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Awe and Boredom: Unravelling Dual Pathways Through Meaning in Life

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ABSTRACT

Possessing high meaning in life can prevent boredom. Recent evidence suggests that awe may increase meaning in life via vastness vis-à-vis the self (feeling connected to something bigger than the self) or decrease it through self-diminishment (feeling insignificant). Accordingly, we proposed and tested in four studies ($N = 1173$) that awe relates to boredom via these two competing pathways. We consistently found a negative indirect effect of awe on boredom via vastness vis-à-vis the self and meaning in life (Studies 1–3). This effect remained for threat-based awe (Study 3) and even after controlling for co-occurring emotions (Studies 2b and 3). The evidence for a positive indirect effect of awe on boredom via self-diminishment and meaning in life was present, albeit to a lesser extent. This research highlights the intricate relationship between awe and boredom, suggesting that awe can impact boredom through opposing effects on meaning in life.

1 | Introduction

> "People in awe never complain that church is boring"—Sproul (2013, 137)

> "A sense of wonder so indestructible that it would last throughout life, as an unfailing antidote against the boredom and disenchantment of later years"—Carson (1965, 20)

Sproul (2013) and Carson (1965) argued, as outlined above, that a sense of awe and wonder is a clear antidote to boredom, whether in the context of religious activities or against the mundane concerns of adulthood. Imagine gazing up at a clear starry sky at night or standing on top of a mountain with a panoramic view of stunning nature below. These experiences are absorbing, allow us to transcend mundane concerns, and feel connected to something bigger than ourselves (Jiang et al. 2024; Keltner and Haidt 2003). Now imagine being bored; feeling restless, like what you are doing lacks meaning, and like you can't engage your attention (Eastwood et al. 2012; Van Tilburg and Igou 2012). Although awe and boredom are characterized by largely opposing experiences, both emotions share a crucial connection to perceptions of meaning.

Unique to the experience of awe is 'the feeling of being a small, separate entity, and yet significant somehow and connected to the universe' (Schneider 2009, 81–82). In other words, awe elicits the small self, which has two components: vastness vis-à-vis the

self and self-diminishment (Piff et al. 2015). Vastness vis-à-vis the self refers to an awareness of a larger force or entity to which the self is connected to, whereas self-diminishment reflects a sense that the self is insignificant (Bai et al. 2021). Awe may make you feel connected to something bigger than your immediate self, thereby boosting meaning in life (Danvers et al. 2016; Ihm et al. 2019), but it may also evoke feelings of insignificance, negatively impacting meaning in life (Dai et al. 2022; Rivera et al. 2020). Meanwhile, many theories on boredom highlight the key role of meaning (Barbalet 1999; Igou et al. 2024; Westgate and Wilson 2018; Tam, Van Tilburg, Chan, Igou et al. 2021)—low perceptions of meaning are a precursor to boredom. Depending on how awe relates to meaning, awe may alleviate or exacerbate boredom. Accordingly, we propose a dual-pathway model to understand how awe impacts boredom.

2 | Awe and Boredom

Boredom is a common, unpleasant affective experience (Chin et al. 2017) and has been defined as 'a restless, irritable feeling that the subject's current activity or situation holds no appeal' (Barbalet 1999, 631). Boredom arises when there is a discrepancy between actual and desired levels of cognitive engagement (Danckert and Elpidorou 2023; Tam, Van Tilburg, Chan, Igou et al. 2021) and is associated with increased stress responses on a physiological level (Merrifield and Danckert 2014) and a failure to engage attentional control networks on a neural level (Danckert and Merrifield 2016). It is a distinct emotion characterized by attention failures (Eastwood et al. 2012), a lack of perceived challenge (Van Tilburg and Igou 2012), high avoidance and low exploration of information in a situation (Seiler et al. 2022), and—critical to the current investigation—a perceived lack of meaning (Barbalet 1999; Fahlman et al. 2009; Van Tilburg and Igou 2011; Westgate and Wilson 2018).

Boredom is often linked to psychological and societal harms. Boredom proneness, also referred to as trait boredom (Tam, Van Tilburg, and Chan 2021; Farmer and Sundberg 1986), is predictive of numerous problematic well-being and societal outcomes such as greater depression and anxiety (Goldberg et al. 2011), psychopathology (Seiler et al. 2023) and aggressive tendencies (Pfattheicher et al. 2021). State boredom refers to the momentary experience of boredom (Chan et al. 2018; Fahlman et al. 2013) and can trigger a variety of responses that can sometimes be adaptive (e.g., increased prosocial intentions; Van Tilburg and Igou 2017) but are often maladaptive (e.g., non-suicidal self-injury, Nederkoorn et al. 2016; unwarranted risk-taking, Kılıç et al. 2020). Thus, understanding the antecedents of boredom and how it can be mitigated has both intrapersonal and interpersonal importance.

Awe is a self-transcendent emotion that arises when people perceive that they are in the presence of something vast that transcends one's current understanding (Keltner and Haidt 2003). Awe is predictive of ample physical and mental health benefits (see Monroy and Keltner 2023 for a review) such as reductions in daily stress and increases in life satisfaction, well-being and perceptions of time (Bai et al. 2021; Rudd et al. 2012). It has a unique neurophysiological profile. For instance, in Takano and Nomura (2020), awe experiences deactivated the left middle temporal gyrus, compared to a positive affect control condition, which plays a critical role in matching existing schema to events. Further, awe differs from other positive epistemic emotions—emotions that arise as a function of the information provided—like surprise and curiosity, in that it is associated with exceeded expectations and sufficient information. Meanwhile, surprise is associated with both exceeded *and* disconfirmed expectancies, and curiosity is associated with having little or no information (Noordewier and Gocłowska 2024; Seiler and Dan 2024). Notably, awe can be evoked in response to pleasant external events like nature and witnessing another's kindness (Monroy and Keltner 2023) and to threatening events, such as natural disasters (Gordon et al. 2017). Despite the mystical nature of the experience, awe is common in daily life (Bai et al. 2017; Stellar et al. 2024).

Despite many calls for strategies to mitigate boredom (Seiler et al. 2023; Weybright et al. 2020) and the booming research supporting the well-being benefits of awe (Monroy and Keltner 2023), the relationship between awe and boredom is yet to be empirically tested. There is good reason to suspect that awe would negatively predict boredom. Although awe and boredom are both epistemic emotions, their features differ in important ways. Awe is associated with high exploration, low avoidance, enhanced attention and positive affect, whereas boredom is widely characterized by low exploration, high avoidance, a difficulty to engage attention and negative affect (Noordewier and Gocłowska 2024; Seiler and Dan 2024; Van Elk et al. 2016; Tam and Inzlicht 2024). Boredom occurs when skill level is higher than the demands of the task (Ulrich et al. 2014), opposite to the concept of flow, which occurs when there is a perceived fit between abilities and task demands (Csikszentmihalyi 1975). Awe and flow share similarities in terms of self-transcendence, altered time perception and positive affect, but they are distinct experiences, as a certain skill level is not a prerequisite to experience awe as it is with flow. In fact, awe occurs with stimuli that transcend current understanding (Keltner and Haidt 2003). Nevertheless, a core similarity that awe and boredom do share is that they both impact perceptions of meaning in life (Fahlman et al. 2009; Rivera et al. 2020; Van Tilburg and Igou 2012; Yuan et al. 2023). The present studies consider how awe and its processes influence boredom through two contrasting existential pathways. We primarily hypothesized a negative pathway from awe to boredom (awe → vastness vis-à-vis the self → meaning in life → boredom). Our model also accounts for a positive pathway from awe to boredom (awe → self-diminishment → meaning in life → boredom). We outline these hypothesized pathways below.

3 | Awe, the Small Self, and Meaning in Life

Awe has a range of interpersonal benefits (Monroy and Keltner 2023). The most prevailing explanation for this social function of awe is the *small-self hypothesis* (Bai et al. 2017; Piff et al. 2015). This hypothesis states that awe can significantly diminish the self, shifting attention to concerns outside of the self, leading to prosocial outcomes (Perlin and Li 2020; Piff et al. 2015). However, the small self is also a mechanism by which awe decreases perceptions of meaning in life (Rivera et al. 2020), suggesting its intrapersonal functions are not always positive. The small self consists of two components: *vastness vis-à-vis the self* and *self-diminishment* (Bai et al. 2017; Piff et al. 2015).

Vastness vis-à-vis the self (which we will refer to as 'vastness' from this point on for conciseness) is often described as an awareness of a larger force or entity to which the self is connected to (Bai et al. 2021) and is elicited by the experience of awe (Keltner and Haidt 2003). In both narrative and experimental accounts of awe, vastness and connectedness are closely related (Bonner and Friedman 2011; Edwards et al. 2023). Arguably, vastness elicits self-transcendence rather than a shrinking of the self (Tyson et al. 2022) and may elicit more of the self-transformative aspects of awe (see Perlin and Li 2020; Jiang et al. 2024), like greater meaning in life.

The second component of the small self—self-diminishment—is also elicited by awe and reflects a sense that the self is insignificant (Bai et al. 2021). Notably, self-diminishment is different from reduced self-focus and self-salience (Jiang et al. 2024). One can experience reduced self-focus without self-diminishment (e.g., in a flow state), and feelings of insignificance may increase an awareness of the self. Evidence shows that the concepts of vastness and self-diminishment are distinct (Piff et al. 2015) and lead to diverging effects on crucial well-being variables. In prior studies, vastness was related to higher self-esteem and connectedness, whereas self-diminishment was related to lower self-esteem and feelings of isolation (Edwards et al. 2023; Hornsey et al. 2018; Tyson et al. 2022). Further, vastness, but not self-diminishment, is a mechanism through which awe reduces daily stress (Bai et al. 2021). Despite these apparent differences, many studies examine self-diminishment and vastness as a single construct under the umbrella of the small self (e.g., Gordon et al. 2017; Rivera et al. 2020).

Meaning in life, the feeling that one's life is significant, coherent, and purposeful (Costin and Vignoles 2020; Martela and Steger 2016), is vital for well-being (Zika and Chamberlain 1992). Scholars have commonly proposed that experiences of awe elevate an individual's sense of meaning (Ihm et al. 2019). For instance, Chen and Mongrain (2021, 772) suggested that awe is 'a conduit to social connection, oneness with environments and meaning in life', whereas Danvers et al. (2016) propose that awe experiences develop a mindset that is conducive to a sense of meaning in life. On the other hand, Van Cappellen (2017) theorized that existential security may be required for the experience of awe to remain a positive (and meaningful) one. Recent empirical evidence elucidates that the relationship between awe and meaning is indeed nuanced. Dai et al. (2022) found that an awe induction increased meaning in life compared to the control condition, whereas Kim et al. (2022) found no differences. In addition, Rivera et al. (2020) and Yuan et al. (2023) found inconsistent main effects of awe on meaning in life across studies. In terms of mechanisms, Rivera et al. (2020) suggested that awe can *increase* meaning via happiness, but it can also *decrease* meaning through the small self. Yet, happiness is not the most theoretically sound mediator for awe's effect on meaning, as outlined by Dai et al. (2022) and Yuan et al. (2023), as happiness is not a prototypical feature of awe (Keltner and Haidt 2003). Meanwhile, Rivera et al. (2020) measured both components of the small self as a single construct. Collapsing two opposing constructs into one measure (i.e., the small self) is likely to dilute the effects of each variable and does not tell the full story of how awe relates to meaning in life.

3.1 | Awe Predicts Less Boredom Through Vastness and Higher Meaning in Life

Vastness is likely to bolster meaning in life. Positive emotions predispose individuals to feel that life is meaningful (King et al. 2006). Self-transcendent emotions, like awe, are generally experienced positively (Van Cappellen 2017; Yaden et al. 2017); however, they go beyond general positive affect as they also offer a sense of connectedness. Indeed, Van Cappellen et al. (2013) found that self-transcendent emotions increased meaning in life over the effects of other positive emotions like amusement. Indeed, self-transcendence is often argued to be quintessential to a meaningful life (Frankl 2011; Huang and Yang 2023; Van Cappellen 2017; Wong 2016). Vastness, a feeling of connectedness to something or someone bigger than the self, allows individuals to transcend the self, thereby contributing to the sense that life is meaningful (Edwards et al. 2023; Jiang et al. 2024; Yaden et al. 2017). We propose that awe bolsters perceptions of meaning in life via vastness.

A robust body of literature demonstrates a negative association between boredom and meaning (Barbalet 1999; Chan et al. 2018; Van Tilburg and Igou 2012, 2017). Experimental manipulations of high meaning causally increase attention, a key feature of boredom (Eastwood et al. 2012; Tam et al. 2024). Thus, a paradigm to contain boredom has focused on augmenting meaning in life through various sources, which has now received significant theoretical and empirical support (Coughlan et al. 2019; O'Dea et al. 2022, 2023; Van Tilburg et al. 2019). For example, gratitude predicts less boredom by bolstering perceptions of meaning in life (O'Dea et al. 2023). Therefore, if awe predicts greater meaning in life through vastness, it is likely, in turn, to predict less boredom.

3.2 | Awe Predicts More Boredom Through Self-Diminishment and Lower Meaning in Life

Feeling that one's life has inherent value, worth and importance is a central component of perceptions of meaning in life (Costin and Vignoles 2020; Martela and Steger 2016). Awe experiences have the potential to make an individual feel small and unimportant relative to the grandness of what they are experiencing (Piff et al. 2015), which can have negative implications for meaning in life. Consistently, Dai et al. (2022) found that awe indirectly decreased meaning in life by reducing the sense of significance. We hypothesize that self-diminishment, feeling like the self is insignificant, will decrease meaning in life. Experimentally manipulating low perceptions of meaning in life precedes an increase in boredom (Fahlman et al. 2009; Westgate and Wilson 2018). If awe predicts lower meaning in life through self-diminishment, it may, in turn, predict higher levels of boredom. In sum, to accurately predict the consequences of awe on boredom, we needed to consider the implications of both vastness and self-diminishment on meaning in life.

4 | Overview

We propose a dual-pathway model with two opposing mechanisms accounting for the influence of awe on boredom

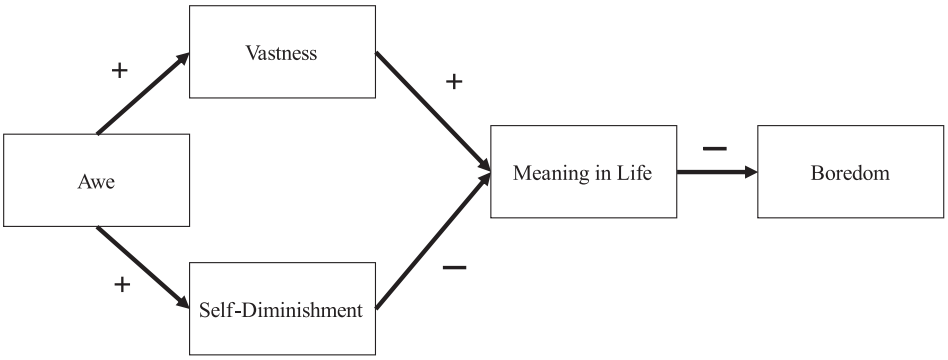

FIGURE 1 | Conceptual path model of how awe relates to boredom.

(Figure 1). The order of variables in our model is supported by rigorous theoretical underpinnings and a significant body of empirical evidence (Dai et al. 2022; Piff et al. 2015; O'Dea et al. 2023; Rivera et al. 2020; Van Tilburg et al. 2019; Westgate and Wilson 2018). Research suggests that approximately three-quarters of awe experiences are conflated with positive emotions (Chaudhury et al. 2022; Gordon et al. 2017; Monroy and Keltner 2023). Thus, awe is most often felt as a positive experience, leading to mostly adaptive outcomes (Monroy and Keltner 2023). The link that awe has with meaning appears to be similarly duplex; awe mostly enhances meaning and lowers it to a lesser degree (Dai et al. 2022; Yuan et al. 2023). Accordingly, we hypothesize that awe primarily predicts less boredom via increases in vastness and meaning in life (Hypothesis 1). We also hypothesize that awe predicts greater boredom via increases in self-diminishment and decreases in meaning in life (Hypothesis 2), although we suspect this pathway will be present to a lesser extent.

We conducted four studies using correlational and experimental methods. Individuals can experience boredom without necessarily being boredom prone (Mercer-Lynn et al. 2013; Mercer-Lynn et al. 2014). Thus, we were interested in testing and generalizing the effects of awe and boredom on both the trait and state level. Past research on gratitude, another self-transcendent emotion, found that the negative impact of gratitude on boredom via meaning in life was functionally equivalent on both the trait and state level (O'Dea et al. 2023). On the basis of shared similarities between awe and gratitude (Stellar et al. 2017), we predict that the relationships between awe, meaning and boredom will similarly be evident on both levels of analysis. Accordingly, in cross-sectional Study 1, we tested whether the feelings of vastness and self-diminishment elicited by dispositional awe predicted opposing effects on meaning in life and boredom proneness. In Studies 2a and 2b, we examined these hypotheses using experimental inductions of awe and state measures of the key variables. Study 3 replicated the results of Studies 2a and 2b with different awe inductions and extended the findings to threat-based awe.

5 | Transparency and Openness

All studies received ethical approval from the Education and Health Sciences Research Ethics Committee at the University of Limerick and were programmed via Qualtrics. We report how we determined our sample size, all data exclusions, and all manipulations and measures used in the current research.

We deposited data, analysis code and study materials/codebook at the OSF: https://osf.io/754cz/?view_only=9526ae2cba034bda94d0c00890ff10fd. Studies 1 and 2 were not preregistered; Study 3's design and analysis were (https://aspredicted.org/7H4_4HW).

6 | Study 1

Study 1 was designed to test whether individuals who are prone to awe experience greater perceptions of meaning in life through greater vastness, in turn predicting lower levels of boredom proneness (Hypothesis 1). We also tested whether individuals prone to awe experience lower perceptions of meaning in life through greater self-diminishment and, in turn, are more prone to boredom (Hypothesis 2).

6.1 | Methods

6.1.1 | Participants

We required a sample of 244 participants to achieve a power of $(1-\beta) = 0.80$ adopting a Type-I error of $\alpha = 0.05$ (moderate correlations $\rho = 0.40$, two-tailed; Schoemann et al. 2017; 1000 replications with 20,000 Monte-Carlo draws) to detect effects among three mediators (Schoemann et al. 2017). Moderate correlations were hypothesized between the variables in line with prior research on another self-transcendent emotion (gratitude), meaning in life and boredom (O'Dea et al. 2023)[1]. We recruited 272 participants from M-Turk; however, 1 participant did not consent to partake in the study, and 74 others failed the attention check, resulting in an effective sample of 197 participants, resulting in a power of $(1-\beta) = 0.72$[2]. The final sample included 125 males and 72 females with an age range of 19–66 ($M_{age} = 36.11$, $SD_{age} = 9.64$), and the vast majority described their nationality as US American (99%).

6.1.2 | Procedure and Materials

After giving informed consent, participants were required to indicate what they were being asked to do in the study as an attention check. Those who answered incorrectly were later excluded from the analysis. They reported age, gender and

TABLE 1 | Zero order correlation matrix for measures in Study 1.

Measure	1	2	3	4	5	6	7
1 Awe	1	0.67***	0.49***	0.52***	0.51***	0.49***	0.52***
2 Vastness		1	0.57***	0.50***	0.50***	0.47***	0.50***
3 Self-dim			1	0.01	0.78***	0.70***	0.77***
4 MP-MLQ				1	−0.03	−0.01	−0.02
5 BPS-SF					1	0.88***	0.97***
6 HBPS						1	0.97***
7 BOR-I							1

Abbreviations: BOR-I, boredom index (BPS-SF and HBPS aggregate); BPS-SF, shortened boredom proneness scale; HBPS scale, Harthouse Boredom Proclivity scale; MP-MLQ, meaning presence from MLQ; Self-dim, self-diminishment subscale.

*$p < 0.05$.

**$p < 0.01$.

***$p < 0.001$.

nationality and proceeded to engage with a series of measures. Dispositional awe was measured by the six-item subscale from the Dispositional Positive Emotions Scale (Shiota et al. 2006). Sample items included 'I often feel awe' and 'I see beauty all around me' (1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = 0.83$). The small self was measured using the 10-item scale used in Piff et al. 2015; Study 4). The scale was adapted to emphasize generalized and trait-like responses to the items by using phrases such as 'in general' and 'most of the time'. The measure included two subscales, vastness ('In general, I feel a part of some greater entity'; $\alpha = 0.92$) and self-diminishment ('I often feel small or insignificant'; $\alpha = 0.90$), 1 = *not at all true*, 7 = *very true*. Participants then completed the Presence of Meaning in Life subscale from the Meaning in Life Questionnaire (MP-MLQ; Steger et al. 2006), for example, 'I understand my life's meaning', with one reverse-scored item, 'My life has no clear purpose' (1 = *absolutely untrue*, 7 = *absolutely true;* $\alpha = 0.75$). We measured boredom proneness with two scales. We used the shortened form of the boredom proneness scale (BPS-SF; Struk et al. 2015), an eight-item measure (e.g., 'I often find myself at 'loose ends' not knowing what to do'; 1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = 0.95$). Participants also completed a measure to assess boredom more directly, the Harthouse boredom proclivity scale (HBPS; Van Tilburg et al. 2019). The scale contains four items (e.g., 'How prone are you to feeling bored?'; $\alpha = 0.92$), to which participants responded to the first three items on a scale ranging from 1 (*not at all*) to 7 (*very much*). The fourth item asked participants, 'Specifically, how often do you feel bored?', using a scale from 1 (*once or twice a year*) to 7 (*at least once a day*). Lastly, they were thanked, debriefed and rewarded for their participation.

6.2 | Results

To assess multicollinearity, variance inflation factor (VIF) values were examined for all predictors. VIF values ranged from 1.53 to 2.53, indicating no serious multicollinearity concerns. The BPS-SF and the HBPS were combined to make one boredom index (BOR-I). Zero-order correlations are presented in Table 1. PROCESS (Hayes 2021) uses a series of ordinary least squares (OLS) regressions to test how much a predictor variable effects an outcome variable through a mediator(s) (i.e., indirect effect). PROCESS analyses the model using successive multiple and saturated regression analyses, and thus has 'perfect' model fit by default. Using bootstrapping, PROCESS provides bias-corrected confidence intervals for indirect effects, which improves reliability. Accordingly, we examined the relationship between dispositional awe and boredom with 3 mediators (vastness, self-diminishment and meaning in life) using PROCESS Model 80 with 10,000 bootstraps (Hayes 2021; Figure 2). The predictors explained a significant proportion of variance in boredom, $R^2 = 0.64$, $F(4, 192) = 85.18$, $p < 0.001$. There was a negative indirect effect of dispositional awe on boredom proneness via vastness and meaning in life, $B = -0.108$, SE = 0.055, 95% CI [−0.237, −0.024]. Meanwhile, there was a positive indirect effect on boredom proneness via self-diminishment and meaning in life, $B = 0.08$, SE = 0.029, 95% CI [0.021, 0.136]. We provide results corrected for common method bias for all studies in the Supporting Information section, the results of which were largely consistent.

6.3 | Discussion

Study 1 demonstrates two diverging indirect effects of awe on boredom (Figure 2)[3]. Dispositional awe predicted less boredom proneness via greater levels of vastness and higher levels of meaning in life (Hypothesis 1), in line with our predictions. We also found that dispositional awe predicted greater levels of boredom proneness via higher levels of self-diminishment and lower perceptions of meaning in life (Hypothesis 2).

7 | Studies 2a and 2b

Study 1 demonstrated the two opposing pathways between dispositional awe and boredom proneness through the small self and meaning in life. The next two studies aimed to extend these findings to experimental inductions of awe. Videos-based manipulations are a common and effective way to induce awe in online settings (e.g., Gordon et al. 2017; Jiang and Sedikides 2022). Study 2a included measures of positive and negative affect to ensure our manipulation was specifically inducing awe and not positive or negative affect more generally. Study 2b aimed to

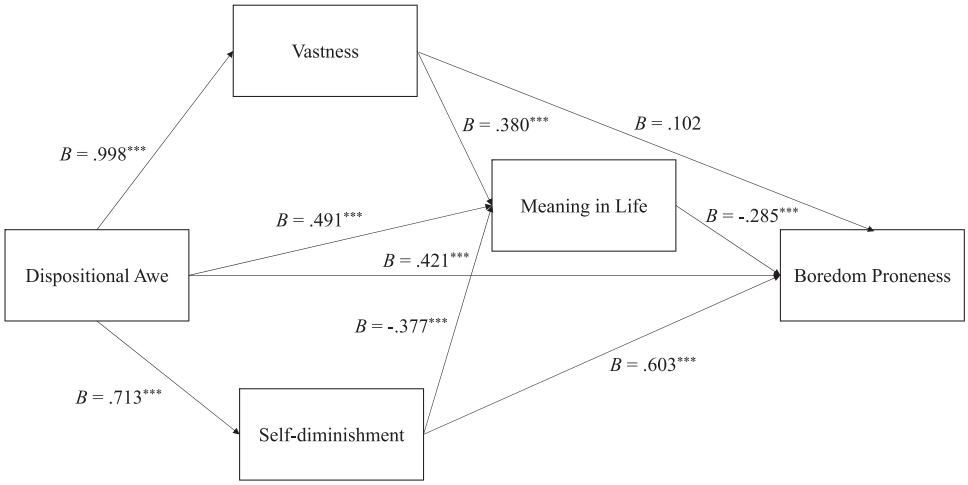

FIGURE 2 | Mediational path model for Study 2. Total effect: $B = 0.782$, SE = 0.093, $p < 0.001$, 95% CI [0.598, 0.965]. $N = 197$. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The full statistics for each path are reported in the Supporting Information section.

replicate and complement the findings of Study 2a. Awe tends to be accompanied by other emotions (Jiang and Sedikides 2022; Piff et al. 2015). Study 2b thus measured distinct emotional states, allowing us to control for the role of co-occurring emotions.

7.1 | Method

7.1.1 | Participants

We required a sample of 244 participants to achieve a power of $(1 - \beta) = 0.80$ to detect effects among 3 mediators, adopting a Type-I error of $\alpha = 0.05$ (Schoemann et al. 2017; moderate correlations $\rho = 0.40$ [O'Dea et al. 2023], 2-tailed; [Schoemann et al. 2017]; 1000 replications with 20,000 Monte-Carlo draws). Participants were recruited on M-Turk.

Study 2a. Two hundred and eighty-five participants were recruited. Five participants chose not to continue after they were given instructions to watch the video, and 11 admitted paying less than 50% of their attention to the video. After the exclusion of these participants, there was an effective sample of 269 participants[4]. There were 135 participants randomly assigned to the experimental awe condition and 134 to the control condition.

Study 2b. We recruited 316 participants who identified as US American (bar 2 Native Americans and 1 Hispanic). One participant didn't consent to the study, one admitted to not watching the video, and nine indicated that they paid less than 50% of their attention to the video. These participants were excluded, resulting in a final sample of 305 participants (165 males, 139 females and 1 other) between the ages of 20 and 71 ($M_{age} = 38.31$, $SD_{age} = 11.33$). Again, participants were randomly assigned to the awe condition ($N = 165$) or the control condition ($N = 149$).

7.1.2 | Procedure and Materials

All participants gave informed consent. We manipulated awe by having participants watch a 4-min video of vast scenes of nature from Yosemite with slowly building instrumental music ('Outro' by M83). The video was featured as an 'awe video' on the Greater Good Science Centre website (https://ggia.berkeley.edu/practice/awe_video). First, we pilot-tested the validity of the use of this video ($n = 20$) in an online survey, as it had not been used in research prior, and found that participants reported feeling awe ($M = 4.90$, SD = 1.21; 1 = *I did not feel awe at all*, 7 = *I felt awe intensely*) after watching this video.

Participants in the neutral control condition watched an instructional video of the same length on how to furnish a wooden countertop (https://www.youtube.com/watch?v=a6x2myAH6og). This has been used as a comparison condition in awe research previously (e.g., Kim et al. 2022). Participants in both conditions were instructed to watch the video with close attention, in full-screen mode, and with the volume on. To monitor engagement, participants were asked if they watched the video, if they watched the video in full-screen mode, if the sound was on, and how much attention they paid to the video, from 0% to 100% of their attention.

Afterwards, participants in Study 2a were asked how much awe they experienced watching the video (1 = *I did not feel this at all*, 7 = *I felt this very intensely*). Similarly, the manipulation check in Study 2b asked participants to indicate how much awe they experienced during the video on a scale of 1 = *not at all* to 6 = *extremely* (Jiang and Sedikides 2022). Next, we measured the small self (Piff et al. 2015) with four items relating to vastness ('I feel a part of some greater entity'; $\alpha = 0.89$, $\alpha = 0.90$) and five items measuring self-diminishment ('I feel small or insignificant'; 1 = *not at all true*, to 7 = *very true*; $\alpha = 0.87$, $\alpha = 0.90$). We then measured the state of presence of meaning in life with a modified version of the five-item subscale from the MLQ ($\alpha = 0.75$, $\alpha = 0.74$; SMP-MLQ; Steger et al. 2006; O'Dea et al. 2022), example items include, 'In this moment, I understand my life's meaning' (1 = *strongly disagree*, 7 = *strongly agree*). State boredom was measured using the multidimensional state boredom scale's (Fahlman et al. 2013) eight-item short version (MSBS-SF; Hunter et al. 2016), for example, 'I seem to be forced to do things that have no value to me'; 1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = 0.94$, $\alpha = 0.95$) and a more direct three-item measure to ensure we were explicitly measuring boredom (e.g.,

TABLE 2 | Correlations across conditions in Study 2a.

Measure	1	2	3	4	5	6	7
1 Awe	1	0.63***	0.55***	0.28***	0.06	0.31***	0.54***
2 Vastness		1	0.69***	0.41***	0.02	0.28***	0.70***
3 Self-diminishment			1	0.25***	0.25***	0.48***	0.55***
4 State meaning in life				1	−0.24***	−0.02	0.54***
5 State boredom index					1	0.74***	−0.04
6 Negative affect						1	0.26***
7 Positive affect							1

***$p < 0.001$.

TABLE 3 | Means and standard deviations for outcomes variables in Study 2a.

	Awe		Control	
Variable	***M***	**SD**	***M***	**SD**
Awe	6.01	0.91	5.20	1.69
Vastness	5.50	1.10	4.86	1.54
Self-diminishment	5.27	1.13	4.75	1.54
State meaning	4.96	1.04	4.86	1.15
State boredom	4.18	1.72	4.20	1.74
Positive affect	3.77	0.68	3.68	0.89
Negative affect	2.76	1.11	2.43	1.24

'Do you experience boredom right now?', 1 = *not at all*, 7 = *very much*; $\alpha = 0.92$, $\alpha = 0.94$; SBOR; Van Tilburg et al. 2013).

Study 2a included the positive and negative affect schedule (PANAS). The PANAS contains 20 items (Watson et al. 1988), for example, 'Indicate the extent to which you feel distressed'; 1 = *very slightly or not at all*, 5 = *extremely* ($\alpha = 0.87$, for the positive subscale, PA; $\alpha = 0.95$ for the negative subscale, NA). In Study 2b we included measures of distinct emotional states. Participants were asked to indicate the extent they felt anger, disgust, fear, pride, sadness and happiness (1 = *not at all*, 6 = *extremely;* Jiang and Sedikides 2022) in random order. Participants were thanked, debriefed and rewarded for their participation.

7.2 | Results

7.2.1 | Study 2a

To assess multicollinearity, VIF values were examined for all predictors. VIF values ranged from 1.21 to 2.53, indicating no serious multicollinearity concerns. Zero-order correlations across conditions are presented in Table 2. Descriptive statistics are reported in Table 3. Participants in the awe condition felt significantly more awe than the control condition, $F(1, 267) = 24.07$, $p < 0.001$, $\eta_p^2 = 0.083$. The manipulation was successful. Similarly, participants in the awe condition reported greater feelings of vastness, $F(1, 267) = 9.37$, $p = 0.002$, $\eta_p^2 = 0.034$, and self-diminishment, $F(1, 267) = 9.65$, $p = 0.002$, $\eta_p^2 = 0.035$, than the control condition. There was no difference between conditions in scores of state meaning in life, $F(1, 267) = 0.65$, $p = 0.421$, $\eta_p^2 = 0.002$, state boredom, $F(1, 267) = 0.01$, $p = 0.927$, $\eta_p^2 < 0.001$, or positive affect, $F(1, 267) = 0.94$, $p = 0.334$, $\eta_p^2 = 0.003$. However, participants reported more negative affect in the awe condition than the control, $F(1, 267) = 5.20$, $p = 0.023$, $\eta_p^2 = 0.019$. Controlling for negative affect, the difference in awe between the two conditions remained significant, $F(1, 266) = 19.24$, $p < 0.001$, $\eta_p^2 = 0.067$.

Indirect Effects. We employed PROCESS Model 80 (Hayes 2021) with 10,000 bootstraps to test our mediational analysis. We included awe as the independent variable (1 = *experimental awe condition*, 0 = *control condition*), vastness, self-diminishment and state meaning in life as mediators, respectively, and state boredom as the dependent variable (Figure 3). The predictors explained a significant proportion of variance in boredom, $R^2 = 0.17$, $F(4, 264) = 13.49$, $p < 0.001$. In a similar manner to the previous studies, the MSBS-SF and the SBOR were highly correlated ($r = 0.80$, $p < 0.001$) and were combined to create a state BOR-I. The indirect effect of awe on state boredom, via vastness and state meaning in life, was negative and significant, $B = -0.083$, SE = 0.042, 95% CI [−0.181, −0.020]. The indirect effect of awe on state boredom via self-diminishment and state meaning in life was nonsignificant, $B = 0.011$, SE = 0.023, 95% CI [−0.037, 0.058].

7.2.2 | Study 2b

To assess multicollinearity, VIF values were examined for all predictors. VIF values ranged from 1.64 to 2.91, indicating no serious multicollinearity concerns. Zero-order correlations across conditions are presented in Table 4. Means and standard deviations are presented in Table 5. Participants in the experimental condition felt significantly more awe than those in the control condition, $F(1, 303) = 16.39$, $p < 0.001$, $\eta_p^2 = 0.051$. The manipulation was successful. Participants felt more feelings of vastness in the awe condition. $F(1, 303) = 4.53$, $p = 0.03$, $\eta_p^2 = 0.015$, but self-diminishment did not differ between conditions, $F(1, 303) = 0.83$, $p = 0.36$, $\eta_p^2 = 0.003$. There was no difference in state boredom between the conditions, $F(1, 303) = 3.02$, $p = 0.08$, $\eta_p^2 = 0.010$, or state meaning in life, $F(1, 303) = 0.02$, $p = 0.89$, $\eta_p^2 < 0.001$. Further, the two conditions did not differ in anger, $F(1, 303) = 3.11$, $p = 0.08$, $\eta_p^2 = 0.010$; disgust, $F(1, 303) = 0.99$, $p = 0.32$, $\eta_p^2 = 0.003$; fear, $F(1, 303) = 0.40$, $p = 0.85$, $\eta_p^2 < 0.001$; pride, $F(1, 303) = 0.65$, $p = 0.42$, $\eta_p^2 = 0.002$; sadness, $F(1,$

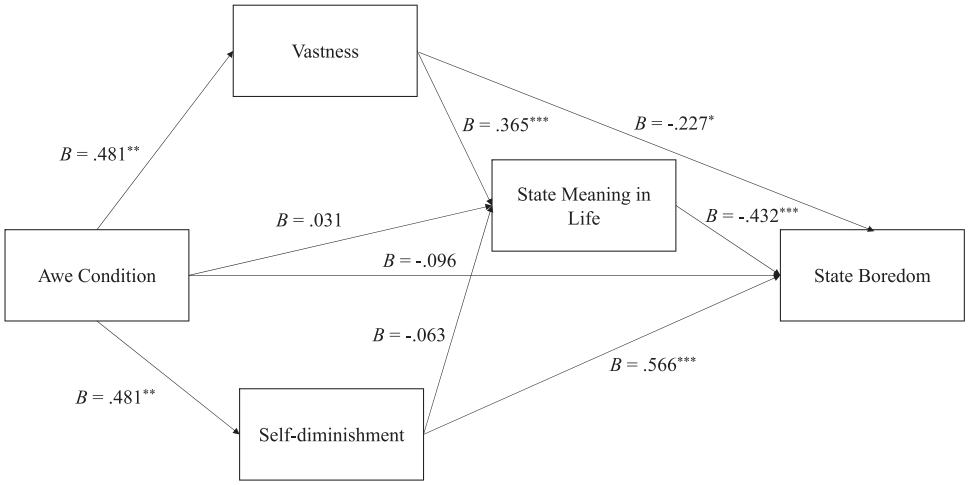

FIGURE 3 | Mediational path model for Study 2a. Total effect: $B = -0.019$, SE = 0.211, $p = 0.927$, 95% CI [−0.435, 0.400]. $N = 269$. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The full statistics for each path are reported in the Supporting Information section.

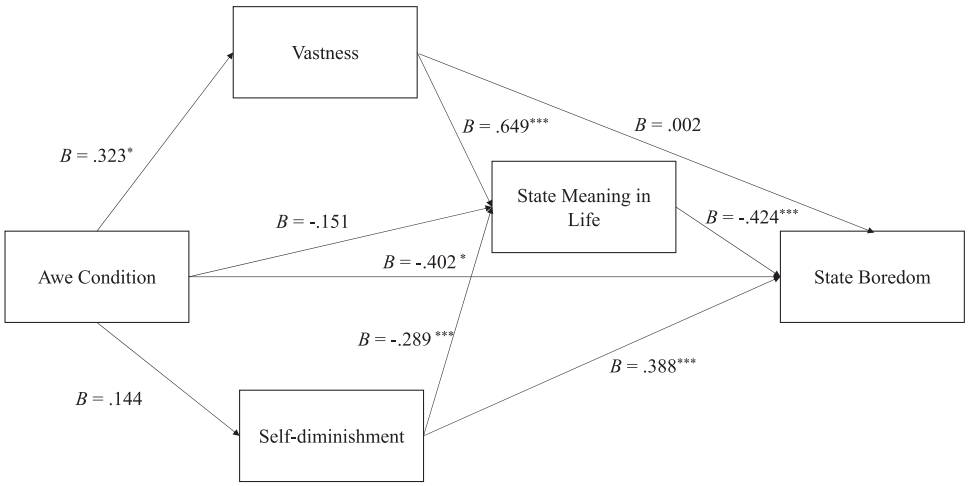

FIGURE 4 | Mediational path model for Study 2b. Total effect: $B = -0.352$, SE = 0.203, $p = 0.083$, 95% CI [−0.751, 0.047]. $N = 305$. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The full statistics for each path are reported in the Supporting Information section.

303) = 0.35, $p = 0.55$, $\eta_p^2 = 0.001$; or happiness, $F(1, 303) = 0.15$, $p = 0.70$, $\eta_p^2 < 0.001$.

Indirect Effects. Again, we employed PROCESS Model 80 (Hayes 2021) to test the full mediational path (Figure 4). The predictors explained a significant proportion of variance in boredom, $R^2 = 0.15$, $F(4, 300) = 13.65$, $p < 0.001$. The MSBS-SF and the SBOR were highly correlated ($r = 0.95$, $p < 0.001$) and were again combined to create a state BOR-I. The indirect effect of awe on state boredom, via vastness and meaning in life, was negative and significant, $B = -0.089$, SE = 0.051, 95% CI [−0.202, −0.006]. However, awe did not predict state boredom via self-diminishment and state meaning in life, $B = 0.018$, SE = 0.022, 95% CI [−0.020, 0.067].

Even though the awe manipulation did not have a significant effect on these emotions, prior research reports that pride and happiness tend to covary the most with the elicitation of awe (Jiang and Sedikides 2022; Piff et al. 2015). We thus tested our model when controlling for pride and happiness. The negative indirect effect of awe on state boredom via increased vastness and state meaning in life held when controlling for both happiness, $B = -0.077$, SE = 0.038, 95% CI [−0.165, −0.018], and pride, $B = -0.115$, SE = 0.048, 95% CI [−0.224, −0.033].

7.3 | Additional Analyses

Given that we used identical manipulations and outcome measures in Study 2a and Study 2b, we combined the effective samples and conducted the same mediational analysis to provide a robust test of our primary predictions. The effective sample consisted of 574 participants (Study 2a, $N = 269$; Study 2b, $N = 305$). The experimental awe condition consisted of 296 participants, whereas the control condition hosted 278 participants.

Means and standard deviations are reported in Table 6. Participants in the awe condition felt significantly more awe than the control condition, $F(1, 572) = 34.52$, $p < 0.001$, $\eta_p^2 = 0.057$. Similarly, participants in the awe condition felt greater feelings of vastness, $F(1, 572) = 13.41$, $p < 0.001$, $\eta_p^2 = 0.023$, and self-diminishment, $F(1, 572) = 7.63$, $p = 0.006$, $\eta_p^2 = 0.013$, than the

TABLE 4 | Correlations across conditions in Study 2b.

Measure	1	2	3	4	5	6	7	8	9	10	11
1 Awe	1	0.60***	0.51***	0.26***	0.07	0.17**	0.22***	0.25***	0.36***	0.19***	0.30***
2 Vastness		1	0.60***	0.56***	0.02	0.14*	0.18**	0.25***	0.51***	0.11	0.54***
3 Self-diminishment			1	0.10	0.27***	0.36***	0.36***	0.40***	0.31***	0.32***	0.24***
4 State meaning in life				1	−0.23***	−0.12*	−0.07	−0.06	0.39***	−0.16**	0.54***
5 State boredom index					1	0.73***	0.74***	0.69***	0.21***	0.74***	−0.04
6 Anger						1	0.82***	0.84***	0.33***	0.79***	0.02
7 Disgust							1	0.81***	0.35***	0.78***	0.10
8 Fear								1	0.37***	0.80***	0.11
9 Pride									1	0.26***	0.54***
10 Sadness										1	−0.03
11 Happiness											1

*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

TABLE 5 | Means and standard deviations for outcomes variables in Study 2b.

	Awe		Control	
Variable	***M***	**SD**	***M***	**SD**
Awe	5.09	0.93	4.53	1.43
Vastness	5.43	1.18	5.11	1.46
Self-diminishment	5.03	1.25	4.88	1.51
State meaning	5.02	1.20	5.00	1.00
State boredom	3.78	1.79	4.13	1.74
Anger	2.83	1.76	3.19	1.82
Disgust	2.93	1.73	3.13	1.76
Fear	3.05	1.75	3.09	1.86
Pride	4.12	1.45	4.26	1.43
Sadness	3.03	1.77	3.15	1.81
Happiness	4.58	1.25	4.64	1.23

TABLE 6 | Means and standard deviations for outcomes variables in combined Studies 2a and 2b.

	Awe		Control	
Variable	***M***	**SD**	***M***	**SD**
Awe	5.51	1.03	4.86	1.59
Vastness	5.47	1.14	5.06	1.49
Self-diminishment	5.14	1.20	4.82	1.52
State meaning	4.99	1.13	4.93	1.07
State boredom	3.97	1.77	4.17	1.74

control condition. There was no difference between conditions in scores of state meaning in life, $F(1, 572) = 0.46$, $p = 0.499$, $\eta_p^2 = 0.001$, or state boredom, $F(1, 572) = 1.91$, $p = 0.168$, $\eta_p^2 = 0.003$.

7.3.1 | Indirect Effects

Studies 2a and 2b were conducted 10 days apart. Thus, we controlled for potential temporal differences by dummy coding the date of each study (0 = 3 June, 1 = 13 June). Again, using PROCESS Model 80 (Hayes 2021), we tested awe as the independent variable (1 = *awe condition*, 0 = *control condition*) and vastness, self-diminishment and state meaning in life as mediators, respectively. State boredom was the dependent variable, and date of study was a covariate (Figure 5). The predictors explained a significant proportion of variance in boredom, $R^2 = 0.16$, $F(4, 569) = 26.82$, $p < 0.001$. The indirect effect of awe on state boredom, via vastness and state meaning presence, was negative and significant, $B = -0.090$, SE = 0.032, 95% CI [−0.163, −0.037]. The indirect effect of awe on state boredom via self-diminishment and state meaning presence was positive and significant, $B = 0.025$, SE = 0.013, 95% CI [0.006, 0.055].

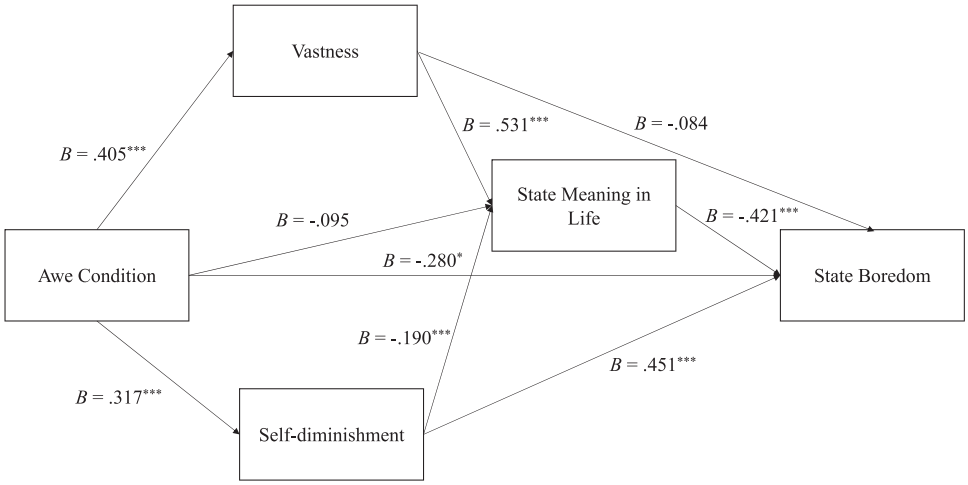

FIGURE 5 | Mediational path for Study 2a and Study 2b combined. Total effect: $B = -0.196$, SE = 0.146, $p = 0.181$, 95% CI [−0.483, 0.091]. $N = 574$. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$. The full statistics for each path are reported in the Supporting Information section.

7.4 | Discussion

In Study 2a, Study 2b, and the combined analysis, we found that awe predicted less boredom via higher levels of vastness and state presence of meaning in life, supporting Hypothesis 1. Further, controlling for pride and happiness in Study 2b confirmed that the effect of awe on boredom via vastness and meaning in life was unique and specific to awe and, importantly, can be disentangled from positive emotions more generally. The indirect effect of awe on state boredom via self-diminishment and meaning was absent in both studies, but it was present in the combined analysis, suggesting that the relationship is slightly less robust (Hypothesis 2). This is consistent with previous literature suggesting that most awe experiences are interpreted and felt as positive and a smaller amount are felt more negatively (Chaudhury et al. 2022; Monroy and Keltner 2023).

8 | Study 3

Studies 1 and 2 found that awe predicted less boredom via vastness and meaning in life on both the trait and state levels. However, as aforementioned, awe can also emerge in response to threatening experiences, described as *threat-based awe* (Chaudhury et al. 2022; Gordon et al. 2017). Although less common than positive awe experiences, threat-based awe experiences do occur with regularity in daily life (Gordon et al. 2017). This study was designed to consider threat-based and positive awe experiences and their effect on boredom simultaneously. If the positive emotions that often co-occur with awe do not explain the effects of awe on boredom via meaning, then we predict that threat-based awe should function similarly and elicit the same pattern of effects on boredom and meaning as positive awe. Study 3 (preregistered; https://aspredicted.org/7H4_4HW) therefore has three aims: (1) to generalize our findings to a more negatively valenced form of awe; (2) to replicate the previous findings using a different video to induce positive awe; (3) to test our predictions using a high-powered, non-M-Turk sample. These aims broaden our ability to generalize.

8.1 | Method

8.1.1 | Participants

In Study 3, we aimed for a power of 0.90 to provide an even more stringent test of our hypotheses. We thus required a sample of 327 participants to achieve a power of $(1 - \beta) = 0.90$ to detect effects among 3 mediators, adopting a Type-I error of $\alpha = 0.05$ (Schoemann et al. 2017; moderate correlations $\rho = 0.40$ (based off O'Dea et al. 2023), two-tailed; Schoemann et al. 2017; 1000 replications with 20,000 Monte-Carlo draws). We aimed to recruit at least 400 participants on Prolific (https://www.prolific.co/) to account for dropouts and data exclusions. Four participants admitted paying less than 50% of their attention to the video, and 17 recommended that we exclude their response because they did not take the survey seriously and were consequently excluded, resulting in a final sample of 402 participants (135 males, 264 females, 2 non-binary, 1 gender fluid; $M_{age} = 39.20$, $SD_{age} = 13.89$). The study was open to a range of English-speaking countries; however, most of the sample came from the United Kingdom (80%).

8.1.2 | Procedure and Materials

After providing consent and demographic details, participants were randomly assigned to a positive awe, threat-based awe or neutral control condition. In the positive awe condition, the participants watched scenes from the BBC's *Planet Earth* series, depicting clips of Earth's vast landscape accompanied by uplifting music ('Hoppípolla' by Sigur Rós). The threat-based awe video included scenes of tornados set to ominous music taken from the Discovery Channel. The neutral control condition involved an instructional video on how to build a wall. These three videos have been validated in previous research (e.g., Gordon et al. 2017; Study 5). Nevertheless, we piloted the videos with students at an Irish University($N = 127$). Across conditions, participants reported statistically different levels of awe, $F(2, 124) = 34.95$, $p < 0.001$, $\eta_p^2 = 0.36$. This pilot study confirmed that participants in the positive awe ($M = 4.68$, SD = 1.37;

TABLE 7 | Correlations across conditions in Study 3.

Measure	1	2	3	4	5	6	7	8	9	10	11
1 Awe	1	0.76***	0.57***	0.12*	−0.34***	0.28***	−0.01	0.00	0.28***	0.05	0.14**
2 Vastness		1	0.68***	0.22***	−0.34***	0.29***	−0.04	−0.05	0.35***	0.00	0.23***
3 Self-diminishment			1	0.15*	−0.14**	0.35***	0.03	0.08	0.22***	0.13*	0.15*
4 State meaning in life				1	−.37***	0.01	−0.12*	−0.17***	0.48***	−0.33***	0.52***
5 State boredom index					1	−0.06	0.23***	0.21***	−.38***	0.32***	−0.45***
6 Fear						1	0.05	0.10*	0.04	0.25***	−0.02
7 Anger							1	0.68***	0.08	0.56***	−0.14**
8 Disgust								1	0.04	0.54***	−0.12*
9 Pride									1	−0.10	0.65***
10 Sadness										1	−0.31***
11 Happiness											1

*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

$N = 47$) and threat-based awe ($M = 3.68$, SD = 1.40; $N = 40$) conditions felt significantly more awe than the control condition ($M = 2.23$, SD = 1.33; $N = 40$), $p < 0.001$, $d = 1.815$ and $p < 0.001$, $d = 1.062$, respectively. Participants in the awe condition also felt significantly more awe than the threat-based awe condition, $p < 0.001$, $d = 0.72$. Threat-based awe elicits fear (Chaudhury et al. 2022); thus, as manipulation checks for the threat-based awe condition, participants were asked how much awe and fear they felt on a scale of 1 (*Not at all*) to 6 (*Extremely*). Measures of vastness, self-diminishment, state perceptions of meaning in life, state boredom, and emotional states were identical to Study 2b. Attention checks were identical to Studies 2a and 2b. We also explicitly asked participants if they took the study seriously and if we should exclude their responses because they did not take it seriously. Participants were debriefed, thanked and rewarded for their participation.

8.2 | Results

To assess multicollinearity, VIF values were examined for all predictors. VIF values ranged from 1.06 to 3.19, indicating no serious multicollinearity concerns. Zero-order correlations across conditions are presented in Table 7. Table 8 provides a summary of descriptive statistics. Across conditions, participants reported statistically different levels of awe, $F(2, 399) = 136.01$, $p < 0.001$, $\eta_p^2 = 0.401$. Post hoc analyses revealed participants in the positive awe and threat-based awe conditions felt significantly more awe than the neutral control condition, $ps < 0.001$, $ds = 1.95$ and 1.44, respectively. Participants in the positive awe condition reported greater awe than those in the threat-based awe condition, $p < 0.001$, $d = 0.46$, consistent with prior research (e.g., Seo et al. 2023). Participants reported significantly different levels of fear, $F(2, 399) = 82.74$, $p < 0.001$, $\eta_p^2 = 0.293$. Validating the threat-based awe manipulation (Chaudhury et al. 2022), participants in the threat-based awe condition felt significantly more fear than the positive awe ($p < 0.001$, $d = 1.05$) and neutral control ($p < 0.001$, $d = 1.40$) conditions. The three conditions did not differ in anger, $F(2, 399) = 1.54$, $p = 0.215$, $\eta_p^2 = 0.008$, disgust, $F(2, 399) = 1.37$, $p = 0.255$, $\eta_p^2 = 0.007$ or sadness, $F(2, 399) = 1.09$, $p = 0.339$, $\eta_p^2 = 0.005$. However, participants felt different levels of pride, $F(2, 399) = 7.20$, $p < 0.001$, $\eta_p^2 = 0.035$, and happiness, $F(2, 399) = 4.45$, $p = 0.012$, $\eta_p^2 = 0.022$, across conditions. Corroborating with the positive valence of the positive awe condition, higher levels of pride and happiness were experienced in the positive awe condition than in the control conditions, respectively, $p < 0.001$, $d = 0.47$ and $p = 0.003$, $d = 0.37$. There were no differences in pride and happiness between the positive and threat-based awe conditions, respectively, $p = 0.118$, $d = 0.186$ and $p = 0.129$, $d = 0.200$. Controlling for happiness and pride, the effect of the three conditions on awe remained significant, $F(2, 397) = 125.97$, $p < 0.001$, $\eta_p^2 = 0.388$.

Levels of vastness differed significantly across the three conditions, $F(2, 399) = 185.95$, $p < 0.001$, $\eta_p^2 = 0.482$. Consistent with predictions and Studies 2a and 2b, participants in both the positive awe and threat-based awe conditions felt greater levels of vastness than the control, $ps < 0.001$, $d = 2.30$ and $d = 1.58$, respectively. Participants in the positive awe condition felt greater levels of vastness than the threat-based awe condition, $p < 0.001$, $d = 0.71$. Further, self-diminishment scores differed significantly across conditions, $F(2, 399) = 62.38$, $p < 0.001$, $\eta_p^2 = 0.238$. Consistent with Study 2a and our predictions, participants in the awe conditions felt greater levels of self-diminishment compared to the control, $ps < 0.001$, $d = 1.28$ (positive awe) and $d = 1.03$ (threat-based awe). Self-diminishment scores did not differ between the positive awe and threat-based awe conditions, $p = 0.092$, $d = 0.21$.

State perceptions of meaning in life did not differ between conditions, $F(2, 399) = 0.71$, $p = 0.493$, $\eta_p^2 = 0.004$, in line with Studies 2a and 2b and previous research (Kim et al. 2022; Rivera et al. 2020). However, unlike the prior experiments, levels of state boredom did differ significantly across conditions, $F(2, 399) = 21.21$, $p < 0.001$, $\eta_p^2 = 0.096$. Participants in the neutral control condition felt significantly more bored than in both the awe conditions, $ps < 0.001$, $d = 0.76$ (positive awe) and $d = 0.71$ (threat-based awe). The positive awe and threat-based awe conditions did not differ in state boredom, $p = 0.456$, $d = 0.09$.

TABLE 8 | Means and standard deviations for outcomes variables in Study 3.

	Positive Awe (n = 134)		Threat-based Awe (n = 134)		Control (n = 134)	
Variable	***M***	**SD**	***M***	**SD**	***M***	**SD**
Awe	4.81	1.24	4.22	1.36	2.28	1.35
Fear	1.78	0.93	3.01	1.37	1.40	0.87
Vastness	5.33	1.36	4.35	1.40	2.11	1.43
Self-diminishment	4.47	1.35	4.18	1.44	2.65	1.50
State meaning	4.33	1.36	4.16	1.45	4.14	1.45
State boredom	2.94	1.17	3.05	1.16	3.83	1.28
Anger	1.81	1.13	2.00	1.10	2.06	1.35
Disgust	1.58	1.04	1.77	1.07	1.78	1.22
Pride	3.68	1.27	3.43	1.41	3.07	1.31
Sadness	2.54	1.41	2.81	1.44	2.66	1.52
Happiness	4.16	1.07	3.95	1.14	3.75	1.17

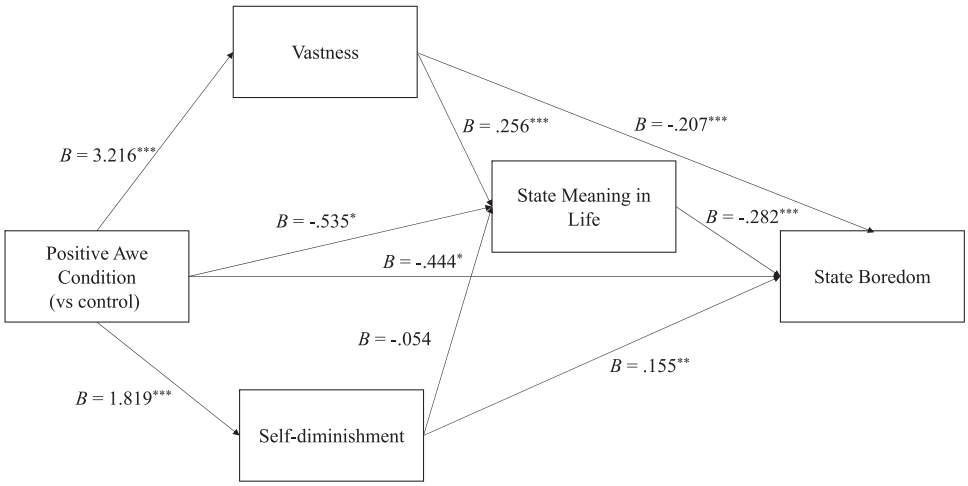

FIGURE 6 | Mediational path for Study 3 comparing positive awe condition against control condition. Total effect: $B = -0.883$, SE = 0.151, $p < 0.001$, 95% CI [−1.179, −0.588]. Positive awe condition = 1, neutral control condition = 0; $N = 268$. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The full statistics for each path are reported in the Supporting Information section.

8.2.1 | Indirect Effects

As preregistered, we used PROCESS Model 80 (Hayes 2021) with 10,000 bootstraps to test the mediation model. The MSBS-SF and the SBOR were again combined to create a state BOR-I ($r = 0.56$, $p < 0.001$).

Positive awe. We first tested the positive awe condition against the control (Figure 6). We entered positive awe as the independent variable (1 = *positive awe*, 0 = *control*), vastness, self-diminishment and state meaning in life as the mediators, and state boredom as the dependent variable. The predictors explained a significant proportion of variance in boredom, $R^2 = 0.26$, $F(4, 263) = 23.60$, $p < 0.001$. In support of Hypothesis 1 and the earlier studies (Table 9), the indirect effect of positive awe on state boredom, via vastness and state meaning in life, was negative and significant, $B = -0.232$, SE = 0.085, 95% CI [−0.423, −0.090]. There was a non-significant indirect effect from positive awe to state boredom via self-diminishment and state meaning in life, $B = 0.028$, SE = 0.040, 95% CI [−0.051, 0.110].

Threat-based awe. We then tested this mediation model with the threat-based awe condition contrasted to the control (1 = threat-based awe, 0 = control) to examine if the indirect effects extend to threat-based awe (Figure 7). The predictors explained a significant proportion of variance in boredom, $R^2 = 0.24$, $F(4, 263) = 20.41$, $p < 0.001$. Supporting Hypothesis 1, threat-based awe predicted less state boredom via vastness and state meaning in life, $B = -0.195$, SE = 0.066, 95% CI [−0.338, −0.082]. The indirect effect of threat-based awe on state boredom via self-diminishment and state meaning in life was non-significant, $B = 0.048$, SE = 0.039, 95% CI [−0.026, 0.129].

Mixed awe. Given the large effects of both the positive and threat-based awe conditions on self-reported awe relative to the

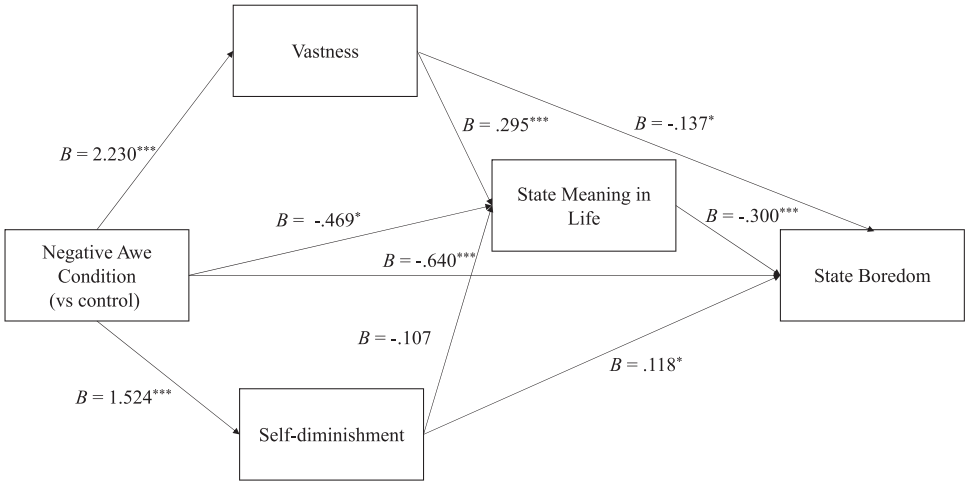

FIGURE 7 | Mediational path for Study 3 comparing threat-based awe condition against control condition. Total effect: $B = -0.773$, SE = 0.150, $p < 0.001$, 95% CI [−1.067, −0.478]. Threat-based awe condition = 1, neutral control condition = 0; $N = 268$. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The full statistics for each path are reported in the Supporting Information section.

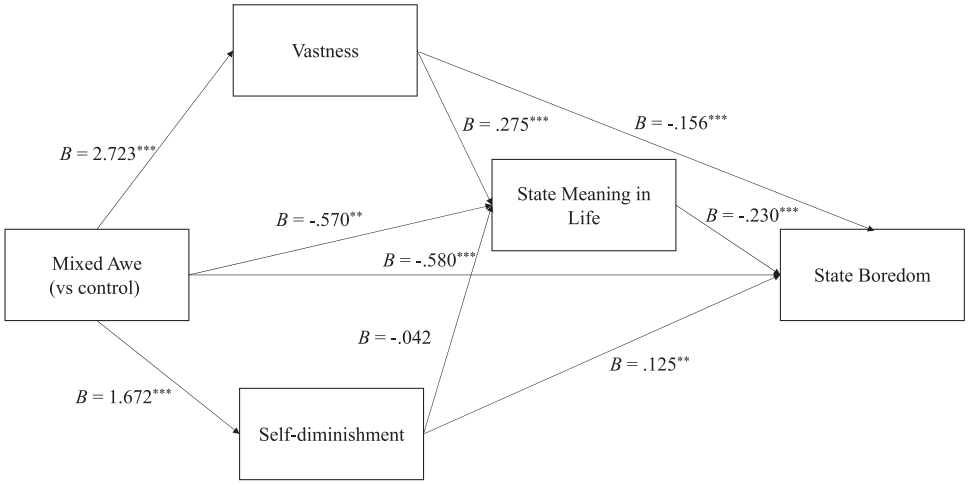

FIGURE 8 | Mediational path for Study 3 comparing mixed-valence awe against control condition. Total effect: $B = -0.828$, SE = 0.128, $p < 0.001$, 95% CI [−1.079, −0.576]. Positive awe and threat-based awe conditions = 1, neutral control condition = 0. $N = 402$. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The full statistics for each path are reported in the Supporting Information section.

controls, the two awe conditions were combined to test the effects of a mixed-valenced awe on state boredom via the mediators (Figure 8). The predictors explained a significant proportion of variance in boredom, $R^2 = 0.25$, $F(4, 397) = 32.91$, $p < 0.001$. Mixed awe (1 = *positive awe condition and threat-based awe condition*, 0 = control) predicted less state boredom via vastness and state meaning in life, $B = -0.222$, SE = 0.060, 95% CI [−0.349, −0.117], providing further support for Hypothesis 1 and corroborating with all of the previous studies (Table 9). Again, the indirect effect from mixed awe to state boredom via self-diminishment and state meaning in life was non-significant, $B = 0.021$, SE = 0.032, 95% CI [−0.042, 0.085]. As happiness and pride differed from the control but not between the two awe conditions, we tested the indirect effect of mixed awe on boredom via vastness and meaning in life while controlling for pride, $B = -0.073$, SE = 0.036, 95% CI [−0.154, −0.013], and happiness, $B = -0.073$, SE = 0.031, 95% CI [−0.143, -0.022]. The effects remained.

8.3 | Discussion

In order to generalize our effects across different awe-elicitors, Study 3 examined the effect of both positive awe, using a different awe-eliciting video, and threat-based awe on boredom. Positive awe, threat-based awe and mixed awe all predicted less boredom via heightened perceptions of vastness and meaning in life (Hypothesis 1). Importantly, awe's diminishing effect on boredom via vastness and meaning in life cannot be explained by positive co-occurring emotions evoked by awe. However, the indirect pathway via self-diminishment (Hypothesis 2) was not present for any of the mediation analyses in Study 3. There have been mixed discussions about the functions of threat-based awe. For instance, Gordon et al. 2017, 17) argue that this negative variant of awe appears to have 'little benefit for personal well-being'. However, our findings are more consistent with the recent reconceptualization of threat-based awe as a mixed, rather than purely negative,

TABLE 9 | Summary of key indirect effects and confidence intervals in Studies 1–3.

Study	X	M1	M2	Y	Effect (SE)	95% CI	*N*
Study 1	Trait awe	Vastness	Meaning	Boredom	−0.11 (0.06)	[−0.24, −0.02]	197
Study 2a	Awe	Vastness	Meaning	Boredom	−0.08 (0.04)	[−0.18, −0.02]	269
Study 2b	Awe	Vastness	Meaning	Boredom	−0.09 (0.05)	[−0.20, −0.01]	305
Studies 2a and 2b	Awe	Vastness	Meaning	Boredom	−0.09 (0.03)	[−0.16, −0.04]	574
Study 3	Threat-based Awe	Vastness	Meaning	Boredom	−0.20(0.07)	[−0.34, −0.08]	268
Study 3	Positive awe	Vastness	Meaning	Boredom	−0.23 (0.09)	[−0.42, −0.09]	268
Study 3	Mixed awe	Vastness	Meaning	Boredom	−0.22 (0.06)	[−0.35, −0.12]	402
Study 1	Trait Awe	SD	Meaning	Boredom	0.08 (0.03)	[0.02, 0.14]	197
Study 2a	Awe	SD	Meaning	Boredom	0.01 (0.02)	[−0.04, 0.06]	269
Study 2b	Awe	SD	Meaning	Boredom	0.02 (0.02)	[−0.02, 0.07]	305
Studies 2a and 2b	Awe	SD	Meaning	Boredom	0.02 (0.01)	[0.01, 0.06]	574
Study 3	Positive awe	SD	Meaning	Boredom	0.03 (0.04)	[−0.05, 0.11]	268
Study 3	Threat-based awe	SD	Meaning	Boredom	0.05 (0.04)	[−0.03, 0.13]	268
Study 3	Mixed awe	SD	Meaning	Boredom	0.02 (0.03)	[−0.04, 0.09]	402

Note: Awe is coded as awe condition = 1 versus neutral condition = 0. Positive awe is coded as positive awe condition = 1 versus neutral condition = 0. Threat-based awe is coded as threat-based awe condition = 1 versus neutral condition = 0. Mixed awe is coded positive awe condition and threat-based awe condition = 1 versus neutral condition = 0.
Abbreviation: SD, self-diminishment.

emotion (Chaudhury et al. 2022). Threat-based awe may facilitate the notion of 'beauty in adversity' (Chaudhury et al. 2022, 1667), reflecting this negative indirect relationship between threat-based awe and boredom through vastness and meaning.

9 | General Discussion

To date, the relationship between awe and boredom, two ostensibly opposing emotions, has not been examined, nor have vastness and self-diminishment been investigated as separate mediators from awe to meaning in life. Both awe and boredom have important implications for perceptions of meaning in life (Rivera et al. 2020; Van Tilburg and Igou 2012). Awe has been theorized to be a meaning-making emotion; however, empirical evidence to date has been inconsistent. Meanwhile, high perceptions of meaning in life can prevent boredom, whereas low perceptions of meaning can produce it (O'Dea et al. 2022, 2023; Van Tilburg et al. 2019). To understand awe's relationship to boredom, we aimed to clarify how awe and its processes influence boredom.

We provided four empirical studies (one correlational; three experimental) highlighting two opposing mechanisms through which awe relates to boredom (Figure 1, Table 9). We tested a primary hypothesis that awe elicits perceptions of vastness, which in turn predicts greater meaning in life and less boredom (Hypothesis 1). We found support for this hypothesis on the trait level (Study 1). This pathway was replicated with experimental inductions of awe and state measures of the outcome variables (Studies 2–3) and even when controlling for emotions that often covary with awe, that is, happiness and pride (Study 2b and Study 3). Study 3 demonstrated that this effect also extends to more negative, threat-based forms of awe. Simultaneously, we tested a secondary hypothesis that awe elicits feelings of self-diminishment, which predicts lower perceptions of meaning in life and higher levels of boredom (Hypothesis 2). We found less evidence for this secondary hypothesis (Table 9). The effect was present on the trait level (Study 1) and on the state level with a large dataset (Study 2 Additional Analyses), but not in the individual experiments (Studies 2–3). The lack of an indirect effect in the experiments may be explained by the fact that most awe experiences are interpreted positively, especially in Western cultures (which all our samples were from; Stellar et al. 2024). Overall, we found robust support for our primary hypothesis that awe predicts lower boredom via greater feelings of vastness and perceptions of meaning in life (Table 9), whereas further research is needed to fully understand the secondary pathway.

9.1 | Implications

The present investigation complements and extends both the burgeoning awe and boredom literature. Our findings emphasize the importance of perceptions of meaning in life in regulating the experience of boredom (Fahlman et al. 2009; Van Tilburg and Igou 2012), supporting existential theories on boredom (Igou et al. 2024). We see that a decrease in meaning predicts more boredom, whereas high meaning predicts less boredom (O'Dea et al. 2022, 2023; Van Tilburg et al. 2019). Alongside other positive emotions like gratitude and self-compassion (O'Dea et al. 2022, 2023), we found that awe, whether in response to positive or threatening events, can predict less boredom, here via vastness and meaning in life. Awe and boredom are frequently experienced in daily life (Bai et al. 2017; Chin et al. 2017). Given the wide range

of negative well-being and behavioural consequences associated with boredom (e.g., Pfattheicher et al. 2021; Seiler et al. 2023), understanding how we can harness awe to mitigate boredom has practical significance for everyday life. Perceptions of vastness appear to be a crucial link in this chain, and researchers and practitioners may wish to target this construct more in the development of awe interventions for well-being.

Furthermore, our research dovetails with recent empirical findings showing that awe relates to meaning in life via competing pathways (Dai et al. 2022; Rivera et al. 2020), contrary to theoretical claims (Danvers et al. 2016; Ihm et al. 2019). We did not find a direct effect of the awe manipulation on meaning in any of our experimental studies (consistent with Kim et al. 2022; Rivera et al. 2020; Yuan et al. 2023). Further, we found that pathways with vastness and self-diminishment led to opposing outcomes on boredom, supporting recent recommendations to investigate the components of the small self separately (Edwards et al. 2023; Tyson et al. 2022). Relevant to the current investigation, Rivera et al. (2020) found a negative indirect effect of awe on meaning via the small self (including both vastness and self-diminishment). Here, we found that awe predicted greater meaning via vastness and, as a result, lower levels of boredom. By including vastness and self-diminishment as one construct, Rivera et al. (2020) likely did not fully capture the negative mediating role of self-diminishment, as the opposing function of vastness may have diluted the effect. Consistent with recent arguments (Jiang et al. 2024), this research suggests that vastness leads to more expansive self-transcendent outcomes (i.e., greater meaning in life, Van Cappellen et al. 2013), rather than a shrinking of the self, and may be better conceptualized as a construct separate from the small self. This marks a significant advancement in understanding of the relationship between awe and meaning in life.

Awe did not have a consistent direct effect on boredom. In Study 1 there was a positive association, in Studies 2a and 2b there were no differences in boredom levels between the awe and control conditions, and in Study 3 the awe conditions reduced boredom compared to the control. This suggests that the relationship between awe and boredom is indeed complex, and there may be a variable in the secondary pathway that we have not accounted for that can further explain a positive indirect effect of awe on boredom. Evidently, some individuals may feel isolated in response to awe, whereas others feel connected (Edwards et al. 2023; Jiang and Sedikides 2022), and there are a range of individual differences that may account for this. Individuals with low self-esteem are more likely to report feeling self-diminishment (Tyson et al. 2022) and thus are likely to be more vulnerable to the negative aspects of awe identified in this article, that is, less meaning and more boredom. Self-esteem may moderate this secondary pathway, but future research is needed to confirm this notion.

10 | Limitations and Future Directions

Despite many strengths, this research has some noteworthy limitations. The experimental findings in Studies 2–3 employed three different awe videos. Despite contrasts in valence, all of the videos feature scenes of nature (e.g., sunsets, mountain ranges and tornados). We thus cannot generalize our findings to non-nature-based awe-eliciting stimuli nor to non-video awe elicitors (e.g., recall tasks, pictures). Second, we did not employ a positive control condition in the experimental studies. We chose not to include a positive control condition, as prior research has extensively demonstrated the unique effects of awe on a variety of outcomes compared to other positive emotions such as pride, joy and happiness (e.g., Jiang and Sedikides 2022; Piff et al. 2015; Pan and Jiang 2022), and in the current research, we control for positive emotions (Study 2b and Study 3) and generalize our effects threat-based awe (Study 3). Nonetheless, future research may wish to incorporate a positive control to provide further validation of the findings.

Although we anticipated that the link between awe and boredom would be present at both the trait and state level, this does not mean that the psychological processes associated with trait and state boredom are necessarily the same, especially when considering how boredom in turn affects behaviour. Whereas state boredom has been argued to trigger a search for meaningful, novel and satisfying activity (e.g., Elpidorou 2024; Van Tilburg and Igou 2011), trait boredom has been argued to be overall detrimental to self-regulation efforts (Danckert 2019). Although we did not examine boredom-induced behaviours, it is plausible that in cases where awe increases boredom (through its self-diminishment pathway), the subsequent impact on behaviour is critically dependent on whether this process occurred at the state or trait level. The former might promote self-regulation attempts, whereas the latter might instead undermine self-regulation. Future research should address this possibility.

The present research focuses on mainly US (M-Turk) and UK (Prolific) samples. Although our key findings replicate across these samples, we acknowledge that this limits the generalizability of our findings across cultures. Cultural differences can play a role in the experience of awe (Stellar et al. 2024), with a study by Nakayama et al. (2020) suggesting that the tendency to interpret awe as positive or negative is partially mediated by culture (Nakayama et al. 2020). Testing these hypotheses in a variety of cultures will be essential to provide compelling cultural generalizability.

The absence of a significant zero-order correlation between meaning in life and boredom proneness in Study 1 (Table 1) was unexpected. We suspect that this is an anomaly given that prior studies consistently find a negative relationship between these constructs (e.g., Coughlan et al. 2019; Fahlman et al. 2009; O'Dea et al., 2023; Tam, Van Tilburg, and Chan 2021; Van Tilburg et al. 2019; Yang et al. 2021). As for awe and boredom, the absence of a zero-order correlation between them in Studies 2a and 2b (Tables 2 and 4) is consistent with the proposition and finding that there are two antagonistic pathways in which these variables are linked, with self-diminishment accounting for a positive partial indirect association and vastness accounting for a negative partial indirect association. It appears that only through examining these consequences of awe simultaneously can we understand awe's link with boredom. Nevertheless, future research is necessary to strengthen these findings. These findings relied on self-report measures which can be vulnerable to common method variance. Even though we provided tests for common method bias, it is a prevalent concern in psychological research (Podsakoff et al. 2024) that requires greater consideration. Furthermore, awe and

boredom feature experiential, cognitive and neuropsychological patterns that appear to be quite different from each other, and the psychological markers of those two emotions have not often been compared directly to each other within a single study context. Future research would do well to further disentangle those using diverse measurements, including self-report, physiological and neurophysiological assessments.

In Studies 2–3, we are assuming causation in our mediation analyses on the basis of strong prior theoretical and methodological knowledge. Given awe's close link to self-diminishment and vastness (Keltner and Haidt 2003), it is difficult to isolate these constructs experimentally. In such cases, the 'measurement of mediation' approach that we adopted is recommended (Spencer et al. 2005). However, experimental manipulations of these variables are needed in future research to support causal interpretations. Lastly, some scholars have suggested that awe leads to meaning-making by first provoking the search for meaning (Monroy and Keltner 2023). This would insinuate that awe engenders meaning in life over time, not instantaneously, which may explain why we, and other researchers, don't find a main effect of experimental awe on meaning in life. Longitudinal studies would help to capture the impact of awe experiences on meaning in life over time and in more ecologically valid contexts.

11 | Conclusion

Boredom arises when meaning perceptions are low and is prevented when meaning perceptions are high. Awe is theoretically a meaning-making emotion, but empirical research has demonstrated opposing effects of awe on meaning in life. Here, we provide consistent evidence for a negative indirect effect of awe on boredom via greater perceptions of vastness vis-à-vis the self and meaning in life (Studies 1–3). We also identified an opposing positive indirect effect of awe on boredom through increased self-diminishment and lower perceptions of meaning, but this effect was present to a lesser extent (Study 1 and Study 2 Additional Analyses). This research advances our understanding of awe and its complex existential implications. People in awe may not be bored, as Sproul (2013) and Carson (1965) proposed, but this appears to be contingent on how the awe experience impacts perceptions of meaning. Future research on how we can optimize awe to successfully generate meaning and combat boredom will have valuable implications across a broad range of contexts.

Ethics Statement

All procedures performed in studies involving human participants followed the institutional research committee's ethical standards and the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the studies. All studies received ethical approval from the Education and Health Sciences Research Ethics Committee at the University of Limerick.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data files and materials for the conducted studies are available via the Open Science Framework (OSF): https://osf.io/754cz/?view_only=9526ae2cba034bda94d0c00890ff10fd. Studies 1 and 2 were not preregistered; Study 3's design and analysis were (https://aspredicted.org/7H4_4HW).

Endnotes

[1] This power analysis (Schoemann et al. 2017) does not allow for two parallel and one serial mediators (only three parallel); however, we believe this indirect power calculation best captures our required analysis, and we generally exceeded this sample size in the following studies to account for this.

[2] We did not anticipate that so many participants would fail the attention check; thus, the sample size was slightly less than what our power analysis required. Nevertheless, Study 1 provided an initial test of our theoretical model, and we further tested our model experimentally in Studies 2–3 in samples with adequate power.

[3] Contrary to our predictions and robust empirical evidence, there was no zero-order correlation between meaning in life and boredom proneness.

[4] Due to a programming error, demographic details were not collected for this sample. As demographic details were not being investigated in relation to our key variables in this study, we believe it was unlikely to impact findings. However, we acknowledge the importance of sample characteristics and thus ran a near identical study, Study 2b, again on M-Turk with demographics included.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

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