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The Impact of a Two-week Daily Intervention on Increased and Sustained Experiences of  
Awe

THESIS

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by

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Thank you to all who have been with me along each step of this process.

## ABSTRACT OF THE THESIS

The Impact of a Two-week Daily Intervention on Increased and Sustained Experiences of Awe

by

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Master of Arts in Social Ecology

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The emotion awe is associated with numerous individual and social benefits, including increased physical and mental health, prosocial behavior, and humility (Stellar et al., 2017). Additionally, individuals can vary in their dispositional tendencies to awe. However, the emergent scientific literature on awe has not yet explored awe induced over time. Guided by intervention work on similar positive emotions (e.g., gratitude, compassion), I tested whether an awe intervention would a) increase daily reports of awe and individuals' dispositional proneness to experiencing awe, and b) whether this proneness would be sustained after the end of the intervention. Participants ( $N = 237$ ) were randomly assigned to 1 of 3 conditions (awe, pride, control) in which they were instructed to seek out and attune to emotional experiences pertaining to their condition over a 14-day intervention period. Participants in the awe condition reported greater daily awe across the 14-day intervention. Likewise, dispositional awe increased in only the awe condition between the beginning and end of the intervention period, and this increase was maintained two weeks after the end of the intervention. Results suggest that seeking out and attuning to awe for a prolonged period of time can increase daily and dispositional awe in a sustained way.

Keywords: Awe, dispositional, intervention, emotion

## **Introduction**

The sensation of awe is a transformative experience characterized by feeling small in the presence of something greater than the self (Keltner & Haidt, 2003; Piff, Dietze, Feinberg, Stancato, & Keltner, 2015). Awe can be felt in response to a range of stimuli, including religious and mystical epiphanies, beautiful art and music, displays of virtuosity or magnanimity, and natural wonders (Keltner & Haidt, 2003, Shiota, Keltner, & Mossman, 2007; Stellar et al., 2018). Awe leads to a diminished sense of self and is associated with a host of positive outcomes, including increased physical and mental health (Rudd, Vohs, & Aaker, 2012; Stellar et al., 2015), prosocial behavior (Piff et al., 2015), and humility (Stellar et al., 2018), among others. Despite this growing body of work, however, little is known about awe induced in a longitudinal setting— can the experience of awe be increased and sustained over time? Given awe’s associated benefits, the ability to experience more awe in one’s life would appear to be a desirable quality. Building on work showing that similar positive emotions (e.g., compassion, gratitude) can be increased through the use of interventions, I tested whether people can be made to feel more awe in a sustained way via an awe intervention.

### **Defining Awe**

Awe is an emotion felt in response to vast experiences that transcend current frames of reference and shift attention away from the self, triggering self-perceptions of relative insignificance. Examples of awe-inducing experiences can be as perceptually vast as coming upon sweeping views of Yosemite National Park for the first time, or as conceptually vast as watching the laws of physics unfold in the impact of a single droplet of water on a liquid surface (Bait et al., 2017; Piff et al., 2015). Although the elicitors can vary, awe-inspiring instances characteristically involve attending to a novel, vast stimulus that challenges concepts for



understanding the world and gives its audience the sense of being in the presence of something greater than themselves, resulting in a need to accommodate what's being experienced into new schemata (Keltner & Haidt, 2003). Awe challenges the frameworks with which people see the world and requires one to restructure them to more fully make sense of what is being experienced.

In recent years, awe has increasingly gained empirical attention. Awe can be elicited experimentally via videos of sweeping natural landscapes, narratives of awe-inspiring experiences, and by immersion in nature (Bai et al., 2017; Piff et al., 2015; Valdesolo & Graham, 2014). Importantly, awe has been associated with a host of positive, individual-oriented outcomes. For example, awe increases spirituality among the spiritual and religious, and it moderates attraction to religious or scientific explanations of reality, depending on individual differences in theism (Valdesolo, Park, Gottlieb, 2016; Valdesolo, Shtulman, Baron, 2017; Van Cappellan & Saroglou, 2012). Feeling awe has also been found to increase slower, systematic processing of persuasive messages and decrease the reliance on cognitive heuristics (Griskevicius, Shiota, Neufeld, 2010). Similarly, awe-inspiring experiences alter time perception, expanding one's sense of time, increasing patience, willingness to volunteer one's time to help others, as well as preference for experiential purchases over material ones (Rudd, Vohs, Aaker, 2012). Awe shifts focus to the present and elicits disengagement from the self, thereby reducing attention to the concerns of everyday life (Shiota, Keltner, & Mossman, 2007).

Likewise, there's evidence that awe is associated with multiple social benefits. For instance, after experiencing awe via videos of grand, sweeping shots of nature, or while gazing up at tall trees, people are more likely to behave generously towards others, endorse ethical behavior, help other people, and feel less entitled (Piff et al., 2015). Feeling awe increases

humility and appreciation for the value and contributions of others (Stellar et al., 2018). Across cultures, experimentally induced awe positively affects collective engagement vis-à-vis a reduced sense of self. Following an awe manipulation, Americans report greater social ties, whereas Chinese individuals report greater closeness to others in their social network (Bai et al., 2017).

The experience of awe is not limited to sweeping natural environs. Indeed, awe can be positive or negative. For example, dangerous natural phenomena can be simultaneously awe-inspiring and frightening when they threaten the self, induce uncertainty, and when there is less perceived control over the situation. Such threat-based awe can instill a sense of powerlessness and elicit psychological and physiological stress (Gordon et al., 2016). However, the majority of awe-inspiring experiences tend to be positive, and negative awe can still boost prosocial behavior (Piff et al., 2015).

Importantly, people can differ in their tendencies to experience awe. Levels of dispositional awe, or the extent to which someone reports often feeling wonder, amazement, and awe in their life, can vary among individuals and groups. Indeed, awe proneness can vary as a function of personality: high openness to experience is positively correlated with dispositional awe (Shiota, Keltner, Mossman, 2007). Likewise, dispositional awe is evident across Western and non-Western cultures, with the average amount of dispositional awe varying by country (Razavi, Zhang, Hekiert, Yoo, Howell, 2016).

High levels of dispositional awe are associated with psychological and physiological benefits. Being prone to experiencing awe is correlated with emphasizing universals when categorizing one's self-concept (e.g., defining oneself as "an inhabitant of Earth") and low need for cognitive closure (Danvers & Shiota, 2017; Shiota et al., 2007). Awe prone individuals are

more likely to be seen as humble by their peers (Stellar et al., 2018). Moreover, research has found that individuals high in dispositional awe exhibit low levels of proinflammatory cytokines (Stellar et al., 2015). Dispositional awe can vary among people, and, like momentary experiences of awe, it is associated with individual and social benefits. This work suggests that awe proneness is a desirable quality, yet the question of whether dispositional awe can be shifted over time remains unanswered.

### **Awe and longitudinal work**

Although empirical work on awe has expanded in recent years, research has yet to explore awe induced in a longitudinal setting. It is unknown whether awe can be induced and increased in a sustained manner over time. A small number of studies have involved daily diary procedures, in which participants complete daily reports that measure the extent to which they felt certain emotions, including awe. In one study, participants were asked to report on their well-being, indicate their daily feelings of awe, and describe the experience during their day that brought them the most awe each night for 14 consecutive nights (Gordon et al., 2016). On days when participants reported positive awe experiences, happiness, life satisfaction, and daily feelings of awe were significantly increased relative to days without awe experiences. Stellar et al. (2018) found that, over the course of a 2-week daily diary period, feeling more awe during one's day was associated with feeling greater humility. Likewise, in a 2-week daily diary study conducted by Bai and colleagues (2017), feeling more awe during one's day was found to be associated with a smaller sense of self. Yet, to date, work on awe involving daily diaries has not instructed participants to actively seek out awe-inspiring experiences. In the aforementioned studies, participants simply kept track of their daily emotions or reported whether they had had awe experiences during their days. It is unknown whether awe can be increased and sustained

over time, outside of short-term, experimental manipulations. To date, work has not yet attempted to induce awe via a long-term psychological intervention.

Despite the paucity of work on longitudinally-induced awe, emotional interventions have been implemented, perhaps most relatedly, in work on other positive emotions such as gratitude and compassion. Gratitude occurs when people recognize that they have benefitted from another's actions, whereas compassion arises when one feels motivated to help when confronted with another's suffering (e.g., Emmons & McCullough, 2003; Goetz, Keltner, & Simon-Thomas, 2010). Research on gratitude has found evidence for the ability of interventions to increase feelings of gratitude and its associated benefits through the use of interventions. For example, across three studies, Emmons and McCullough (2003) examined whether gratitude interventions could be used to reliably increase gratitude ratings, as well as psychological and physiological well-being. Across a two-week, three-week, and nine-week period, participants were instructed to reflect back on things for which they were grateful either on a weekly basis in the nine-week period or on a daily basis during the two and three-week periods. Gratitude significantly increased among participants in each of the three intervention periods relative to comparison groups, and the interventions led to increased physical and mental well-being and prosocial behavior. Similarly, Sheldon and Lyubomirsky (2006) instructed participants to make an effort to think about the things in their lives that they were grateful about over the course of four-weeks. After the four-week period, positive affect was increased, compared to the control condition. In a separate study, participants that expressed gratitude once a week for six weeks exhibited increased well-being (Sheldon & Lyubomirsky, 2004). Froh, Kasdan, Ozimkowski, and Miller (2009) found that writing, and eventually delivering, a gratitude letter over the course of two-weeks increased gratitude for youth low in positive affect.

Likewise, compassion has also been cultivated through the use of interventions with similar structures (Kirby, 2017; Weisz & Zaki, 2017). For example, Jazieri and colleagues (2015) had participants undergo nine weeks of compassion training, in which participants received compassion cultivation training (e.g., meditation, lectures, group discussions, and small group exercises) and were instructed to engage in daily formal home compassion meditation practices for at least 15 minutes. The authors employed daily experience sampling via web-based surveys to measure self and other-oriented compassion over the nine-week intervention period. During and after the intervention, participants reported increased compassion towards oneself and others. Similarly, Condon, Desbordes, Miller, and DeSteno (2013) found that eight weeks of compassion training enhanced compassionate responding. As with intervention work on gratitude, compassion interventions have been able to successfully induce and increase care directed toward the self and others. Together, this research indicates that instructing participants to seek out and write about emotional experiences can be used as an intervention to increase relevant emotions.

The apparent similarities between the outcomes (e.g., prosocial behavior, life satisfaction, general well-being) and constituent feelings (e.g., a sense of wonder, concern for others) associated with awe, gratitude, and compassion make the literature on gratitude and compassion interventions a useful outline to follow in designing an intervention for awe. Awe's associations with perceptual vastness and a need for accommodation, however, set it apart from gratitude and compassion. Given that awe is emotion with distinct characteristics, and that it has not yet been the focus of an intervention, an investigation of an awe intervention's effects would be a novel and generative addition to the existing literature on awe and related positive emotions. Moreover,

awe's unique psychological and behavioral benefits call for the examination of whether, and how, the ability to experience awe can be increased and maintained.

### **The present study**

Whether reflected upon in an anecdote, experienced in nature, or induced in an experiment, awe and its effects may be ephemeral. How, then, might reoccurring doses of awe affect an individual over time? None of the reviewed empirical literature directly examines awe induced over a prolonged period of time. Thus, given the major individual and social benefits that are associated with feeling awe, the present work examines whether one's ability to experience awe can be positively shifted and sustained. Specifically, I hypothesize that inducing awe over a prolonged period of time via an awe intervention will increase both (1) daily reports of awe and (2) dispositional proneness to awe. If awe can indeed increase concern for others, and instill greater physical and mental well-being, the merits of those effects warrant an investigation into whether one's ability to experience awe can be positively shifted and sustained.

To test my hypotheses, I conducted a four-week longitudinal experiment. Participants were randomly assigned to one of three conditions. Each condition pertained to a different intervention, in which participants engaged in brief structured daily exercises over a 14-day period. Participants' emotions and experiences were measured before, during, and after the intervention period. A follow-up survey sent two weeks after the intervention assessed whether the effects of the intervention were sustained.

### **Method**

#### **Sample and procedures**

Two hundred thirty-seven undergraduates (215 female, 21 male, 1 unreported; age 18–60,  $M = 21.39$ ,  $SD = 4.25$ ) from a large public university in the southwestern United States

participated in this study in exchange for course credit. The sample was 34.9% Asian or Asian American, 33.1% Latin American, 2.8% Black or African American, 19.6% White, 5% Middle Eastern, and 5% other ethnicities. Participants were enrolled in waves over the course of six months. The study spanned 4 weeks and all surveys were completed online. After providing consent, each wave of participants was emailed a baseline survey at 8 p.m. on a Sunday, where their dispositional awe was assessed, as well as demographics and other variables not pertinent to the present work. Participants were then randomly assigned to 1 of 3 conditions – awe ( $n = 75$ ), pride ( $n = 81$ ), or a control condition ( $n = 81$ ), as part of a 14-day intervention period.

The use of pride as a condition allowed for the contrasting of the effects of awe, typically a positive emotion, to those of another positive emotion, to test awe's effects above and beyond positive affect in general. There are several reasons for using pride as a comparison. Although both awe and pride are, generally, positive and arousing emotions, each emotion differs in terms of their respective elicitors and self-related appraisals. Awe is often externally elicited (e.g., nature, art, music), whereas pride's elicitors tend to be internally focused on personal accomplishment or abilities. Likewise, where awe diminishes one's sense of self (i.e., feeling small, powerless, and insignificant; Gordon et al., 2016), pride has self-inflating qualities (i.e., a sense of dominance and superiority over others). Given the distinctions between awe and pride in their elicitors and associated appraisals, pride has often been used as comparison to awe in prior research (e.g., Piff et al., 2015; Shiota et al., 2007; Van Cappellan et al., 2012).

### **Intervention**

Participants in the two emotion conditions were given definitions of either awe or pride and then instructed to seek out and attune to emotional experiences pertaining to their condition. For example, participants in the awe condition first read a definition of awe (e.g., "Awe is the

emotion that people feel in the presence of something beautiful, overwhelming, vast, and/or wondrous that they can't easily wrap their minds around and that defies their expectations in some way.") and were prompted to seek out awe (e.g., "Tomorrow, as you go about your day, make an effort to feel awe. Think about the activities, thoughts, or experiences in your life that move you to feel awe and try to incorporate at least one of these into your day."), whereas those in the pride condition sought pride. Participants in the control condition simply kept track of their days.

Each day of the intervention period, participants completed online check-ins where they rated their daily emotions, including awe, and wrote about their experiences. They received email reminders that included the link to the online check-in survey and their respective intervention definitions and prompts each night between 8 p.m. and 11:59 p.m. A total of 14 check-in surveys were sent out to participants, one for each night of the intervention period.

### **Follow-up surveys**

After the intervention period (i.e., two weeks), participants completed a post survey. Finally, a follow-up survey was sent out 2 weeks after the end of the intervention. Each of these surveys measured participants' dispositional awe.

### **Measures**

*Dispositional awe.* Participants indicated their levels of dispositional awe via the awe subscale of the Dispositional Positive Emotion Scales (DPES), a well-validated measure that assesses individual differences in dispositional tendencies to experience distinct positive emotions (Piff et al., 2015; Shiota, Keltner, & John, 2006). The questionnaire contains seven subscales (e.g., amusement, awe, contentment, compassion, joy, love, pride) each consisting of five to six items. The awe scale contains six items, including "I feel wonder almost every day"



and “I seek out experiences that challenge my understanding of the world.” Participants indicated the extent to which they agree with each statement on a 7-point Likert scale (1 = “*strongly disagree*,” 7 = “*strongly agree*”). Dispositional awe was measured at the pre-intervention, post-intervention, and follow-up survey, with a two-week time span between each survey. The six items were measured to form separate composite scores for each survey; reliability was good for the pre-intervention ( $\alpha = .75$ ;  $M = 4.85$ ,  $SE = .87$ ), post-intervention ( $\alpha = .81$ ;  $M = 4.91$ ,  $SE = .96$ ), and follow-up ( $\alpha = .78$ ;  $M = 5.00$ ,  $SE = .89$ ) surveys.

*Dispositional pride.* In order to compare the effects of the awe intervention to those of the pride, dispositional awe was measured with the DPES pride subscale (Shiota et al., 2006). Similar to the DPES awe subscale, the pride scale is a 5-item questionnaire that assesses a dispositional tendency to experience pride, with such items as “I am proud of myself and my accomplishments” and “Many people respect me.” The five items were measured to form separate composite scores for each survey; reliability was good for the pre-intervention ( $\alpha = .79$ ;  $M = 4.94$ ,  $SE = .92$ ), post-intervention ( $\alpha = .82$ ;  $M = 5.00$ ,  $SE = .97$ ), and follow-up ( $\alpha = .84$ ;  $M = 5.00$ ,  $SE = 1.00$ ) surveys.<sup>1</sup>

*Daily affect.* On each daily check-in survey, participants indicated the extent to which they felt several emotions (e.g., Amusement, Awe, Anxiety, Contentment, Excitement, Fear, Gratitude, Humble, Joy, Love, Pride, Sadness, Surprise) over the course of their day (1 = *not at all*, 7 = *extremely*).

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<sup>1</sup> This study was conducted as part of a larger project. Although there were additional variables collected that are not reported here, analyses were guided systematically by the present analytic framework and a priori decisions.

## **Analytic strategy**

Analyses were conducted in Stata, version 13.0 (Stata Corp.). For each major survey, I calculated the marginal means for each condition's dispositional awe composites. Using procedures outlined by Mitchell (2012), I conducted piecewise regression analyses on both pre-intervention and post-intervention average dispositional awe scores and on post-intervention and follow-up dispositional awe scores, with a spline placed at the post-intervention survey. A spline demarcates a point in time before and after which regression slopes are to be compared. Piecewise regression is an appropriate modeling technique for investigating change in time-series data where an established point of change occurs (Jones, Wojick, Sweeting, & Silver, 2016). Accordingly, this procedure enabled me to observe and compare between- and within-condition changes in regression-line slopes between the beginning and end of the intervention, and between the end of the intervention and the follow-up. In so doing, I could ascertain whether participants' dispositional awe changed over time.

Participants completed three separate surveys at three different points of time over the course of the study, answering the same dispositional awe subscale each time. Thus, it is possible that participants' dispositional awe scores across surveys could be correlated, and, therefore, not independent, violating a central assumption to many statistical procedures (Jones et al., 2016). Specifically, this violates the assumption of independent residuals for an ordinary least square regression analysis. To compensate for the possible correlations within participants, dispositional awe scores were clustered within participants in all regression analyses (UCLA Statistical Consulting Group, 2015). In all contrasts, the control condition served as the comparison group.

## Results

### Effects on daily state awe

A composite daily awe score for each condition was computed by averaging daily awe reported at each check-in across the 14-day intervention. Analysis of variance (ANOVA) was conducted with the composite index of daily awe as the dependent variable. There was a significant condition effect on daily reported awe,  $F(2, 234) = 67.202, p < .001, \eta^2 = .36$ . Average daily reported awe was highest in the awe condition ( $M = 5.23, SE = 1.20$ ), and a Tukey post hoc test revealed that this was significantly higher than mean daily awe in both the pride ( $M = 3.61, SE = 1.60, p < .001$ ) and control ( $M = 2.79, SE = 1.30, p < .001$ ) conditions. Figure 1 depicts average daily awe by condition over the 14-day intervention period.

Similarly, a composite daily pride score for each condition was computed by averaging daily pride reported at each check-in across the 14-day intervention. With the composite index of daily pride as the dependent variable, an ANOVA was conducted. There was a significant condition effect on daily reported pride,  $F(2, 234) = 73.755, p < .001, \eta^2 = .37$ . Average daily pride was highest in the pride condition ( $M = 5.27, SE = 1.27$ ), and a Tukey post hoc test revealed that this was significantly higher than mean daily pride in both the awe ( $M = 3.30, SE = 1.38, p < .001$ ) and control ( $M = 2.93, SE = 1.28, p < .001$ ) conditions. Figure 2 depicts average daily pride by condition over the 14-day intervention period. These results indicate that the awe and pride intervention increased average daily awe and pride, respectively.

Table 1 depicts averages for the remaining daily emotions by condition. There were no differences in amusement, excitement, fear, or love across conditions. The awe condition produced lower levels of anxiety than the pride and control conditions, though sadness was low in all conditions. Participants felt significantly more surprise, gratitude, and humility in the awe

and pride conditions than the control condition, but they did not differ from one another.

Likewise, the awe and pride conditions produced significantly lower levels of sadness than the control condition, but they did not differ and sadness was low across all conditions.

### **Effects on dispositional awe**

Figure 3 depicts changes in average dispositional awe over the course of the study. Between the beginning and end of the intervention, dispositional awe significantly increased in only the awe condition ( $b = .38, SE = .10, p < .001$ ). Dispositional awe scores in the pride condition did not significantly increase between the beginning and end of the intervention ( $b = .10, SE = .09, p = .252$ ); however, scores in the control condition significantly decreased ( $b = -.18, SE = .07, p = .015$ ).

At the post-intervention survey, there was a significant difference in average dispositional awe between the awe ( $M = 5.21, SE = .11$ ) and control ( $M = 4.64, SE = .09$ ) conditions ( $b = .57, SE = .14, p < .001$ , but not between the awe ( $M = 5.21, SE = .11$ ) and pride ( $M = 4.99, SE = .11$ ) conditions ( $b = .214, SE = .15, p = .16$ ). The difference between average dispositional awe scores in the pride and control conditions was significant ( $b = .35, SE = .14, p = .012$ ).

Between the end of the intervention and the follow-up sent after two weeks, dispositional awe did not significantly decrease ( $b = -.09, SE = .10, p = .36$ ). Although the slopes were positive, dispositional awe did not significantly increase for the pride ( $b = .12, SE = .08, p = .172$ ) or the control ( $b = .16, SE = .08, p = .05$ ) conditions. At the follow-up survey, average dispositional awe in the awe condition ( $M = 5.12, SE = .11$ ) was significantly different from mean dispositional awe in the control ( $M = 4.80, SE = .08$ ) condition ( $b = .32, SE = .13, p = .018$ ), but not from scores in the pride ( $M = 5.11, SE = .11$ ) condition ( $b = .01, SE = .15, p = .96$ ). The difference between average dispositional awe scores in the pride and control conditions was

significant ( $b = .31, SE = .13, p = .019$ ). In other words, the awe intervention increased dispositional awe, and this increase was sustained two weeks after the intervention.

Figure 4 shows changes in average dispositional pride over time. between the beginning and end of the intervention, dispositional pride did not significantly increase in the pride ( $b = .13, SE = .08, p = .120$ ) or control ( $b = -.15, SE = .08, p = .059$ ) conditions; however, there was a significant increase in the awe condition ( $b = .26, SE = .10, p = .008$ ). At the post-intervention survey, participants in the awe condition ( $M = 5.15, SE = .10$ ) reported marginally higher dispositional pride than those in the control condition ( $M = 4.85, SE = .12; b = .30, SE = .16, p = .053$ ). There was not a significant difference between average dispositional pride at the post-intervention survey between the awe and pride ( $M = 5.04, SE = .13$ ) conditions ( $b = .11, SE = .16, p = .503$ ). Finally, none of the slopes for each condition significantly changed between the post-intervention and follow-up surveys. Thus, the pride intervention did not meaningfully increase dispositional pride.

### **Exploratory Analyses**

In an effort to better understand why the dispositional awe scores in the awe condition were not significantly different from scores in the pride condition after the intervention, I examined daily changes in awe over the intervention period among individuals in the awe condition to see if there might be some variation in how people responded to the intervention that might explain this observation. Participants in the awe condition were grouped by whether they were high or low in average dispositional awe measured at the beginning of the study (i.e., before the start of the intervention), as determined by a mean split. If their average dispositional awe scores were greater than the mean ( $M = 4.85, SE = .87$ ), indicating that they often felt awe to some extent throughout their lives, participants were considered to be high in dispositional awe.

Conversely, participants were considered to be low in dispositional awe if their average dispositional awe scores were less than the mean, indicating that, on average, they had disagreed, or had reported neither agreement nor disagreement, with the dispositional awe subscale statements.

Figure 5 shows the high awe ( $n = 58$ ) and low dispositional awe ( $n = 17$ ) groups' average daily awe trajectories over the 14-day intervention period. Participants who were in the high awe group generally reported feeling more daily awe during the intervention. Participants who were low in dispositional awe prior to the intervention, however, showed a markedly different trend. Average daily awe scores in the low group started out lower and increased slightly around the middle of the intervention, before sharply declining and never recovering. Daily awe scores in the low group decreased at about the same time that scores in the high group increased. This pattern did not appear in the average daily awe trajectories between the high and low dispositional awe groups within the pride (Figure 6) or control (Figure 7) conditions. In both cases, those high in dispositional awe felt more daily awe, and those in the low group appear to have consistently felt the similar low levels of daily awe each day. It is not clear why the difference in daily awe trajectories in the awe condition emerged, but it may have been due to participants in the low awe group experiencing different awe experiences than those reported by the low group.

To examine this possibility, I investigated what participants wrote in their daily awe diaries completed at each check-in. Using a custom R (R Core Team, 2015) script, I assessed the frequency with which words appeared within all of each group's awe diaries. An analysis of every description written by dozens of participants across multiple awe diaries yields thousands of word frequencies. Thus, visualization can be a useful aid in interpreting the patterns that may

emerge. I used word clouds to intuitively depict the results. Word clouds are used as an effective and insightful method for summarizing the words that appear most often within a text corpus (Schwartz et al, 2013). Word size is scaled by how frequently they appear within a group's awe diaries; that is, the larger the word, the more often it appeared. Figures 8 and 9 depict word clouds for the high awe and low dispositional awe groups, respectively. Many of the words that appear most often in the in high dispositional awe group were also among the frequently mentioned words in the low awe group, including "weather, beautiful, friends, home, feeling, life," and "sky," suggesting that participants' awe descriptions did not differ much between groups.

Inverse document frequencies (IDF) are used to examine how distinct a word is to a text corpus. IDF decreases the weight of commonly used words within a body of text and increase the weight of rarely used words (Klein, Clutton, & Polito, 2018). Figure 10 shows the inverse document frequencies for the seven most unique words to the high or low awe groups. Unique words in the high group include "parents, blessed, reminded, and super," whereas the low group includes "focusing, caused, cancer, and lyrics." Although these findings highlight words that were used less frequently within their respective groups, rather than simply the most frequently used words depicted in the word clouds, it appears that some of the rarer words within each group may have differed.

## **Discussion**

In recent years, awe has increasingly gained empirical attention. Numerous positive outcomes have been associated with experimentally manipulated feelings of state awe and with dispositional proneness to experiencing awe, including increased physical and mental health, humility, and prosocial behavior. (Piff et al., 2015; Stellar et al., 2015; Stellar et al., 2018).

Despite this growing body of work, research has not yet investigated longitudinally induced awe. Although some work has implemented daily diary methodologies to investigate awe (Bai et al., 2017; Gordon et al., 2016; Stellar et al., 2018), this research did not instruct participants to actively seek out awe-inspiring experiences or implement similar intervention procedures. Guided by intervention work on similar positive emotions (e.g., Emmons & McCullough, 2003; Sheldon & Lyubomirsky, 2006) I investigated whether state and dispositional awe would be increased and sustained via an awe intervention.

A four-week study using a 14-day intervention, during which participants were instructed to seek out and attune to awe-inspiring experiences during their days, yielded evidence to support this prediction. Participants in the awe condition felt more daily awe during the intervention period than the pride and control conditions, whereas daily pride was highest in the pride condition, indicating that the awe intervention successfully elicited greater state awe and that these results were specific to the awe condition. Likewise, dispositional awe increased for only participants in the awe condition between the beginning and end of the intervention. Furthermore, dispositional awe in the awe condition did not meaningfully decrease two weeks after the end of the intervention. These results suggest that people who were instructed to search for, and take note of, awe-inspiring experiences throughout their days became more dispositionally prone to experiencing awe and that these changes were sustained two weeks later.

Interestingly, exploratory analyses revealed that participants in the awe intervention felt awe in markedly different ways, depending on whether they were high or low in dispositional awe reported before the intervention. Participants who were low in dispositional awe reported decreasingly felt less awe as the intervention progressed. There are a few possible explanations for why this pattern was observed. It's possible that people who don't often experience awe



might find it increasingly uncomfortable to report on it. Also, perhaps such individuals are more likely to become habituated to awe over time. Individuals who are prone to experiencing awe tend to report greater openness to experiences, a quality that may enable such people to continue to experience awe over time (Silvia, Fayn, Nusbaum, & Beaty, 2015). People who are low in dispositional awe may be less likely to seek out new awe experiences over time, which might decrease awe's novelty. Additionally, the intervention might not have been strong enough for people low in dispositional awe. Descriptive text analyses of participants' awe-inspiring entries in their daily awe diaries did not reveal notable differences between the low and high groups. Participants in both groups appeared to write about mostly the same things for their daily awe-inspiring experiences.

### **Limitations and future directions**

In interpreting my findings, certain limitations and future directions should be kept in mind. Given that participants in the awe and pride conditions were given definitions of awe or pride and instructed to seek out and attune to emotional experiences on a daily basis for their respective interventions, it is possible that demand effects could have arisen. Because they were consistently asked to search for awe or pride, participants may have felt that they should report more awe or pride on their daily check-ins or via the DPES subscales. However, if demand effects were present, those in the awe condition should have exhibited similar elevated levels of daily awe, rather than the split that took place between the high and low groups. Likewise, if being instructed to seek out awe or pride cued participants to report more of their respective intervention emotions on the DPES awe and pride subscales, it seems reasonable to expect that average dispositional pride scores would have increased over the course of the intervention similar to the elevated DPES awe scores observed in the awe condition. However, dispositional

pride in the pride condition did not significantly increase between the beginning and end of the intervention.

Although text analyses of participants in the awe condition's daily awe diaries did not appear to reveal notable differences in what participants wrote about, these analyses were descriptive, showing just the frequencies of words in the high and low dispositional awe groups. Future analyses should examine whether significant differences exist between each groups' awe descriptions by examining not only word frequencies, but content and affect as well.

Sophisticated text analyses methodologies, such as latent semantic analysis, can be used to detect meaning in word use in a wide variety of psychologically meaningful categories, including attentional focus, thinking styles, and emotionality (Landauer, 1999; Tausczik & Pennebaker, 2010). Depending on whether they are high or low in dispositional awe, participants may have displayed differing levels of positive and negative affect in their awe diaries. Insofar as awe-inspiring experiences can be positive or negative, it is unknown whether individuals who are less prone to experiencing awe would use more negative, or positive, emotion when describing awe-inspiring experiences. Perhaps such individuals would use less awe-related words. To test this question, an awe dictionary, in which words that often used to describe feelings of awe are identified, could be created.

Conversely, existing text analyses programs may not provide accurate descriptions of written awe-inspiring experiences. Simply analyzing the frequency of awe-related words in a body of text might not tell whether an experience was more or less awe-inspiring than another. Indeed, awe-inspiring instances can include ineffable qualities that may make describing one's experiences difficult, which could warrant a more holistic approach to investigating written descriptions of feeling awe. Future work investigating how dispositional differences in awe

proneness may be reflected in awe diaries, or similar text descriptions, could benefit from using coders trained to identify awe-inspiring experiences or more sophisticated text analyses.

Although dispositional awe significantly increased in only the awe condition, and these results did not significantly decrease two weeks after the intervention, average dispositional awe in the awe condition measured at the post-intervention and follow-up surveys was not significantly different from the pride condition. Given that feelings of awe and pride can both be elicited by interpersonal events, it is possible that seeking out and attuning to awe throughout one's day might increase dispositional proneness to experiencing pride, in addition to dispositional awe, and vice versa. Furthermore, the aforementioned results could be due to the variation in how the intervention was experienced by those low and high in dispositional awe. The intervention appeared to have an opposite effect on those who were not prone to experiencing awe, and this variation could have negatively impacted the overall effect of the intervention on dispositional awe.

Finally, future research should investigate deeper into the differences between those who are low and high dispositional awe. Differences in religiosity, spirituality, personality dimensions, and emotional arousability, among others, could influence how an individual experiences awe (Eisenberg et al, 1991; Preston & Shin, 2016; Shiota et al., 2007). Better understanding the characteristics between levels of dispositional awe might help identify strategies for designing a more powerful intervention aimed at those who don't often experience awe, given that such individuals may stand to reap the most benefits from increasing awe within their lives.

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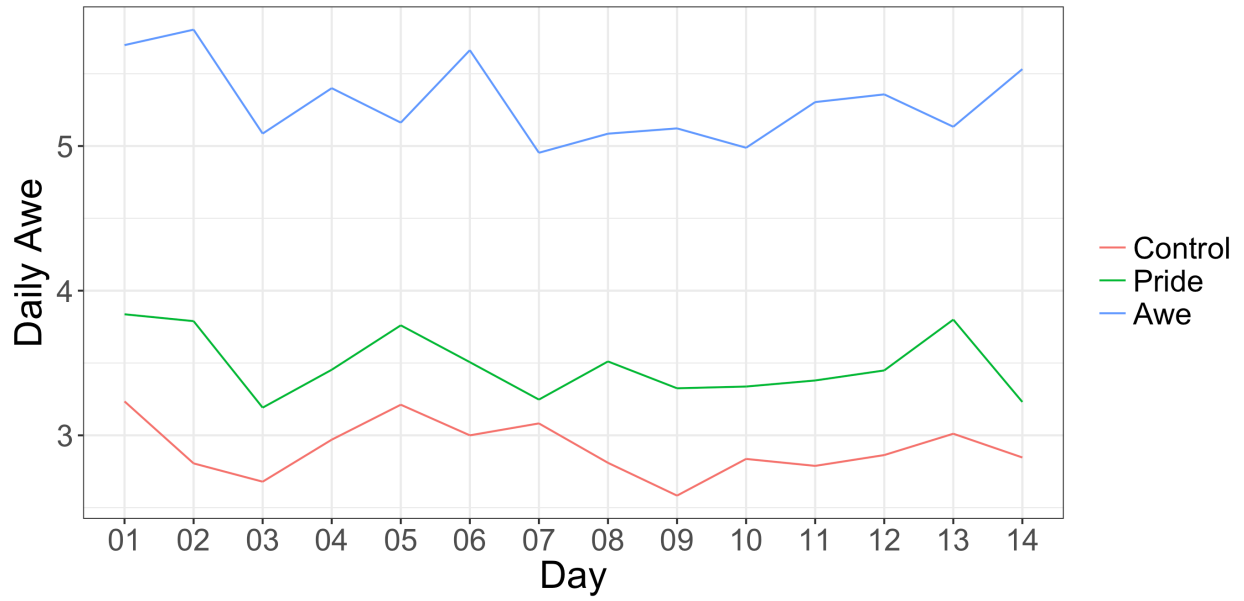
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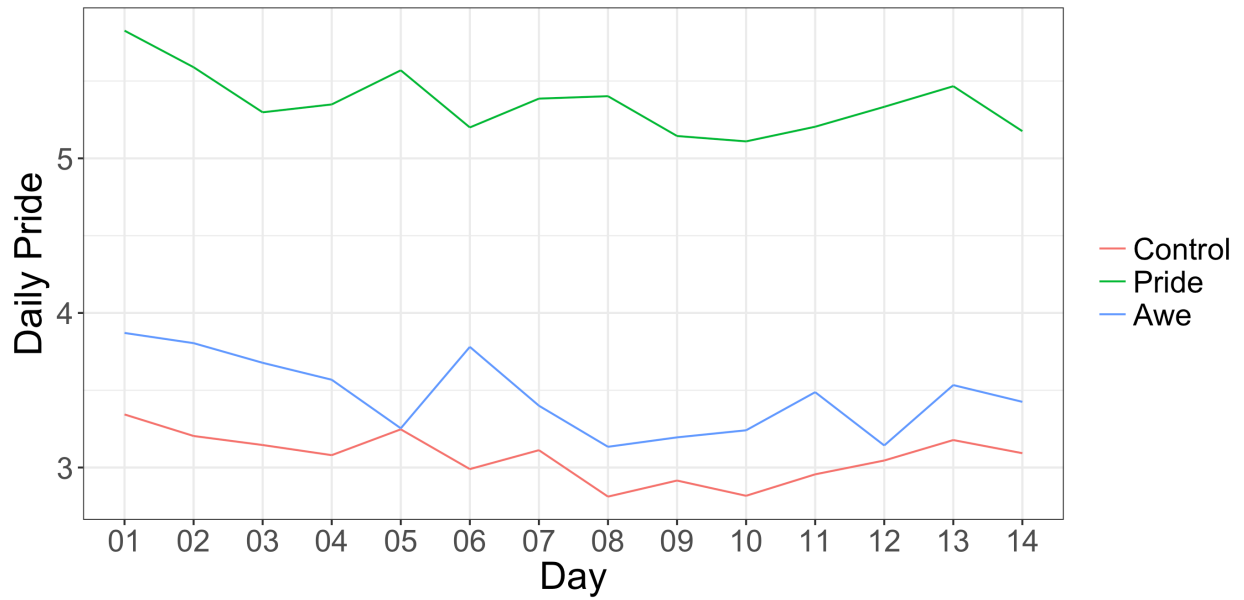


## Figures

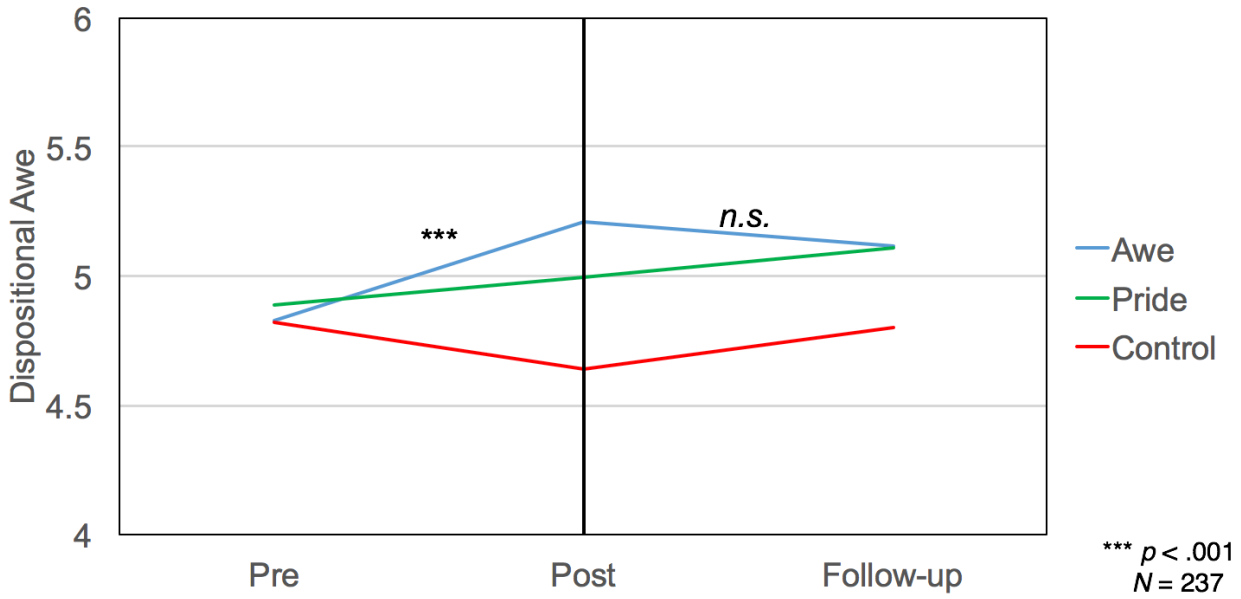
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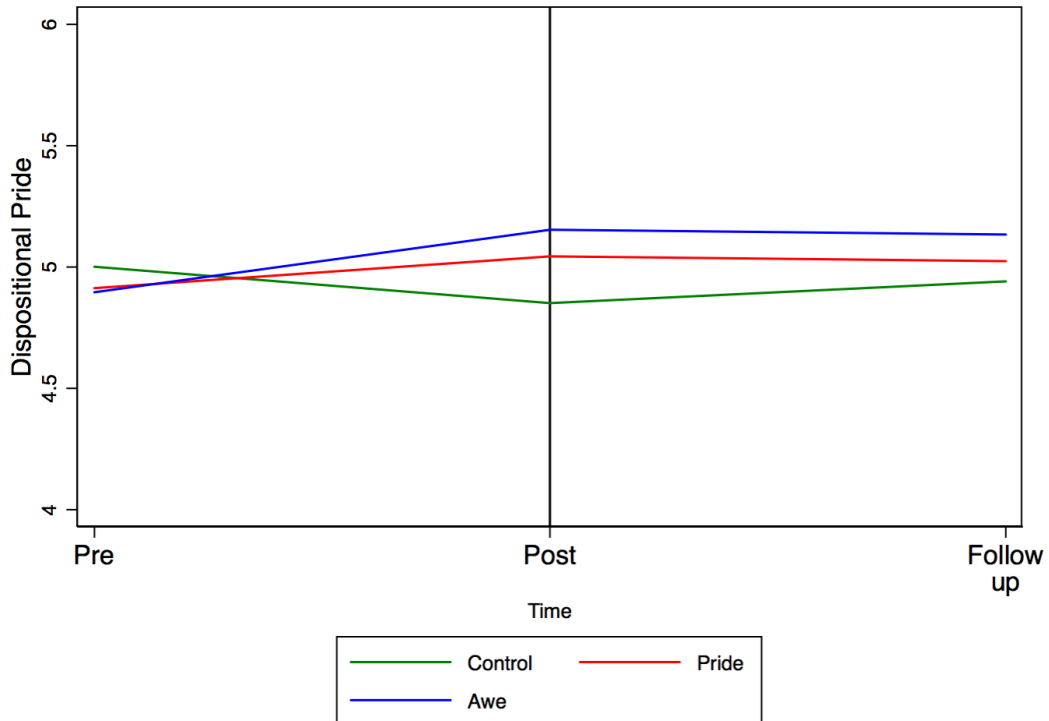
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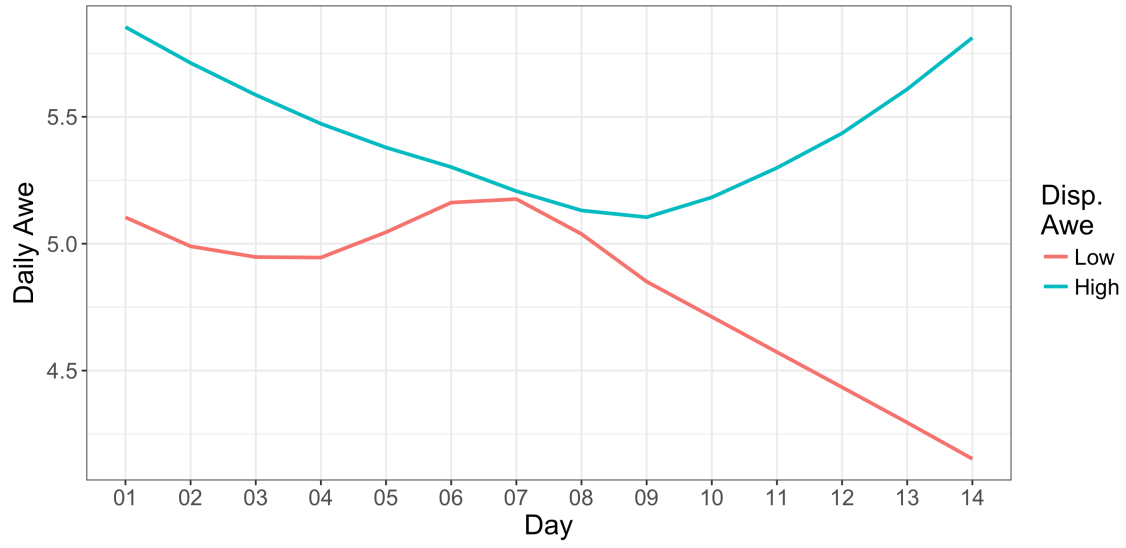
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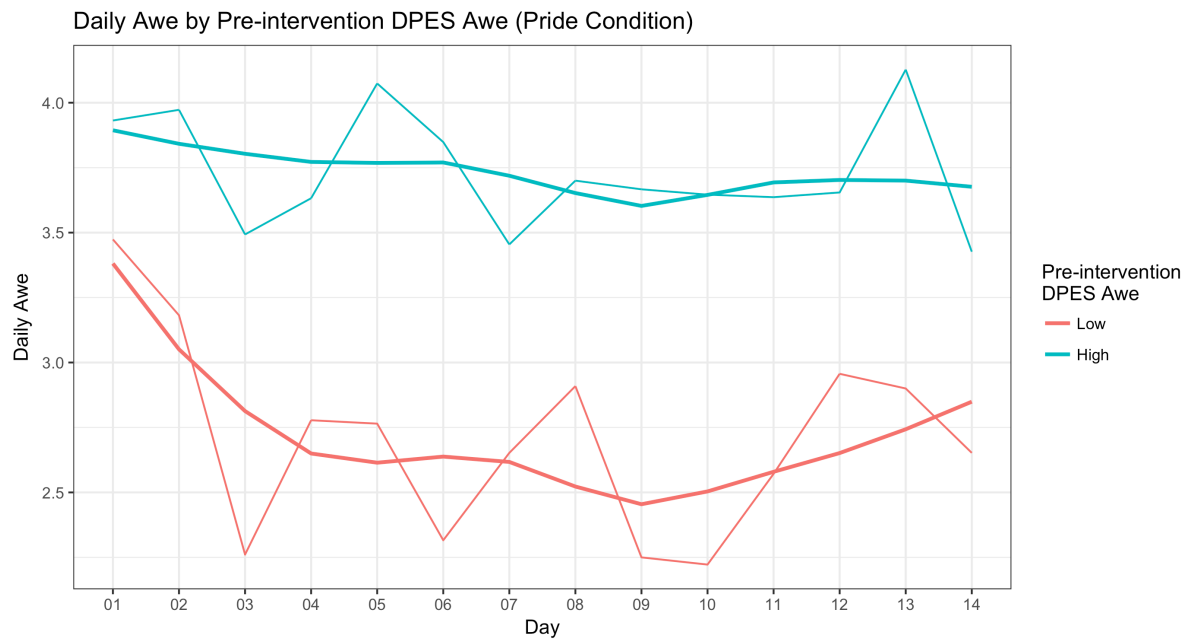
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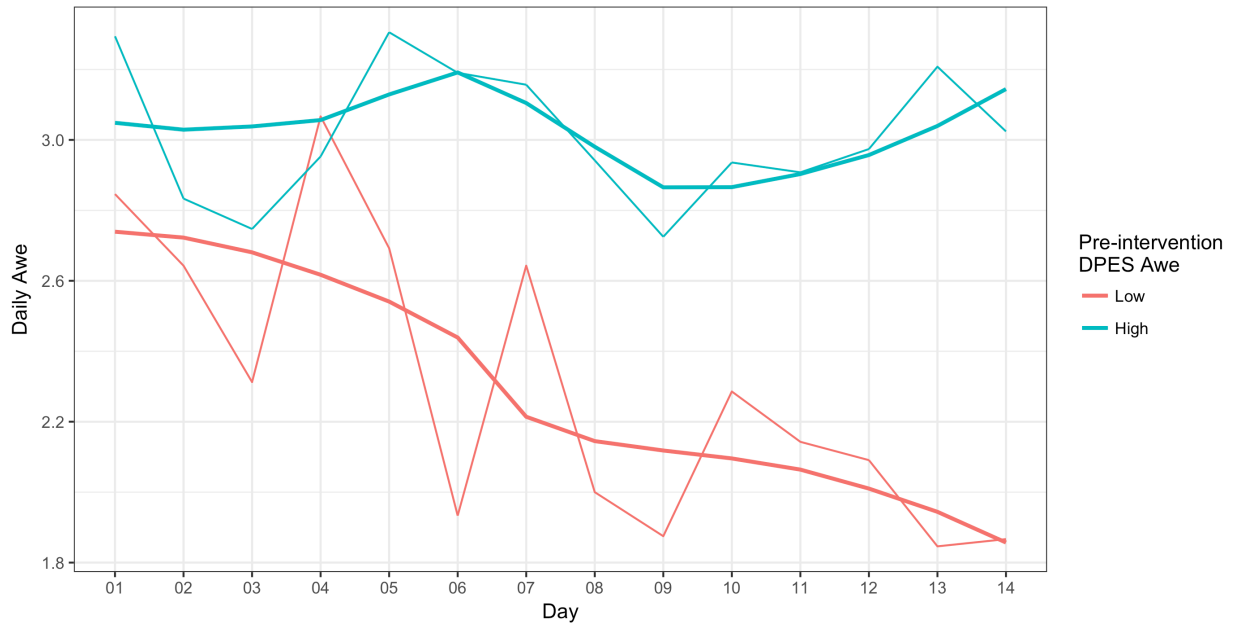


6.



7.

Daily Awe by Pre-intervention DPES Awe (Control Condition)



8.



9.



10.

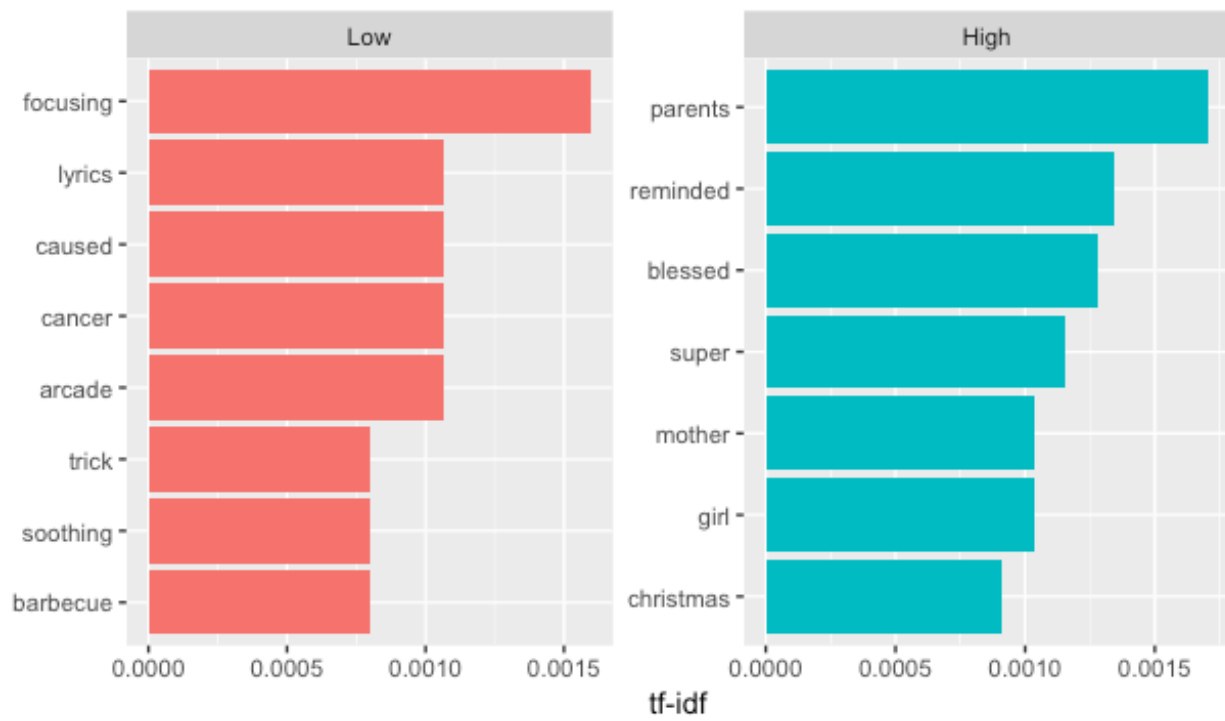


Table 1

*Mean scores for daily reported emotions over the intervention period (SDs in parentheses)*

	Conditions		
	Awe (n = 75)	Pride (n = 81)	Control (n = 81)
Amusement	4.15 (1.41)	3.73 (1.51)	3.99 (1.20)
Anxiety	2.27 (1.25) <sup>b,c</sup>	2.74 (1.17) <sup>a,c</sup>	3.34 (1.22) <sup>a,b</sup>
Awe	5.28 (1.20) <sup>b,c</sup>	3.61 (1.57) <sup>a,c</sup>	2.79 (1.30) <sup>a,b</sup>
Contentment	4.75 (1.19)	5.07 (1.31) <sup>c</sup>	4.34 (1.37) <sup>b</sup>
Excitement	4.38 (1.23)	4.40 (1.39)	3.99 (1.28)
Fear	2.02 (1.18)	2.17 (1.08)	2.40 (1.00)
Gratitude	4.88 (1.27) <sup>c</sup>	4.79 (1.35) <sup>c</sup>	4.24 (1.44) <sup>a,b</sup>
Humble	4.19 (1.38) <sup>c</sup>	4.24 (1.47) <sup>c</sup>	3.47 (1.52) <sup>a,b</sup>
Joy	4.87 (1.15)	4.97 (1.34) <sup>c</sup>	4.40 (1.23) <sup>b</sup>
Love	4.52 (1.42)	4.00 (1.53)	4.23 (1.47)
Pride	3.30 (1.38) <sup>b</sup>	5.27 (1.27) <sup>a,c</sup>	2.94 (1.28) <sup>b</sup>
Sadness	2.11 (1.06) <sup>c</sup>	2.05 (0.99) <sup>c</sup>	2.59 (1.06) <sup>a,b</sup>
Surprise	3.99 (1.20) <sup>c</sup>	3.59 (1.35) <sup>c</sup>	2.99 (1.23) <sup>a,b</sup>

*Note.* All responses were made using single items and 7-point scales, with higher values

indicating increased emotion. <sup>a</sup> These means are significantly different from those in the awe

induction condition ( $p < .05$ ); <sup>b</sup> These means are significantly different from those in the pride

induction condition ( $p < .05$ ); <sup>c</sup> These means are significantly different from those in the control

condition.