8 Awe as a Meaning-Making Emotion

On the Evolution of Awe and the Origin of Religions

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"religious awe is the same organic thrill which we feel in a forest at twilight, or in a or in a mountain gorge."
– William James, *The Varieties of Religious Experience*, 1902/1982

Introduction

Awe is a powerful and mysterious emotion, elicited by a wide variety of stimuli. We may feel awe when taking in the view from a mountaintop or inside a cathedral, witnessing the birth of a child or watching the approach of a deadly hurricane. What characteristics do awe-eliciting stimuli have in common? And what is the nature of the common emotional response to such a diverse set of stimuli, religious and otherwise? This chapter explores these questions by examining the relationship between awe and meaning.

Individuals understand the world through cognitive structures composed of foundational beliefs, values and goals. These structures are known as meaning systems (Park 2007). The content of meaning systems determines how we react to the world, both behaviorally and psychologically. If we see the world as a comprehensible place where our actions matter, we are rewarded with a subjective sense of meaning in life (MIL) (see Martela and Steger (2016)). When a person's core beliefs or sense of agency are challenged, they may feel disoriented and seek to restore a sense of meaning in one of two ways. They may cling more tightly to their closely held beliefs, but if the challenge to their meaning system is great enough, they may question and revise their beliefs in a process known as meaning-making (Proulx and Inzlicht 2012).

We propose that awe is a meaning-making emotion. Awe-eliciting stimuli are not readily comprehended. They challenge preexisting meaning systems, inspiring people to explore their environments and think in new ways (Frijda 1986; Keltner and Haidt 2003). This can cause people to change their meaning systems, including core beliefs and sense of identity by the process of meaning-making. Such changes are frequently regarded as positive, and they may enhance feelings of MIL (Ihm, Baas, and Schooler, in prep).

If awe is a meaning-making emotion, could it have played a role in the development of religious meaning systems? To explore the evolutionary roots of meaning-making, we will consider evidence of awe-like states in chimpanzees. Since our ancestors diverged from the same ancestors of chimpanzees, the neural structures underpinning emotion and social cognition have grown larger and more complex. Explicit meaning systems, including religions, have come to govern both individual and social behavior. We propose that the precursors to modern religions were conceived and developed during awe-like states in our hominid ancestors.

Awe and Meaning

The psychology of awe

An experience of awe may feel blissfully positive, dreadfully negative or mixed in its affective valence (Gordon et al. 2017; Pearsall 2007). It may inspire hope, terror or some combination of the two. Experiences of awe are common in stories of religious revelation, including Paul's conversion on the road to Damascus and Arjuna's encounter with Krishna on the battlefield (Keltner and Haidt 2003). Yet awe also provides inspiration for secular and scientific worldviews (e.g., Dawkins 2012).

The emerging scientific consensus suggests that awe is elicited by stimuli that are "big and baffling" (Pearsall 2007). The leading model of awe holds that the prototypical experience of awe involves two key cognitive appraisals: vastness and a need for accommodation (Keltner and Haidt 2003). Vastness may refer to physical scale and complexity, as found in rich natural landscapes. But the physical size of an object is not necessarily the key factor involved in awesome experiences. Rather, the key factor is the degree of psychological expansiveness triggered by the stimulus. Awe-eliciting stimuli may be vast in a more abstract sense, such as the extent of the Dalai Lama's compassion or the explanatory power of the theory of natural selection. Thus, awesomeness implies a sense of scope beyond what one might ordinarily imagine in terms of size, beauty, implications or many other dimensions. Indeed, awe is commonly elicited by complex and information-rich stimuli, such as art, music and natural landscapes (Shiota et al. 2007).

The second appraisal, need for accommodation, is a sense that one cannot fully comprehend the current situation and thus must adjust to it. The stimulus exceeds expectations and defies explanation. In Piagetian terms, the new experience cannot be easily *assimilated* into one's existing understanding of the world. As a result, there is a felt need to revise one's beliefs, a process that Piaget (1971) called *accommodation* (Gordon et al. 2017; Keltner and Haidt 2003). States of awe are associated with an exploratory style of attention, which may facilitate changes in belief and behavior.

In an early psychological discussion of awe, Frijda (1986) distinguished states of wonder or amazement from the surprise response that humans

share with many other animals. Frijda describes wonder/amazement as "a passive, receptive mode of attention" (18), with eyes wandering toward peripheral stimuli. These observations were echoed by experiments showing that awe is associated with the widening of the eyes, the dropping of the jaw and leaning forward, as if trying to extract as much information as possible from the current situation (Shiota et al. 2003). Responding in this manner would seem critical to the process of accommodation that is thought to accompany experiences of awe.

Certain stimuli are widely regarded as awe-inspiring. Natural wonders such as the Grand Canyon and human-built structures like the Great Pyramid of Giza draw slack-jawed visitors from across the world. But in other cases, it is clear that awe is in the eye of the beholder. What inspires awe in one person may be another boring commencement ceremony or unremarkable painting for another person. The awesomeness of any given stimulus depends on an individual's existing beliefs, values and goals – that is, their meaning system. Ihm and colleagues (in prep) found that meaningful life events were frequently the source of awe. These included traditional cultural events (e.g., marriage, birth, graduation), singular events of societal importance (e.g., the 9/11 attacks) and unique or idiosyncratic events with personal significance (e.g., discovering a personal interest). These events often represented major life turning points, and in many cases, they led to significant and lasting changes in worldview and identity. These findings suggest that personal relevance is another key determinant of awe, which may give rise to the need for accommodation.

The Psychology of Meaning

We propose that awe is a meaning-making emotion. In addition to a sense of vastness and a need for accommodation, awe appears to be characterized by a subjective sense of meaning and self-understanding, which may stem from the cognitive effects of awe-eliciting stimuli. To introduce these findings, it is necessary to elaborate on the relationship between the cognitive and affective components of meaning systems.

Meaning systems and meaning in life

The pursuit of a meaningful life is a perennial human concern. People are motivated to try to understand the world around them. We like to feel that the world makes sense and that we have a meaningful role to play within it. The subjective sense of MIL is an intuitive understanding that one's life has purpose and significance and that it matters. Research on the causes and consequences of the subjective sense of meaning has led to a tripartite model of MIL, which links it to the cognitive content of meaning systems. This approach distinguishes three subconstructs: (1) coherence/comprehension; (2) purpose; and (3) significance/mattering (George and Park 2016; Martela and Steger 2016).

Coherence (or comprehension)

Coherence is the extent to which an individual can "make sense" out of their own experiences. This is related to the psychological need for control, which depends on perceiving the world as structured, consistent and comprehensible (Landau et al. 2015). Coherence is supported by meaning systems that are consistent and non-contradictory (George and Park 2016).

In a similar vein, research on narrative identity theory suggests that the ability to tell a coherent life story, with a clear thematic and causal structure, is predictive of psychological health and well-being (McAdams 2011). The core values expressed in the life story relate to the notion of the "true self," or a person's idea of who they really are. The "true self" espouses a set of ideals and values that may not always be manifested in behavior. The concept of the "true self" is reflected in Aristotle's *eudaimonia*, a sense of well-being derived from acting in accordance with one's *demon*, or spirit. Less formal usage of the "true self" concept spans popular music, literature and folk wisdom, such as Shakespeare's "To thine own self be true," paraphrased by Cloninger (2004) as "just be yourself." Modern psychological approaches have shown that individuals whose "true self" is more cognitively accessible tend to report a greater sense of MIL (Schlegel et al. 2011). The study of narrative identity and the "true self" highlights the connection between cognitive coherence and subjective meaning.

Purpose

This refers to one's commitment to goals that are perceived as valuable and worthwhile (Martela and Steger 2016). Purpose can be viewed from the perspective of Carver and Scheier's (1998) self-regulation model, which stresses that the continuous identification and pursuit of goals is central to human behavior. Meaning systems ultimately guide behavior by mapping the current situation onto existing knowledge and behavioral tendencies (Tullett et al. 2013).

Significance (or mattering)

This is the sense that one's life has inherent value and significance (George and Park 2016; Martela and Steger 2016). Significance depends on a system of valuation that imbues one's actions with a sense of importance. Something of significance, something that matters, is that which is worth living for (Frankl 1955).

Overall, meaning systems that are characterized by coherence, purpose and significance provide a cognitive foundation for goal-directed action. They describe a comprehensible world, a set of goals to pursue and a framework for evaluating one's actions and experiences. Thus, the psychological "need for meaning" appears to stem from the more basic imperative of

acting in the world, for which "making sense of the world" is a prerequisite. The three proposed components of MIL illustrate the connection between the experience of MIL and the capacity for goal-directed behavior. This analysis suggests that the sense of MIL may function as a subjective signal that one's meaning systems are oriented toward effective action in the world, shedding light on the hypothetical "need for meaning" (Tullett et al. 2013).

Meaning maintenance and meaning-making

How do people respond when their sense of meaning is disrupted? An individual's sense of meaning can be undermined in a variety of ways. Someone may feel disoriented if they lose control over a situation. Existential anxiety may overcome a person who reflects on their own mortality. Being ostracized by a social group may leave a person wondering where they truly belong. Such experiences are considered *meaning violations*, since they challenge the beliefs underpinning one's sense of meaning (Heine et al. 2006). Meaning violations can be construed as a conflict between one's general worldview, or global meaning system, and one's appraisals of the current situation, or situational meaning (Park and Folkman 1997).

The attempts to restore meaning following meaning violations are broadly referred to as meaning maintenance. The meaning maintenance model (Heine et al. 2006) is inspired by Festinger's (1957) theory of cognitive dissonance, which holds that conflicting cognitions create an aversive psychological state that motivates attempts to restore cognitive consistency. It therefore emphasizes the coherence component of MIL. The meaning maintenance model describes two broad categories of behaviors that can restore a sense of meaning: fluid compensation and meaning-making (Proulx and Inzlicht 2012).

Meaning violations can be elicited experimentally by confronting a person with information that conflicts with existing beliefs and expectations or that undermines one's sense of control. When these meaning violations are relatively minor, they can be resolved by asserting one's global meaning system more strongly – a process known as fluid compensation. For instance, Kay and colleagues (2008) instructed research participants to recall past situations in which they lacked control. This led to increased self-reported belief in external sources of control, such as belief in a god that manages earthly events. However, fluid compensation does not require religious belief. Believing in science may play a similar role in fluid compensation efforts. Farias and colleagues (2013) found that the experimental elicitation of distressing thoughts about one's own mortality led to a greater endorsement of a scientific worldview, among university students and staff. The assertion of existing meaning systems, both religious and secular, is a common strategy for addressing violations of meaning (Landau et al. 2015; Proulx and Inzlicht 2012).

In the event of severe meaning violations, such as traumatic or life-changing events, one may bolster existing beliefs through fluid compensation

as a way to restore a sense of meaning, or one may revise one's beliefs through accommodation or meaning-making (Park and Folkman 1997; Proulx and Inzlicht 2012). Fluid compensation, as illustrated here, may not suffice to restore a sense of meaning when a new situation seems irreconcilable with one's former beliefs. In such cases, one makes an effort to accommodate global meaning systems into the new situation, akin to the need for accommodation that is associated with awe (Keltner and Haidt 2003). To illustrate, Larner and Blow (2011) give an example of a soldier who was unable to preserve the lives of the soldiers under his command. If this soldier believes that a good leader keeps his soldiers alive, then this belief may be difficult to reconcile with the deaths of his fellow soldiers. Based on the prior belief, the soldier might be forced to conclude that he is a bad leader and that he is responsible for these deaths. Coming to terms with incompatible information and restoring a sense of meaning and self-acceptance may require modifying one's meaning systems – what one believes, values and pursues – through an accommodative process of meaning-making.

We have seen that the subjective sense of meaning is related to one's understanding of the world. In particular, the sense of MIL may depend on seeing the world as a comprehensible place wherein one's actions are imbued with purpose and significance. This may help explain why humans are motivated to achieve and maintain a sense of MIL. When the beliefs, goals and values that constitute an individual's meaning system are challenged, they are driven to restore meaning by bolstering existing beliefs or by revising their beliefs through an accommodative process of meaning-making. However, it remains to be established how awe may be understood as a meaning-making emotion.

Awe and Meaning-Making

Ihm and colleagues (in prep) examined whether experiences of awe were associated with appraisals and outcomes related to meaning-making. In an online sample of American participants, those who reported more frequent experiences of awe tended to score higher on questionnaires measuring their sense of MIL, coherence of narrative identity and closeness to their "true self" or core values. These findings suggest that people who regularly experience awe are more likely to have coherent meaning systems, indicated by an enhanced sense of MIL and self-understanding. This raises two possibilities: (1) frequent experiences of awe serve to update meaning systems over time, and/or (2) having a coherent meaning system increases the likelihood of experiencing awe. Follow-up experiments investigated the first possibility by examining whether experiences of awe are associated with appraisals related to meaning and lasting changes in meaning systems. We encourage future research to investigate the second possibility: whether characteristics of meaning systems influence a person's susceptibility to awe.

To examine whether awe may play a role in the development of meaning systems, Ihm and colleagues (in prep) asked participants to reflect on

emotional experiences from their past. A second online sample described either a positive experience of awe, a negative experience of awe or one of three control emotions: amusement, relaxation or fear. These descriptions were evaluated for the presence of accommodative changes in meaning systems, specifically self-described changes in worldview or personal identity. Both positive and negative experiences of awe, compared to other positive and negative emotions, were associated with lasting changes in worldview and identity. Describing the experience of giving birth, one participant proclaimed "I was one person before, and I was someone else right afterwards." Such changes in worldview or identity were greatest for participants who reported having felt a sense of meaning and purpose during the experience. Finally, experiences of awe that led to accommodative meaning-making were associated with self-reported positive changes in mood, attitudes and behavior. These findings lend support to the hypothesis that awe-eliciting stimuli often inspire changes in meaning systems.

The cognitive mechanisms underlying accommodative meaning-making remain largely speculative. Some light can be shed on this question by examining the appraisals that people report during and following experiences of awe. In addition to vastness and a need for accommodation, experiences of awe are also associated with a diminished sense of ego, or a dissolution of one's everyday sense of self. This is indicated by the endorsement of appraisals such as "I lost all sense of ego" and "I felt a sense of self-transcendence" (Ihm et al., in prep). This is consistent with reduced reliance on existing schemas, particularly one's everyday understanding of the self, or self-schema (Mandler 1984).

This interpretation is supported by an fMRI study by van Elk and colleagues (in prep), which showed that absorption in awe-eliciting videos is associated with reduced activity in two key brain areas associated with meaning system processes, the posterior cingulate cortex (PCC)/precuneus and ventro-medial (vm)PFC. The PCC/precuneus is involved in the instigation of internally generated and self-referential thought, which is guided by preexisting schemas rather than novel information coming from the environment (Brewer et al. 2013; Davey et al. 2016). Strongly connected to the PCC, the vmPFC is a hub that links schematic knowledge in long-term memory with sensory and emotional information related to the current situation (van Kesteren et al. 2010). The (vm)PFC has thus been described as a generator of "affective meaning," which makes it possible for an organism to conceptualize itself in the context of current and future situations (Roy et al. 2012). Reduced activity in the PCC/precuneus and vmPFC is therefore consistent with reduced reliance on schemas and internally guided thought during states of awe (although this interpretation is susceptible to reverse inference). This shift away from schema-driven processing provides a plausible mechanism linking states of awe with accommodative meaning-making.

Awe reportedly involves a sense of self-diminishment – that is, feeling small or insignificant in the presence of something greater than the self (Piff

et al. 2015; Shiota et al. 2007). The findings of Ihm and colleagues (in prep) suggest a different interpretation, though. Participants are more likely to endorse the appraisal "I felt small or insignificant" after experiences of awe, compared to other emotional experiences. However, Ihm and colleagues also found that for positive experiences of awe, the modal response to this item, on a Likert scale from 1 (not at all) to 7 (to a great extent), was 1. Related items that were more consistently endorsed – with a modal response of 7 – include "I lost all sense of ego," "I felt a sense of self-transcendence" and "I felt the presence of something greater than myself." In contrast to the self-diminishment hypothesis, other items with a modal response of 7 in the positive awe condition include "I felt closer to my true self," "I felt connected with my personal values" and "I felt as though I knew who I really was." This suggests that although certain aspects of the self or ego are felt to be diminished during states of awe, there is a set of core values, a "true self," that is enhanced or made salient. The everyday sense of self falls away, laying bare the core features of a person's identity. These central components of meaning systems are likely to be particularly stable, due in part to their cultural inculcation (Haidt 2012; McAdams 2011). We suggest that one's core values and sense of "true self" serve as a relatively stable foundation for meaning-making when other schemas are undermined. As a consequence, during experiences of awe, individuals remain grounded in their core beliefs, which provide a foundation from which meaning-making can be pursued.

Collectively, these findings suggest that awe can be viewed as a meaning-making emotion. Experiences of awe are characterized by a sense of meaning and closeness to one's core values or "true self." Awe involves acute changes in attention, memory and neural activity, which may facilitate long-term positive changes in meaning systems, including worldview and identity. These processes may explain why awe-prone people tend to report greater trait-level MIL, coherence of identity and closeness to core values (or the "true self"), although future research should investigate this relationship through experimental and longitudinal studies.

Awe and Religious Meaning Systems

What does awe as a meaning-making emotion have to do with human religions? To address this issue, the relationship between religions and meaning systems first needs clarification. Meaning systems are not only possessed by individuals but also shared within communities. By drawing on a common set of beliefs, values and goals, members of a society can engage in cooperative behavior and experience positive feelings of cohesion and belonging (Bellah 2012; Echterhoff et al. 2009; Haidt 2012). Religions are among the most pervasive and organized forms of shared meaning systems. They provide a shared set of beliefs and practices that may define an entire society, and they structure the meaning systems of individuals within that society.

Stories of awe-inspiring miracles and revelations are foundational to many major religions. Beliefs about deities with the awe-inspiring characteristics of omniscience and omnipotence motivate god-fearing people to behave themselves. Religious leaders dazzle their audiences with divinely ordained charisma, inspiring them to great action (Keltner and Haidt 2003). Religious ideas are spread and reinforced through both collective rituals and individual experiences, including singular awe-inspiring events that lead to religious conversion. Experiences of awe may therefore play a prominent and perhaps fundamental role in religions. Most central to the present discussion are religious explanations of the natural world. Religious beliefs are often invoked to explain awe-inspiring natural phenomena, from coincidental rainbows to deadly hurricanes. This is true even today, although scientific explanations are available. To what extent have religious beliefs been inspired by experiences of awe?

Inherent in a state of awe is the struggle to understand something new and overwhelming. Awe-like states may have served a similar meaning-making function in our hominid ancestors. Many stimuli that commonly elicit awe in humans – including birth, waterfalls and wildfires – have also been observed to evoke awe-like states in chimpanzees (de Waal 1996; Goodall 2005). These states are characterized by novel patterns of behavior, which can potentially be understood as rudimentary meaning-making. We can only speculate at this stage (well aware of the pitfall of generating "just so stories"); still we propose the intriguing possibility that religious beliefs may have been conceived and developed during awe-like states in our hominid ancestors, who already possessed many of the social cognitive abilities that underpin religious belief and behavior in humans.

Religions as Shared Meaning Systems

Religions are said to contain many things: doctrines, myths, truths, falsities, messages from God or the gods, rules for how to live, pathways to ultimate reality and more. Each religion may manifest any variety of these or other elements. Such characterizations, however, are often claims made by an "insider" or descriptions as seen from an "outsider." These characterizations are not necessarily false, but they are not complete in any scientific sense. Psychologically, religions are meaning systems full of the beliefs, values, goal orientations, categories of personal identity and loci of ultimate concern that exist in any global meaning system (Park 2007).

The importance of shared meaning systems for organizing communities is illustrated by Haidt's (2012) concept of moral matrices. Haidt suggests that early hominid communities began to flourish as they developed the ability to understand each other's thoughts and intentions. This allowed for cooperation based on widely held goals and furnished such communities with a set of shared expectations for social behavior, eventually giving rise to more elaborated meaning systems, such as religions (Bellah 2012; Donald 1991).

The problem of the origin of religions can be recast in terms of meaning systems: How did our ancestors come to develop, share and reinforce meaning systems, religious and otherwise?

Humans are motivated to maintain a sense of commonality with the beliefs and feelings of others. This pursuit of "shared reality" leads people to adjust their beliefs, and even their memories, to achieve consistency with the perceived meaning systems of others (Echterhoff et al. 2009). In turn, shared meaning systems provide a foundation for communication, cooperative behavior and feelings of social cohesion. The sharing of meaning systems is therefore made possible by social cognition, particularly by the capacity to represent the mental states of others, known as theory of mind (ToM).

A shift in emphasis from studying *religions* to the broader category of *meaning systems*, and the processes by which they are maintained and updated, highlights evolutionary questions about more general cognitive processes that may have coevolved with religions, including meaning-making, ToM, imitation, language and storytelling (Deacon 1997; Donald 1991). Religions serve the various functions of meaning systems, including the regulation of individual and communal behavior (Haidt 2012; Norenzayan et al. 2016) and the cultivation of a sense of meaning (Tullett et al. 2013; Park 2007). The beliefs, rituals and experiences that characterize modern religions can be considered as products of a set of building blocks that include social cognition, community organization, cultural transmission and awe-like states (Taves 2015). When did these building blocks appear in the course of hominid evolution? They may have been present in a rudimentary form roughly seven million years ago, at the time of our last common ancestor with chimpanzees.

Hominid Building Blocks of Meaning Systems

Chimpanzees have a number of social cognitive capacities that may be considered building blocks of religions and other meaning systems (Taves 2015; Turner et al. 2017). Maryanski (2018) refers to this suite of proto-religious behaviors as the community complex. It consists in (1) the organization of communities beyond local groups, (2) ritual behavior in everyday interaction and community-wide events and (3) the social cognitive faculties related to ToM and self-awareness that underlie these social phenomena (Turner et al. 2017). The community complex also enables a basic capacity for cultural invention and transmission in nonhuman primates, including techniques for cleaning food and using tools (de Waal 1999). Paleontological and genetic evidence suggests that humans descended from a common ancestor with chimpanzees roughly six to eight million years ago, which suggests that the roots of religious meaning systems may run deep into our evolutionary history (Jensen-Seaman and Hooper-Boyd 2008; Turner et al. 2017).

At some time in the past eight million years, these hominid building blocks came together under the rubric of religion. The emerging capacity

for language gave way to storytelling. Our ancestors codified their behavioral rules in the form of explicit beliefs and narratives, which likely provided benefits for the memory and transmission of shared meaning systems. Thus, the chimpanzee community complex, along with the emerging capacity for language and storytelling, gave our hominid ancestors the tools to create the unifying narratives that are central to human religions. But what was the proximal cause that inspired religious beliefs? We have seen that states of awe are frequently associated with accommodative meaning-making, which may be driven by a reduced reliance on existing schemas and increased exploratory attention and may produce lasting changes in belief and behavior (Ihm et al., in prep). We contend that awe-inspiring natural phenomena were the proximal cause of meaning-making efforts that ultimately led to religious beliefs and facilitated the development of religious meaning systems.

All mammals appear to share a palette of primary emotional states, including fear, anger, sadness and joy, rooted in subcortical neural systems (Panksepp 1998). Great apes, such as chimpanzees, have several distinct subcortical structures involved in emotion, such as the amygdala, septum and hippocampus. In modern humans, these subcortical areas have roughly doubled in size, along with a similar doubling in the size of the neocortex (Turner et al. 2017). Both of these developments likely increased the scope and richness of the emotional palette, creating a variety of extensions and combinations of the primary emotional states. For instance, Turner and colleagues (2017) argue that the human emotions of shame and guilt constitute elaborated combinations of the primary negative emotions of fear, anger and sadness.

Primatologists have observed that chimpanzees display an awe-like response to stimuli that also tend to elicit awe in humans (e.g., de Waal 1996; Goodall 2005). The awe-like responses of chimpanzees appear to involve novel combinations of emotional behaviors outside of their usual contexts, including certain aspects of the human awe response. For instance, Jane Goodall describes the reaction to a raging waterfall or a sudden heavy rain: aggressive charging displays, followed by a silent period of motionless, wide-eyed attention, and rhythmic stomping in the water (1986, 2005). A similar combination of divergent emotional responses and ritualistic behavior has been observed in chimpanzees in response to other natural phenomena (e.g., wildfires), as well as birth and death (de Waal 1996; Pruetz and LaDuke 2010), which are associated with awe in humans (Ihm et al. in prep).

The aggressive displays that take place when chimpanzees encounter death or great natural forces (e.g., water, fire) are linked to predatory behavior (Goodall 1986). They involve bristling the hair, or *piloerection*, which is also a common correlate of awe in humans, often referred to as "chills" or "goosebumps" (Konecni 2005; Maruskin et al. 2012). This novel application of predatory behaviors to stimuli as diverse as waterfalls or the death

of a community member suggests some capacity for abstraction and for the generalization of emotional responses (Deacon 1997; Donald 1991; Turner et al. 2017). Rather than responding to a specific environmental threat, the power of natural forces may represent a more abstract threat that cannot be assimilated to existing meaning systems. Nevertheless, the behavioral response is the same – piloerection and charging behavior – despite its unusual co-occurrence with affiliative and exploratory behaviors. Thus, in hominid evolution, the capacity to experience awe may have been a natural by-product of the increasing richness and complexity of hominid meaning systems and their underlying neural structures. In turn, a rudimentary form of meaning-making may have contributed to the development of more elaborate meaning systems, including religions.

We suggest that experiences of awe marked the boundaries of more primitive hominid meaning systems, as they appear to do in humans (Ihm et al. in prep; Keltner and Haidt 2003; Pearsall 2007). That is, awe may be experienced when meaning systems are pushed to the limits of their capacity to link stimuli with appropriate actions. In humans, this is frequently associated with a need to make meaning out of ambiguity, which Keltner and Haidt (2003) refer to as a need for accommodation.

Notably absent from the repertoire of chimpanzee building blocks of religions are shared narratives about the supernatural world (Donald 1991; Turner et al. 2017). The ability to share collective narratives would likely have facilitated social organization, allowing behavior to be coordinated across greater spans of time (Haidt 2012) – but only to the extent that these narratives could survive the challenges posed by novel experiences. We propose that the content of these narratives was shaped by meaning-making efforts in response to awe-eliciting stimuli. In the absence of scientific explanations for birth, death and powerful natural forces, supernatural explanations may have been provided by neurocognitive systems tuned to detect agentic beings and represent the mental states of others (Atran 2002; Barrett 2000). Such explanations may also be provided, developed or reinforced through social processes of appraisal and attribution (Taves 2016). Once our ancestors developed the ability to conceive of the most rudimentary supernatural agents, these agents could have gradually assumed the characteristics of "big gods," who keep communities in line through their constant threats of supernatural punishment, by means of continuing biological and cultural evolution (Fehr and Fishbacher 2003; Norenzayan et al. 2016).

Conclusion

The psychology of meaning offers promising avenues for the study of awe and religions. Meaning systems, religious and otherwise, provide a framework for individual and collective behavior and contribute to a sense of MIL. The experience of awe is associated with stimuli that cannot be assimilated to existing meaning systems, which may motivate attempts at accommodative

meaning-making. Compared to other positive and negative emotions, experiences of awe are more frequently associated with lasting changes in meaning systems, including worldview and identity (Ihm et al. in prep). Frequent experiences of awe are positively correlated with MIL, coherence of narrative identity and feelings of closeness to one's "true self." Therefore, awe appears to be a meaning-making emotion involved in updating meaning systems while maintaining or enhancing their coherence and integrity.

The presence of an awe-like state in chimpanzees points to the deep cognitive roots and potential evolutionary significance of awe. Chimpanzees exhibit an awe-like response to various stimuli that also tend to elicit awe in humans. This observation adds to a collection of social cognitive building blocks of religions present in nonhuman primates and highlights the utility of a meaning systems perspective in the study of awe and the cognitive science of religion.

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