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Perspective

Awe, wonder, and the human mind

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The human mind is unique in its ability to form, store, and manipulate elaborate conceptual models of the world; yet these models have vast, inevitable gaps. Where the models end, the potential for *wonder* and *awe* begins. Psychology research has begun to uncover distinctive implications of awe for how we perceive our environment and ourselves. More science investigating basic features of awe is needed to fulfill its promise for improving the human experience. Awe, accessible in everyday life, can be a valuable tool for enhancing well-being.

Keywords: awe; wonder; emotion; mental representation; self-concept; well-being

As I work on this essay, I am gazing out over the Pacific Ocean, listening to the deep roar of the tide and absorbing the glittering patterns of afternoon sunlight on the waves. It is December 2020. For the past nine months I have spent most waking moments with my eyes fixed on one small digital screen or another, often from the same spot on the sofa in my San Francisco home. I have often deliberately kept my focus narrow, partly to plow through each day's endless list of responsibilities, but also to prevent feeling overwhelmed by the chaos of the times. My mind now feels inflexible, on autopilot, bereft of meaning. From the ocean's edge I am trying to reconnect with the vast natural world, with the universe beyond my professional and personal responsibilities, and beyond this moment in time. I am searching for awe.

What are *awe* and *wonder*? Why do humans recognize and respond distinctively to that which is extraordinary? Why do these experiences mean so much to us—peak moments in our lives, enriching our sense of meaning and well-being? Is awe as transformative as it feels, and are its effects on us always desirable? Are we, as individuals and as a society, losing our capacity for awe? Can we get it back? For many years I have addressed these ques-

tions in my research and in my life. Here are my thoughts.

The marvelous human mind

The human mind is extraordinary. Like no other species on Earth, we are able to construct and store within our brains elaborate conceptual models of our environment—mental images of people, places, objects, and events that can be activated consciously and manipulated at will. This capacity is a defining feature of human nature and is the foundation of wonder and awe.

Our brains, like those of other animals, are built to take in the world around us and guide behavior that is likely to be beneficial, given the circumstances. Some animals rely mainly on innate stimulus–response rules to achieve this. Bees instinctively fly toward colors associated statistically with flowers and nectar, and sharks are drawn toward the scent of blood. Birds and mammals have evolved more sophisticated neural circuitry for learning which stimuli predict reward and which signal danger. They learn which locations are likely to offer food and at what times; they remember places, situations, objects, and individuals associated with fear or pain, and then avoid them. Many

animals even learn to predict the future. Consider Pavlov's dogs, who, having repeatedly received food right after hearing a certain sound, began to salivate in response to the sound itself. They learned that the sound meant that a treat would soon be presented. Their brains, like our own, track and learn from *predictive errors*,¹ illustrated, in this case, as times when an expected event fails to occur. Stop giving the dog treats after the sound, and after a while the dog will stop responding to the sound with anticipation. Consistently offer a previously abused dog kindness and safety, and eventually its fear of people will dissipate. Continually updating their knowledge of how the environment works, animals can take better advantage of its resources and avoid its threats.

In humans, the ability to model and predict the outside world reaches an entirely new level. No other animal appears to develop such a complex, vivid, internal vision of the environment, or to show such imagination in engaging with and manipulating that vision.² Close your eyes, call up a cherished memory, and you can be right there, reliving it again. We fantasize about experiences we would like to have, and we imagine arguments and painful scenes, sometimes in remarkable detail. We imagine how others will respond to one situation or another. As one of the few animals possessing a self-concept, we are characters in our own inner worlds. After an awkward social interaction, we may spend hours imagining how else we could have handled the situation, what else we might have said, and how it would have turned out. We envision future triumphs; we dream of possible futures.

The ability to construct and move through our mental models of the world is a huge asset. We depend on the models to predict how real people are likely to behave—how real events are likely to play out—and these predictions guide our actions. We can simulate the consequences of our actions within these models as well, deciding which path to choose. We can map out the best route to a destination before starting the car and plan in advance what we will say in an important conversation. We can imagine our future selves; and people who feel more connected to those selves tend to show better academic, economic, and health outcomes, suggesting better decision making.^{3–5} We can even improve a skill by vividly imagining performing the task over and over again. Much of this occurs automatically,

without intent or even conscious awareness. The result is that, by adulthood, our day-to-day experience is heavily and continuously filtered through the model's lens.

Wonder, awe, and the boundaries of imagination

What does all this have to do with wonder and awe? Despite the scope and complexity of our mental models, they can only capture a fraction of the whole of objective reality. We can usually ignore this fact, as we possess sufficient knowledge to get through the day. We are aware of some gaps—those that lie at the fringes of our current understanding. When the topic is important to us, this awareness of gaps leads to wonder—the desire to know more. Wonder is highly motivating; the search for knowledge is experienced as fun, and the sense of reward that comes from acquiring new knowledge is great.

I think of awe as the moment when we're faced with a blank space in the model of which we were unaware, or we are reminded of a gap in understanding so vast we can never possibly fill it. This might be the sight of a landscape never encountered before; a human achievement or act of generosity we could never have imagined; an event that captures or will determine a turning point in history; a work of art that radically changes our perspective; or even a view of the night sky, reminding us how much universe lies beyond our tiny, brief experience. Presented with the extraordinary, our predictive models fail us, and we confront the limits of our understanding. Where our mental models allow us to act, model failure is paralyzing, at least for the moment. We are transfixed, attention compelled by this astounding thing. Studies show we experience time as moving more slowly⁶ and that some cardiac activity supporting physical exertion dials down.⁷ Our minds are not passive; on the contrary, psychology experiments suggest that we absorb as much information as we can during awe, presumably in an attempt to add to the model.⁸ Feeling uncertain, we are motivated to understand and explain what we are seeing.⁹

Because we are part of our own mental models, such experiences raise a question perhaps only humans can ask: "Where do I fit in?" Many studies have found that we feel small—personally insignificant in response to an awe-eliciting stimulus.¹⁰ Our minds detach from the mundane problems and

concerns that typically hold our attention. We feel the presence of something greater than the self, but also part of it—identity expanding to include connection with humanity and living beings in the self-concept.¹¹ The potential to find meaning may lie in this space, as our perspective widens far beyond the fragments of our daily lives.

Enlightenment-era Western philosophy associated the great or sublime with *terror*, suggesting that awe should be tinged with fear. The word *awe* itself is derived from an Old English word for terror or dread. Certainly awe can be accompanied by horror. In the past months I've been awed by this summer's racial justice protests, the grief and rage they released, as well as hope for change; by apocalyptic, burnt orange skies caused by September's devastating wildfires; by the chaos surrounding the November election; and by the unfathomable behavior Americans have displayed during the coronavirus pandemic. In each case, awe was intermingled with distress. Yet we typically respond to the extraordinary unknown with open arms and a sense of appreciation and fulfillment. That is a blessing.

The benefits and limits of awe

Since I first began conducting research on awe—awe being an outcast among emotions twenty years ago—it has become popular. Humans throughout history declared awe-inspiring places sacred, and sought out or created structures—experiences evoking awe. Awe has developed into a Western cultural phenomenon, a proposed panacea for the modern world's ills. Awe is the subject of several nonfiction books, as well as dozens of articles and podcasts—from niche environmental and self-help publications, to *NPR*, the *Atlantic*, and the *New York Times*. It is even featured in the recent Pixar movie, *Soul*, which vividly and exquisitely depicts experiences of awe in music and nature. In nearly every case, the message is that awe confers a wide range of benefits for personal and societal well-being, and that we all need more awe in our lives.

I simultaneously agree with this message and also have some reservations. The current popular interest in awe followed a burst of much-needed scientific research on awe's desirable features and downstream psychological and behavioral effects. As noted earlier, much research finds that prototype awe is experienced as deeply pleasant and center-

ing; it is great for alleviating stress. In well-designed experiments, awe has been found to promote a heightened concern for others—feelings of connectedness, humility, helping of strangers, proenvironmental attitudes, and behavioral intentions.^{12–14} My own research suggests that in awe we briefly lower the filters of our mental models, seeing the world a bit more as it is, less influenced by cognitive shortcuts and dominant assumptions.^{8,15} Much good can be done with these effects as a foundation, and interest is growing in awe-based interventions to promote psychological well-being and healthy, sustainable behavior.^{14,16} I myself am interested in the potential awe may have as a tool in cognitive therapy, end-of-life decision making, and management of cravings in treatment for addiction.

What makes me nervous is the implicit assumption, especially in popular culture, that all effects of awe are good and that all problems can be fixed by awe. Several years ago, I began to receive a growing number of requests for interviews about awe. Nearly every journalist with whom I spoke wanted me to say that awe makes us better people. It probably does—sometimes, and maybe even most of the time. Awe is pleasant, and evidence, thus far, suggests that our capacity for awe is adaptive—that it is a useful response to certain circumstances. But awe is not good or bad per se, and has no inherent moral value. Our propensity for awe is used by cult leaders, dictators, conspiracy theory pushers, and religious extremists to secure devoted believers who go on to commit atrocities against themselves and others. Awe seems to produce a little earthquake in the mind, a moment of cognitive malleability offering a chance to expand and reconstruct one's mental model of the world. The model that emerges depends on what happens in the moments during and after encountering the awe stimulus. We still know far too little about that phase of awe.

We should be investigating potential uses of awe to improve the human condition. However, we possess only fractional understanding of what awe is, and what psychological and behavioral processes are altered in response to awe stimuli. Much additional, rigorous science is needed to address these questions and to understand when awe can be beneficial, and by what means. Without that knowledge, we risk taking a screwdriver to every problem in the house rather than identifying the right tool for the job.

Little earthquakes in the mind

Skepticism aside, I do think most of us would benefit from more awe, if only to provide a moment's respite from the strain and frenetic pace of modern life, and to encourage some perspective. I am in need of awe myself. The other question I am always asked by journalists is "How can people experience more awe?" As we grow older, as we accumulate more and more knowledge and spend the bulk of time in routine activities and tasks, we do tend to experience less awe. Yet awe is readily accessible. Academic researchers and laypeople alike often assume that awe is only evoked by extremely rare experiences, such as seeing the Grand Canyon or the view from the Eiffel Tower for the first time. This is no more true than the proposal that we only feel fear when being violently attacked by a tiger. Just as we experience a bit of fear upon seeing a spider in the bathroom, we can experience a bit of awe in the course of normal life.

Many things can trigger little earthquakes in the mind. Keep your eyes open; notice the unexpected. Figure out how wide and deep your typical field of vision is; then go outside, lift your eyes, and look as far away as you can, letting your eyes roam freely. Alternatively, look more closely at the wind in the leaves, at the shape and color of flowers, at architectural details above your normal line of sight. Walk new routes in your neighborhood, or take meandering drives, and pay attention. On walks in San Francisco, I've discovered tiny sidewalk verge plots, either beautifully landscaped or containing elaborate fantasy scenes, as well as whole networks of lovely hidden stairways. This city is even more remarkable than I knew. Animals—wild, domestic, urban—can be delightful awe stimuli. Last spring my husband bought a hummingbird feeder and installed it on the balcony outside our living room window. We have spent hours in quarantine gazing at the birds' behaviors, which truly never cease to amaze. Our natural world is full of the extraordinary; we just have to slow down and look.

Seek out new music, literature, visual art, dance, or drama, and learn to appreciate these art forms more deeply through classes or self-guided instruction. It's okay if you don't enjoy everything you see or hear; the goal is to deepen your understanding of the art form so that you recognize the revolution, the extraordinary achievement, when you

encounter it. Read a popular press book on physics (I particularly recommend Brian Greene), and see what crazy stuff is going on in the universe! On a clear night, take a walk, go for a drive, and look up at the stars—you're never really going to understand what's out there, so the potential for awe is endless.

Embracing the unknown

We live in an extraordinary time and don't know what lies ahead. Today, the United States of America is itself an enormous, complicated awe stimulus. Granted, it takes effort to see it that way; anxiety, anger, and depression are natural responses to those features of the situation that are most salient in the media and in our personal lives. On good days, I can zoom out in historical perspective and appreciate being here to experience all that is happening. Bad days are grim, and I have trouble sleeping. Lying awake late at night, thoughts racing in the dark, I listen intently to the many-layered rumbles of the tide; in it I hear the vastness of the ocean. Reassured, I embrace that great unknown, and my consciousness drifts away.

Competing Interests

The author declares no competing interests.

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