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EMPIRICAL ARTICLE

CHILD DEVELOPMENT

Seeing awe: How children perceive awe-inspiring visual experiences

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Abstract

Awe is a profound, self-transcendent emotion. To illuminate its origin, four preregistered studies examined how U.S. 4- to 9-year-old children perceive awe-inspiring stimuli (N=444, 55% female, 58% White, tested in 2020–2023). Awe-inspiring expansive nature (Study 1) and natural disaster scenes (Study 2) evoked perceived vastness, motivation to explore, and awareness of the unknown more than everyday scenes did (d ranging 0.32–1.76). Compared to expansive social stimuli, expansive nature stimuli more positively affected children's sense of self (Study 3). Diverse awe-inspiring scenes (vast nature, natural disasters, and slow-motion objects) all elicited awe and higher learning motivation than everyday scenes did (Study 4). These findings suggest that children appreciate awe-inspiring visual experiences, illuminating the origins and nature of awe as a self-transcendent experience.

Among various experiences we have in life, some experiences are able to profoundly move us beyond our usual concerns and the boundary of the self. Awe-inspiring experiences—experiences that induce the feeling of perceiving something vast that transcends one's current understanding—is one such self-transcendent experience (Keltner, 2023). Awe has been central in spiritual and peak experiences (e.g., Burke, 1757/1990; James, 1902/1987; Maslow, 1964) and has been theorized to help our ancestors survive throughout history (e.g., Chirico & Yaden, 2018; Keltner & Haidt, 2003). Given its profound nature, is awe a complex subjective state that only emerges with substantial life experiences and wisdom, or is it a deeply rooted experience appreciated even in early life? Despite abundant research showing that adults appreciate and react positively to awe-inspiring experiences (e.g., Bai et al., 2017; Gottlieb et al., 2018; Guan et al., 2019; McPhetres, 2019; Piff et al., 2015; Rivera et al., 2020; Rudd et al., 2012; Valdesolo et al., 2017), little research has examined how awe-inspiring experiences are perceived early in life (Prade, 2022). To understand the origins of our capacity to perceive awe, our work adopts a social cognitive developmental approach and systematically investigates how 4–9 year-old children perceive awe-inspiring visual experiences.

Existing developmental research on children's emotional experiences has mainly focused on children's appreciation and understanding of experiences involving *basic emotions* (e.g., happiness, sadness, anger, fear; e.g., Harris et al., 2016; Rosnay & Harris, 2002; Wellman & Banerjee, 1991; Widen & Russell, 2008) and *self-conscious emotions* that center around the self (e.g., pride, shame, guilt; Baker et al., 2012; Kochanska et al., 2002; Lewis & Sullivan, 2005; Thompson & Hoffman, 1980). Evidence shows that even infants can distinguish basic positive emotional facial expressions from negative ones (Barrera & Maurer, 1981; Bornstein & Arterberry, 2003; Farroni et al., 2007). By age two or three, children are able to use and understand languages for basic emotions such as happiness and sadness (e.g., Bartsch & Wellman, 1995; Widen & Russell, 2008), as well as reason about the basic emotional states of individuals (e.g., Ruba & Pollak, 2020; Wellman et al., 2000; Wellman & Banerjee, 1991). In preschool years, children start to understand and experience self-conscious emotions, such as guilt, shame, and embarrassment (e.g., Bafunno & Camodeca, 2013; Kochanska et al., 2002; Lewis & Sullivan, 2005; Thompson & Hoffman, 1980). Although research in the past decades has demonstrated that children begin to comprehend and appreciate a variety of basic and self-conscious emotions quite early, it is yet to be understood how perceptions of *self-transcendent* experiences, such as awe-inspiring experiences, fit into the developmental picture.

On the one hand, the lack of developmental research on awe may reflect the assumption that such complex

emotional experiences may only be present later in life (Stamkou et al., 2023). Awe has been viewed as a complex subjective experience involving multiple social, cognitive, and self-related facets (Yaden et al., 2019) and even a profound ineffable experience associated with religion and spirituality (Van Cappellen & Saroglou, 2012). This suggests the possibility that an appreciation for awe experiences may be relatively late-emerging, which perhaps is only appreciated once individuals gain advanced cognitive abilities (e.g., metacognitive awareness of one's own mental and emotional states; representations of the self in relation to entities larger than the self) and substantial life experiences (e.g., sufficient exposure with awe inspiring scenes and experiences). Children's more limited metacognitive awareness and skills compared to adults may prevent them from understanding their own complex mental and emotional states (e.g., Kuhn, 2000). Therefore, it is possible that awe-inspiring stimuli and experiences could be too challenging for young children to perceive and appreciate, given their developing social cognitive skills and limited life experiences.

On the other hand, self-transcendent experiences, such as compassion, gratitude, and awe, have been theorized to have served adaptive functions throughout history (e.g., Chirico & Yaden, 2018; Keltner & Haidt, 2003), which predicts that children might have capacities for perceiving them relatively early in life. Supporting this possibility, preschool children are able to understand and experience self-conscious emotions (e.g., guilt, shame), which requires some level of engagement with awareness of the self in relation to others as well (e.g., Bafunno & Camodeca, 2013; Kochanska et al., 2002; Thompson & Hoffman, 1980). Preschoolers also show prosocial emotions toward other individuals such as empathy and sympathy (e.g., Decety et al., 2018; Eisenberg et al., 2006). Given that awe is hypothesized to serve similar prosocial functions, it is possible that even young children might be able to differentiate awe-eliciting experiences from other types of everyday experiences.

Moreover, perception of vastness and the need for accommodation have been theorized as two key components of awe experiences (Keltner & Haidt, 2003). Children's literal small size and newness in the world means that they may need to accommodate more experiences in life compared to adults and, thus, may have awe experiences quite often. To date, it has been found that brief exposures to awe-inspiring experiences make children more likely to explore novel toys (Colantonio & Bonawitz, 2018) and motivate 8- to 13-year-olds to help members of a national minority (Stamkou et al., 2023). These findings lead to the interesting question how children themselves perceive awe-inspiring experiences. To shed light on this question, our studies adopt a social cognitive approach to systematically examine how children perceive diverse aspects of different awe-inspiring visual experiences from their own perspectives.

Awe-inspiring experiences have been found to have diverse social, cognitive, and motivational effects among adults. In particular, awe has been theorized and found to be a "*collective emotion*" that facilitates prosociality and helps people bond in social groups (e.g., Bai et al., 2017; Goldy et al., 2022; Keltner & Haidt, 2003; Piff et al., 2015; Prade & Saroglou, 2016). Awe is also a "*feel good*" emotion and promotes positive affect (e.g., Rivera et al., 2020; Rudd et al., 2012), as well as an "*epistemic emotion*" that motivates people to explore their environment and inspire scientific thinking (e.g., Gottlieb et al., 2018; McPhetres, 2019; Stellar et al., 2018; Valdesolo et al., 2017). Based on these effects, our work examines how children perceive awe-inspiring visual experiences in terms of these effects.

Beyond these effects, we also explored their effects on children's sense of self. It has been found that awe-inspiring experiences elicit a sense of "small self" among adults (Piff et al., 2015), which mediates multiple benefits of awe, such as the effects on collective engagement and prosocial behaviors (Bai et al., 2017; Piff et al., 2015; Preston & Shin, 2017). One important open question is whether all visual stimuli that comprise perceptual vastness and potentially make the self feel small will be appreciated as similarly awe-inspiring. For example, unlike awe-inspiring experiences, experiences like being in a large crowd often have negative effects on people's psychology, such as making us feel trivialized and deindividualized (Crossey et al., 2021; Neal, 1993). We are interested in how potentially self-trivializing *crowd* visual stimuli are perceived in contrast to awe-inspiring stimuli, especially in terms of their effects on diverse aspects of the self (e.g., self-transcendence, self-efficacy, sense of one's own uniqueness, and aspirations regarding oneself).

In summary, our work focused on 4- to 9-year-old children's appreciation and perceptions of awe-inspiring stimuli. Across four preregistered studies, we examined children's responses to awe-inspiring videos and images, relative to stimuli that depicted other kinds of experiences (everyday scenes and large crowds). We investigated children's perceptions of positive awe-inspiring stimuli involving vast nature scenes (Study 1) and negative awe-inspiring stimuli involving natural disasters (Study 2), in comparison to visual stimuli involving everyday nature scenes. We also studied if children distinguished awe-inspiring vast nature scenes from crowd scenes involving large groups of people, especially if the two types of stimuli were perceived differently in relation to children's sense of self (Study 3). Finally, we examined how children perceive diverse types of awe-inspiring imagery, including vast nature, natural disasters, and objects in slow motion, in comparison to imagery depicting diverse everyday scenes (Study 4). We included a sample of adults in all of our studies (total $N = 492$) to explore the developmental endpoint and continuity. As one of the first work on children's perceptions of awe, the analyses

conducted in the paper were exploratory rather than confirmatory. We report all questions and analyses conducted in all studies. Stimuli, Supporting Information, and all data and analyses are shared on OSF (https://osf.io/wzsny/?view_only=e82db9c5bb494b66951be524530c87ab).

STUDY 1

Study 1 investigates children's perceptions of awe-inspiring visual stimuli in comparison to an everyday experience. Existing adult research has utilized neutral experiences that involve simple moving shapes (Stellar et al., 2015) or an individual describing crafting processes, such as the construction of a kitchen countertop (Piff et al., 2015) or the production of beer (Saroglou et al., 2008), the content of which differs substantially from the vast nature scenes that were used to elicit awe. To examine whether children distinguish an awe experience from a more closely related everyday experience, we presented children with a video that involves visual and thematic focuses on nature (e.g., backyard garden scenes involving different plants) but not the defining characteristic of awe experiences—perceptual vastness. It has been shown that experiences with everyday nature have positive effects on people (Berman et al., 2008; Kaplan, 1995), and it is unknown if children distinguish awe visual experiences involving vast nature scenes from everyday varieties of nature scenes. We measured children's perceptions of perceived vastness, sense of connection, motivation to explore, and awareness of the unknown, which are major effects of awe visual experiences that have been theorized and found in adult literature.

Methods

Participants

We preregistered a sample size of at least 60 child participants. We recruited seventy-one 4- to 9-year-old participants (starting from July 2020), and 9 participants were excluded due to inattention or parental interaction, leaving a final sample of 62 participants (M_{age} = 7.52 years, SD = 1.66 years, range = 4.30–9.91, male = 25, female = 37). According to G*Power (Faul et al., 2007), this sample size has at least 80% power to detect a medium effect size of g = 0.19 for a two-tailed, binomial test. We recruited the child participants in all studies by emailing and messaging families in the University of [masked for review]'s developmental research database. The majority of families in the database were working- and middle-class. Among all the child participants in this work, 58.33% were White American, 11.71% were Black or African American, 11.04% were Asian or Asian American, 8.56% were Hispanic, and 10.36% identified as Other or did not answer.

We also recruited an adult sample of 100 participants on TurkPrime (Litman et al., 2017). Three adult participants were excluded due to incomplete data, leaving a final sample of 97 adult participants (M_{age} = 40.80 years, SD = 13.93 years, range = 18–74, male = 43, female = 54). We tested adult participants in this and subsequent studies to get a general sense of the developmental endpoints, not for direct statistical comparisons to children's data. We recruited more adults than children in all studies, in case some adults do not provide valid data in online studies (Chmielewski & Kucker, 2020). All adult participants in this and subsequent studies were located in the United States and had a higher than 97% approval rate with at least 100 completed tasks on the platform. Among all the adult participants in this work, 70.73% were White American, 10.57% were Black or African American, 9.76% were Asian or Asian American, 2.03% were Hispanic, and 6.91% were Other. All studies reported in this paper were approved by the Institutional Review Board of The University of Chicago , protocol IRB #19-1347-AM042. Written parental consent and adult participant consent were obtained in advance of all testing; children also provided verbal assent prior to testing.

Procedure

For all of our child studies, each child was tested individually in a quiet space at their home in a 5- to 10-min online session over Zoom. All testing stimuli and questions were presented using a Qualtrics survey through Zoom. Before beginning the testing session, we asked the parents to check that the technical devices were working, minimize the background noise, and remove other distractions. Parents were allowed to remain in the same room as the child but were instructed not to talk to the child or comment on the study during the testing session. The sessions that were influenced by parents were excluded from our data analyses. We also had practice trials to make sure children understood the online testing platform and how they would be directed (e.g., verbally respond to which of two stimuli the mouse was pointing at). Testing began once the child's comprehension was confirmed.

Each child participant watched two videos in a randomized order: a *Vast Nature* video and an *Everyday Garden* video. The *Vast Nature* video was used in our Study S1 (see Supporting Information) and previously validated in investigations of awe experience among adults (Rivera et al., 2020). The *Everyday Garden* video comprised footage of small plants growing in an ordinary backyard garden—a context which involves nature scenes like the *Vast Nature* video but without the defining feature of perceived vastness (Keltner &

Haidt, 2003). Both videos were approximately 45 s in length and included original, pleasant background music as tested in previous studies (Piff et al., 2015; Rivera et al., 2020).

After watching each video, to stimulate children to think about how the videos made them feel, children were first asked to rate on four familiarization questions (see Supporting Information for the descriptions and results). To examine whether children perceived the awe-inspiring stimuli and everyday stimuli differently, after children watched both videos, we also directly asked children to indicate which video made them feel more intensely in terms of five testing questions: *Perceived Vastness* ("Which video makes you feel like the world is bigger?"), *Sense of Connection* ("Which video makes you feel like you are connected to more things in the world?"), *Motivation to Explore* ("Which video makes you feel like there are a lot more interesting things in the world you would like to explore?"), *Awareness of Unknown* ("Which video makes you feel like there are a lot more things in the world you want to understand?"), as well as a *Hedonic Preference* measure at the very end about which video they would like to watch again if given the opportunity. Adult participants completed this and subsequent studies through a Qualtrics survey. To ensure data quality, they had to pass an attention check about the video content to complete each study.

Results

We first analyzed adult choices of the *Vast Nature* (coded as 1) and *Everyday Garden* videos (coded as 0). We conducted a preregistered overall generalized linear mixed effects model to see if their responses were significantly predicted by measure, with a random intercept for each participant. According to the drop1 function in R, "measure" significantly improves model fit, $\chi^2(4, N=97)=117.5$, $p<.001$. Binomial tests indicated that the *Vast Nature* video, in comparison to the *Everyday Garden* video, led adults to perceive the world as bigger ($M=0.98$, SD=0.14, $p<.001$, $d=3.36$), to feel a somewhat greater sense of connection to more things in the world ($M=0.66$, SD=0.48, $p=.002$, $d=0.34$), to feel an increased motivation to explore interesting things in the world ($M=0.99$, SD=0.10, $p<.001$, $d=4.82$) and to be aware of unknown things in the world ($M=0.96$, SD=0.20, $p<.001$, $d=2.30$). Adults also overwhelmingly preferred the *Vast Nature* video over the *Everyday Garden* ($M=0.94$, SD=0.24, $p<.001$, $d=1.81$), Figure 1.

To see if children distinguished the two types of visual experiences and whether age played a role in their responses, we conducted a preregistered overall generalized linear mixed effects model using measure, age (in years), and their interaction predicting their responses, with a random intercept for each participant. According to the "drop1" function in R, the interaction between measure and age did not significantly improve model fit, $\chi^2(4, N=62)=1.32$, $p=.86$. There was no significant effect of age either: $\chi^2(4, N=62)=2.21$, $p=.14$. There was a significant effect of measure: $\chi^2(4, N=62)=61.36$, $p<.001$.

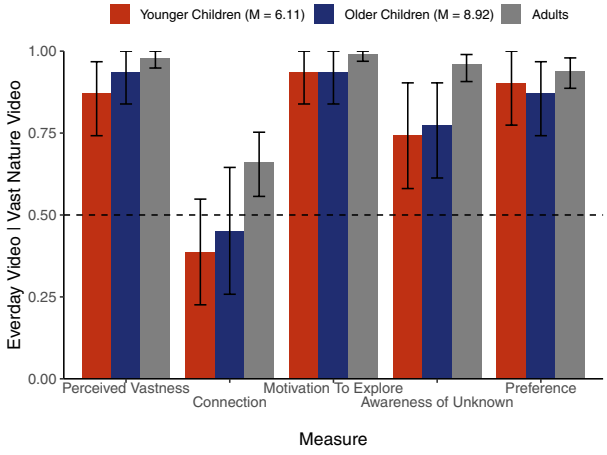

FIGURE 1 Participants' responses to vast nature stimuli compared to everyday garden stimuli by measure and age group (based on median split of age) in Study 1.

Binomial tests indicated that the *Vast Nature* video, in comparison to the *Everyday Garden* video, led children to perceive the world as bigger ($M=0.90$, SD=0.30, $p<.001$, $d=1.35$), to feel an increased motivation to explore interesting things ($M=0.94$, SD=0.10, $p<.001$, $d=1.76$) and to understand unknown things in the world ($M=0.76$, SD=0.20, $p<.001$, $d=0.60$), but did not lead them to feel more connected to everything in the world ($M=0.42$, SD=0.48, $p=.31$, $d=1.62$). Children preferred to watch the *Vast Nature* video over the *Everyday Garden* video ($M=0.89$, SD=0.24, $p<.001$, $d=1.21$), Figure 1. These results suggest that children and adults derive enjoyment from and perceive diverse effects of awe-inspiring visual experience compared to the everyday experience.

STUDY 2

Study 1 found that children distinguished positive awe-inspiring stimuli from everyday scenes. It has been theorized and found that awe could be elicited not only by positive stimuli but also be elicited by negative, threatening stimuli such as those involving natural disasters (Gordon et al., 2017; Takano & Nomura, 2022). Adults' experience of threat-based awe are accompanied by increased feelings of fear and uncertainty (Chaudhury et al., 2021) and mediated by a sense of powerlessness (Gordon et al., 2017). It is known that children learn and explore less when they feel insecure and fearful (Easterbrooks et al., 1993; Fearon et al., 2010). Therefore, children might be aversive to negative awe-inspiring stimuli. To explore this possibility, Study 2 investigated children's perceptions of negative awe-inspiring stimuli

involving natural disasters in comparison to the everyday garden scenes.

Methods

Participants

As in Study 1, we preregistered to have a sample size of at least 60 participants. Data collection started in September 2020 and was stopped once this goal was met. We recruited seventy-eight 4- to 9-year-olds and 6 participants were excluded due to inattention or distractions in the environment, leaving a final sample of 72 participants (M_{age} = 7.31 years, SD = 1.67 years, range = 4.01–9.92, male = 30, female = 42). According to G*Power (Faul et al., 2007), this sample size has at least 80% power to detect a medium-small effect size of g = 0.16 for a two-tailed, binomial test. We also recruited a sample of 100 adult participants on TurkPrime (M_{age} = 37.87 years, SD = 11.33 years, range = 22–71, male = 58, female = 42).

Procedure

Study 2 followed the same design and online testing procedure as Study 1, except that in this study, children watched a *Natural Disaster* video instead of the *Vast Nature* video. The *Natural Disaster* video consisted of destructive footage of tornadoes, avalanches, and volcanic eruptions (see S1 for images). Children also watched the same *Everyday Garden* video, and then answered the same familiarization and test questions as in Study 1. Both videos were about 45 s in length with original background music.

Results and discussion

As in Study 1, we first conducted a preregistered overall linear mixed effects model to see if the adult responses to the videos were significantly predicted by measure. According to the "drop1" function in R, "measure" significantly improves model fit, $\chi^2(4, N = 100) = 195.13$, $p < .001$. Binomial tests indicated that in comparison to the *Everyday Garden* video, the *Natural Disaster* video led adults to perceive the world as bigger ($M = 0.92$, SD = 0.27, $p < .001$, $d = 1.54$), to feel an increased motivation to explore interesting things ($M = 0.74$, SD = 0.44, $p < .001$, $d = 0.54$) and to understand unknown things in the world ($M = 0.87$, SD = 0.34, $p < .001$, $d = 1.09$), but the *Everyday Garden* video led adults to feel a greater sense of connection to everything in the world ($M = 0.27$, SD = 0.45, $p < .001$, $d = 0.52$). Adults preferred to watch the *Natural Disaster* video over the *Everyday Garden* video ($M = 0.77$, SD = 0.42, $p < .001$, $d = 0.64$), Figure 2.

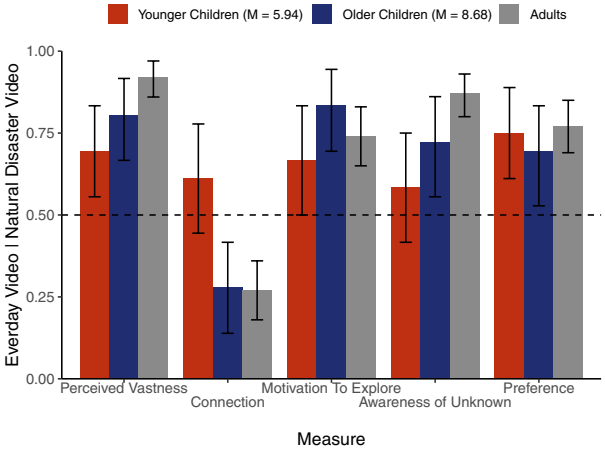

FIGURE 2 Participants' responses to natural disaster stimuli compared to everyday garden stimuli by measure and age group (based on median split of age) in Study 2.

We then conducted a preregistered linear mixed effects model using measure, age (in years), and their interaction to predict children's responses, with a random intercept for each participant. According to the "drop1" function in R, the two-way interaction between measure and age significantly improved model fit, $\chi^2(4, N = 72) = 15.21$, $p = .004$. There was no significant effect of age: $\chi^2(4, N = 72) = 0.07$, $p = .79$. There was a significant effect of measure: $\chi^2(4, N = 72) = 23.64$, $p < .001$. To further understand the interaction, we conducted separate generalized linear models using age to predict each measure. With age, children became less likely to feel connected to the world in response to the *Natural Disaster* video ($B = -0.42$, SE = .16, $z = -2.64$, $p = .008$). Age did not have a significant effect on other measures ($ps > .096$), Figure 2.

Binomial tests indicated that the *Natural Disaster* video, similar to adults, in comparison to the *Everyday Garden* video, led children to perceive the world as bigger ($M = 0.75$, SD = 0.44, $p < .001$, $d = 0.57$), to feel and overall increased motivation to explore interesting things ($M = 0.75$, SD = 0.44, $p < .001$, $d = 0.57$) and to understand unknown things in the world ($M = 0.65$, SD = 0.48, $p = .013$, $d = 0.32$). Children also preferred the *Natural Disaster* video over the *Everyday Garden* video ($M = 0.72$, SD = 0.45, $p < .001$, $d = 0.49$). Because we found an age effect for the connection measure, we conducted binomial tests with younger children ($M = 5.94$ years) and older children ($M = 8.68$ years) separately based on median split of age. Similarly to adults, the *Everyday Garden* video actually led older children to feel more connected to everything in the world ($M = 0.28$, SD = 0.45, $p = .011$, $d = 0.49$), whereas younger children did not significantly distinguish the two types of visual experiences ($M = 0.61$, SD = 0.49, $p = .24$, $d = 0.22$).

This study found that similar to the positive awe-inspiring stimuli, children and adults felt that the negative awe-inspiring stimuli were more likely than everyday garden scenes to make them perceive

vastness and motivate them to explore new things and understand more unknown things in the world. Older children and adults felt the everyday visual experience made them feel a stronger connection to the world, suggesting they perceived in a selective rather than similar manner across different measures. Taken together, Studies 1 and 2 suggested that children distinguish both positive and negative awe-inspiring stimuli from everyday nature stimuli, and both types of awe-inspiring visual experiences are more likely to spark children's motivation to explore and learn about the world around them compared to everyday visual experiences.

STUDY 3

In Study 3, we aimed to further investigate if children and adults responded similarly to vast nature stimuli (as tested in previous studies) versus vast social stimuli (i.e., large crowds of people moving in diverse contexts and locations). Based on the literature that large crowds often make people feel trivialized and deindividualized (Crossey et al., 2021; Neal, 1993), we hypothesized that while both vast nature and crowd stimuli involve perceptual vastness (and may both elicit a sense of being small), crowd visual experiences may be less likely to elicit a positive sense of the self. For this purpose, in addition to the measures we used in previous studies, we also included a variety of exploratory measures related to the sense of self, including one's sense transcending everyday concerns, self-efficacy, perception of uniqueness, and aspirations to be better.

Methods

Participants

We preregistered a sample size of 100 child participants and 100 adult participants. Data collection started in December 2020 and was stopped once the goal was met. We recruited 119 children and 8 were excluded due to inattention, distractions in the environment, or parental influence, leaving a final sample of 111 child participants (M_{age} = 7.09 years, SD = 1.68 years, range = 4.03–9.88, male = 57, female = 54). This sample size has at least 80% power to detect a small effect size of g = 0.14 for a two-tailed, binomial test. We also recruited a sample of 101 adult participants on TurkPrime (M_{age} = 39.89 years, SD = 11.02 years, range = 21–73, male = 48, female = 52, other = 1).

Procedure

We followed the same online testing procedure as in previous studies. As in Studies 1 and 2, each child watched two videos in a randomized order: a *Vast Nature* video and a *Crowd* video. The *Vast Nature* video comprised footage of the same nature-montage used in Studies 1 and 2. The *Crowd* video comprised footage of large groups of people moving through city streets (see Supporting Information for images). Each video was approximately 1 min in length. Both videos included the same background music as in the control condition of Piff et al. (2015). Children then answered questions about similar measures as in Study 1 and Study 2, except that we replaced the *Perceived Vastness* measure with a *Small Self* measure ("Which video makes you feel smaller?"), and we slightly modified the wording of the previous *Sense of Connection* measure ("Which video makes you feel like you are connected to more things in the world?") to better capture the sense of oneness that is often described by individuals who have experienced awe ("Which video makes you feel like you are more closely related to everything in the world?").

In addition to these questions, all children then answered questions about exploratory measures related to their sense of self: *Self-Transcendence* ("Which video makes you think more beyond your usual needs and desires?"), *Self-Efficacy* ("Which video makes you feel more like you can make your life better?"), *Perceived Uniqueness* (reverse coded: "Which video makes you feel more like you can be easily replaced in the world?"), and *Self Aspirations* ("Which video makes you want to be nicer and kinder?").

Adults responded to the same questions through Qualtrics. Because the *Crowd* video had not been used in any previous adult studies, we also asked adult participants to report how much they feel *awe* (awe, wonder, amazement), *positive affect* (cheerful, pride, amusement), and *negative affect* (anger, sad, fear) on a five-point scale (1 = not at all, 5 = very much), before and immediately after they watched each video.

Results and discussion

To first get a sense of how watching the videos made adults feel, we conducted an overall linear mixed effects model using condition (*Baseline*, *Vast Nature* video, *Crowd* video), emotion type (awe emotions, positive emotions, negative emotions), and their interaction to predict their responses, with a random intercept for each participant. The interaction term significantly improved model fit, F = 135.7, p < .001. To understand the interaction, we then conducted separate linear mixed effects models using "condition" to predict their responses to each type of emotion, with *Crowd* video as the reference level. We found that the *Crowd* video (M = 2.33) elicited lower levels of awe-related emotions (*awe*, *wonder*, *amazement*) compared to the *Vast Nature* video (M = 4.04; B = 1.71, SE = .08, t = 22.03, p < .001), but higher levels of these emotions compared

to their baseline feelings ($M=1.97$), $B=-0.36$, SE = .08, $t=-4.69$, $p<.001$. The *Crowd* video ($M=1.92$) also elicited significantly lower levels of positive emotions (*cheerfulness*, *pride*, *amusement*) compared to both the *Vast Nature* video ($M=2.70$; $B=0.78$, SE = .08, $t=10.08$, $p<.001$) and their baseline feelings ($M=2.39$; $B=0.47$, SE = .08, $t=6.02$, $p<.001$). Finally, the *Crowd* video ($M=1.60$) elicited significantly higher levels of negative emotions (*anger*, *sadness*, *fear*) compared to the *Vast Nature* video ($M=1.27$; $B=-0.33$, SE = .05, $t=-6.4$, $p<.001$) and their baseline feelings ($M=1.37$; $B=-0.23$, SE = .05, $t=-4.422$, $p<.001$).

We then conducted a generalized linear mixed effects model using "measure" to predict adult choices between the *Vast Nature* video (coded as 1) and the *Crowd* video (coded as 0). We found that measure significantly improves model fit, $\chi^2(7, N=101)=94.31$, $p<.001$. Binomial tests indicated that the *Vast Nature* video led adults to feel smaller ($M=0.63$, SD = 0.48, $p=.017$, $d=0.28$), to feel a somewhat greater sense of connection to everything in the world ($M=0.60$, SD = 0.49, $p=.045$, $d=0.21$), to feel an overall increased motivation to explore interesting things ($M=0.95$, SD = 0.22, $p<.001$, $d=2.07$) and to understand unknown things in the world ($M=0.90$, SD = 0.30, $p<.001$, $d=1.34$), compared to the *Crowd* Video. In addition, the *Vast Nature* video also led adults to think more beyond their usual needs and desires ($M=0.91$, SD = 0.29, $p<.001$, $d=1.44$), to feel a greater sense of self-efficacy ($M=0.81$, SD = 0.39, $p<.001$, $d=0.79$), to feel more unique (reverse coded) ($M=0.92$, SD = 0.27, $p<.001$, $d=1.56$), and to aspire to be nicer and kinder ($M=0.69$, SD = 0.46, $p=.001$, $d=0.42$). Adults also overwhelmingly preferred to watch the *Vast Nature* video again over the *Crowd* video ($M=0.95$, SD = 0.22, $p<.001$, $d=2.07$).

For children's data, as in Study 1 and Study 2, we conducted an overall generalized linear mixed effects model, to see if children's responses were predicted by measure, age (in years), and their interaction, with a random intercept for each participant. We found that the two-way interaction of measure and age did not significantly improve model fit, $\chi^2(7, N=111)=6.78$, $p=.45$. Inspection of Figure 3 suggests potential age difference for some measures, so we still conducted separate generalized linear models using age to predict each measure. We found that with age, children were more likely to report the *Vast Nature* video led them to feel more connected

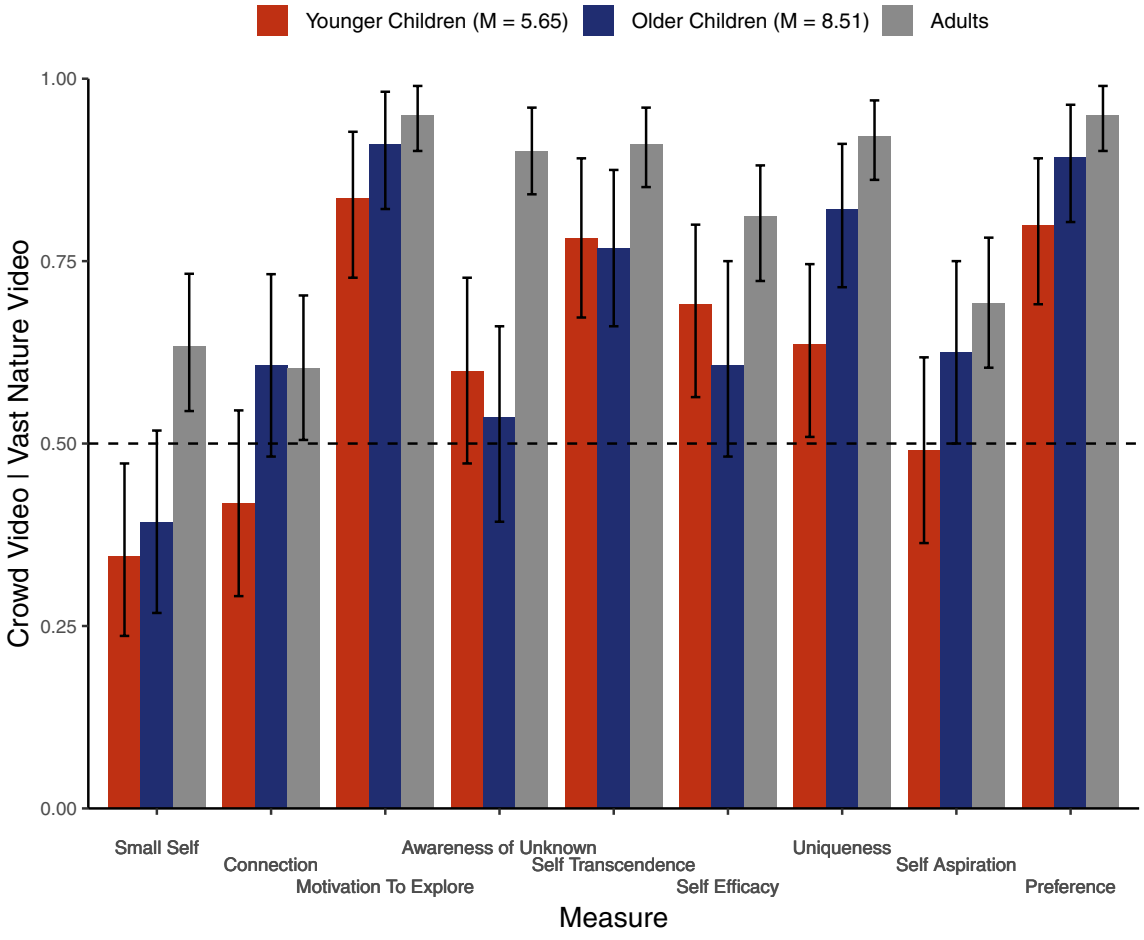

FIGURE 3 Participants' responses to vast nature and crowd visual experiences by measure and age group (based on median split of age) in Study 3.

to everything in the world (B=0.24, SE=.12, z=2.03, p=.043) and feel higher levels of uniqueness (B=0.40, SE=.14, z=2.88, p=.004). Age did not have significant effects on other measures (ps>.05).

Binomial tests indicated that the *Crowd* video made children across ages feel smaller than the *Vast Nature* video (M=0.37, SD=0.48, p=.008, d=0.27), suggesting that the vast social scenes successfully elicited a sense of being small among children. But the *Vast Nature* video, in comparison to the *Crowd* video, led children to be more motivated to explore interesting things in the world (M=0.87, SD=0.33, p<.001, d=1.12), to think more beyond their usual needs and desires (M=0.78, SD=0.42, p<.001, d=0.65), and to feel a greater sense of self-efficacy (M=0.65, SD=0.48, p=.002, d=0.31), although it did not lead them to be more aware of unknown things (M=0.57, SD=0.50, p=.18, d=0.14), or aspire to be nicer and kinder (M=0.56, SD=0.50, p=.25, d=0.12). Like adults, children strongly preferred watching the *Vast Nature* video again over the *Crowd* video (M=0.85, SD=0.36, p<.001, d=0.96).

For the connection and uniqueness measures that we have found an age difference, we compared younger children (M=5.66 years) and older children's (M=8.51 years) responses separately to chance level (based on median split of age). Binomial tests indicated that neither younger (M=0.42, SD=0.50, p=.28, d=0.16) nor older children (M=0.61, SD=0.49, p=.14, d=0.22) distinguished the two types of visual experiences in terms of their sense of connection, although the older children's pattern is more similar to adults. In terms of uniqueness, older children (M=0.82, SD=0.39, p<.001, d=0.83) felt more uniqueness in response to the *Vast Nature* video than the Crowd video, and a similar but weaker trend was found among younger children too (M=0.64, SD=0.49, p=.058, d=0.28), Figure 3.

The results in this study suggest that children and adults distinguish awe-inspiring stimuli from the large crowd stimuli, despite that both types of stimuli involve perceptually vast scenes (indeed, children actually reported that the crowd video made them feel smaller compared to the vast nature video). Children indicated stronger motivation to explore interesting things in response to the vast nature visual experience than to the crowd visual experience, an effect consistent with those in Studies 1 and 2. We also found multiple effects in relation to their sense of self: Children reported that vast nature visual experiences made them think more beyond their usual needs and desires, to feel a greater sense of self-efficacy, and to feel more unique. Adults showed similar effects, and they also reported that the vast nature visual experience motivated them to understand unknown things and aspire to become nicer and kinder. These results suggest that awe-inspiring stimuli are perceived positively by children and adults in ways that cannot be accounted for by perceptual vastness alone.

STUDY 4

In the literature, at least three types of awe-inspiring stimuli have received significant theoretical attention and have been examined separately in adult studies: expansive nature, threatening natural disasters, and depictions of objects at an unusual scale (e.g., microscopic or objects moving in slow motion). In Study 4, we aimed to investigate children's perceptions of these major varieties of awe-inspiring stimuli in a single study and compare them to perceptions of everyday scenes. In addition to the primary measures from Studies 1–3, which assessed the sense of feeling small, connected to the world, motivation to explore and learn, and hedonic preference, we also introduced new measures to assess children's perceived emotions of awe, fear, and joy, as well as their sense of familiarity with the visual experiences.

Methods

Participants

We preregistered a sample size of 180 child participants. Data collection started in July 2023 and was stopped once the goal was met. A total of 199 child participants signed up and completed our study (M_{age}=7.13 years, SD=1.59 years, range=4.49–9.98, male=91, female=108). According to G*Power (Faul et al., 2007), this sample size has at least 80% power to detect an effect size of g=0.19 for a two-tailed, binomial test in each condition. Eleven additional children were tested but excluded from data analyses due to inattention and distractions in the environment. We also recruited 200 adults on TurkPrime (not preregistered; findings presented in Supporting Information), among which 194 adult participants completed our study (M_{age}=42.92 years, SD=11.72 years, range=23–77, male=98, female=90, other or prefer not to say=6).

Design and procedure

We followed the same online testing procedure as in previous studies. Each child was randomly assigned to one of three between-subject conditions that differed in terms of the awe-inspiring images: *Nature* (photos of beautiful, vast nature scenes), *Disaster* (photos of destructive natural disaster scenes), and *Slow Motion* (photos of objects in slow motion). In each condition, children viewed four different awe-inspiring images in one block and four everyday images in another block. The two blocks were presented in a randomized order. All images were prevalidated with a piloting study involving 100 adults. All images were rated as representing each intended category and were of good quality (mean ratings higher than 5 on a 7-point scale ranging from

strongly disagree to strongly agree). To ensure diversity and representativeness for the everyday images, besides including an image of a backyard garden that has been used in our previous studies, we also included a collage of familiar shapes, an image of a city building, and an image of a kitchen in an everyday home. These images were selected because each of the scenes have been used as controls in previous studies (Piff et al., 2015; Stellar et al., 2015), Figure 4.

Immediately after participants viewed both blocks of images, they were shown collages of the images again side by side, and responded to eight forced-choice questions about their feelings and perceptions: *Awe* ("Which group of pictures makes you want to say "wow!"?"), *Fear* ("Which group of pictures makes you feel more afraid?"), *Joy* ("Which group of pictures makes you feel happier?"), *Self-Perception* ("Which group of photos makes you feel that you are much smaller compared to the world?"), *Motivation To Explore* ("Which group of pictures makes you feel more excited to learn about new things in the world?"), *Relationship to World* ("Which group of pictures makes you feel like you are part of a world much bigger than yourself?"), *Familiarity* ("Which group of pictures shows things that you are more used to seeing in your life?"), and *Preference* ("Which group of pictures shows things that you like more?"). Following the procedure in previous literature (Stamkou et al., 2023), emojis were used to facilitate children's comprehension of the emotion questions (e.g., *This picture shows someone who is happy* [point to smiley face emoji]. *Which group of pictures makes you feel happier?*).

Results

To get a sense of how children perceive the images, we first conducted a preregistered generalized linear mixed effects model using condition, measure, and their interaction to predict children's responses, with a random intercept for each participant. We found that the interaction term significantly improved model fit, $\chi^2(14, N=199)=111.26$, $p<.001$. We then examined children's responses to each measure for each condition separately.

Nature condition

As preregistered, we conducted a generalized linear mixed effects model using measure, age (in years), and their interaction predicting children's responses in each condition, with a random intercept for each participant. We found that the interaction between age and

FIGURE 4 Testing images for awe-inspiring stimuli and everyday stimuli in Study 4.

measure significantly improved the model fit for this condition, $\chi^2(68, N=64)=32.04$, $p<.001$. With age, the *Nature* images increasingly led children to perceive a greater sense of fear ($B=0.56$, SE = .18, $z=3.06$, $p=.002$), feeling small ($B=0.64$, SE = .23, $z=2.77$, $p=.006$), and less familiarity with the images ($B=-0.64$, SE = .26, $z=-2.46$, $p=.014$). We did not find age differences in other measures ($ps>.059$).

As preregistered, we compared children's response to the measures to chance using binomial tests. For the measures that we did not find a significant age difference, we found that similar to adults (see Figure 5; Supporting Information), children across ages felt the *Nature* images led them to feel a greater sense of awe ($M=0.94$, SD = 0.24, $p<.001$, $d=1.86$), to feel increased motivation to learn new things ($M=0.81$, SD = 0.40, $p<.001$, $d=0.78$), somewhat greater joy ($M=0.62$, SD = 0.49, $p=.068$, $d=0.24$), although not to perceive themselves as part of a world much bigger than themselves ($M=0.60$, SD = 0.49, $p=.114$, $d=0.21$) than the *Everyday images*. The *Nature* images were also more liked ($M=0.76$, SD = 0.43, $p<.001$, $d=0.62$) than the *Everyday images*.

For those measures that we found an age difference, we conducted binomial tests for younger children and older children separately by median split of age. We found that compared to the *Everyday* images, the *Nature* images led older children ($M=0.86$, SD = 0.36, $p<.001$, $d=1.01$) but not younger children ($M=0.48$, SD = 0.51, $p=1.00$, $d=0.03$) to feel a greater sense of fear. The *Nature* images were more likely to elicit a sense of feeling small among younger children ($M=0.70$, SD = 0.47, $p=.001$, $d=0.42$) and even more so among older children ($M=0.81$, SD = 0.28, $p<.001$, $d=1.46$). Younger children ($M=0.24$, SD = 0.44, $p=.005$, $d=0.59$) and to a stronger extent older children ($M=0.06$, SD = 0.24, $p<.001$, $d=1.88$) perceived the *Nature* images as less familiar than the *Everyday* images, Figure 5.

Disaster condition

Similar to the *Nature* condition, generalized linear mixed effects model revealed that the interaction between age and measure was also significant in this condition, $\chi^2(7, N=64)=31.09$, $p<.001$. With age, the *disaster* images increasingly led children to perceive a greater sense of awe ($B=0.72$, SE = .26, $z=2.83$, $p=.005$), a decreased sense of joy ($B=-0.57$, SE = .29, $z=-2.01$, $p=.044$), and greater motivation to explore ($B=0.61$, SE = .20, $z=3.01$, $p=.003$). We did not find age differences in other measures ($ps>.060$).

Binomial tests indicated that overall, children across ages felt the *Disaster* images led them to feel a greater sense of fear ($M=0.94$, SD = 0.24, $p<.001$, $d=1.79$) and to perceive themselves as smaller in comparison to the world ($M=0.69$, SD = 0.47, $p<.001$, $d=0.40$), than the *Everyday* images. The *Disaster* images did not lead children to perceive themselves as part of the world bigger than themselves ($M=0.52$, SD = 0.50, $p=.901$, $d=0.03$). In addition, the *Disaster* images were less familiar to children ($M=0.08$, SD = 0.27, $p<.001$, $d=1.56$) and less liked

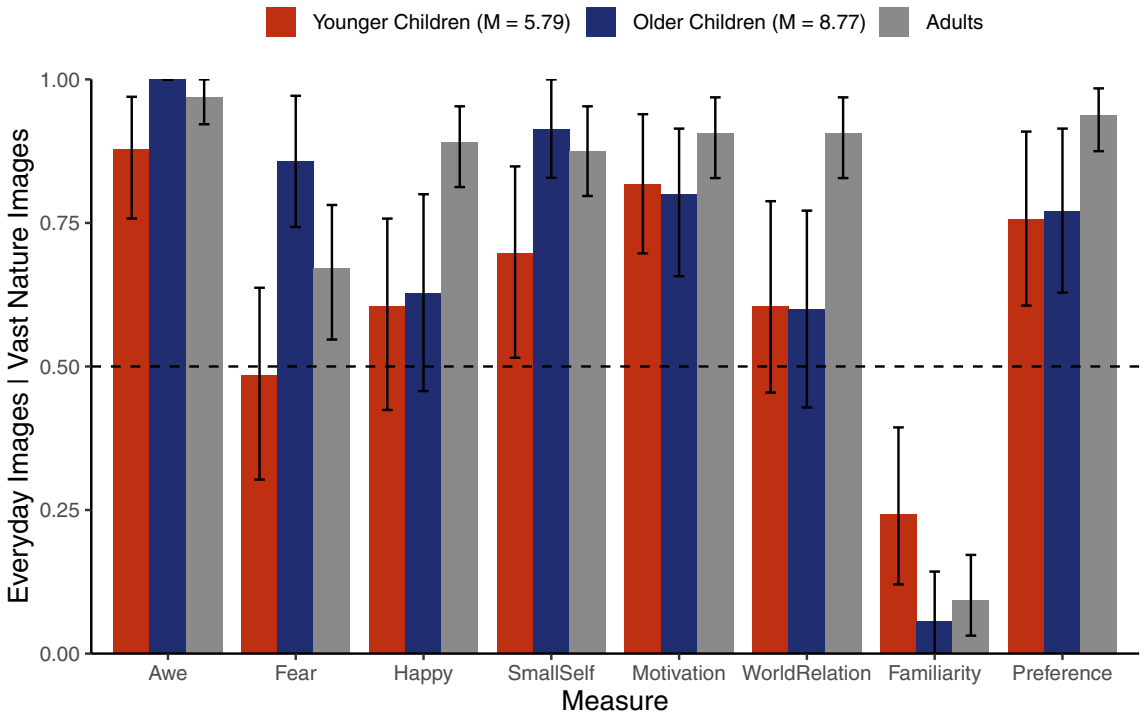

FIGURE 5 Participants' choice between vast nature and everyday images by measure and age group (based on median split of age) in Study 4.

(M=0.28, SD=0.45, p<.001, d=0.48) than the *Everyday* images.

For the measures where we found age differences (awe, joy, and motivation), binomial tests indicated that compared to the *Everyday* images, the *Disaster* images led older children (M=0.91, SD=0.30, p<.001, d=2.65) but not younger children (M=0.59, SD=0.50, p=.377, d=0.19) to feel a greater sense of awe. The *Disaster* images led to a lower sense of joy among younger children (M=0.25, SD=0.44, p=.007, d=0.57) and even less joy among older children (M=0.06, SD=0.25, p<.001, d=0.79). The *Disaster* images led older children (M=0.78, SD=0.42, p=.002, d=2.65) but not younger children (M=0.34, SD=0.48, p=.110, d=0.32) to be more motivated to learn about new things in the world, Figure 6.

Slow motion condition

Similar to the other two conditions, we found a significant interaction between age and measure in this condition, $\chi^2(7, N=67)=26.67$, p<.001. With age, the *slow motion* images increasingly led children to perceive a greater sense of awe (B=0.81, SE=.29, z=2.79, p=.005), a greater sense of fear (B=0.48, SE=.18, z=2.63, p=.009), less familiarity (B=−0.79, SE=.53, z=−2.24, p=.025), and greater preference (B=0.33, SE=.17, z=1.93, p=.054). We did not find age differences in other measures (ps>.080). Binomial tests indicated that children across ages did not feel the *Slow Motion* images lead them to feel a greater sense of joy (M=0.43, SD=0.50, p=.328, d=0.24). The *Slow Motion* images were less likely to make children perceive themselves as smaller in comparison to the world (M=0.30, SD=0.46, p=.001, d=0.78), or to perceive themselves as part of a world much bigger than themselves (M=0.22, SD=0.42, p<.001, d=0.21) than the *Everyday* images.

Based on our age analysis and the inspection of Figure 7, younger and older children responded differently for the measures of awe, fear, motivation, familiarity, and preference. Binomial tests indicated that compared to the *Everyday* images, the *Slow Motion* images led younger children to feel a greater sense of awe (M=0.73, SD=0.45, p=.014, d=0.50) and even more so for older children (M=0.94, SD=0.24, p<.001, d=1.85). The *Slow Motion* images also led to a greater sense of fear among older children (M=0.85, SD=0.36, p=.007, d=0.98), but not among younger children (M=0.48, SD=0.51, p=1, d=0.03). There is a trend for *Slow Motion* images to motivate older children (M=0.68, SD=0.47, p=.058, d=0.37), but not younger children (M=0.45, SD=0.51, p=.728, d=0.09) to learn new things. The *Slow Motion* images were less familiar to younger children (M=0.21, SD=0.42, p=.001, d=0.69) and even more so for older children (M=0, SD=0, p<.001, d=infinite). The *Slow Motion* images were more liked than *Everyday* images by older children (M=0.71, SD=0.46, p=.024, d=0.45) but not by younger children (M=0.58, SD=0.50, p=.487, d=0.15), Figure 7.

Collectively, the findings from this study show that children across ages perceive three major types of awe-inspiring stimuli (vast nature, natural disaster, and

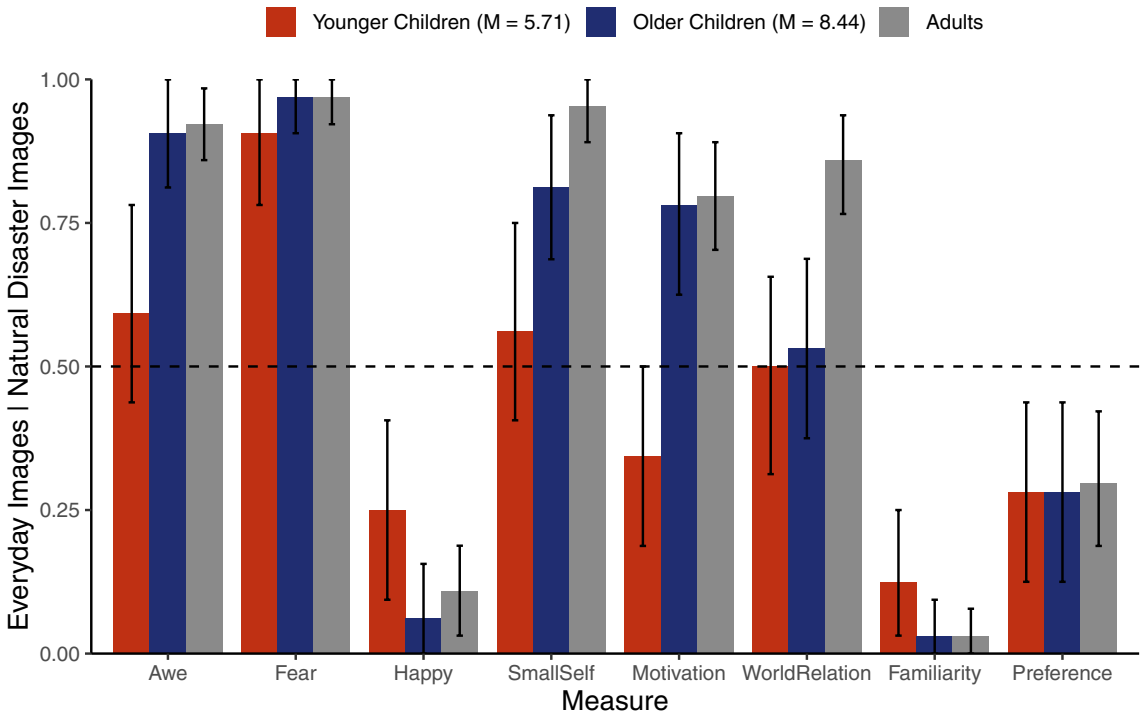

FIGURE 6 Participants' choice between natural disaster and everyday images by measure and age group (based on median split of age) in Study 4.

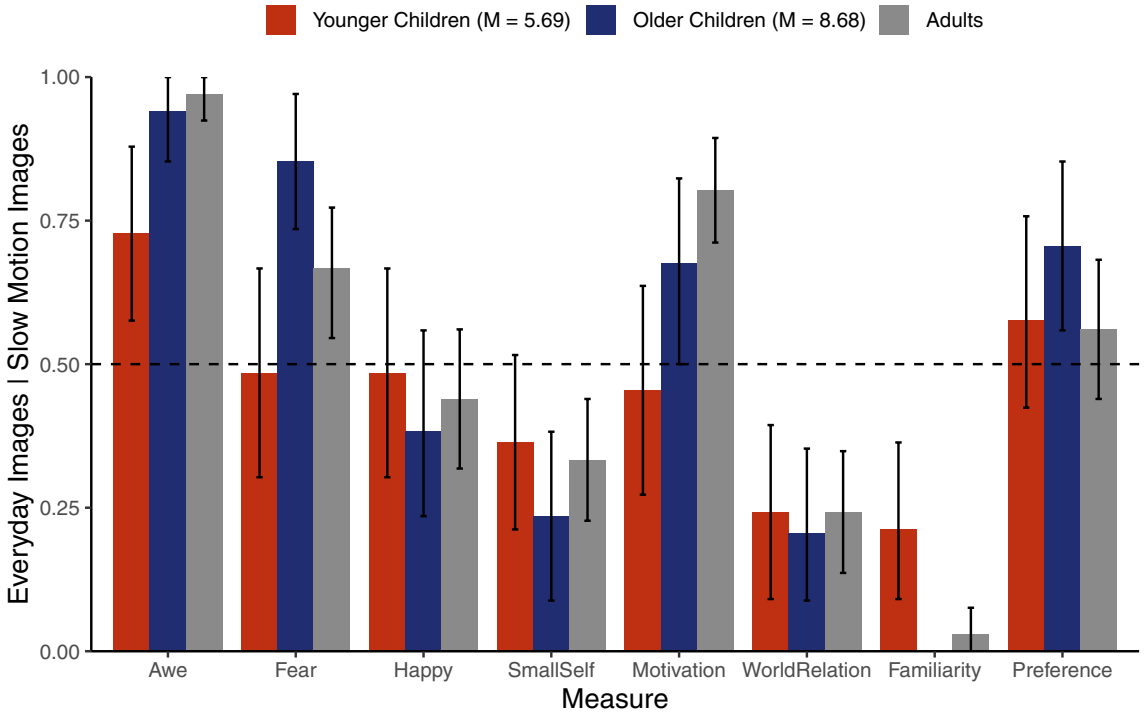

FIGURE 7 Participants' choices between slow motion and everyday images by measure and age group (based on median split of age) in Study 4.

slow motion objects) all elicited greater sense of awe and are less familiar than everyday objects and scenes. Among the three types of awe-inspiring stimuli, vast nature elicited the most positive perceptions compared to everyday scenes, including greater feelings of awe, joy, increased motivation to learn, a sense of feeling small and greater preference. Importantly, natural disaster stimuli also elicited a greater sense of awe, a feeling of smallness, and, among older children, increased motivation to learn, despite children feeling that everyday stimuli elicited more joy and were more liked. Children, especially older ones, indicated that the slow motion images elicited a greater sense of awe and fear, greater motivation to learn, less familiarity, and more preference than the everyday images. However, they did not perceive the slow-motion images as eliciting a greater sense of joy, a feeling of smallness, or a sense of being part of the world. The findings suggest that children can distinguish between the three types of awe-inspiring stimuli, and they perceive that all of them elicit greater awe compared to everyday scenes.

GENERAL DISCUSSION

Across four studies, our findings provided novel evidence on how children perceive and respond to awe-inspiring stimuli. Both positive vast nature (Study 1) and negative natural disaster (Study 2) stimuli, relative to everyday nature stimuli, made children perceive themselves as smaller and feel more motivated to explore and to understand unknown things. In addition to these cognitive and motivational effects, vast nature scenes were also more likely than vast social scenes to lead children to think beyond their usual needs and desires, to feel more capable of improving their own lives, and to feel more unique (Study 3). Diverse types of awe-inspiring stimuli (vast nature, natural disaster, and objects in slow motion) all elicited greater sense of awe compared to everyday objects and scenes and increased children's motivation to learn new things (especially among older children) (Study 4).

Consistent with the view that awe may serve important adaptive functions for individuals (e.g., Chirico & Yaden, 2018; Keltner & Haidt, 2003; Lucht & van Schie, 2023; Richesin & Baldwin, 2023), our studies present new evidence showing that sensitivity toward awe-inspiring visual experiences is present early in life. Children differentiate diverse types of awe-inspiring stimuli from other kinds of everyday stimuli, even when the comparison stimuli share some key features of the awe-inspiring stimuli in our studies (e.g., similarities involving nature, perceptual vastness, background music, and diversity of scenes). Therefore, even though awe experiences are considered to be a complex subjective state involving multiple facets (Keltner & Haidt, 2003; Shiota et al., 2007; Yaden et al., 2019), it appears that we do not have to wait until we develop mature cognitive, philosophical, or spiritual understanding to perceive awe-inspiring visual stimuli. Our work thus brings us one step closer to understanding the nature and origins of awe experiences.

From a developmental perspective, our work helps shed light on the perceptions of a new dimension of emotional experiences among children, namely, self-transcendent experiences—experiences that take one beyond the self. Extensive research has explored children's perceptions and experience of basic emotions (e.g., happiness, sadness, anger; Barrera & Maurer, 1981; Bornstein & Arterberry, 2003; Farroni et al., 2007) and self-conscious emotions (e.g., guilt, pride; Bafunno & Camodeca, 2013; Kochanska et al., 2002; Lewis & Sullivan, 2005; Thompson & Hoffman, 1980). Additionally, young children exhibit prosocial emotions, including empathy (Decety et al., 2018; Eisenberg et al., 2006), an appreciation for gratitude displays (Vaish & Savell, 2022), and an intrinsic motivation to meet others' needs (Hepach et al., 2017). Our findings contribute to this body of work by revealing children's capacity to perceive stimuli that evoke awe experiences. Future research may explore the emergence, development, and benefits of a broader range of self-transcendent experiences, including awe, compassion, love, flow, and gratitude, which collectively will provide a more comprehensive understanding of children's rich emotional worlds.

Across studies, our most consistent finding was that children across ages feel that awe-inspiring stimuli motivated them to explore and to understand more things in comparison to the everyday visual experiences. Consistent with the view that awe is an "epistemic emotion" (e.g., Gottlieb et al., 2018; McPhetres, 2019; Richesin & Baldwin, 2023; Valdesolo et al., 2017), these findings suggest that the effects of awe-inspiring stimuli on learning may be readily perceived early in life. Notably, these epistemic effects were found both with positive and negative awe-inspiring stimuli, despite that the negative awe-inspiring stimuli involving natural disasters have been found to induce fear and uncertainty (Gordon et al., 2017) and children are known to learn and explore less when they feel insecure and fearful (Easterbrooks et al., 1993; Fearon et al., 2010). The effects of negative awe-inspiring stimuli also suggest that perceptual beauty or pleasantness alone may not account for the effect of awe-inspiring stimuli. It will be fruitful to investigate awe's effects on children's actual learning and exploration behaviors in future studies.

In contrast, we did not find an equally strong effect on children's sense of connection (and the connection effect for adults was also somewhat weaker compared to the effects on motivation and sense of small self). One possible explanation for the lack of effects is that children's abstract reasoning about the physical and social world is still developing (Marini & Case, 1994; Uttal et al., 2009), and their everyday experiences primarily revolve around concrete individuals and contexts (Bronfenbrenner & Morris, 2006). Therefore, the concept of connection to "*everything in the world*," although an essential aspect of awe experiences (Yaden et al., 2019), may be too abstract for children to readily grasp. Awe experiences in adults have been shown to foster a sense of closeness to their community (Bai et al., 2017), and it is worth exploring whether awe's effects on connections to *related others* might be more accessible to children than connections to *everything in the world*.

Furthermore, consistent with past literature on awe's effects on "small self" (e.g., Bai et al., 2017; Piff et al., 2015; Preston & Shin, 2017), we found that children and adults also perceive multiple positive effects on their sense of self in response to awe-inspiring stimuli. Compared to crowd stimuli, for example, children and adults reported that awe-inspiring stimuli involving vast nature inspired them to think more beyond themselves, to feel capable of making their lives better, to aspire to become nicer and kinder, and to feel an increased sense of uniqueness. Children's ideas of who they are change with age, and these developing self-views can have lasting impacts on their social relationships and well-being (Starmans, 2017). Our findings thus motivate future research on the role of awe-inspiring experiences in positively shaping children's self identity.

The stronger positive effects of vast nature stimuli compared to vast social stimuli suggest that not all scenes with perceptual vastness are perceived as equally positive or awe-inspiring, despite that perceptual vastness is a key component of awe experiences (Keltner & Haidt, 2003). Our findings highlight that awe-inspiring stimuli involving vast nature or natural disasters are unique in eliciting a sense of smallness without feelings of trivialization and deindividuation. People often experience a trivialized and deindividualized sense of self in large crowds (Crossey et al., 2021; Neal, 1993), which aligns with the negative perceptions of crowd stimuli found in our study. However, it is worth noting that our crowd stimuli depicted unrelated individuals, and it is possible that more cohesive crowds would have different effects. In cases where members feel socially connected through synchronized movements or shared purposes, collective crowds can offer self-transcendent experiences—although we should also be aware that, at times, this can motivate individuals to prioritize their group over others or society at large (e.g., protestors, sports fans, mobs; Haidt et al., 2008; Hopkins et al., 2019; Levine et al., 2005). Further research and theorizing are needed to understand the features of vast experiences that lead to a sense of trivialization versus elevation, as well as the downstream effects on people's motivation and behaviors.

As an initial effort in studying children's sense of awe, our work has certain limitations that should be addressed in future research. The participants were all U.S. children, and cross-cultural data are needed to see whether the effects are generalizable to children in other cultures. Our data were collected online and our empirical

design was primarily limited to a virtual format. We acknowledge that viewing awe-inspiring stimuli may differ perceptually and psychologically from physically participating in an awe-inspiring experience. Future studies should consider more realistic ways of eliciting awe, such as firsthand experiences or virtual reality. Furthermore, all our measures were in the form of verbal questions, and they might not reveal children's full range of experiences and capacities. More sensitive measures, such as pupil dilation, body elevation, eye-tracking, and physiological indicators (e.g., Hepach et al., 2015), could significantly enhance the research on children's sense of awe and their emotional experiences in general.

Across four preregistered studies, we found that children differentiate awe-inspiring stimuli from other kinds of everyday stimuli, in terms of their sense of awe, joy, fear, their motivation to explore, awareness of things to understand, and multiple aspects of their sense of self. Therefore, as complex and profound as awe experiences are, it seems we do not have to wait until adulthood to perceive them. Instead, we are given the gift to appreciate awe-inspiring visual experiences even as children, which we carry into adulthood as we are continually awed and inspired in life.

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CONFLICT OF INTEREST STATEMENT

We have no conflict of interest to disclose.

DATA AVAILABILITY STATEMENT

Preregistration links: Study 1 preregistration: https://aspredicted.org/blind.php?x=iv5r7x. Study 2 preregistration: https://aspredicted.org/blind.php?x=hx9jr7. Study 3 preregistration: https://aspredicted.org/blind.php?x=ya5fv8. Study 4 preregistration: https://aspredicted.org/BFN_55Q. We report all questions and analyses conducted in all studies. Stimuli, Supplemental Materials,, and all data and analyses are shared on OSF (https://osf.io/wzsny/?view_only=e82db9c5bb494b66951be524530c87ab).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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