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Awe-full uncertainty: Easing discomfort during waiting periods

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ABSTRACT

Waiting for uncertain news is a common and stressful experience. We examined whether experiencing awe can promote well-being during uncomfortable periods of uncertainty. Across two studies (total $N = 729$), we examined the relationship between trait awe and well-being as participants awaited feedback on a novel intelligence test or ratings from peers following a group interaction. These studies further examined the effect of an awe induction, compared to positive and neutral control conditions, on well-being. We found partial support for a relationship between trait awe and well-being during waiting periods, particularly with positive emotion. We also found partial support for the benefits of an awe induction: People consistently experienced greater positive emotion and less anxiety in the awe condition compared to a neutral control condition, although these benefits did not always improve upon the positive control experience. Importantly, these benefits emerged regardless of one's predisposition to experience awe.

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Awe; well-being; emotion; uncertainty

Waiting for uncertain news is a common and stressful experience. People may feel uncertain as they wait to learn the outcome of a cancer screening, a job interview, a home purchase, or an academic exam. Although many examples of uncertain waiting periods come readily to mind, still relatively little is known about the best way to manage the thoughts and feelings that arise as people await the uncertain outcome. We propose that experiencing awe, an expansive state of wonder and reverence, can help people effectively navigate a difficult waiting period by broadening their perspective and increasing patience and well-being.

Navigating uncertain waiting periods

The types of waiting periods described in the preceding paragraph combine two profoundly uncomfortable states: a lack of control and a lack of certainty about one's future (Sweeny, 2018). That is, after undergoing a medical screening, completing a job interview, bidding on a house, or taking an exam, people do not know what their future holds and can do little to nothing to change their fate. Perhaps unsurprisingly, then, a growing body of research suggests that awaiting uncertain news can be more anxiety-provoking than receiving the bad news one fears (Boivin & Lancaster, 2010; Sweeny & Falkenstein, 2015). In addition to anxiety, persistent and unpleasant thoughts tend to arise

when awaiting uncertain news (Sweeny & Andrews, 2014), comprising the experience of worry (Sweeny & Dooley, 2017). This emotional and cognitive turmoil is not only aversive, but it may also undermine people's health and sleep as they await personally important news (Howell & Sweeny, 2016). Thus, researchers who study waiting periods have sought to identify strategies people can adopt during these acute moments of uncertainty to mitigate distress and thus buffer ill effects on health and well-being. Initial efforts have revealed that mindfulness meditation (Sweeny & Howell, 2017) and flow-inducing activities (Rankin, Walsh, & Sweeny, 2018) provide some relief during waiting periods. However, meditation is not for everyone, and it can be difficult to achieve a state of flow when worry is raging out of control (Rankin et al., 2018). Thus, the present studies test the effectiveness of an experience that may be more easily achieved even during stressful waiting periods – namely, the experience of awe.

The experience of awe

Although the concept of awe has deep roots in religion, philosophy, literature, and art, was incorporated into William James' discussion of religious phenomena (1902), and was a key feature of Abraham Maslow's concept of peak experiences (1964), its arrival on the

scene of modern psychological research is relatively recent. Psychologists describe awe as a moral, spiritual, and aesthetic emotion in which two appraisals are central: perceived vastness and a need for accommodation (Keltner & Haidt, 2003). Perceived vastness refers to one's sense of something greater than the self that can make a person feel small and even insignificant (e.g., nature, royalty, an earthquake). The need for accommodation is a concept borrowed from developmental psychology (Piaget & Inhelder, 1966/1969) and describes the need to reorganize mental structures that cannot comfortably assimilate an overwhelming and even frightening experience that may also bring about a sense of enlightenment and newness. Other situational features that can elicit awe – most commonly, threat, beauty, exceptional ability, virtue, or the supernatural – may color the experience of awe but are not considered necessary or sufficient to create the experience (Keltner & Haidt, 2003).

The experience of awe is stimulus-focused and self-diminishing (Shiota, Keltner, & Mossman, 2007), improves mood and increases prosociality (Joye & Bolderdijk, 2015; Zhang, Piff, Iyer, Koleva, & Keltner, 2014), and promotes feelings of connectedness and humility (Nelson-Coffey et al., *under review*). Daily positive emotion experiences, especially awe, wonder, and amazement, have even been linked with lower levels of pro-inflammatory cytokines, suggesting that these experiences are associated with and potentially contribute to greater physical and mental health (Stellar et al., 2015).

However, some people are more likely to experience awe than others. People who regularly experience awe tend to be more open to new experiences and more extroverted (Shiota, Keltner, & John, 2006) and have less need for cognitive closure (Shiota et al., 2007). Fortunately, even people who do not naturally experience awe on a regular basis can raise their levels of awe through simple exercises. Recent research confirms that experiencing awe or writing about past awe experiences expands perceptions of time, improves decision-making, and, most relevant to the current set of studies, increases well-being and patience (Rudd, Vohs, & Aaker, 2012), making awe a good candidate for an intervention to reduce worry and other negative experiences typically associated with difficult waiting periods.

Overview and hypotheses

Given the ubiquity of waiting periods and the detrimental effects of these acute moments of uncertainty, the goal of the current paper is to explore the experience of awe as a means of easing distress as people

wait. A pilot study revealed that *trait awe* (i.e., the dispositional tendency to readily and frequently experience awe) was weakly associated with positive emotions – but not with negative emotions, anxiety, or worry – during an uncertain waiting period in which participants awaited feedback on what they believed was an intelligence test. Although the findings from this initial study do not provide strong evidence for a reliable relationship between trait awe and well-being during an uncertain waiting period, the pilot study used a relatively small sample ($N = 89$) and did not include an awe manipulation. Thus, we proceeded with an experimental induction of awe in the present studies. It may be that a dispositional tendency to experience awe is not particularly beneficial for well-being in and of itself during waiting periods, absent an external cue to tap into that tendency. The two studies included in this paper test the effect of an awe induction (e.g., Rudd et al., 2012), compared to positive and neutral control conditions, on well-being in two different uncertain waiting periods. In Study 1, participants await performance feedback on an intelligence test, and in Study 2, participants believed they were awaiting interpersonal feedback about how others perceived them in a recent group interaction.

Drawing on previous research linking awe to well-being, we hypothesized that people higher in trait awe (*Hypothesis 1*) and people who undergo an awe induction (*Hypothesis 2*) will report greater well-being while awaiting news about their intellectual or social prowess. We also explored whether people higher in trait awe are more or less reactive to an awe induction. On one hand, participants who are higher in trait awe may benefit most from the awe induction given their natural tendency toward the experience. On the other hand, participants lower in trait awe may benefit most from the awe induction because it is a more novel experience.

Study 1

Participants

Participants were 330 undergraduate students (67.0% female; $M_{age} = 19.76$, $SD = 2.24$) from an introductory psychology course who consented to participate in the study for partial course credit. Participants were diverse in terms of race and ethnicity: 38.6% identified as Hispanic or Latinx, 38.30% as Asian, 13.4% as White, 6.1% as American Indian/Alaska Native, 2.7% as Black, and 0.9% as Native Hawaiian/Pacific Islander. We aimed to recruit 100 participants per video condition, consistent with the recommendations of experts in the field

(Vazire, 2015), but continued the study through the end of the relevant academic quarter after reaching our target sample size.

Procedure

Participants arrived at the lab for a study called 'Test Your Skills' and were told they would complete sets of measures before and after a novel intelligence test. Participants were randomly assigned to one of two feedback conditions: *immediate* or *delayed*. Although no participants would receive feedback on their performance, participants in the *immediate* condition believed they would receive feedback at the end of the session (intended to heighten worry), whereas participants in the *delayed* condition believed they would receive feedback several months in the future. This manipulation was not central to our hypotheses and will not be discussed further.

After completing measures of individual differences and emotions, participants were given instructions for Raven's Matrices problems (Raven, 1941) and completed a practice item before continuing on to the novel intelligence test, which consisted of 10 Raven's Matrices problems of increasing difficulty (Georgiev, 2008). After the intelligence test (but before completing the final measures), participants were randomly assigned to watch one of three videos: an *awe induction* ($n = 118$), a *positive control* ($n = 95$), or a *neutral control* ($n = 111$; see below for details about the videos). These conditions were crossed with the feedback manipulation condition, in which half of the participants anticipated feedback immediately after the session and the other half expected to receive feedback several months after the session. After viewing the video, participants completed final measures of well-being. In total, participants waited approximately 10 min while watching the video and completing these measures, after which the researcher returned and debriefed them. Full study materials are available on the Open Science Framework (study measures are available on the Open Science Framework: <https://osf.io/mhqbw/>).

Pilot testing of videos

Paid Amazon Mechanical Turk users ($N = 332$) were randomly assigned to watch one of six pilot videos (two per condition: awe induction, positive control, and neutral control) and rate the extent to which the video made them feel each of 26 discrete emotions (e.g., interest, awe, amusement/humor, fear/anxiety; adapted from Sherman, Haidt, & Coan, 2009; Smith, 2010) using a 6-point scale (1 = *not at all*, 6 = *extremely*). All videos were approximately 5 min long and selected

because they (or similar videos) had been used successfully in previous studies. The final set of three videos were selected over their alternatives because they were the most representative of the intended emotional response as described below (descriptive statistics available in the supplemental table). We included a control condition targeting positive emotions generally rather than the specific emotion of awe to reduce the likelihood that any findings are due to demand characteristics. That is, participants in both conditions watched a pleasant, enjoyable video, and thus participants in the awe condition were unlikely to guess that we were particularly interested in awe. Supporting this belief, no participant mentioned awe or anything similar in the debriefing process prior to revealing the purpose of the study.

Awe induction

When asked to recall personal experiences with awe, people most frequently describe encounters with nature, followed by art or music (Shiota et al., 2007). Participants in the *awe induction* condition watched a 4.5-min high definition (HD) video that pairs beautiful shots of the Earth (e.g., sunrise, mountains, waterfalls, opening blossoms, migration, aurora borealis) with an instrumental music piece (<https://www.youtube.com/watch?v=zV5zEP2QZ0Y>). This prompt was intended to elicit relatively high ratings of awe, moral uplift, inspiration, optimism about humanity, the desire to be a better person, warmth in the chest, hope, and admiration.

Positive control

Participants in the *positive control* condition watched a 4.5-min HD video of 'cute animal couples' (<https://www.youtube.com/watch?v=WUrJ1oCz0oQ>) intended to elicit general positive feelings. People tend to experience interest, happiness, calmness, tenderness, amusement, and entertainment when viewing 'high-cuteness' compared to 'low-cuteness' images, but they do not typically experience feelings of awe or other morality-based appraisals (Sherman et al., 2009) or negative emotions like sadness, shame, disgust, or anger.

Neutral control

Participants in the *neutral control* condition watched a 4.5-min video clip of how padlocks are made from the television show *How It's Made*[™] (https://www.youtube.com/watch?v=TZ62bhXRJ_k). This video was selected to be interesting but neutral in terms of participants' physical and emotional responses (Smith, 2010).

Measures

Baseline measures

Dispositional positive emotions. Trait awe was assessed using the awe subscale of the Dispositional Positive Emotion Scales (DPES; Shiota et al., 2006), a 6-item subscale rated on a 7-point scale (e.g., 'I feel wonder almost every day'; 1 = *strongly disagree*, 7 = *strongly agree*; $M = 5.00$, $SD = .81$, $\alpha = .63$).

Positive and negative emotions. Participants completed the Affect Adjective Scale (Diener & Emmons, 1985), rating the extent to which they had experienced a set of positive and negative emotions in the past week. Positive emotion was measured with four items (e.g., happy, pleased; 1 = *not at all*, 7 = *extremely*; $M = 4.66$, $SD = 1.15$, $\alpha = .90$). Negative emotion was also measured with four items (e.g., angry/hostile, depressed/blue; 1 = *not at all*, 7 = *extremely*; $M = 2.70$, $SD = 1.12$, $\alpha = .81$). Inspection of the distribution of the negative emotion measure showed a substantial positive skew in the waiting data (below). For consistency across repeated measures of negative emotion, we log-10 transformed negative emotion at both time points.

Anxiety. Participants completed an 8-item measure of anxiety that asked participants to indicate how they had been feeling in the past three days¹ (e.g., calm, anxious, distressed; 1 = *not at all*, 7 = *extremely*; $M = 3.56$, $SD = 1.12$, $\alpha = .87$).

Worry. Worry was assessed with three items similar to those used in other studies of waiting experiences (e.g., Dooley et al., 2018; Sweeny & Howell, 2017; 'I am worried about my performance on the intelligence test,' 'I feel anxious every time I think about my performance on the intelligence test,' 'I can't seem to stop thinking about my performance on the intelligence test'; 1 = *strongly disagree*, 7 = *strongly agree*; $M = 3.02$, $SD = 1.39$, $\alpha = .85$).

Waiting period measures

Positive and negative emotion. Participants again completed the Affect Adjective Scale (Diener & Emmons, 1985) they completed at baseline, this time indicating how they felt at that moment, for both positive emotion ($M = 4.00$, $SD = 1.60$, $\alpha = .94$) and negative emotion ($M = 1.39$, $SD = .72$, $\alpha = .79$). As noted above, negative emotion was log-10 transformed prior to conducting analyses.

Anxiety. Participants again completed the 10-item measure of anxiety they completed at baseline, indicating for each how they felt in the current moment ($M = 2.42$, $SD = 1.05$, $\alpha = .86$).

Worry. Worry was assessed with three items similar to those used in other studies of waiting experiences ('I am worried about my performance on the intelligence test,' 'I feel anxious every time I think about my performance on the intelligence test,' 'I can't seem to stop thinking about my performance on the intelligence test'; 1 = *strongly disagree*, 7 = *strongly agree*; $M = 2.65$, $SD = 1.42$, $\alpha = .89$).

Results

Manipulation check

Participants were asked to describe the video they watched and the extent to which the video made them feel the same 26 discrete emotions described in the pilot study to confirm that the manipulation had the intended effect and that ratings for each video were consistent with those observed in the pilot study (see Supplemental Materials for descriptive statistics on manipulation check items). Participants in the *awe* condition experienced significantly greater feelings of awe, $F(1, 323) = 43.56$, $p < .0001$, partial $\eta^2 = .12$, and other morality-based appraisals (e.g., a desire to help others, inspiration; the only exception was the desire to be a better person), $F_s > 6.60$, $p_s < .02$, partial $\eta^2_s > .02$, relative to *control* conditions; participants in the *positive control* condition had the highest ratings of amusement/humor, entertainment, and surprise relative to the other two conditions, $F_s > 5.00$, $p_s < .03$, partial $\eta^2_s > .02$; and participants in the *neutral control* condition consistently had the lowest ratings on both positive and negative emotions. Participants in the *awe induction* condition had significantly higher ratings than control conditions on several negative emotions, namely shame, disgust, and sadness, $F_s > 13.50$, $p_s < .0004$, partial $\eta^2_s > .004$.

Associations with trait awe

Table 1 presents correlations among key study variables, and Table 2 presents the results of multiple regression analyses predicting waiting experiences from trait awe, controlling for relevant baseline measures. Consistent with *Hypothesis 1*, greater trait awe was associated with greater positive emotion and less negative emotion and anxiety, after controlling for baseline emotion. Trait awe was not associated with worry (after controlling for baseline worry) during the wait for intelligence test results.

Effects of the awe induction

Table 3 presents the descriptive statistics for well-being by condition. To test *Hypothesis 2*, we conducted one-way ANOVA procedures, followed by weighted contrast

Table 1. Correlations among key study variables.

	Waiting			Anxiety
	Trait awe	Positive emotion	Negative emotion	
Study 1 (N= 339)				
Trait awe				
Waiting				
Positive emotions	.34**			
Negative emotions	-.17**	-.21**		
Anxiety	-.25**	-.50**	.52**	
Worry	-.05	-.09	.03	.23**
Study 2 (N= 399)				
Trait awe				
Waiting				
Positive emotions	.32**			
Negative emotions	-.02	-.21**		
Anxiety	-.10*	-.39**	.62**	
Worry	-.03	-.12*	.14**	.27**

† $p < .10$, * $p < .05$, ** $p < .01$. All estimates are bivariate correlations with trait awe.

tests, to examine the effect of video condition (*awe* vs. *positive* vs. *neutral*), while also controlling for the relevant baseline measure. Video condition had an effect on positive emotion, $F(2, 318) = 45.17$, $p < .0001$, partial $\eta^2 = .22$, and anxiety, $F(2, 318) = 7.24$, $p = .0007$, partial $\eta^2 = .04$, controlling for baseline positive emotion and anxiety, respectively. Regarding positive emotion, contrast tests adjusting for baseline positive emotion revealed that participants reported considerable greater positive emotion in the *awe induction* condition than in the *neutral control* condition, $F(1, 318) = 83.62$, $p < .0001$, partial $\eta^2 = .21$, and somewhat greater positive emotion (albeit falling short of traditional standards for statistical significance) in the *awe induction* condition than in the *positive control* condition, $F(1, 318) = 3.65$, $p = .057$, partial $\eta^2 = .01$. Participants also reported greater positive emotion in the *positive control* condition than in the *neutral control* condition, $F(1, 318) = 45.69$, $p < .0001$, partial $\eta^2 = .13$.

Regarding anxiety, contrast tests adjusting for baseline anxiety revealed that participants reported less anxiety in the *awe induction* condition than in the *neutral control* condition, $F(1, 318) = 14.62$, $p = .0002$, partial $\eta^2 = .04$. Although the means were in the

hypothesized direction, participants in the *awe induction* condition did not report significantly less anxiety than participants in the *positive control* condition, $F(1, 318) = 1.81$, $p = .18$, partial $\eta^2 = .006$. Participants also reported less anxiety in the *positive control* condition than in the *neutral control* condition, $F(1, 318) = 5.23$, $p = .02$, partial $\eta^2 = .02$. Video condition did not affect negative emotion, $F(2, 318) = .03$, $p = .98$, partial $\eta^2 = .0001$, or worry, $F(2, 318) = 1.35$, $p = .26$, partial $\eta^2 = .008$, after controlling for baseline measures.

The moderating role of trait awe

We now turn to our exploratory analysis addressing the role of trait awe in the effects of the video condition. We conducted multiple regression analyses predicting well-being during the waiting period from video condition (*awe induction* = + 1, *positive* = -.5, *neutral* = -.5), trait awe, and their interaction, controlling for relevant baseline measures. As shown in Table 4, no interaction effect was significant.²

Discussion

The findings from Study 1 suggest that people who are predisposed to experiencing awe in their every day lives may also experience more positive emotion during uncertain waiting periods and, to a lesser extent, less negative emotion and anxiety. However, it is not necessary to be high in trait awe in order to benefit from an experience of awe. People who were exposed to the awe induction in Study 1 – even a brief video viewed in a lab setting – experienced greater positive emotion and less anxiety during the wait for intelligence test results compared to people who watched a neutral video, regardless of their level of trait awe. The effect of these videos were nearly twice as large for positive emotions as they were for anxiety, and the effects on worry and negative emotions were near-zero. Furthermore, our findings suggest that the awe induction was somewhat better at promoting positive

Table 2. Multiple regression analyses predicting waiting well-being from trait awe and baseline well-being.

	Study 1		Study 2	
	Trait awe	Relevant well-being measure at baseline	Trait awe	Relevant well-being measure at baseline
Waiting well-being				
Positive emotion	.16**	.37**	.15**	.43**
	[.05, .27]	[.26, .48]	[.10, .40]	[.42, .64]
Negative emotion	-.10*	.41**	.06	.45**
	[-.20, -.005]	[.31, .51]	[-.01, .03]	[.32, .48]
Anxiety	-.14**	.50**	-.03	.57**
	[-.23, -.04]	[.40, .59]	[-.14, .06]	[.44, .59]
Worry	.02	.66**	.01	.65**
	[-.06, .10]	[.58, .75]	[-.12, .15]	[.57, .72]

Standardized betas with 95% confidence intervals. † $p < .10$, * $p < .05$, ** $p < .01$.

Table 3. Descriptive statistics for well-being while waiting by condition.

	Study 1			Study 2		
	Awe	Positive control	Neutral control	Awe	Positive control	Neutral control
Positive emotion*	4.61 (1.35) _a	4.37 (1.57) _b	3.03 (1.42) _c	4.60 (1.32) _a	4.70 (1.34) _a	3.68 (1.29) _b
Negative emotion	1.35 (0.67) _a	1.43 (0.73) _a	1.36 (0.68) _a	1.43 (0.75) _a	1.39 (0.75) _a	1.48 (0.82) _a
Anxiety*	2.17 (0.94) _a	2.45 (1.15) _a	2.63 (1.05) _b	2.27 (1.07) _a	2.42 (1.07) _b	2.49 (1.05) _b
Worry	2.64 (1.37) _a	2.37 (1.34) _a	2.83 (1.50) _a	2.66 (1.47) _a	2.74 (1.64) _a	2.76 (1.48) _a

Means and standard deviations for well-being by condition. *Video is a statistically significant predictor in a One-Way ANOVA model: positive emotions ($ps < .0001$, partial $\eta^2 > .13$) and anxiety ($ps < .08$, partial $\eta^2 > .01$). Within each row for each study that is statistically significant, means that share a subscript do not statistically differ from one another.

Table 4. Multiple regression analyses predicting well-being from trait awe and the awe manipulation.

	Study 1			Study 2		
	Video	Trait awe	Interaction	Video	Trait awe	Interaction
Positive emotion	.30** [.20, .39]	.17** [.06, .28]	-.01 [-.11, .08]	.15** [.07, .23]	.15** [.05, .25]	-.01 [-.10, .09]
Negative emotion	-.03 [-.12, .07]	-.10* [-.20, -.001]	.02 [-.07, .12]	-.01 [-.11, .07]	.06 [-.03, .15]	.02 [-.07, .11]
Anxiety	-.15** [-.24, -.06]	-.12* [-.22, -.03]	.03 [-.07, .12]	-.09* [-.17, -.01]	-.03 [-.12, .06]	-.005 [-.09, .08]
Worry	.02 [-.06, .10]	-.003 [-.08, .08]	.06 [-.02, .14]	-.03 [-.11, .06]	-.01 [-.07, .08]	-.02 [-.10, .05]

Standardized betas and 95% confidence intervals. Models are predicting well-being from video condition *awe induction* = +1, *positive* = -.5, *neutral* = -.5), trait awe, the video condition, and trait awe interaction, while also controlled for baseline measures of well-being.

† $p < .10$, * $p < .05$, ** $p < .01$.

emotions and slightly (though not significantly) better at reducing anxiety compared to the positive control condition. To further investigate these relationships and test the generalizability of an awe induction across domains, we conducted a conceptual replication of Study 2 by changing the domain of uncertainty from intelligence to social skill.

Study 2

Participants

Participants were 399 undergraduate students (66.0% female; $M_{age} = 19.03$, $SD = 1.28$) from an introductory psychology course who consented to participate in the study for partial course credit. Participants were diverse in terms of race and ethnicity: 38.1% identified as Hispanic or Latinx, 36.8% as Asian, 8.7% as White, 7.8% as more than one race/ethnicity, 4.0% as Black, 3.5% as Middle Eastern, and 0.8% as Native Hawaiian/Pacific Islander. We aimed to recruit 100 participants per video condition but continued the study through the end of the relevant academic quarter after reaching our target sample size.

Procedure

Study 2 followed the same basic design as Study 1, but instead of taking an intelligence test, participants were brought into the lab in groups of three to participate in what they presumed to be a study about personality and first impressions. If a third student was unavailable for the session, a research assistant stepped in as a confederate (21.6% of sessions). Participants were told they would complete sets of personality and emotion measures before and after a brief peer interaction and that they would be evaluating (and evaluated by) each of the other group members. They were told that they would see the results of these evaluations, and as in the previous studies, participants were randomly assigned (by group) to expect either immediate or delayed feedback (this manipulation will not be discussed further).

The peer interaction was unscripted and lasted for 5 min. Each person was assigned a letter and instructed to refer to the other group member by letter instead of name when taking notes. Participants were told they could talk about anything that arose naturally in conversation such as hobbies, hometowns, or year in

school, but were asked to avoid talking about the current study or any other studies.

After the peer interaction, participants waited approximately 10 min and were randomly assigned to watch one of three videos, as in Study 2: an *awe induction* ($n = 136$), a *positive control* ($n = 129$), or a *neutral control* ($n = 134$), after which they completed video evaluations, peer evaluations, and the final set of study measures before being debriefed. Full study materials are available on the Open Science Framework (study measures are available on the Open Science Framework: <https://osf.io/y2btc/>)

Measures

Study 2 measures were the same as those in Study 1. Baseline measures included trait awe ($M = 5.09$, $SD = .85$, $\alpha = .75$), positive affect ($M = 4.67$, $SD = 1.15$, $\alpha = .87$), negative emotion ($M = 2.71$, $SD = 1.18$, $\alpha = .83$), anxiety ($M = 3.56$, $SD = 1.16$, $\alpha = .87$), and worry ($M = 3.23$, $SD = 1.54$, $\alpha = .89$; e.g., 'I am worried how others will see me in the group interaction'). Waiting period measures included measures of positive emotion ($M = 4.34$, $SD = 1.39$, $\alpha = .91$), negative emotion ($M = 1.43$, $SD = .77$, $\alpha = .83$), anxiety ($M = 2.39$, $SD = 1.06$, $\alpha = .87$), and worry ($M = 2.72$, $SD = 1.52$, $\alpha = .91$). As in Study 1, an inspection of the distribution of the negative emotion measure showed a substantial positive skew in the waiting data. For consistency across repeated measures of negative emotion, we log-10 transformed negative emotion at both time points.

Results

Manipulation check

As in Study 1, participants were asked to describe the video they watched and the extent to which the video made them feel 26 discrete emotions. As intended, participants in the *awe induction* condition experienced significantly greater feelings of awe, $F(1, 398) = 23.94$, $p < .0001$, partial $\eta^2 = .06$, and other morality-based appraisals (e.g., a desire to help others, inspiration; once again, the only exception was the desire to be a better person) relative to control conditions, $F_s > 9.40$, $p_s < .003$, partial $\eta^2_s > .02$; participants in the *positive control* condition had the highest ratings of amusement/humor, entertainment, and surprise, $F_s > 10.20$, $p_s < .002$, partial $\eta^2_s > .03$; and participants in the *neutral control* condition consistently had the lowest ratings on both positive and negative items (see Supplemental Materials for full manipulation check results). As in Study 1, participants in the *awe induction* condition had significantly higher ratings than control conditions on several negative emotions, namely

shame, fear/anxiety, and sadness, $F_s > 13.56$, $p_s < .002$, partial $\eta^2_s > .01$.

Associations with trait awe

Table 1 presents correlations between trait awe and key study variables, and Table 2 presents the results of multiple regression analyses predicting waiting experiences from trait awe, controlling for relevant baseline measures. Greater trait awe was again associated with greater positive emotion and less anxiety, after controlling for baseline emotion. Trait awe was not associated with negative emotion or worry during the wait for social feedback.

Effects of the awe induction

Table 3 presents the descriptive statistics for well-being by condition. To test Hypothesis 2, we conducted one-way ANOVA procedures as in Study 1. Video condition had an effect on both positive emotion, $F(2, 395) = 29.72$, $p < .0001$, partial $\eta^2 = .13$, and anxiety (falling short of traditional standards for statistical significance in the case of anxiety), $F(2, 395) = 2.52$, $p = .08$, partial $\eta^2 = .01$, controlling for baseline positive emotion and anxiety, respectively. Regarding positive emotion, contrast tests adjusting for baseline positive emotion revealed that participants reported considerably greater positive emotion in the *awe induction* condition than in the *neutral control* condition, $F(1, 395) = 56.82$, $p < .0001$, partial $\eta^2 = .10$, but no more than in the *positive control* condition, $F(1, 395) = 0.03$, $p = .88$, partial $\eta^2 < .0001$. Participants also reported greater positive emotion in the *positive control* condition than in the *neutral control* condition, $F(1, 395) = 58.96$, $p < .0001$, partial $\eta^2 = .10$.

Regarding anxiety, contrast tests adjusting for baseline anxiety revealed that participants reported somewhat less anxiety in the *awe induction* condition than in the *neutral control* condition (albeit falling short of traditional standards for statistical significance), $F(1, 395) = 3.16$, $p = .076$, partial $\eta^2 = .007$, and significantly less anxiety than participants in the *positive control* condition, $F(1, 395) = 4.27$, $p = .04$, partial $\eta^2 = .01$. Participants did not differ in their anxiety between the *positive control* condition and the *neutral control* condition, $F(1, 395) = 0.07$, $p = .79$, partial $\eta^2 = .0001$. Video condition did not affect negative emotion, $F(2, 395) = .06$, $p = .94$, partial $\eta^2 = .0003$, or worry, $F(2, 395) = 1.05$, $p = .35$, partial $\eta^2 = .005$, after controlling for baseline measures.

The moderating role of trait awe

We once again conducted multiple regression analyses to examine trait awe as a moderator of video effect, predicting well-being during the waiting period from video condition (*awe induction* = + 1, *positive* = -.5,

neutral = -0.5), trait awe, and their interaction, controlling for relevant baseline measures. As shown in Table 4, no interaction effect was significant.³

Discussion

The pattern of results in Study 2 was similar to that of Study 1, with several notable differences. As in Study 1, the pattern of findings suggests that trait awe is associated with greater positive emotions and less anxiety and is unrelated to negative emotions and worry while waiting for peer ratings. Regardless of one's predisposition to feeling awe, experiencing an awe induction resulted in greater positive emotion (compared to a neutral control condition) and less anxiety during the uncertain waiting periods (compared to positive and neutral control conditions). Once again, the effect of the videos on positive emotions was nearly twice the magnitude of their effect on anxiety, and the effects on worry and negative emotions were again near-zero.

General discussion

Uncertainty is an inevitable part of life, and it can be a source of significant distress. In two studies, we investigated the role of awe during uncertain waiting periods. We expected that people who were predisposed to experiencing awe in their everyday life would report greater well-being during the waiting period. Our findings provide partial support for a relationship between trait awe and well-being, such that trait awe was consistently associated with greater positive emotion and, to a lesser degree, lower negative emotion and anxiety, but trait awe was consistently unrelated to worry while waiting for news.

Across two studies, we investigated the effect of an awe induction to test the hypothesis that people who have a momentary experience of awe (regardless of their predisposition) would report greater well-being compared to positive and neutral control conditions during an uncertain waiting period. Again, we found partial support for this hypothesis. Experiencing awe offered a boost in positive emotion and reduced anxiety during an uncertain waiting period compared to neutral control conditions. However, these benefits did not always exceed the benefits of a general positive control condition. It is also important to note that participants in our pilot study who viewed the awe video reported more negative emotion, such as shame and fear, compared to the control conditions.

Lastly, we explored the role of trait awe in the effect of our awe induction. It could be that people who are predisposed to experiencing awe would experience

particularly large benefits to well-being following an awe induction due to their natural proclivity to experience the emotion. On the other hand, those who do not naturally experience awe may benefit more from an awe induction if the novelty of the experience leads to a greater impact. Interestingly, our findings suggest that being predisposed to experiencing awe did not benefit or hinder the effects of our awe induction. People experienced greater positive emotion and less anxiety during the wait regardless of one's level of trait awe, suggesting that awe is broadly (if inconsistently) advantageous during stressful waiting periods.

This research expands our understanding of how people can manage uncertainty productively, providing empirical evidence for a strategy that effectively promotes well-being by maximizing positive emotions and minimizing anxiety. Because the concept of awe is relatively new to psychological research, this research also expands the field's understanding of awe by revealing nuances in its beneficial effects and opening new avenues for study in the field of positive psychology.

Unanswered questions

The current set of studies is the first to investigate the role of awe in uncertain waiting periods. Although our efforts produced some consistent effects (namely the relevance of awe for positive emotions and anxiety rather than worry or other negative emotions), we suggest several future directions for research on this topic. First, the settings contrived in our lab allowed us to maximize experimental control but did not provide a sense of how awe may function in naturally occurring situations and settings – both naturally-occurring waiting periods and naturally-occurring awe experiences. Additionally, we focused on how to promote well-being during the wait, but 'waiting well' can also mean that people wait in a way that facilitates an adaptive response to the news when it arrives (Sweeny, Reynolds, Falkenstein, Andrews, & Dooley, 2016). Awe shifts people's focus from the self to the 'bigger picture,' increasing feelings of connectedness, prosociality, and humility, which could have even greater benefits in the face of bad news than in the face of uncertainty.

Research on the development of awe interventions should also address questions about dosage (e.g., frequency, duration). Given that our findings were paired with relatively small effect sizes, it is possible that awe interventions may be less effective in situations in which distress is more severe and awe is thus more difficult to achieve. One way to combat these

constraints may be to use alternative durations or frequencies in awe interventions. For example, a recent study suggested that more frequent experiences of awe, even small ones found in daily life, predict positive outcomes weeks later (Keltner, 2016). With attention and intention, awe can be found in daily life; an all-consuming experience is not necessary for one to reap the benefits, and it may be the case that a practice designed to focus one's attention on such experiences (e.g., mindfulness) would enhance these benefits.

However, it is important to note that these benefits only seemed to accrue for positive emotions and anxiety. Other studies have also found it difficult to minimize worry during the waiting period (Dooley et al., 2018; Rankin et al., 2018), suggesting that worry may be particularly tenacious in these moments. Of course, as mentioned earlier, people can benefit from their worry. Worry motivates people to prepare for the worst, and evidence suggests that it does so successfully, buffering the blow of bad news if it arrives (Sweeny & Dooley, 2017; Sweeny et al., 2016). It could be that the benefits of awe interventions are twofold: They bolster positive emotions during the wait while allowing people to worry and thus prepare for the worst. Thus, a fruitful avenue for future research could examine how awe can be manipulated outside of the lab, the contexts in which it may be especially beneficial, and whether awe can be implemented in a way that targets the emotional and cognitive components of worry. Of course, as noted at the outset of the paper, awe often entails a combination of positive emotions and more mixed or even negative experiences, particularly the sense of being small or insignificant. Interventionists should be attentive to the potential for awe experiences to exacerbate pre-existing tendencies toward insecurity or low self-esteem and ensure that recipients of such interventions receive the accommodation necessary to achieve the sense of enlightenment that awe can confer.

The historical and cultural contexts that have shaped our understanding of awe in psychological research and other domains are a rich source of information for further investigating and understanding awe in terms of its relationship to related constructs (e.g., religiosity, spirituality, other moral emotions), potential applications (e.g., decision-making), and tailored interventions to improve well-being in the course of daily life.

Notes

1. The difference in timeline between baseline positive/negative emotions (1 week) and anxiety (3 days) was simply due to an oversight. Our intention with these

baseline measures was to control for recent emotional tendencies, which led us to inquire about recent days rather than simply state emotions at baseline. Although we recognize that controlling for participants' emotional state entering the study has some advantages, we argue that controlling for recent emotional tendencies also has advantages in ruling out third-variable explanations for our findings.

2. We also ran these models comparing the (1) *awe induction* condition to the *neutral control* condition (*awe induction* = +1, *positive* = 0, *neutral* = -.1) and (2) *awe induction* condition to the *positive control* condition (*awe induction* = +1, *positive* = -1, *neutral* = 0). The only difference in our findings when approached this way is that in the second model, the effect of condition (*awe* vs *positive*) dropped slightly below traditional standards for statistical significance as a predictor of anxiety, $\beta = -.08$ [-.17, .01], $p = .07$.
3. As in Study 1, we also ran these models comparing the awe condition to the positive and control conditions separately. Using this approach, the effect of awe vs. control condition dropped slightly below traditional standards for statistical significance as a predictor of anxiety, $\beta = -.07$ [-.15, .01], $p = .08$, and the effect of awe vs. positive did not predict positive emotions, $\beta = -.01$ [-.09, .08], $p = .91$, consistent with our contrast tests.

Disclosure statement

No potential conflict of interest was reported by the authors.

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