $p = 1.29\text{E-}06$, 95% CI [-0.320, -0.136]

Threat to Eudaimonia

Figure 3 Mediation analysis of individual difference in Study 1

Effects of dispositional awe are omitted from the display. Only significant paths are displayed. For full detail of the results, see Table S-1 and Supplementary Codes “1.3.2 SEM for individual difference”

Emotion Induction

Emotions in Each Condition. Mean, SD and Cronbach's alpha for each type of emotion are displayed in Table 3. Awe and awe-related negative emotions were higher in the collective threat condition. Positive emotions were also higher in the collective threat condition, suggesting that awe is a mixed emotion. In contrast, other types of negative emotion were higher in the control condition. The difference between the conditions cannot be attributed to mere differences in valence. There was no difference in meaning making.

Mediation Analysis. The conceptual model in Figure 2 was implemented into a structure equation model using the lavaan package in R (Rosseel, 2012) to test Hypothesis 3. Figure 4 displays the model and estimated path coefficients. Table S-2 displays the estimated direct and indirect effects and their confidence intervals using the adjusted bootstrap percentile (BCa) method. To examine the experimental manipulation effect that is above and beyond awe-related individual differences, the frequency of thinking about the typhoon, bullying and rugby world cup, and the two types of dispositional awe scales were included as covariates, which are omitted in Figure 4 and Table S-2.

Hypothesis 3 was supported by significant positive indirect effect of recollecting typhoon (vs. bullying) → awe in the experience → meaning making → self-transcendent values (0.035, $p = 2.67E-04$, 95% CI [0.016, 0.053]; Figure 4).

Table 2 Emotions during the remembered events in Study 1 and Study 2

Emotion	Typhoon/Awe		Bullying/Control		Awe minus Control			Mean	COVID-19/Awe		Affair/Control		Mean	Awe minus Control	
	Mean	SD	Mean	SD	t-value	p-value	Cohen's <i>d</i>		SD	Mean	SD	t-value	p-value	Mean	p-value
Awe	3.71	1.33	2.77	1.17	7.60	p = 2.14E-13	0.75	3.26	1.24	2.38	1.16	7.24	p = 2.46E-12		
Awe-related negative	5.31	1.12	4.44	1.24	7.42	p = 7.15E-13	0.73	4.77	1.21	3.19	1.53	11.58	p = 6.67E-27		
High-arousal negative	3.57	1.26	5.76	0.92	-20.14	p = 5.23E-62	-1.98	4.38	1.21	4.48	1.59	-0.68	p = 4.95E-01		
Low-arousal negative	4.16	1.25	5.09	0.98	-8.42	p = 6.90E-16	-0.83	4.11	1.16	3.78	1.56	2.39	p = 1.73E-02		
High-arousal positive	2.76	1.15	2.47	0.95	2.80	p = 5.37E-03	0.28	2.40	1.00	2.47	1.19	-0.66	p = 5.10E-01		
Low-arousal positive	2.70	0.98	2.31	0.95	4.12	p = 4.55E-05	0.41	3.08	1.18	2.88	1.23	1.63	p = 1.04E-01		
Meaning making	3.39	1.16	3.43	1.09	-0.34	p = 7.37E-01	-0.03	3.46	1.00	2.86	1.18	5.57	p = 4.77E-08		

(Continued)

Emotion	Study 2 COVID-19 minus Study 1 Control		
	t- value	p-value	Cohen's <i>d</i>
Awe	3.98	p = 8.28E-05	0.41
Awe-related negative	2.67	p = 7.96E-03	0.27
High-arousal negative	-12.56	p = 4.44E-30	-1.29
Low-arousal negative	-9.00	p = 1.30E-17	-0.92
High-arousal positive	-0.70	p = 4.84E-01	-0.07
Low-arousal positive	7.01	p = 1.22E-11	0.72
Meaning making	0.31	p = 7.60E-01	0.03

Indirect Effect for Hypothesis 3

Recollection of Typhoon (vs. Bullying) → Awe → Meaning Making → Self-Transcendent Values
= 0.035, $p = 2.67\text{E-}04$, 95% CI [0.016, 0.053]

Figure 4 Mediation analysis of experimental manipulation in Study 1

A Path to Eudaimonia

Only significant paths are displayed. For full details of the results, see Table S-2 and Supplementary Code “1.4.2 SEM for emotion manipulation effects”

Study 2

Method

Study 2 utilized similar methods as Study 1. Only the deviating parts are described below.

COVID-19 (Collective Threat Condition)

Study 2 was conducted on February 9, 2019, during the early stage of COVID-19 spread in Japan. At that time, the latest press release on February 7, by the Ministry of Health, Labor and Welfare indicated that there were 25 positive cases in Japan including 21 cases from those who have stayed in the Hubei Province in China. No mortality was reported. The release also indicated that there were 31,161 positive cases in China, of which 636 of those afflicted were dead (Ministry of Health Labor and Welfare, 2019). We assumed that (perceived) harm was minimal but threat was salient for Japanese participants. For more contextual information, see Supplementary Material “COVID-19 (Study 2, Collective Threat Condition)”.

Affair by Celebrities (Control Condition)

To control for the attention to negative events in general, we also surveyed about affairs by celebrities (among famous couples). Around the survey period, affairs by celebrities were covered by media and we assumed that the event elicited negative emotions such as (moral) anger and disgust (by violating the Japanese normative expectation of being the best romantic partner) among many Japanese people. For more contextual information, see Supplementary Material “Affair by Celebrities (Study 2, Control Condition)”.

Participants

We recruited 406 Japanese participants via a Japanese crowdsourcing site Lancers (<https://www.lancers.jp>). They were paid 250 JPY. Sixteen participants accessed the survey page but did not complete the survey and were not included in the analysis. One participant was also excluded from the analysis because he or she failed to follow instructions.

There were 229 participants who identified themselves as male, 172 as female, and 3 as neither. Mean ($\pm$ SD) age was 41 ($\pm$ 10). There were five students, 193 full-time workers, 44 part-time workers, 56 housewives/househusbands, 37 unemployed, and 71 outside those categories. There were 216 unmarried, 168 married, 17 divorced/widowed, and five undisclosed. All prefectures but Shiga and Saga had at least one participant (see Supplementary Codes “2.2 Demographics”). Participants were randomly assigned to either collective threat ($n = 189$) or control condition ($n = 219$).

Procedure

In addition to the set of measures in Study 1, participants were asked to respond to the Japanese version of Perceived Vulnerability to Disease scale (Fukukawa et al., 2014) and political attitudes before emotion induction. They were also asked to respond to norm-violation-related items modified from Mu et al. (2015), three self-construal items from Singelis et al. (1995), after the emotion induction. These items were included to explore more specific effects of COVID-19 and were not included in the reported analyses below.

The image of a (cute) puppy in a cup was not included in Study 2 because the survey was longer than Study 1.

Frequency of Thinking about Recent Public Events

Participants were asked how often they had been thinking about each public event using a five-point scale (1. Not thinking at all to 5 Always thinking). COVID-19 was included as a target event to measure attention to collective threat. We included affairs by celebrities, to control for attention to negative events in general.

Emotion Induction

To induce awe or negative emotions (control), participants were asked to recall and write about one of the target events, COVID-19 (collective threat condition) or affairs by celebrities (control condition). If participants were assigned to the collective threat condition but responded to the frequency question with “Not thinking (about COVID-19) at all”, then they were asked to recall and write about an episode when they felt the threat of an infectious disease or epidemic. If participants were assigned to the control condition but they had responded to the frequency question with “Not thinking (about affairs) at all”, then they were asked to recall and write about an episode when they felt anger, disgust, and/or horror toward a public event.

Results

Individual Difference Measures

Correlation among Measures. Simple correlations among the individual difference measures are displayed in Table 3.

Table 3 Correlation coefficients of individual difference measures in Study 2

	1	2	3	4	5	6	7
1 Dispositional negative awe	-	0.36***	0.15**	0.02	0.17***	0.13**	-0.02
2 Dispositional positive awe	n = 406	-	0.06	0.02	0.21***	0.27***	0.18***
3 Thinking about COVID-19	n = 406	n = 406	-	0.17***	0.16**	0.03	0.01
4 Thinking about affair	n = 406	n = 406	n = 406	-	0.17***	0.10*	0.12*
5 Self-transcendent values	n = 406	n = 406	n = 406	n = 406	-	0.47***	0.41***
6 Valuation of individual effort	n = 406	n = 406	n = 406	n = 406	n = 406	-	0.24***
7 General well-being	n = 406	n = 406	n = 406	n = 406	n = 406	n = 406	-

*: $p < .05$ **: $p < .01$ ***: $p < .001$

Mediation Analysis. The conceptual model in Figure 1 was implemented into a structure equation model using the lavaan package in R (Rosseel, 2012) to test Hypotheses 1 to 3. Figure 5 displays the model and estimated path coefficients. Table S-3 displays the estimated direct and indirect effects and their confidence intervals using the adjusted bootstrap percentile (BCa) method. To control for non-specific attention to public events, the frequency of thinking about affairs by celebrities were included as covariates, which are omitted in Figure 5 and Table S-3.

Hypothesis 1 was supported by the significant positive indirect effect of dispositional negative awe on self-transcendent values via thinking about COVID-19 (0.021, $p = 0.044$, 95% CI [0.001, 0.041]; Figure 5).

Hypothesis 2 was supported by the positive indirect effect of dispositional negative awe on general well-being via self-transcendent values (0.047, $p = 0.033$, 95% CI [0.004, 0.090]; Figure 5) in contrast to the negative direct effect (-0.138, $p = .004$, 95% CI [-0.232, -0.043]; Figure 5).

Indirect Effect for Hypothesis 1

Dispositional Negative Awe → Thinking about Typhoon → Self-Transcendent Values
= 0.021, $p = 0.044$, 95% CI [0.001, 0.041]

Indirect Effect for Hypothesis 2

Dispositional Negative Awe → Self-Transcendent Values → General Well-being
= 0.047, $p = 0.033$, 95% CI [0.004, 0.090]

Direct Effect for Hypothesis 2

Dispositional Negative Awe → General Well-being
= -0.138, $p = .004$, 95% CI [-0.232, -0.043]

Figure 5 Mediation analysis of individual differences in Study 2

Effects of dispositional awe are omitted from the display. Only significant paths are displayed.

For full details of the results, see Table S-3 and Supplementary Code “2.3.2 SEM for individual difference”

Emotion Induction

Data Exclusion. Inspection of the free response from the emotion induction task indicated that six participants who were assigned to the control/affair condition had not thought about the event and wrote about COVID-19 instead. As they were asked to write about an event where they felt anger, disgust, and/or horror, they reported, for example, anger at how the Japanese government had dealt with COVID-19. Hence, their data were excluded from the analysis for emotion manipulation.

Emotions in Each Condition. Mean, SD, Cronbach's alpha for each type of emotion are displayed in Table 2. The collective threat condition showed higher or similar levels of any type of measured negative emotion, suggesting that the manipulation of awe might be confounded with that of mere negativity. To examine whether this imperfect manipulation of the emotion seriously affected the results, we report a comparison of the COVID-19 condition in Study 2 with the control (bullying) condition in Study 1 in the following analyses. As displayed in Table 2, the collective threat (COVID-19) condition showed higher levels of awe, awe-related negative emotions, and low arousal positive emotions than the control condition in Study 1. In contrast, the control condition in Study 1 showed higher levels of high-arousal negative emotions and low-arousal negative emotions than the collective threat (COVID-19) condition. High arousal positive emotions and the extent of meaning making did not differ between the conditions. This pattern of result indicates that the comparison of the collective threat (COVID-19) condition in Study 2 with the control condition in Study 1 was not confounded with mere negativity unlike the comparison with the control condition in Study 2.

Mediation Analysis. The conceptual model in Figure 2 was implemented into a structure equation model using the lavaan package in R (Rosseel, 2012) to test Hypothesis 3. Figures 6 and 7 display the model and estimated path coefficients for the comparison within Study 2 and

the comparison between Study 2 and Study 1, respectively. Tables S-4 and S-5 display the estimated direct and indirect effects and their confidence intervals using the adjusted bootstrap percentile (BCa) method. To examine the experimental manipulation effect that is above and beyond awe-related individual differences, the two types of dispositional awe scales were included as covariates in both analyses. The frequency of thinking about COVID-19 and affairs by celebrities were included as covariates only in the within Study 2 comparison. Covariates are omitted in Figures 6 and 7 and Tables S-4 and S-5.

The comparison of collective threat and control conditions in Study 2 did not support Hypothesis 3 because the recollection of COVID-19 (vs. affair) → awe → meaning making → eudaimonia mediation effect was only marginally significant (0.019, $p = .055$, 95% CI [0.000, 0.039]). The reduction of the effect compared to Study 1 might be caused by the reduction of the effect of meaning making on self-transcendent values, though the effect itself was still significant (Table S-4, Row 4). Although the non-significance of the mediation effect may be a caution against robustness, the robustness of the result will be discussed after reporting all analyses.

The comparison of Study 2's collective threat condition and Study 1's control condition supported Hypothesis 3 because the recollection of COVID-19 (vs. bullying) → awe → meaning making → eudaimonia mediation effect was marginally significant (0.019, $p = .006$, 95% CI [0.005, 0.033]).

Discussion

For individual difference measures, the results supported both Hypotheses 1 and 2. For emotion induction, the indirect effect was significant when the collective threat (COVID-19) condition was compared to the control condition in Study 1. In addition, further analysis showed

that the indirect effect was significant when the collective threat (COVID-19) condition was compared to the control condition in Study 2 excluding those who had not thought about the target event at all (see Supplementary Materials “Study 2, Emotion Induction” in “Robustness of the results”). In contrast, the indirect effect was not significant when the collective threat (COVID-19) condition was compared to the control condition in Study 2 without excluding those who had not thought about the target event at all. Taken together, it is plausible that the lack of effect is attributable to inadequacy of the control condition in Study 2. As we aimed to examine responses to very recent or ongoing collective threats (i.e., typhoon and COVID-19), it was difficult to select a perfect control event (i.e., recent, negative, public event). The selection of the control condition is a potential limitation of the current study. However, considering the inadequacy of the control condition, the overall pattern of results supported Hypothesis 3.

Indirect Effect for Hypothesis 3

Recollection of COVID-19 (vs. Affair) → Awe → Meaning Making → Self-Transcendent Values
= 0.019, $p = .055$, 95% CI [0.000, 0.039]

Figure 6 Mediation analysis of experimental manipulation within Study 2

A Path to Eudaimonia

Only significant paths are displayed. For full details of the results, see Table S4 and Supplementary Code “2.4.2 SEM for emotion manipulation effects”

Indirect Effect for Hypothesis 3

Recollection of COVID-19 (vs. Bullying) → Awe → Meaning Making → Self-Transcendent Values
= 0.019, $p = .006$, 95% CI [0.005, 0.033]

A Path to Eudaimonia

Figure 7 Mediation analysis of experimental manipulation between Study 2's collective threat condition and Study 1's control condition.

Only significant paths are displayed. For full details of the results, see Table S5 and Supplementary Code "2.4.2 SEM for emotion manipulation effects"

General Discussion

The current study demonstrated the existence of a path from collective threat to eudaimonic well-being. Two types of real collective threat events (i.e., typhoon and COVID-19) evoked the emotion of awe and meaning making that led to the acceptance or (re-)affirmation of self-transcendent values and eventually to eudaimonic well-being. The current findings connect research on collective threat with research on awe. We discuss implications for each line of research.

Implications for Research on Collective Threat

Research on collective threat seldom focus on the emotion of awe that is elicited by collective threat. However, collective threat is theorized as one of the elicitors of awe because it has a large-scale impact (vastness) that most people have not experienced (need for accommodation) and even imagined (Keltner & Haidt, 2003). The current study empirically confirmed this assumption by demonstrating that people feel awe during the in vivo experience of collective threat. Past research on awe has demonstrated various consequences of awe such as self-transcendence, curiosity, and time-perception (Nakayama, 2020). These findings on awe enables the generation of interesting hypotheses on the consequence of collective threat. For example, awe increases commitment to science (Valdesolo et al., 2017). As such, it is predicted that collective threat would increase people's commitment to science which might eventually facilitate the invention of solutions for overcoming collective threat (e.g., vaccine for an infectious virus).

The current study demonstrated that collective threat was linked to self-transcendent values, confirming and generalizing findings from responses to a severe earthquake (Uchida et al., 2014). In addition, awe played a role in connecting collective threat to the acceptance or reaffirmation of self-transcendent values. These findings show the mechanism underlying how collective threat might contribute to the rise of cultural value systems. It has been known that certain values are functionally rooted in collective threat and might become more valuable under collective threat. Potential risk of natural disasters was associated with tight cultures (Gelfand et al., 2011), collectivism among rich countries (Oishi & Komiya, 2017), and lower relational mobility (Thomson et al., 2018). Indeed, low relational mobility might prevent COVID-19 spread (Salvador et al., 2020) and collectivism predicted face mask wearing during COVID-19 (Lu et al., 2021). Nonetheless, the role of emotion in these connections has been unclear. We clarified the role of awe by measuring in vivo experience of collective threats.

Meaning making, in response to collective threat, has also been suggested by research on collective trauma (Hirschberger, 2018). Collective trauma and meaning making has typically been investigated in the context of inter-group relations/conflict such as the holocaust (Dudai, 2020; Hirschberger, 2018; but see, Mercer et al., 2012). One critical difference between collective threat by inter-group conflict and natural disasters is the presence of a perpetrator. The presence of a perpetrator might evoke the emotion of moral disgust rather than awe (Taylor & Uchida, 2021). Future research is needed to examine whether the current findings are generalizable and/or how they may differ from responses to collective threat/trauma in the context of inter-group conflict.

Implications for Research on Awe

Awe research has barely touched on the function of awe in response to (collective) threat with a few exceptions (Piff et al., 2015). We demonstrated that *negative awe positively* predicted well-being via self-transcendent values by which people may be buffered from and even accept the sense of powerlessness and insignificance as were the cases for positive awe (Koh et al., 2019; Stellar et al., 2018). This eudaimonic component exhibited clear contrast with the hedonic component (i.e., the negative residual direct effect of dispositional negative awe on well-being) that explains the obscured effect on well-being in previous research. Even if the hedonic tone is negative, awe towards collective threat still has positive contributions to eudaimonia.

Limitations and Future Directions

It should be noted that the current study did not examine responses to actual harm but rather the potential threat of a disaster or pandemic. Those who participated in Study 1 are assumed to have experienced no severe consequence from the typhoon. Study 2 was conducted during the early stage of the COVID-19 spread in Japan (i.e., no lockdown, well before declaration of a state of emergency). Although the current results should not be generalized to responses toward actual harm (Taylor & Uchida, 2021; Vardy & Atkinson, 2019) without further empirical investigation, they still have important implications. Self-transcendent values would enhance non-victim's happiness from helping victims. Behavior change is required to *prevent* actual harm (e.g., stay at home to prevent spreading COVID-19) which could be enhanced by changing values that guide behavior (e.g., stay at home to protect others from COVID-19; Bavel et al., 2020; Habersaat et al., 2020).

Relatedly, although we demonstrated population-level response to collective threat, an important future direction would be to examine individual and/or situational difference among

those who did not experience severe and direct harm. People may construe the external world differently depending on individual traits or the situation. A reasonable hypothesis would be that an abstract and transcendental construal of collective threat may lead to more shifts towards self-transcendent values (Trope & Liberman, 2010). Indeed, our preliminary work suggested that if people perceived more societal impact in a video on collective threat, then they were subsequently more moved towards prosociality (Koh et al., submitted).

A potential limitation of the current study is the restriction to a Japanese sample. Participants might not have experienced a complete change in values but rather an affirmation of existing values, such as humility, tightness or collectivism. They are also relatively familiar with natural disasters and may know how to psychologically and physically react to the disaster. They are also relatively rich, have access to relatively good medical infrastructure, and might experience less competition for limited resources. These socio-cultural backgrounds could help the Japanese in endorsing self-transcendent values (see Stephens et al., 2009; Vardy & Atkinson, 2019, for how socio-cultural backgrounds might (not) affect post-disaster values and behaviors). However, enhancement of self-transcendence by both positive and negative awe has been reported in non-Japanese samples (e.g., Piff et al., 2015), showing some extent of generalizability beyond a Japanese sample. Cross-cultural generalization (to non-Japanese) by future studies is not only theoretically important (Henrich et al., 2010), but also societally important because global-level threat requires the cooperation of culturally diverse people with diverse value systems.

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Appendix

This is a placeholder, which will be filled if it becomes necessary in the future revision.

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Supplementary Materials

Hypothesis regarding dispositional positive awe

Hypothesis

For exploratory purposes, we examined how dispositional *positive* awe predicts attention to collective *threat*. Two competing hypotheses were tested as Hypotheses S1a and S1b. Since typhoon and COVID-19 are usually perceived as *negative* events, and because the dispositional tendency to feel positive awe (Shiota et al., 2006) is differentiable from feeling negative awe (Nakayama et al., 2020), dispositional positive awe would not positively predict attention to threatening events (Hypothesis S1a). However, those who tend to feel positive awe might also appraise the seemingly negative (and awe eliciting) events rather positively. For example, they might even see the beauty of nature in the typhoon or its magnificent power, especially without experiencing direct harm. If such tendency for subjective appraisal is central to dispositional positive awe, dispositional positive awe would *positively* predict attention to threatening events (Hypothesis S1b).

Results

Study 1. Regarding the exploratory examination of Hypothesis S1, Hypothesis S1b instead of S1a was supported by the positive association between dispositional positive awe and thinking about typhoon ($0.127, z = 2.46, p = .014$; Table S-1 Row 5).

Study 2. In contrast to Study 1, Hypothesis S-1a instead of S-1b was supported. There was no association between dispositional positive awe and thinking about COVID-19 ($0.009, z = 0.171, p = .86$; Table S-3 Row 5).

Discussion

We speculate that although Reiwa 1 East Japan Typhoon was stronger than typical typhoons that had hit Japan, Japanese people might know how to physically and psychologically respond to typhoons from past experiences. The uncertainty-related fear toward the Typhoon might be relatively lower than COVID-19 and some participants might know how to positively appraise (e.g., finding beauty of nature) such a seemingly threatening event. In contrast, COVID-19 is a novel threat that evokes high levels of uncertainty. It might be difficult to positively appraise the event. In sum, the association between dispositional positive awe and collective threat might not be as strong as with dispositional negative awe. Further research is needed to investigate how dispositional positive awe relates to different types of collective threat.

Contexts for collective threat and control events

Reiwa 1 East Japan Typhoon (Study 1, Collective Threat Condition)

To empirically demonstrate the public attention to the event, Figure S-1 displays the relative frequency of google search records for the word “台風/typhoon” in Japan based on Google Trends (see Hamamura & Chan, 2019, for a use of Google Trends in psychological research). There was an acute increase in search records for “typhoon” immediately before the survey period. This pattern indicates that the typhoon attracted much public attention at that time. To estimate the harm participants might have received, we checked the writing about the typhoon and only two out of 211 participants explicitly reported the harm to their neighbors but no one reported harm to themselves. As a population, the participants are assumed to had received minimal harm from the typhoon.

Workplace bullying among Elementary School Teachers (Study 1, Control Condition)

To empirically demonstrate the public attention to the event, dashed lines in Figure S-1 display the relative frequency of google search records for bullying-related words “いじめ/bullying”, “小学校/elementary school” and “神戸/Kobe, the city where it occurred”, in Japan based on Google Trends. There was an acute increase in search records for “bullying” before the survey period, but the relative frequency is low compared to the typhoon. The difference between the search records for “typhoon” and “bullying” might be explained in part by the nature of information searching practices such as repeatedly checking the course of the typhoon. Hence, we assume that the two events differ less in psychological significance and impact than the search records. The patterns for “elementary school” and “Kobe” were less clear but they still showed some extent of increase before the survey period.

Figure S-1 Search records from Google Trends one month before the survey period of Study 1

The lines represent the relative frequency of search records for “台風/typhoon”, “いじめ/bullying”, “小学校/elementary school”, and “神戸/Kobe, the city where bullying occurred”.

Note that relative record frequency in this period is displayed in the scale of 0 to 100.

COVID-19 (Study 2, Collective Threat Condition)

To empirically demonstrate the public attention towards the event then, Figure S-2 displays the relative frequency of google search records for the word “コロナ/corona”, “マスク/mask”, and “せき/cough” in Japan based on Google Trends (see solid lines). There was an acute increase in search records for “corona” and “(facial) mask” before the survey period, indicating that COVID-19 was a threat to be avoided (e.g., by buying and wearing a facial mask). On the other hand, the search record for “cough” (i.e., a known typical symptom of COVID-19 then) did not show such an increase. This pattern confirms that at the time of the survey, COVID-19 attracted acute public attention but (perceived) actual harm was minimal.

Affair by Celebrities (Study 2, Control Condition)

To empirically demonstrate the public attention to the event then, Figure S-2 displays the relative frequency of google search records for the word “不倫/affair”, “東出/ the name of a celebrity who was accused of having an affair” in Japan based on Google Trends (see dashed lines). There was an acute increase in search records before the survey period. This pattern indicates that at the time of the survey, the event attracted acute public attention.

Figure S-2 Search records from Google Trends one month before the survey period of Study 2

Full detail of the structure equation modelling

Study 1, Individual difference measures

Table S-1 Estimated path coefficients for individual differences analysis in Study 1

	Path	Estimate	SE	z-value	p-value	CI lower	CI upper
1	neg. awe → typhoon → transcendent.values -	0.031	0.015	2.141	0.032	0.003	0.060
2	neg. awe → typhoon -	0.119	0.052	2.315	0.021	0.018	0.221
3	- typhoon → transcendent.values -	0.263	0.047	5.641	0.000	0.171	0.354
4	pos. awe → typhoon → transcendent.values -	0.033	0.015	2.258	0.024	0.004	0.062
5	pos. awe → typhoon -	0.127	0.052	2.464	0.014	0.026	0.228
6	neg. awe → typhoon+direct → transcendent.values → gen.well-being	0.059	0.023	2.614	0.009	0.015	0.104
7	neg. awe → transcendent.values -	0.107	0.049	2.173	0.030	0.010	0.203
8	- - transcendent.values → gen.well-being	0.430	0.047	9.115	0.000	0.337	0.522
9	neg. awe → gen.well-being	-0.228	0.047	-4.841	0.000	-0.320	-0.136
10	pos. awe → typhoon+direct → transcendent.values → gen.well-being	0.086	0.024	3.647	0.000	0.040	0.133
11	pos. awe → transcendent.values -	0.168	0.049	3.419	0.001	0.072	0.264
12	pos. awe → gen.well-being	0.106	0.048	2.241	0.025	0.013	0.200
13	neg. awe → typhoon → transcendent.values → gen.well-being	0.013	0.006	2.085	0.037	0.001	0.026
14	pos. awe → typhoon → transcendent.values → gen.well-being	0.014	0.007	2.192	0.028	0.002	0.027
15	- typhoon → transcendent.values → gen.well-being	0.113	0.024	4.797	0.000	0.067	0.159
16	- typhoon → gen.well-being	0.009	0.046	0.202	0.840	-0.081	0.100

Note

Neg. awe: negative dispositional awe

Pos. awe: positive dispositional awe

Gen.well-being: general well-being

Study 1, Emotion Induction

Table S-2 Estimated path coefficients for experimental manipulation effects in Study 1

	Path					Estimate	SE	z-value	p-value	CI lower	CI upper
1	collective threat →	awe →	meaning making →	transcendent.values	-	0.035	0.010	3.645	0.000	0.016	0.053
2	collective threat →	awe	-	-	-	0.376	0.045	8.391	0.000	0.288	0.464
3	-	awe →	meaning making	-	-	0.375	0.049	7.584	0.000	0.278	0.471
4	-	-	meaning making →	transcendent.values	-	0.246	0.051	4.785	0.000	0.145	0.347
5	collective threat →		meaning making	-	-	-0.142	0.049	-2.921	0.003	-0.238	-0.047
6	collective threat →	awe →	meaning making	-	-	-0.142	0.049	-2.921	0.003	-0.238	-0.047
7	-	awe →	meaning making →	transcendent.values	-	0.092	0.023	4.047	0.000	0.048	0.137
8	collective threat →			transcendent.values	-	-0.002	0.050	-0.045	0.964	-0.100	0.096
9	-	awe →		transcendent.values	-	0.027	0.055	0.488	0.626	-0.081	0.134
10	collective threat →	awe →	meaning making →	transcendent.values →	gen. well-being	0.015	0.004	3.396	0.001	0.006	0.024
11	-	-	-	transcendent.values →	gen. well-being	0.434	0.046	9.341	0.000	0.343	0.525
12	-	-	meaning making →	transcendent.values →	gen. well-being	0.107	0.025	4.258	0.000	0.058	0.156
13	-	awe →	meaning making →	transcendent.values →	gen. well-being	0.040	0.011	3.713	0.000	0.019	0.061
14	-	-	meaning making →		gen. well-being	-0.108	0.050	-2.182	0.029	-0.205	-0.011
15	-	awe →			gen. well-being	0.010	0.051	0.196	0.845	-0.090	0.110
16	collective threat →				gen. well-being	-0.049	0.048	-1.021	0.307	-0.142	0.045

Note

In the collective threat manipulation, recollection of typhoon was compared with that of bullying.

Gen.well-being: general well-being

Study 2, Individual difference measures

Table S-3 Estimated path coefficients for individual differences analysis in Study 2

		Path	Estimate	SE	z-value	p-value	CI lower	CI upper
1	neg. awe →	COVID-19 → transcendent.values -	0.021	0.010	2.019	0.044	0.001	0.041
2	neg. awe →	COVID-19 -	0.152	0.052	2.891	0.004	0.049	0.254
3	-	COVID-19 → transcendent.values -	0.136	0.048	2.820	0.005	0.042	0.231
4	pos. awe →	COVID-19 → transcendent.values -	0.001	0.007	0.170	0.865	-0.013	0.015
5	pos. awe →	COVID-19 -	0.009	0.052	0.171	0.864	-0.094	0.112
6	neg. awe →	COVID-19+direct → transcendent.values → gen.well-being	0.047	0.022	2.136	0.033	0.004	0.090
7	neg. awe →	transcendent.values -	0.093	0.052	1.799	0.072	-0.008	0.194
8	-	transcendent.values → gen.well-being	0.411	0.046	8.901	0.000	0.321	0.502
9	neg. awe →	gen.well-being	-0.138	0.048	-2.858	0.004	-0.232	-0.043
10	pos. awe →	COVID-19+direct → transcendent.values → gen.well-being	0.069	0.023	3.061	0.002	0.025	0.113
11	pos. awe →	transcendent.values -	0.167	0.051	3.267	0.001	0.067	0.267
12	pos. awe →	gen.well-being	0.146	0.048	3.024	0.002	0.051	0.240
13	neg. awe →	COVID-19 → transcendent.values → gen.well-being	0.009	0.004	1.969	0.049	0.000	0.017
14	pos. awe →	COVID-19 → transcendent.values → gen.well-being	0.001	0.003	0.170	0.865	-0.005	0.006
15	-	COVID-19 → transcendent.values → gen.well-being	0.056	0.021	2.688	0.007	0.015	0.097
16	-	COVID-19 → gen.well-being	-0.047	0.045	-1.033	0.302	-0.136	0.042

Note

Neg. awe: negative dispositional awe

Pos. awe: positive dispositional awe

Gen.well-being: general well-being

Study 2, Emotion Induction

Table S-4 Estimated path coefficients for experimental manipulation effects in Study 2

	Path					Estimate	SE	z-value	p-value	CI lower	CI upper
1	collective threat →	awe →	meaning making →	transcendent.values	-	0.019	0.010	1.921	0.055	0.000	0.039
2	collective threat →	awe	-	-	-	0.343	0.045	7.604	0.000	0.254	0.431
3	-	awe →	meaning making	-	-	0.488	0.045	10.824	0.000	0.400	0.577
4	-	-	meaning making →	transcendent.values	-	0.115	0.057	2.019	0.043	0.003	0.226
5	collective threat →		meaning making	-	-	0.097	0.045	2.186	0.029	0.010	0.185
6	collective threat →	awe →	meaning making	-	-	0.097	0.045	2.186	0.029	0.010	0.185
7	-	awe →	meaning making →	transcendent.values	-	0.056	0.028	1.985	0.047	0.001	0.111
8	collective threat →			transcendent.values	-	-0.088	0.051	-1.731	0.083	-0.187	0.012
9	-	awe →		transcendent.values	-	0.159	0.058	2.727	0.006	0.045	0.273
10	collective threat →	awe →	meaning making →	transcendent.values →	gen. well-being	0.008	0.004	1.872	0.061	0.000	0.015
11	-	-	-	transcendent.values →	gen. well-being	0.395	0.047	8.331	0.000	0.302	0.487
12	-	-	meaning making →	transcendent.values →	gen. well-being	0.045	0.023	1.963	0.050	0.000	0.090
13	-	awe →	meaning making →	transcendent.values →	gen. well-being	0.022	0.011	1.931	0.053	0.000	0.044
14	-	-	meaning making →		gen. well-being	0.038	0.054	0.705	0.481	-0.068	0.144
15	-	awe →			gen. well-being	-0.040	0.056	-0.717	0.473	-0.149	0.069
16	collective threat →				gen. well-being	0.001	0.048	0.015	0.988	-0.094	0.095

Note

In the collective threat manipulation, recollection of COVID-19 was compared with that of affair.

Gen.well-being: general well-being

Table S-5 Estimated path coefficients for experimental manipulation between Study 2's collective threat condition and Study 1's control condition

	Path					Estimate	SE	z-value	p-value	CI lower	CI upper
1	collective threat →	awe →	meaning making →	transcendent.values	-	0.019	0.007	2.727	0.006	0.005	0.033
2	collective threat →	awe	-	-	-	0.212	0.049	4.322	0.000	0.116	0.309
3	-	awe →	meaning making	-	-	0.451	0.049	9.151	0.000	0.354	0.548
4	-	-	meaning making →	transcendent.values	-	0.198	0.052	3.807	0.000	0.096	0.300
5	collective threat →		meaning making	-	-	-0.069	0.049	-1.407	0.159	-0.165	0.027
6	collective threat →	awe →	meaning making	-	-	-0.069	0.049	-1.407	0.159	-0.165	0.027
7	-	awe →	meaning making →	transcendent.values	-	0.089	0.025	3.515	0.000	0.040	0.139
8	collective threat →			transcendent.values	-	-0.082	0.049	-1.664	0.096	-0.178	0.014
9	-	awe →		transcendent.values	-	0.039	0.056	0.710	0.478	-0.069	0.148
10	collective threat →	awe →	meaning making →	transcendent.values →	gen. well-being	0.008	0.003	2.609	0.009	0.002	0.014
11	-	-	-	transcendent.values →	gen. well-being	0.428	0.048	8.964	0.000	0.334	0.522
12	-	-	meaning making →	transcendent.values →	gen. well-being	0.085	0.024	3.504	0.000	0.037	0.132
13	-	awe →	meaning making →	transcendent.values →	gen. well-being	0.038	0.012	3.272	0.001	0.015	0.061
14	-	-	meaning making →		gen. well-being	-0.005	0.050	-0.100	0.921	-0.102	0.092
15	-	awe →			gen. well-being	-0.034	0.052	-0.661	0.509	-0.136	0.068
16	collective threat →				gen. well-being	0.018	0.046	0.396	0.692	-0.072	0.109

Note

In the collective threat manipulation, recollection of COVID-19 was compared with that of bullying in Study 1.

Gen.well-being: general well-being

Robustness of the results

In this section, we checked robustness of the results that were reported in the main text. We checked if the results show a similar pattern (1) when controlling for potential confounds and (2) when different exclusion criteria is applied. If we empirically found a result that may threaten the robustness of the result, we would (automatically) attempt to clarify the boundary condition. Our intention here was to demonstrate that we did not cherry pick an anomalous result but that reasonably wide range of the analyses did show similar patterns.

Study 1, Individual difference measures

To check if the results reported in the main text confounded with demographic variables, gender, employment status, and marital status were included as dummy variables and standardized age was included as a continuous variable. The indirect effect of dispositional negative awe → thinking about typhoon → self-transcendent values was reduced to non-significant (indirect effect = 0.012, 95%CI [-0.015, 0.039]) because of non-significance in the path from negative awe to thinking about typhoon (0.043, 95%CI [-0.054, 0.140]). The other patterns of results remained unchanged (see Supplementary Codes “1.3.2.2 Controlling for demographics (individual difference)”). The reduction of the effect of dispositional negative awe on thinking about the typhoon was caused by the employment status of house wives/husbands. Once the covariances between house wives/husbands and dispositional negative awe and thinking about typhoon were excluded from the model, the path from negative awe to thinking about typhoon (0.115, 95%CI [0.014, 0.215]) and the path negative awe → thinking about typhoon → self-transcendent becomes significant (indirect effect = 0.030, 95%CI [0.002, 0.058]; see Supplementary Code “1.3.2.3 Controlling for demographics except for employment”). While it is

unclear why the employment status of housewives/husbands were confounded with dispositional negative awe and thinking about the typhoon, this confounded result was not replicated in Study 2 (i.e., the indirect effect was significant after controlling for all demographic variables). Hence, we do not interpret the effect of employment status further.

Study 1, Emotion Induction

Although the emotion of awe played a mediating role between the manipulation, meaning making and self-transcendent values, it is unclear whether awe plays a unique role above and beyond other emotions. Indeed, other types of emotions except for low arousal positive emotions also mediated the effect of condition on meaning making and self-transcendent values (see Supplementary Codes “1.4.2.2 Emotion manipulation (other emotions as a mediator)”). We tested multiple models where each type of emotion was included as covariates in Figure 3. All models still showed the indirect effect of recollection of typhoon (vs. bullying) → awe in the experience → meaning making → self-transcendent values (effects ranged between 0.029 and 0.035, see Supplementary Codes “1.4.2.3 Awe’s effect controlling for other emotions”). Another potential source of fragility of the result is its exclusion/inclusion criteria. One participant from the collective threat condition and 16 participants from the control condition reported that they had not thought about their assigned target event at all and were asked to write about another similar event (e.g., an episode where they experienced the threat of nature). Although inclusion of these participants is justifiable because it can enhance generalizability beyond a specific event, we report the analyses without these participants to demonstrate the robustness of the results. The analyses both with and without controlling for each of the other emotions showed the same pattern of results as the main analysis. Specifically, the indirect

effects of recollection of typhoon (vs. bullying) → awe in the experience → meaning making → self-transcendent values were significant in all models (effects ranged between 0.032 and 0.038, see Supplementary Codes “1.4.2.5 Emotion manipulation (excluding those who had not thought about the target (randomly assigned) event.)”)

Study 2, Individual difference measures

To check if the results above confounded with demographic variables, gender, employment status, and marital status were included as dummy variables and standardized age was included as a continuous variable. The indirect effect of dispositional negative awe → thinking about COVID-19 → self-transcendent values was still significant (indirect effect = 0.024, 95%CI = 0.000 : 0.047), unlike Study 1. The other patterns of results remained unchanged (see Supplementary Codes “2.3.2.2 Controlling for demographics (individual difference)”).

Study 2, Emotion Induction

As in Study 1, we tested multiple models where each type of emotion was included as covariates. When conditions were compared within Study 2, the indirect effect of recollection of COVID-19 (vs. affair) → awe in the experience → meaning making → self-transcendent values was not significant when each of the other emotions was controlled for (effects ranged between 0.015 and 0.019, see Supplementary Codes “2.4.2.3 Awe’s effect controlling for other emotions”).

When Study 2’s collective threat condition was compared to Study 1’s control condition, the indirect effect of recollection of COVID-19 (vs. bullying) → awe in the experience → meaning making → self-transcendent values was significant when each of the other emotions

was controlled for (effects ranged between 0.016 and 0.020, see Supplementary Codes from “2.4.2.6.3 Awe’s effect controlling for peri.awe.neg.s” to “2.4.2.6.7 Awe’s effect controlling for LAP.s”).

Another potential source of fragility of the result is its exclusion/inclusion criteria. Fifty-three participants from the control condition had not thought about the target event (i.e. affairs by celebrities) at all and were asked to write about a similar event (i.e., an episode when they felt anger, disgust, and/or horror for a public events), whereas all participants from the collective threat condition had thought about COVID-19. Although the lack of attention to the control event might indicate invalidity of the control condition, once these participants were excluded from the analysis, the indirect effects of recollection of COVID-19 (vs. affair) → awe in the experience → meaning making → self-transcendent values was significant in all models (effects ranged between 0.028 and 0.032, see Supplementary Codes “2.4.2.5 Emotion manipulation (excluding those who had not thought about the target (randomly assigned) event.)”)