

On the Effects and Boundaries of Awe and Humor Appeals for Pro-Environmental Engagement

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Awe, a self-transcendent emotion often triggered by vast nature panoramas, is likely to stimulate pro-environmental action. We examined whether appealing to awe could promote perceived risk of climate change, support for low-carbon policies, and intentions to perform pro-environmental behaviors. Given conversations around comedy as a strategy for communicating climate change, we also tested whether appealing to humor, another positive emotional experience, could have similar effects. In a preregistered experiment with a national sample of U.S. adults, we found that awe appeals increased all outcomes measured. The parody-based humor appeals strengthened belief in climate change and perceived risk. These findings demonstrate awe-inspiring messages can increase several pro-environmental outcomes and parody can increase belief-oriented outcomes. For outcomes where the effects of the awe appeals depended on individuals' political affiliation, effects were strongest for Republicans.

Keywords: awe, humor, emotional appeals, climate change, air pollution

When it comes to persuasive messaging about environmental issues, negative emotional appeals are typically the default strategy. Appeals to fear in particular have received the bulk of attention in science communication research, with some studies offering evidence for their persuasive potential (e.g., Nabi, Gustafson, & Jensen, 2018; Skurka, Niederdeppe, Romero-Canyas, & Acup, 2018) and others casting doubt on their ability motivate change (e.g., O'Neill & Nicholson-Cole, 2009). Given the enormous threat that human activities pose to the natural world, this emphasis on negative appeals is not surprising and, perhaps to some degree, justifiable.

Even so, the disproportionate focus on the role of negative emotions in response to pro-environmental messaging (and in the emotional appeals literature writ large) has left positive emotions to

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the wayside (Chadwick, 2015; Nabi, 2002). Unlike negative emotions, which narrow our awareness and cognitions to emotion-relevant stimuli, positive emotions broaden our mindset, helping us to build social and psychological resources that are useful in future situations even after the emotions themselves have dissipated (Fredrickson, 2001, 2013). In this investigation, we draw from broaden-and-build theory of positive emotions (Fredrickson, 2001) and appraisal theories of emotion more broadly (Keltner & Haidt, 2003; Lazarus, 1991) to examine the effectiveness of persuasive appeals to two positive emotions—one that is little studied in communication research but that may be especially pertinent in environmental contexts (awe) and another that has been of interest to science communicators in recent years for its ability to draw attention (amusement).

Awe is a self-transcendent emotion in which one's sense of self is diminished and one's feelings of connection with others, nature, or the universe are heightened (Yaden, Haidt, Hood, Vago, & Newberg, 2017). Although Keltner and Haidt (2003) originally noted that awe can be induced via the presence of vast power (and potential threat), it has generally been conceptualized and studied as a self-transcendent *positive* emotion (Yaden et al., 2017). Further, the experience of awe is associated with a host of favorable outcomes, including opening us to new information, reducing our sense of self-importance, making us feel more connected to others and the natural environment, and increasing prosociality (Chirico & Yaden, 2018). For these reasons, awe could be a strong motivator of pro-environmental outcomes (Carter, 2011). However, awe has received little attention from media effects scholars (Possler & Raney, 2021), and psychological research on awe has studied it almost exclusively as an incidental emotion whose influence is unrelated to the task or information at hand. Building on the surge of media psychology research on the power of self-transcendent emotions (Oliver et al., 2018), we investigated whether it is possible for communicators to intentionally elicit awe via mediated, panoramic nature scenes to persuade the public to take action to protect the environment.

As a positive emotion in comparison to awe, we also explored the potential for amusement (a hedonically focused emotion) to achieve similar goals. Science communicators have turned to comedy in recent years in hopes of engaging the public in climate change mitigation efforts (Chattoo & Feldman, 2020; Kaltenbacher & Drews, 2020), and there is promising evidence that humor can promote pro-environmental beliefs, attitudes, and intentions (e.g., Brewer & McKnight, 2015; Skurka et al., 2018). Yet humor is a diverse genre and is by no means a magic bullet for persuasion (Walter, Cody, Xu, & Murphy, 2018). Moreover, much of the extant humor research in the climate domain has focused on young adults who tend to be especially responsive to comedic messaging (Eisend, 2009), leaving open the question of humor's ability to promote pro-environmental outcomes among broader audiences.

We fill these gaps in the literature by conducting a preregistered experiment with a national sample of U.S. adults in which participants viewed panoramic nature videos designed to elicit awe or amusement. Additionally, because the impact of emotional appeals can depend on various features of the audience, situation, and message (Nabi, 2002), we examined two boundary conditions to identify when the influence of awe and humor appeals may be strongest: the persuasion outcome of interest (beliefs, attitudes, or intentions) and the political leaning of the audience. Testing the boundaries of positive emotional appeals' impact is important because it can lead to more nuanced recommendations for strategic communicators promoting environmental causes.

Awe and Amusement as Vehicles for Environmental Communication

Awe: An Epistemic, Self-Transcendent, Prosocial Emotion

Imagine gazing at the expansive Grand Canyon or the kaleidoscopic Aurora Borealis. As you take in these sights, you are likely to experience awe. A rather mysterious emotion often linked to divine encounters (Keltner & Haidt, 2003), awe is the sense of astonishment we feel in response to larger-than-life stimuli that fly in the face of what we know. Awe is associated with a tendency to freeze as well as unique patterns of facial activity (open mouth, wide eyes) and physiological activity (goosebumps, chills; Yaden et al., 2018). Much like the emotion of surprise, awe is an “ambiguous” (Lazarus, 1991, p. 82) emotion that can feel pleasant or unpleasant depending on the cognitive appraisals made of the situation. In this way, awe can take on different variants or “flavors” (Keltner & Haidt, 2003, p. 304)—a negative variant if awe is tinged with threat perceptions (e.g., watching a tornado) but a positive variant when we perceive beauty (e.g., a grand vista). On the whole, however, several studies have demonstrated that awe is a highly pleasant experience, particularly in response to nonthreatening nature scenery (Campos, Shiota, Keltner, Gonzaga, & Goetz, 2013; Shiota, Keltner, & Mossman, 2007). Because we tested the influence of awe-eliciting messages that featured breathtaking Earth panoramas, we treat awe as a positive emotion.

In the first major theoretical treatise of awe in social psychology, Keltner and Haidt (2003) identified two core appraisals that underlie the prototypical awe experience. First, awe involves appraisals of vastness, which is the perceived enormity of the stimulus relative to oneself. We may perceive vastness in a literal sense (e.g., looking up at California’s redwood trees) or a figurative or conceptual sense (e.g., meeting a renowned celebrity, contemplating the idea of infinity). Second, awe entails a need for accommodation, the “Piagetian process of adjusting mental structures that cannot assimilate a new experience” (Keltner & Haidt, 2003, p. 340). In this way, awe-inspiring stimuli are so perceptually vast that we cannot easily fit the stimuli into our existing knowledge stores; we must accommodate or adjust what we know to make sense of the stimuli. These two appraisals must cooccur because it is possible to perceive something as vast but not need to cognitively accommodate the information (as in the case of deference) or to experience the need to accommodate without the stimuli being vast (as with surprise; Keltner & Haidt, 2003). Awe is therefore considered an epistemic emotion because it makes knowledge gaps salient (McPhetres, 2019; Valdesolo, Shtulman, & Baron, 2017).

Like compassion and gratitude, awe is a self-transcendent emotion, motivating us to think beyond ourselves and diminishing our self-importance (Stellar et al., 2017). From the perspective of broaden-and-build theory (Fredrickson, 2001), positive emotions generally do not narrow our focus to the situation at hand (as is the case for negative emotions) but promote openness to ideas and orient us to the accumulation of new experiences and resources (Fredrickson, 2013). Accordingly, awe absorbs us into information-rich stimuli (van Elk, Karinen, Specker, Stamkou, & Baas, 2016) and leads us to perceive that our beliefs and concerns are trivial in the grand scheme of things (Piff, Dietze, Feinberg, Stancato, & Keltner, 2015). This self-diminishment explains—at least, in part—why awe motivates prosocial behaviors: “Awe helps individuals fold into cohesive collectives by leading to a reduced estimation of one’s individual importance” (Stellar et al., 2017, p. 203). In essence, awe makes us feel connected to humanity and the natural world.

Though we can feel awe when directly interacting with nature, we might also feel awe in response to mediated nature experiences (Kahn & Cargile, 2021; Possler & Raney, 2021)—for example, when watching televised programs like BBC's *Planet Earth* (Fothergill, 2006). As we will argue below, awe is an emotion well-suited to cultivating pro-environmental outcomes, suggesting that messages appealing to awe—that is, awe at the marvel of our planet's natural wonders—could be a compelling messaging strategy to inspire action to protect those wonders from environmental threats.

Unpacking Humor and Parody

If awe appeals can indeed influence audiences, it is important to establish whether it is because positive appeals writ large are effective or if there is something specific about awe that makes it a potent motivator of pro-environmental outcomes. Essentially, what is needed is a nontranscendent emotion as a positive-emotion contrast for awe. Thus, we chose to focus on amusement (sometimes called mirth) for several reasons.

First, much prior research has used an amusement comparison when studying the effects of awe because amusement is a pleasant, hedonic experience whereas awe is a pleasant but self-transcendent experience (e.g., Ji, Janicke-Bowles, De Leeuw, & Oliver, 2019; Piff et al., 2015). Second, amusement is typically elicited in psychological studies of emotion when a general positivity comparison is needed (e.g., Piff et al., 2015). Third, amusement offers a useful comparison for awe because amusement, like awe, "is elicited by an incongruity between one's expectations (or default schema) and experience" (Piff et al., 2015, p. 889). Fourth, though our primary focus in this study is to understand awe's effects on pro-environmental outcomes, humor (the messaging strategy that elicits a state of amusement) is an exciting strategy in its own right, having received extensive interest from communication scholars as a way to educate audiences and shift attitudes (Kaltenbacher & Drews, 2020; Walter et al., 2018). This is largely because of the rise of comedic coverage of political, social, and scientific issues in entertainment programs like *Jimmy Kimmel Live!* (Kimmel, 2003) not to mention the spread of funny memes and social media posts about environmental issues (see Chattoo & Feldman, 2020).

Humor researchers have proffered several theories over the years to explain audiences' appreciation of humor, including explanations that humor derives from psychological incongruities, the release of tension, a sense of superiority over others, or harmless violations (for a review, see Warren, Barsky, & McGraw, 2021). As for humor's ability to influence audiences, it is believed that humor amplifies source liking (Nabi, Moyer-Gusé, & Byrne, 2007) and stimulates attention to the information (Eisend, 2009), presumably because audiences seek the hedonic gratification of "getting" a joke. In this study, we focus on parody, a technique of imitating another media genre or style via exaggeration (Buijzen & Valkenburg, 2004). Specifically, we used parodies of nature documentaries, which have become quite popular in recent years, including series like *Planet Earth* (Fothergill, 2006). Though some theorists have argued parody can be cognitively demanding because audiences must be familiar with the imitated genre or text to comprehend the humor (Kreuz & Roberts, 1993; Matthes & Rauchfleisch, 2013), we argue that parodies of broadly familiar, enjoyable content (i.e., nature documentaries) make for a lighthearted, easy-to-process kind of humor.

We also chose to avoid explicitly political arguments with our parody appeals, which offered two main benefits. Methodologically, it ensured that the humor appeals we tested were not more information-heavy than our awe appeals, which did not include overtly political content, thus providing tighter experimental control over our stimuli. Additionally, pro-environmental comedy in the media has often derogated conservatives or skeptics (Chattoo & Feldman, 2020). This study heeds the call to test the efficacy of other comedic takes that avoid making these groups the butt of the joke, reducing the chances of activating politically motivated reasoning and message rejection, as we will describe shortly.

The Case for Awe Appeals to Persuade

There are several reasons to believe persuasive appeals to awe in the environmental domain will be effective. First, even more so than other epistemic emotions like surprise or curiosity, awe is well suited to cultivating openness to science because the need to accommodate gaps in mental schemas motivates information acquisition (McPhetres, 2019; Valdesolo et al., 2017). Therefore, as an epistemic, knowledge-related emotion, awe should affect cognitive outcomes, such as belief in whether climate change is happening and perceived risk of climate change. Relatedly, because awe involves appraisals that the experience is figuratively or literally larger than oneself (Keltner & Haidt, 2003) and increases feelings of connectedness to larger social collectives (Piff et al., 2015; Stellar et al., 2017), awe in response to media messages about the beauty of our planet should foster endorsement of large-scale, collective efforts to protect the environment—in this case, support for pro-environmental public policies.

Second, awe might be particularly appropriate when it comes to encouraging environmentally conscious behaviors because it strengthens beliefs that one is symbiotically connected to the earth (Carter, 2011). Accordingly, nature is a key elicitor for awe (Shiota et al., 2007), and awe has been shown to increase intentions to engage in environmentally conscious behavior by strengthening beliefs that one is connected to nature (Yang, Hu, Jing, & Nguyen, 2018). Third, much work in media psychology has demonstrated the impact of self-transcendent media. For example, self-transcendent emotions such as elevation or inspiration aroused from consuming media messages have been shown to heighten one's sense of connection with others and one's motivation to be a better person (Oliver et al., 2018). Comparatively less work has focused on the media psychology of awe (Kahn & Cargile, 2021; Possler & Raney, 2021), but in one investigation that did, awe-eliciting music motivated people to "do good things for other people" (Ji et al., 2019, p. 314) relative to silence and relative to amusing, funny music.

These arguments, taken together, led us to expect persuasive effects of awe appeals on a range of outcomes. We examined two belief-based outcomes (belief in whether climate change is happening and perceived risk of climate change), one attitudinal outcome (support for low-carbon public policies), and two behavior-related outcomes (intentions to engage in pro-environmental activism and intentions to perform personal mitigation behaviors). Assessing effects on multiple outcomes offers greater theoretical and practical insight as to the boundaries or generalizability of awe's effects across indicators of persuasive success. We hypothesized:

H1: Awe appeals will increase persuasion outcomes relative to unrelated control messages and humor appeals.

The Case for Parody-Based Humor Appeals to Persuade

With H1, we expect awe appeals to outperform parody-based humor appeals because, simply put, the case for humor to persuade is far less convincing. Humor's influence is typically attributed to its ability to enhance attention and source liking (Eisend, 2009; Nabi et al., 2007), but there have been conflicting views among humor theorists and advertising practitioners as to whether humor enhances or undermines persuasion (Eisend, 2009; Nabi et al., 2007). Perhaps this is because unlike negative emotions (Lazarus, 1991) and awe, which motivates prosocial and pro-environmental behaviors (Stellar et al., 2017), amusement does not have clear motivational tendencies associated with it, as outlined by broaden-and-build theory (Fredrickson, 2001, 2013). Offering the most comprehensive evidence to date on humor and persuasion, a meta-analysis found nonzero but small effects on attitudes and intentions and none on behavior, leading the authors to conclude "only by including relevant moderators can we present a clearer picture of the mechanisms that shape the influence of humor on persuasion" (Walter et al., 2018, p. 361).

That said, there is reason to believe humor can hold influence in the realm of environmental communication. More optimistically, a narrative review of research on humor and climate change suggested humor's effects on awareness, beliefs, and learning are generally positive (Kaltenbacher & Drews, 2020). Multiple studies have shown humor can encourage audiences to believe climate change is happening and engage in pro-climate activism (e.g., Brewer & McKnight, 2015; Skurka et al., 2018), though it should be noted that these studies were conducted with young adults who are especially receptive to humor (Eisend, 2009). Most relevant for our study of parody-based humor, Walter and colleagues' (2018) meta-analysis found parody to be the only style of humor that shapes attitudes ($r = .22$) and intentions ($r = .14$). It is not clear from the meta-analysis why that was the case, but humor theorists have argued humor's influence may largely depend on heuristic cues, such as source liking or production qualities (Martin & Ford, 2018), which may be strong and favorable in parody studies. Considering the mixed theoretical and empirical support for the direct effects of humor, and given that much of the available theorizing is based on findings with young adult samples that may not generalize to broader audiences (Skurka et al., 2018), we pose a research question ("RQ"):

RQ1: Will parody-based humor appeals increase persuasion relative to unrelated control messages?

Political Leaning as a Moderator

Political partisanship is one of the strongest predictors of a person's climate change views, with individuals on the political right less likely to believe in climate change than their counterparts on the political left (Hornsey, Harris, Bain, & Fielding, 2016). One leading explanation for this polarization is motivated reasoning, in that individuals are motivated to evaluate new information not with accuracy goals in mind but to uphold their preexisting positions (Kunda, 1990; Taber & Lodge, 2006). By consequence, when conservatives encounter strategic messaging about climate change, which is often at odds with dominant conservative positions on the issue, they are more likely to resist the persuasive attempt because they are filtering the information through a partisan lens, likely resulting in rejection of the message. Science communicators must therefore consider whether different messaging strategies, including emotional

appeals, resonate for various audience segments to identify effective themes worth pursuing (or avoiding) in targeted messaging efforts.

Awe is an emotion that fosters a sense of openness (Yaden et al., 2018). According to broaden-and-build theory, awe, by motivating accommodation of incoming information, facilitates the accrual of new worldviews (Fredrickson, 2013; Shiota et al., 2007). Consistent with this argument, awe has been shown to reduce how committed we are to our positions on social issues like capital punishment and racial bias in law enforcement (Stancato & Keltner, 2019). Consequently, awe may heighten beliefs that society is “all in this together” to stop climate change, attenuating the impact of one’s political views. This line of thought, though untested, suggests evoking awe could resonate equally across the political spectrum.

Regarding humor, if political conservatives are made the target of the jokes, comedy is likely to produce defensive reactions among that group (Chattoo & Feldman, 2020) or sustain political divides (Skurka, Niederdeppe, & Nabi, 2019). This phenomenon is best explained by disposition theory of humor (Zillmann & Cantor, 1976), which proposes audiences will not appreciate humor if the humor target is a beloved figure. However, if the humor deployed avoids explicitly political arguments (as is the case for the parody-based humor messages we developed), it could exert similar effects for political partisans because the political ingroup is not being ridiculed or because motivated reasoning processes are not activated. Even so, given the weak and inconsistent effects humor has had in the persuasion literature (Walter et al., 2018), it seems feasible to expect amusing videos that advocate for environmental protection will only be effective for individuals already favorable toward the issue (in this case, those on the political left). Thus, we offer the following hypothesis, though not preregistered:

H2: Awe appeals will increase persuasion outcomes for individuals regardless of their political party affiliation, but humor appeals will only increase persuasion outcomes for Democrats.

Methods

Recruitment

Qualtrics maintains a national, opt-in panel of U.S. adults that we used for participant recruitment. We recruited roughly equal numbers of Republicans, Democrats, and Independents to ensure sufficient power to conduct interaction tests. Our preregistered hypotheses and study plans are available online: <https://aspredicted.org/blind.php?x=bp3wt4>.² Data, syntax, and study materials are available at the first

² We note a few additional divergences between this study and our preregistration plan. First, we preregistered a sample size of $N = 915$, computed using G*Power version 3.1.9.6. However, one of the coauthors learned of additional funds in their Qualtrics Panel account that would expire if not used in the immediate future. We therefore opted to use those funds for this project and recruit a larger sample size. If anything, this sample size provides greater power to detect effects than our originally proposed sample size. Second, we also measured whether participants clicked a link to learn more about protecting the environment, but click rates were so rare ($n = 23$) that we opted not to present those results here. Third, in light of a reviewer suggestion, we considered belief in climate change as an outcome variable rather than

author's OSF account (Skurka, Eng, & Oliver, 2022). Qualtrics representatives removed data from respondents who failed either of two attention checks before we received the raw data set. After we removed participants who straight-lined survey items ($n = 14$), had technical difficulties viewing the videos ($n = 61$), or spent longer than two standard deviations above the average survey duration ($n = 15$), our final sample consisted of $N = 1507$ participants.

Our sample ($M_{age} = 44.06$, $SD_{age} = 17.45$) leaned female (61%), White (86%), non-Hispanic (91%), and college-educated (55%). To measure party affiliation, the survey asked participants the question: "Generally speaking, do you think of yourself as a . . . ?" and as expected, the sample was evenly split among Republicans (33%), Democrats (33%), and Independents (28%) with 6% choosing "another party" or "no preference." The sample was also balanced on a measure of political ideology, which ranged from *extremely liberal* (1) to *extremely conservative* (7; $M = 4.13$, $SD = 1.80$).

Procedures

In a between-subjects design, participants were randomly assigned to view an awe-eliciting nature video, a humorous nature video designed to amuse, or a control video about a nonenvironmental topic. We created two videos per emotion condition—that is, two awe appeals, two humor appeals, and two control videos—to reduce the possibility that any effects observed would be specific to each video (see videos at Skurka et al., 2022). Participants viewed one of these videos within their randomly assigned emotional appeal condition. The awe appeal videos were montages of panoramic nature clips retrieved from various YouTube videos, including clips from BBC's *Planet Earth* (Fothergill, 2006). The montages showed grand waterfalls, snowy mountains, expansive forests, and the vast night sky. We chose pleasant, uplifting music to accompany each awe appeal—one with a more relaxed tempo (Yared, 2003) and one more up-tempo (Sigur Rós, 2005).

For the humor appeals, we used the same visual content as the awe appeals but replaced the uplifting music with comedic commentary created by a local female improvisation performer. The first humor video used a parody style of humor in which the performer took on the character of a quirky documentarian narrating a fictional Earth documentary series (e.g., "Welcome back to another installment of *Isn't Earth Wild: Earth as You've Never Seen It Before . . .* but you may have actually seen Earth this way before if you've seen an Earth documentary"). The second video used an eccentric style of humor and parodied the "Plizzanet Earth" series on *Jimmy Kimmel Live!* (Kimmel, 2003) in which rapper Snoop Dogg humorously narrated video clips of nature. The voice-over provided zany commentary, including anthropomorphizing the scenery (e.g., "I'm a mountain that no one could even *begin* to understand! Ya' better step back 'cause I'm a sinkhole and I'm *dangerous!*").

The humor and awe appeals concluded with a call to action, edited to match the emotion condition. A black screen appeared with the following text: "Earth is [awesome/hilarious]. Let's keep it that way. Take action

a moderating variable because it was measured after message exposure. Fourth, the preregistration included an additional hypothesis about indirect effects that we do not include in this study for the sake of simplicity.

to reduce [air pollution/climate change].”³ We included the first two sentences to connect the audio/video content (meant to evoke the target emotion) to the call to action, and we included the third sentence to clarify the video’s takeaway recommendation. The videos ran 71 and 75 seconds. A pilot study on Amazon Mechanical Turk confirmed the awe appeals induced greater feelings of awe and lower feelings of amusement than the humor appeals. The control videos were of similar length (71–76 seconds) but were about unrelated topics (travel hacks for smarter traveling, factory footage of how household objects are made).

Measures

Emotional Responses

To measure *awe*, we adapted three items from Fredrickson and colleagues (2003). Participants used a scale of strongly disagree (1) to strongly agree (7) to self-report the extent they felt awe, wonder, and astonishment while watching the video ($M = 5.04$, $SD = 1.45$, $\alpha = .78$). Our five-item measure of *amusement* included three items from Fredrickson and colleagues (2003) about the emotional experience of amusement (how much participants felt amused, silly, and humored, on the same 7-point scale) as well as two items from Nabi and colleagues (2007) that assessed humor appraisals (how funny and humorous participants found the video, on the same 7-point scale; $M = 3.49$, $SD = 1.47$, $\alpha = .83$).

Dependent Variables

Participants indicated their *belief that climate change is happening* by answering the question, “What is your personal opinion about whether or not climate change has been happening?” on a scale from definitely has not been happening (1) to definitely has been happening (7; $M = 5.71$, $SD = 1.75$). Participants reported their *belief about the risk of climate change to humans* (Kahan, Jenkins-Smith, Tarantola, Silva, & Braman, 2015) by answering the question, “Assuming it’s happening, how much risk do you think climate change poses to human health, safety, or prosperity?” on a scale of no risk at all (1) to extreme risk (7). Because participants were not asked this question if they indicated they definitely do not believe climate change is happening, we recoded their data as 1 for this variable ($M = 5.37$, $SD = 1.68$).

Adapting language and policies from Feldman and Hart (2018), we had participants use a scale of strongly oppose (1) to strongly support (7) to report their *support for four low-carbon policies* “as a way to help reduce [air pollution/greenhouse gas emissions and stop climate change]” (e.g., “increasing government investment in renewable energy such as wind and solar”; $M = 4.97$, $SD = 1.24$, $\alpha = .70$). Participants reported how likely, on a scale of very unlikely (1) to very likely (7), they were to engage in 10 *activism* behaviors in the next few months (e.g., “contact elected officials to urge them to take action to reduce [air pollution/climate

³ We manipulated the language in the call to action to describe the environmental issue as “air pollution” or “climate change.” This language had no main effects on our dependent variables, neither did it interact with our emotion manipulation or political leaning. Because we preregistered this element of the study design, interested readers can find full details about this manipulation in the supplemental appendix. We did, however, include this manipulation as a covariate in all analyses presented here.

change]"; $M = 3.83$, $SD = 1.88$, $\alpha = .96$; Feldman & Hart, 2016). Participants also reported on a scale of very unlikely (1) to very likely (7) the likelihood they would take 10 *personal mitigation actions* in the next few months to reduce their contributions to [air pollution/climate change] (e.g., "recycle newspapers, plastics, cans, and glass"; $M = 4.99$, $SD = 1.28$, $\alpha = .87$; Hart, 2010). Correlations between study variables are available in Table S6 of the supplemental appendix (available at Skurka et al., 2022).

Results

We ran ordinary least squares (OLS) regressions for our induction checks and other inferential analyses, as specified in our preregistration plan. Because we used multiple versions for each emotional appeal, we first examined interactions between message version and emotion condition (see data and syntax). Testing for interactions is recommended when more advanced techniques (e.g., multilevel modeling) are not feasible because a limited number of message variations are used (Slater, Peter, & Valkenburg, 2015). These results indicated persuasion effects did not depend on which message version participants watched, so in the analyses presented below, we collapsed the two awe conditions, the two humor conditions, and the two control conditions.

Induction Checks

Dummy-coding the emotion conditions with the awe condition as the reference group, we found that participants exposed to the awe videos ($M = 5.58$, $SD = 1.18$) reported greater awe than participants in the humor ($M = 4.88$, $SD = 1.50$; standardized $b = -.23$, $p < .001$) and control conditions ($M = 4.68$, $SD = 1.50$; $b = -.29$, $p < .001$), $F(3, 1502) = 38.77$, $p < .001$, $R^2 = .07$. Looking to the humor manipulation, we set the humor conditions as the reference group and found that participants who watched the humor videos reported greater amusement ($M = 4.10$, $SD = 1.44$) than those in the awe ($M = 2.67$, $SD = 1.28$; $b = -.46$, $p < .001$) and control conditions ($M = 3.69$, $SD = 1.30$; $b = -.13$, $p < .001$), $F(3, 1503) = 99.42$, $p < .001$, $R^2 = .17$. Thus, our emotion inductions were successful.

The Persuasive Effects of Awe Appeals (H1)

The first hypothesis stated that awe appeals would increase persuasion outcomes relative to control and humor appeals. We ran OLS regressions to test this hypothesis on each of the five dependent variables, setting the awe condition as the reference group. Figure 1 visualizes means across the emotion conditions. The awe appeals marginally increased belief in climate change compared with humor ($b = -.06$, $p = .051$; see Table S1 in the supplemental appendix for full regression results) and compared with control ($b = -.12$, $p < .001$). The awe appeals did not influence perceived risk of climate change compared with the humor appeals ($b = -.04$, $p = .24$) but did increase perceived risk compared with control ($b = -.11$, $p < .001$). The awe appeals significantly increased policy support over humor appeals ($b = -.08$, $p = .008$) and control ($b = -.11$, $p < .001$). They significantly increased activism intentions compared with humor ($b = -.11$, $p < .001$) and control ($b = -.16$, $p < .001$) and showed the same pattern of effects for personal mitigation behavior intentions relative to humor appeals ($b = -.10$, $p = .001$) and control ($b = -.11$, $p < .001$). These results generally support H1.

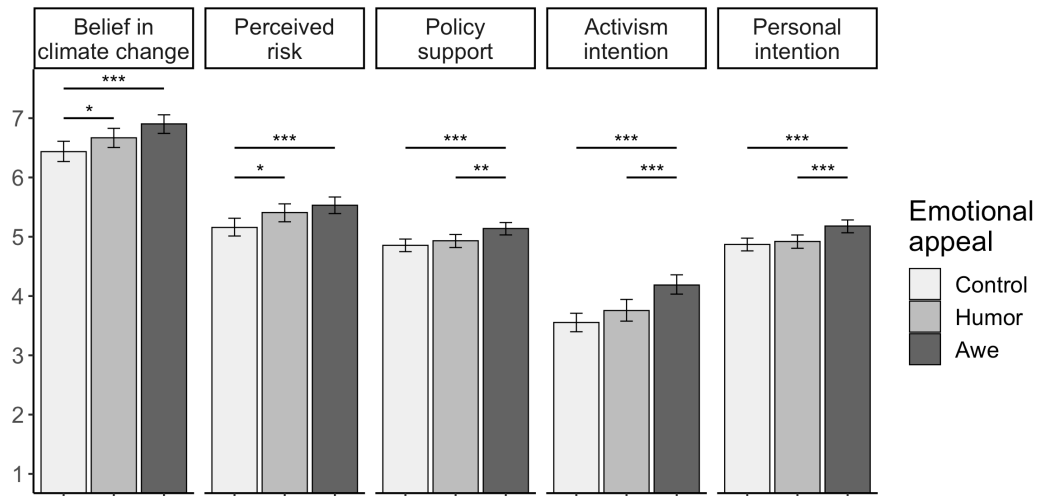


Figure 1. Effects of the emotional appeals on study outcomes. Error bars represent 95% confidence intervals. * $p < .05$. ** $p < .01$. * $p < .001$.**

The Persuasive Effects of Humor Appeals (RQ1)

To address RQ1 (the persuasive effects of the humor appeals vs. control), we ran the same regression models, this time setting the control group as the reference group. The humor appeals (vs. control) increased belief that climate change is happening ($b = .06, p = .045$) and perceived risk of climate change ($b = .07, p = .017$), but humor did not affect policy support ($b = .03, p = .32$), activism intentions ($b = .05, p = .09$), or personal mitigation behavior intentions ($b = .02, p = .53$).

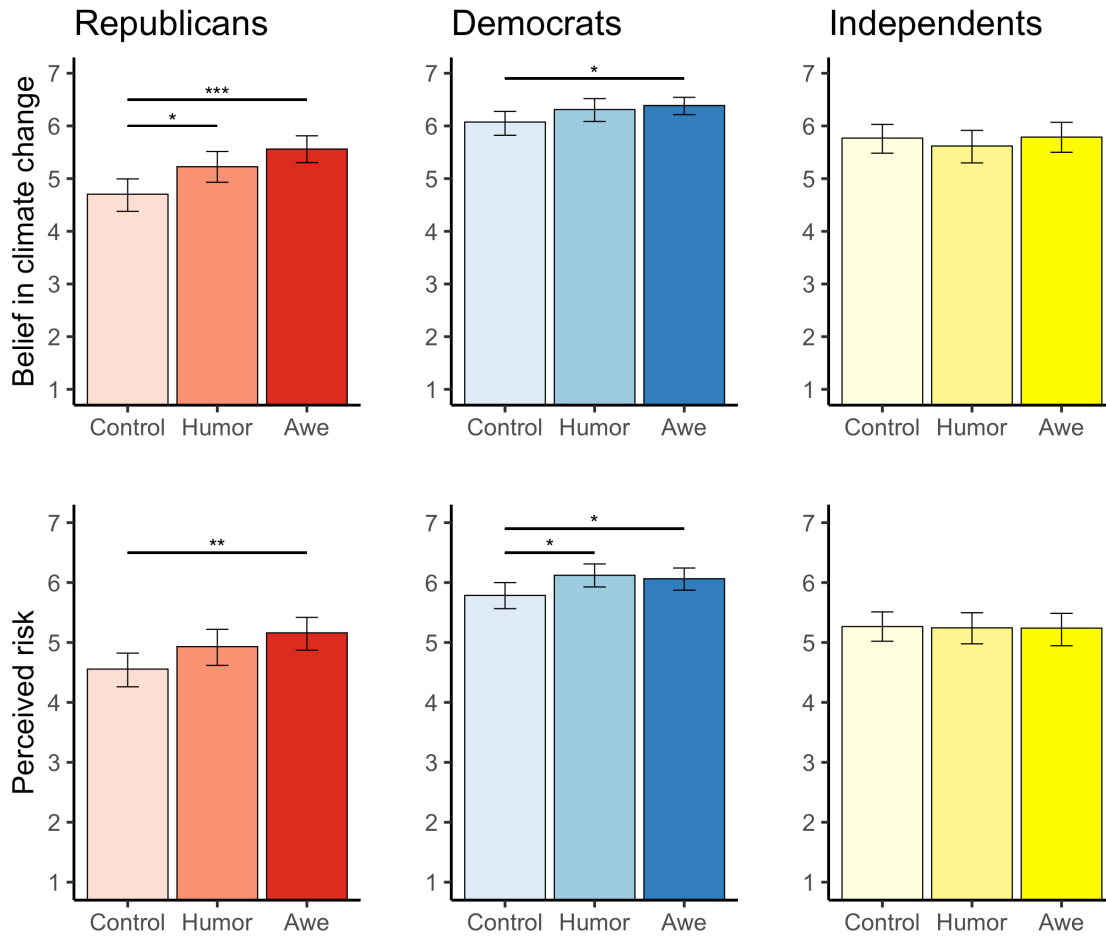


Figure 2. Party affiliation as a moderator of the effects of the awe and humor appeals. Error bars represent 95% confidence intervals. * $p < .05$. ** $p < .01$. * $p < .001$.**

Party Affiliation as a Moderator (H2, not Preregistered)

With H2 (not preregistered), we hypothesized that awe appeals would be influential regardless of political party but that humor appeals would only be influential for Democrats. We again conducted OLS regressions, interacting emotional appeal conditions (control as the reference group) with party affiliation (Republicans as the reference group). Most interactions between party affiliation and emotional appeal condition were not statistically significant ($p > .05$; full results are available in Table S2 of the appendix). However, several interactions were significant for belief that climate change is happening ($b_{awe*Democrat} = -.10, p = .043$; $b_{awe*Independent} = -.14, p = .003$; $b_{humor*Independent} = -.11, p = .015$). Subgroup analyses (visualized in Figure 2) revealed that among Republicans, the awe appeals ($b = .20, p < .001$) and humor appeals ($b = .13, p = .013$) both strengthened climate change belief (see Table S3 in the appendix). Among

Democrats, the awe appeals increased belief ($b = .11, p = .029$) but humor appeals did not ($b = .08, p = .11$). No effects of the awe appeals ($b = .007, p = .90$) or humor appeals ($b = -.04, p = .49$) emerged for Independents.

We also observed a significant interaction for perceived risk ($b_{awe*Independent} = -.11, p = .016$). Subgroup analyses revealed a similar moderation pattern as what emerged for belief in climate change (see Table S4 in appendix). Relative to control, the awe appeals increased perceived risk for Republicans ($b = .15, p = .004$) and Democrats ($b = .13, p = .032$) but not Independents ($b = -.01, p = .90$). The humor appeals increased perceived risk, compared with control, significantly for Democrats ($b = .13, p = .014$), marginally for Republicans ($b = .09, p = .07$), and had no effect for Independents ($b = -.006, p = .92$). In summary, these interaction results suggest (a) the awe appeals' effects on belief in climate change and perceived risk were strongest for Republicans and (b) the humor appeals' effects on belief in climate change were strongest for Republicans. These results partially supported H2.⁴

Discussion

The goal of this experiment was to investigate the persuasive effects of two positive emotional appeals (awe appeals and parody-based humor appeals) as well as their conditional effects across two boundaries: which outcome (beliefs, attitude, intentions) and which audience (political partisans). In our view, the current findings underscore the importance of more fully studying and employing positive emotional appeals in science communication contexts. In particular, our findings unequivocally support the persuasiveness of awe-eliciting video messages, which boosted belief that climate change is happening, climate change risk perception, attitudes toward low-carbon policies, and intentions to partake in environmental activism and environmentally friendly behaviors. Because the awe appeals had broader persuasive impacts than the parody-based humor messages we tested, we conclude that awe's influence is not attributable to its positive valence but to its unique properties as a self-transcendent, epistemic, and prosocial emotion (Keltner & Haidt, 2003; Piff et al., 2015; Valdesolo et al., 2017).

The current findings demonstrate humor can influence a general audience in terms of their certainty that climate change is happening and perceived risk of climate change. These results comport well with the literature on humor in advertising, which generally suggests "humor is more effective for generating lower order than higher order communication effects" (Eisend, 2009, p. 199). Walter and colleagues' (2018) meta-analysis of humor in persuasion tells a similar tale with considerably stronger effects of parody on knowledge compared with intentions. Perhaps these patterns can be explained by functional theories of emotion. Functional theories maintain that emotions are not necessarily irrational psychological forces but goal-directed states that motivate behavior to help us survive and thrive in our physical and social environments (Keltner & Gross, 1999). Awe is believed to motivate prosocial and pro-environmental actions because it orients us to our collective identities and diminishes our self-importance (Piff et al., 2015; Stellar et al., 2017), but amusement does not have an obvious motivational tendency. This might mean humor's influence

⁴ We also ran these analyses using political ideology as a moderator, which produced a comparable pattern of results, such that persuasive effects were strongest among political conservatives. More details are available in Table S5 and Figure S1 of the appendix.

is more likely to manifest in belief or knowledge change rather than changes in behavior or intentions, which is what we see in our data. In any case, examining humor effects across several indicators helps “acknowledge the subjective and ‘slippery’ nature of humor and comedy, which may have distinct effects on different outcomes” (Kaltenbacher & Drews, 2020, p. 725).

Moving conservatives on their climate positions has proven a challenging task (Hornsey et al., 2016), so the fact that the emotional appeals’ influence did not hinge on a person’s political leaning for three of the five outcomes we studied is noteworthy. These findings align with a recent meta-analysis of climate change interventions finding that emotional appeals seemed one of the more promising strategies and that political ideology did not play a moderating role (Rode et al., 2021). The exceptions in this study were that the awe appeals differentially influenced belief that climate change is happening and perceived risk. Namely, the awe appeals were most effective in boosting these outcomes among Republicans compared with Democrats or Independents. It is also promising that the humor videos were effective at heightening Republicans’ belief in climate change, which was not the case for Democrats or Independents. One methodological explanation for why the awe appeals worked so well for Republicans is that Republicans simply had more room to move on these outcomes relative to Democrats, who were at more of a ceiling (see Figure 2). Challenging this explanation, belief in climate change and perceived risk were unaffected for Independents, who were at less of a ceiling than Democrats. More work is needed to explain these conditional effects for political partisans, but what we do know from previous work is that awe reduces our ideological convictions (Stancato & Keltner, 2019). It also increases our sense of connectedness to other people and the planet (Stellar et al., 2017; Yang et al., 2018), making it well-suited to bridging social and political divides.

Practical Implications and Future Directions

Environmental advocates and nonprofit organizations alike may benefit from these findings. If the communicator’s goal is to strengthen climate-change-related beliefs, such as confidence that climate change is happening or that it presents serious risks to human prosperity, our results suggest either awe or parody appeals can be effective—though awe appeals may be especially promising when targeting these outcomes for right-leaning audiences. If the goal is motivating endorsement of policy initiatives or spurring action, appealing to awe may be the way to go. Notably, our videos did not include much substantive content in terms of facts or didactic arguments, suggesting information-heavy messaging is not necessary to persuade audiences when appealing to awe.

We examined parody styles of humor that avoided explicit political arguments, so we suspect other forms of humor—especially aggressive or complex styles that waded into political matters—would evidence different effects. Disposition theory of humor would predict weaker (or unintended) effects for humor that derides individuals or groups the audience holds favorable attitudes toward (Chattoo & Feldman, 2020; Skurka et al., 2019; Zillmann & Cantor, 1976), so we recommend researchers and practitioners continue using comedic climate messages that avoid jokes about political conservatives. It is even possible that because our humorous messages did not engage much with the issue advocated (climate change or air pollution), we are underestimating humor’s potential. Humor tends to be more influential when the humor is relevant to the topic, particularly for audiences who are highly involved in the issue (Eisend, 2009; Walter

et al., 2018), suggesting that incorporating social critique into the comedy, as is the case for much political satire, would be more effective.

Additional next steps should be to untangle the mechanisms of these effects. This could involve specifying the appraisals operative for different outcomes (e.g., perceived vastness predicting support for collective solutions like policy initiatives) or the processing styles these messages engender. For example, whereas humor is likely to be processed heuristically (Martin & Ford, 2018), awe may promote systematic, effortful information processing (Griskevicius, Shiota, & Neufeld, 2010). Evoking awe could also be a promising strategy in other science domains. Because awe can be elicited by perceptions of figurative vastness (Keltner & Haidt, 2003), awe at the marvel of scientific accomplishment could foster support for genetically modified foods or nanotechnology (Valdesolo et al., 2017). Our findings may also have implications for the psychosocial effects of viewing uplifting content in nature documentaries like *Blue Planet*, *Planet Earth*, and their sequels, which the BBC reports have attracted a billion viewers in recent years (Marris, 2021). Studies examining the impact of such documentaries have come to somewhat different conclusions about their ability to effectively motivate change (e.g., Arendt & Matthes, 2016), so it would be worth formally testing if awe plays a role when beneficial effects do occur.

Another intriguing direction would be to examine the extent to which eliciting a negative, threat-based variant of awe motivates pro-environmental action. Human-caused climate change has magnified the frequency and intensity of natural disasters like tropical storms and wildfires—events that could trigger a negative variant of awe because they stimulate threat appraisals (Keltner & Haidt, 2003). Scant research has explored this negative variant, but in one set of studies that did (Gordon et al., 2017), threat-based awe exhibited a different psychological profile than the positive variant: Threat-based awe stemmed from cognitive appraisals of uncertainty and powerlessness and coincided with elevated feelings of fear (see also Piff et al., 2015). Revisiting our own data on emotional responses to the videos (which included an array of emotion items), we are confident the awe appeals that we developed induced a pleasant, nonthreatening variant of awe. Among participants who viewed the awe appeals, self-reported awe was strongly associated with feeling “joy” ($r = .54, p < .001$) but was unrelated to feeling “fear” ($r = -.02, p = .65$). Nonetheless, we look forward to future investigations that consider environmental messaging that taps into the “dark side” (Gordon et al., 2017, p. 310) of awe, which could be a fruitful opportunity to integrate awe theorizing with longstanding persuasion theory on threat-based fear appeals.

Limitations and Conclusion

We did not include a no-emotion, “informational” condition, so our design cannot address the question of how humor and awe appeals stack up against a more neutral comparison appeal. Additionally, some participants provided open-ended feedback at the end of the survey that the humor commentary distracted from the beauty of the nature visuals, suggesting the juxtaposition of the humor with the panoramic nature visuals may have made for a less effective humor appeal than would be seen otherwise. We took this approach for our manipulation (holding the visuals constant and varying the audio—commentary for humor vs. music for awe) because it seemed the cleanest way to induce humor and awe without drastically altering the stimuli (for a similar manipulation approach, see Piff et al., 2015). Along these lines, all our messages included a call to action, which could have enhanced the effectiveness of the

emotion-inducing visual/audio content. Additionally, we used single-item measures of climate change beliefs and perceived risk, which, while validated (e.g., Kahan et al., 2015), are subject to more measurement error than multi-item measures.

In conclusion, this study points to the promise of awe-inspiring messages to change beliefs, attitudes, and intentions in the face of global warming. Furthermore, we found that parody-based humor messages promoted belief in climate change and perceived risk of climate change. The effects of the awe and humor appeals generally were not conditional on a person's political affiliation, although the emotional appeals were more influential in promoting Republicans' belief in climate change and perceived risk compared with Democrats and Independents. Although much work remains to explore the ways that amusement and awe operate in response to media messages about the environment, the boundaries of awe appeals for pro-environmental advocacy, the findings from this study suggest, may be quite wide.

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