On the Origin of Religion

To Charles Darwin, the origin of religious belief was no mystery. "As soon as the important faculties of the imagination, wonder, and curiosity, together with some power of reasoning, had become partially developed, man would naturally crave to understand what was passing around him, and would have vaguely speculated on his own existence," he wrote in *The Descent of Man*.

But our propensity to believe in unseen deities has long puzzled Darwin's scientific descendants. Every human society has had its gods, whether worshipped from Gothic cathedrals or Mayan pyramids. In all cultures, humans pour resources into elaborate religious buildings and rituals, with no obvious boost to survival and reproduction. So how and when did religion arise?

No consensus yet exists among scientists, but potential answers are emerging from both the archaeological record and studies of the mind itself. Some researchers, exploring religion's effects in society, suggest that it may boost fitness by promoting cooperative behavior. And in the past 15 years, a growing number of researchers have followed Darwin's lead and explored the hypothesis that religion springs naturally from the normal workings of the human mind. This new field, the cognitive science of religion, draws on psychology, anthropology, and neuroscience to understand the mental building blocks of religious thought. "There are functional properties of our cognitive systems that lean toward a belief in supernatural agents, to something like a god," says experimental psychologist Justin Barrett of the University of Oxford in the United Kingdom.

Barrett and others see the roots of religion in our sophisticated social cognition. Humans, they say, have a tendency to see signs of "agents"—minds like our own—at work in the world. "We have a tremendous capacity to imbue even inanimate things with beliefs, desires, emotions, and consciousness, … and this is at the core of many religious beliefs," says Yale University psychologist Paul Bloom.

Meanwhile, archaeologists seeking signs of ancient religion focus on its inextricable link to another cognitive ability: symbolic behavior. They, too, stress religion's social component. "Religion is a particular form of a larger, social symbolic behavior," says archaeologist Colin Renfrew of the University of Cambridge in the United Kingdom. So archaeologists explore early religion by excavating sites that reveal the beginnings of symbolic behavior and of complex society.

Yet these fields are developing chiefly in parallel, and there remains a yawning gap between the material evidence of the archaeological record and the theoretical models of psychologists. Archaeological objects fall short of revealing our ancestors' minds, says Bloom, while on the psychological side, "we need more evidence."

Birth of the gods

When did religious beliefs begin? A likely place to find out is the archaeological record, but inferring "religion" from ancient objects and practices can be a tall order. Many researchers take the use of symbols as a clue to budding spirituality. As far back as 100,000 years ago, people at the South African site of Blombos Cave incised pieces of ochre with geometric designs, creating the first widely recognized signs of symbolic behavior (*Science*, 30 January, p. 569). Although it's difficult to equate enigmatic lines on a chunk of ochre with a belief system, researchers agree that such use of symbols is a prerequisite for religion, and some argue that religious beliefs must have existed by this time.

The first deliberate burials are found at roughly the same time, at a site called Qafzeh in Israel, dated to about 95,000 years ago. Researchers have dug up more than 30 individuals, including a 9-year-old child with its legs bent and a deer antler in its arms. And starting about 65,000 years ago or even earlier, Neandertals also sometimes buried their dead. Henry de Lumley of the Institut de Paléontologie Humaine in Paris has referred to these ancient burials as "the birth of metaphysical anguish."

But others aren't sure what metaphysical message burial conveys. "There can be lots of reasons to bury things; just look at kids in a sandbox," says Barrett. Burial by itself, says archaeologist Nicholas Conard of the University of Tübingen in Germany, may best be considered a sign of "protobelief."

If they had to name one time and place when the gods were born, Conard and some others might point to 30,000 to 35,000 years ago in Europe. That's when symbolic expression flowered in what's called the Upper Paleolithic explosion (*Science*, 6 February, p. 709). At this time, Ice Age hunter-gatherers painted strikingly realistic animals—and a few half-animal, half-human figures—on the walls of France's Grotte Chauvet and other caves. They also left small but spectacular figurines in caves in Germany, including a dramatic carved ivory "Venus" reported in May and three "lion-men"—each a carved male body with the head of a lion.

The "Venus of Hohle Fels" illustrates the difficulties of interpreting such ancient objects: Conard, who discovered it, considers the 6-centimeter figure of a headless woman with huge breasts and carefully carved genitalia to be a religious fertility object, while archaeologist Paul Mellars of the University of Cambridge has called it "paleo-porn."

Yet many observers agree that the lionmen, with their combination of human and animal qualities—something seen in many early religions—are strong candidates for a supernatural being or spirit guide. Some go so far as to suggest that the small statues were part of shamanistic rituals, though Conard says we cannot know for sure. "Even if it wasn't shamanism," he says, "I bet the bank it was something I consider religious beliefs."

THE YEAR OF DARWIN

This essay is the 11th in a monthly series. For more on evolutionary origins online, see the Origins blog at **blogs.sciencemag.org/origins.** For more on the Origin of Religion, listen to a podcast by author Elizabeth Culotta at **www.sciencemag.org/multimedia/podcast.**

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The world over. All cultures have religious beliefs, though they express them in diverse ways.

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Twenty thousand years later, humans reached another religious milestone, building what is often considered the world's first temple at the 11,000-year-old site of Göbekli Tepe in Turkey (*Science*, 18 January 2008, p. 278). There, rows of standing stones up to 6 meters tall march down a high hillside in circles; each massive stone is carved with images of wild animals. "There is the erection of monumental and megalithic architecture for the first time," says excavator Klaus Schmidt of the German Archaeological Institute in Berlin.

After this time, more organized sites with apparently religious aspects appear elsewhere. For example, at one of the first settled towns, Çatalhöyük in southern Turkey, excavator Ian Hodder of Stanford University and his crew are finding what they consider copious evidence of spiritual life: feasts with wild bulls, burials of ancestors beneath houses, and sometimes the removal and reinterment of skulls. And yet Hodder notes that separating "religion" from other activities seems arbitrary, as it is not clear that the people of Çatalhöyük themselves separated the religious sphere from the rest of life.

Renfrew cautions that it might not be possible to know for sure that a culture worshipped gods until we can read their names—that is, until the literate societies of ancient Mesopotamia and Egypt, some 5000 years ago. Those early empires had both secular and religious hierarchies, with priestly elites and sometimes a god-king who ruled both the temporal and spiritual realms. In this view, full-fledged "religion" develops hand in hand with organized social hierarchies. It may be that "you don't necessarily have belief in deities until you have persons of enormously high status, who themselves are close to divine," like a pharaoh, says Renfrew.

Born believers?

While archaeologists trace the outward expressions of religious and symbolic behavior, another group of researchers is trying to trace more subtle building blocks of religious belief, seeking religion's roots in our minds.

> "You begin to see that a god is a likely thing for a human mind to construct."
>
> —Deborah Kelemen, Boston University

According to the emerging cognitive model of religion, we are so keenly attuned to the designs and desires of other people that we are hypersensitive to signs of "agents": thinking minds like our own. In what anthropologist Pascal Boyer of Washington University in St. Louis in Missouri has described as a "hypertrophy of social cognition," we tend to attribute random events or natural phenomena to the agency of another being.

Signs of the spirit? Small, 30,000-year-old figurines from Germany suggest religious belief.

When it comes to natural phenomena, "we may be intuitive theists," says cognitive psychologist Deborah Kelemen of Boston University (BU). She has shown in a series of papers that young children prefer "teleological," or purpose-driven, explanations rather than mechanical ones for natural phenomena.

For example, in several studies British and American children in first, second, and fourth grades were asked whether rocks are pointy because they are composed of small bits of material or in order to keep animals from sitting on them. The children preferred the teleological explanation. "They give an animistic quality to the rock; it's protecting itself," Kelemen explains. Further studies have confirmed this tendency. Even Kelemen's own son—who "gets mechanistic explanations of everything"—is not immune: At age 3, after hearing how flowers grow from seeds, his question was, "Who makes the seeds?"

The point of studying children is that they may better reflect innate rather than cultural biases, says Kelemen. But recent work suggests that it's not just children: Kelemen and Krista Casler of Franklin & Marshall College in Lancaster, Pennsylvania, found the same tendency to ascribe purpose to phenomena like rocks, sand, and lakes in uneducated Romany adults. They also tested BU undergraduates who had taken an average of three college science classes. When the undergrads had to respond under time pressure, they were likely to agree with nonscientific statements such as "The sun radiates heat because warmth nurtures life."

"It's hard work to overcome these teleological explanations," says Kelemen, who adds that the data also suggest an uphill battle for scientific literacy. "When you speed people up, their hard work goes by the wayside." She's now investigating how professional scientists perform on her tests. Such purpose-driven beliefs are a step on the way to religion, she says. "Things exist

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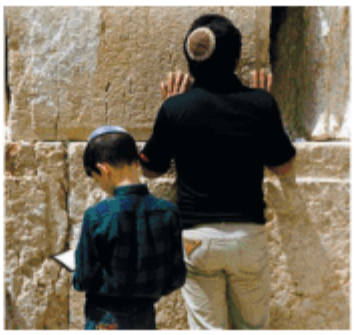


for purposes, things are intentionally caused, things are intentionally caused for a purpose by some agent. ... You begin to see that a god is a likely thing for a human mind to construct."

Other researchers find the work intriguing. "If her data are right, we all from childhood have a bias to see the natural world as purposefully designed," says Barrett. "It's a small step to suppose that the design has a designer."

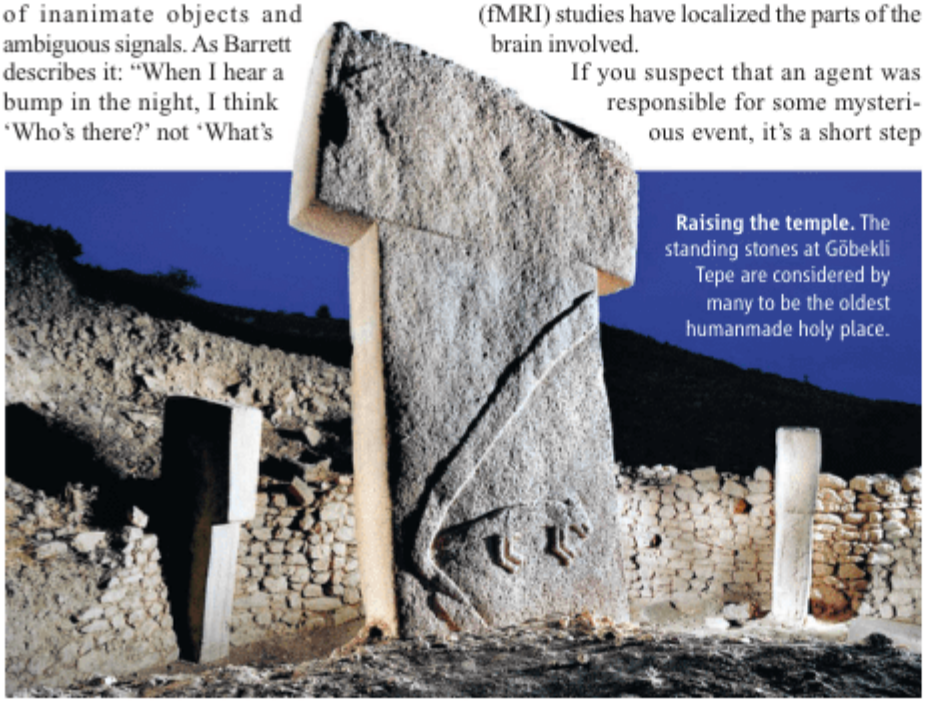
This predisposition to "creationist" explanations has resonance with another tendency in the human mind, says Barrett—something he calls the "hypersensitive agency detection device": looking for a thinking "being" even in nonliving things. In classic experiments in the 1940s, psychologists found that people watching animations of circles, triangles, and squares darting about could identify various shapes as characters and infer a narrative. Anthropologist Stewart Guthrie noted in 1993 that this tendency could help explain religion, because it implies we attribute "agency" to all kinds of inanimate objects and ambiguous signals. As Barrett describes it: "When I hear a bump in the night, I think 'Who's there?' not 'What's there?' ... Given ambiguous stimuli, we often posit an agency at play."

Guthrie suggested that natural selection primed this system for false positives, because if the bump in the night is really a burglar—or a lion—you could be in danger, while if it's just the wind, no harm done.

Of course, this is still a long way from believing in gods or spirits. But a hair-trigger agency detector could work with another sophisticated element of the human mind to make us prone to believe in gods, cognitive researchers say. They refer to what's called theory of mind, or the understanding that another being has a mind with intentions, desires, and beliefs of its own. Studies have shown that this ability develops over time in children and is usually present by age 5; functional magnetic resonance imaging (fMRI) studies have localized the parts of the brain involved.

If you suspect that an agent was responsible for some mysterious event, it's a short step to thinking that the agent has a mind like your own. "Higher order theory of mind enables you to represent mental states of beings not immediately or visibly present, and who could have a very different perspective than your own," says Barrett. "That's what you need to have a rich representation of what it might be like to be a god." (It's also what is needed to have a functional religion, because people need to know that others share their beliefs.) As Darwin put it, humans developing religion "would naturally attribute to spirits the same passions, the same love of vengeance, or simplest form of justice, and the same affections which they themselves feel."

Who made it? Studies suggest that children tend toward creationist explanations of natural phenomena.



Raising the temple. The standing stones at Göbekli Tepe are considered by many to be the oldest humanmade holy place.

Some fMRI studies lend support to this idea. In the 24 March issue of the *Proceedings of the National Academy of Sciences*, a team led by Jordan Grafman of the National Institute of Neurological Disorders and Stroke in Bethesda, Maryland, asked 40 people to evaluate statements about God's emotions and relationships to humans, such as, "God is removed from the world" and "God is forgiving," while they were in an fMRI scanner. The researchers found that the areas that lit up (indicating oxygen uptake and so presumably brain activity), such as the inferior frontal gyrus on both sides of the brain, are also involved in theory of mind. This and other results argue against any special "god region" of the brain as some have suggested, says Grafman. Rather, he says, "religious belief co-opts widely distributed brain sectors, including many concerned with so-called theory of mind."

Other researchers are extending this cognitive model, finding additional thought processes that they say make religious belief natural. For example, Bloom and Jesse

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Bering of Queens University Belfast argue that children are predisposed to think that the mind persists even after the death of the body—something that approaches the idea of an afterlife. Bering showed children ages 4 through 12 years old a puppet show in which a crocodile ate a mouse. Then he asked the children questions about the mouse. Did it feel hunger? Was it still mad at its brother? The children agreed that the mouse's body no longer functioned; it didn't need to eat, for example. But they thought it would still feel hunger; its psychological states persisted. Preschoolers showed this tendency more than older children.

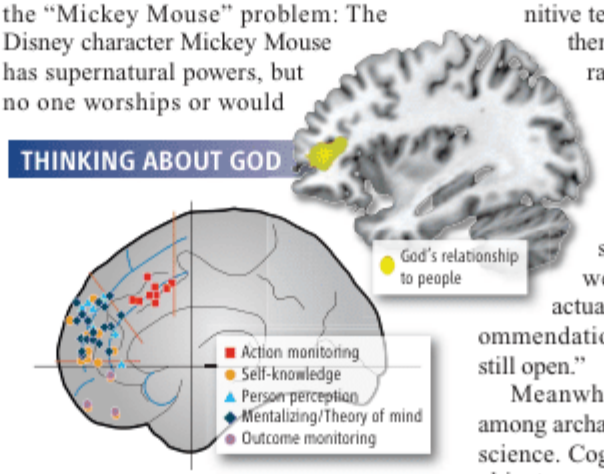
We can acknowledge the death of the body, says Bering, but we believe that the mind continues: "We have this unshakeable sense that our minds are immortal." Bloom notes that this kind of belief "is universal. You won't find a community anywhere where most people don't believe that they are separate from their bodies."

Mind or soul?

Such hypotheses seem to make intuitive sense. But critics such as Paul Harris of Harvard University say that children learn about the afterlife from others. Working in Spain and Madagascar, Harris and colleagues did studies somewhat similar to Bering's, asking children about the physical and psychological states of a person who had died. Older children and adults were more likely than younger children to think that psychological states continued after death, suggesting that ideas of the afterlife are learned. What's more, people in many cultures distinguish between the mind, which learns and changes over time, and something like an unchangeable soul, says Harris. "To say that there is a continuance of mind after death misrepresents these people's beliefs," he says. "I think people are disposed not to dualism but to 'triadism' " of mind, body, and soul.

Even those who embrace the cognitive model concede that more studies are needed to distinguish what is learned from what is innate. As for hypersensitive agency detection, "it's a compelling idea, but I haven't seen lots of empirical evidence that you can get from there to religious beliefs," says social psychologist Ara Norenzayan of the University of British Columbia, Vancouver, in Canada.

Indeed, even if more data are forthcoming, such models are a long way from explaining the complex systems of gods and rituals that make up religion. Cognitive researchers face what has come to be called the "Mickey Mouse" problem: The Disney character Mickey Mouse has supernatural powers, but no one worships or would fight—or kill—for him. Our social brains may help explain why children the world over are attracted to talking teacups, but religion is much more than that. "Deriving belief from the architecture of the mind is necessary but not sufficient," says Norenzayan.



Social circuits. When subjects in an fMRI scanner thought about God's relationship with humans, a part of the brain involved in understanding the thoughts of others lit up (*top right*).

He favors an additional class of explanations for why religion is so prominent in every culture: It promotes cooperative behavior among strangers and so creates stable groups (*Science*, 3 October 2008, p. 58). Other researchers hypothesize that religion is actually adaptive: By encouraging helpful behavior, religious groups boost the biological survival and reproduction of their members. Adhering to strict behavioral rules may signal that a religion's members are strongly committed to the group and so will not seek a free ride, a perennial problem in cooperative groups (*Science*, 4 September, p. 1196).

Norenzayan and others also note that helpful behavior is more common when people think that they are being watched, so a supernatural god concerned with morality could encourage helpful behaviors, especially in large groups where anonymity is possible. Some researchers suggest that cognitive tendencies led to religion, which then took hold and spread because it raised fitness.

But others, such as Boyer, counter that this adaptationist explanation is itself light on data. "It is often said that religion *encourages* or *prescribes* solidarity within the group, but we need evidence that people actually follow [their religion's] recommendations," says Boyer. "The case is still open."

Meanwhile, disciplinary gaps persist among archaeology, psychology, and neuroscience. Cognitive types insist that ancient objects can answer only a small subset of questions, while some archaeologists dismiss the cognitive model as speculation. Yet there have been some stirrings of interdisciplinary activity. Archaeologist Steven Mithen of the University of Reading in the United Kingdom has suggested that the half-human, half-animal paintings and carvings of the Paleolithic demonstrate that early *Homo sapiens* were applying theory of mind to other animals 30,000 years ago. And anthropologists focusing on the development of religion are finding signs of key changes in ritual at archaeological sites like Çatalhöyük. All agree that the field is experiencing a surge of interest, with perhaps the best yet to come. "In the next 10 to 15 years there's likely to be quite a transformation, with a lot more evidence, to give us a compelling story about how religion arose," says Norenzayan.

–ELIZABETH CULOTTA

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