HOMO RELIGIOSUS AND ITS BRAIN: REALITY, IMAGINATION, AND THE FUTURE OF NATURE

by Rodney Holmes

Abstract. "Daddy, is God real or is he a part of people's imagination?" The brain constructs reality by bottom-up, genetically programmed mechanisms. Nature selected the human holistic, symbolically thinking, aesthetic brain using a mechanism of brain-language coevolution. Our religious nature and moral capabilities are rooted in this brain, and in the real images it constructs.

Keywords: brain; evolution; *Homo religiosus*; imagination.

Precious few are the truly fundamental questions dealt with by science: What is the nature and origin of the universe? What is the nature and origin of life? What is the nature and origin of humankind? These questions are truly fundamental in at least two senses. First, they are the abstract groundwork of all that we know. If we knew the answers to them, we would know the essence from which all other properties are derived. Secondly, they are practical root values which motivate and guide. If we knew the answers to them, we would know how to negotiate authentic human lives.

Who are we? is a deceptively simple question, but it is profoundly important to a species which simply does not seem capable of taking itself for granted. In all of the marvelously varied human cultures around the globe, there is not one which lacks stories to account for how people came to be as they are. And for all the richness of these accounts, they all seek to explain how people are in terms of the people's significance in relation to the ultimate forces that shaped them. Perhaps this compulsion to give an account stems partly from the fact that while we are very obviously part of the natural world, we are also set apart from it. Indeed

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every living species has some feature that distinguishes it from every other species; but it is we alone who feel compelled to tell stories about why we are different.

In this article we will take a brief look at our neurological origins to help us appreciate the reality apprehended by the human imagination. Specifically, I try to answer two impossible questions: What neurological resources do we human beings have that give us the abilities to conceive in terms of ultimate concerns and to act in terms of favorable outcomes for others? Although we have fairly good natural science, and sometimes clearly we can imagine the Ultimate, how can we motivate people to take those images seriously? Traditional evolutionary mechanisms do not enable us to do this. Here we derive an answer to these questions from an account of the origins and fundamental nature of human beings: story tellers, narrators, linguistic and aesthetic savants of the natural world.

BACKGROUND

Modern theology, at least since Schleiermacher, has not worried about describing an anthropomorphic God. Rather it has concerned itself with developing an adequate anthropology of that creature which conceives of the divine. Similarly modern biology has always directed its core questions toward fundamental human questions—from Schleiden and Schwann, who defined *life* in founding molecular biology; and Darwin, who attended to demonstrating not so much the physical evolution of humans as the development of their higher mental powers of intelligent history, moral sense, and religiosity; through creative thinkers like E. O. Wilson and Terrence Deacon, who have sought the holy grail of explaining what it means to be human and how we came to be ethical, musical, and poetic.

The evolutionary biologist E. O. Wilson (Wilson 1975) has demonstrated that the binding together of human beings forms one of four pinnacles of sociability among animals. He has shown that each pinnacle is based on fundamentally different mechanisms. Human sociability and human altruism are based, not on genetic identity and chemical exchange (as in the colonial invertebrates), not on genetic relatedness and genetically programmed behaviors (as with the insects and their caste systems), nor merely on milk, animal communication, and memory (as with the other mammals), but rather on uniquely human speech and history. This means that human beings are connected more by story, and not so much by genes reproducing themselves.

To answer our questions we need to discover the brain mechanisms of human sociability. A. R. Luria (1980) has described, in textbook and in biography, the cortical structures necessary for a sense of history and

story making, as well as the disconnection from other people and the loss of a centered self that follows their destruction. Paul MacLean (1985) found that structures in the limbic system that motivate maternal behavior and play behavior among siblings are connected with cortical structures that underlie a certain animal separation call. He believes these neural connections form the basis for humans to make connections with each other, and that they form the basis for human connections with future generations. However, Terrence Deacon (1992) has demonstrated that in evolution, human speech has displaced animal calls neurologically and has become the dominant strategy cognitively. With human speech, symbolic and holistic thought, imagination and ethics, art and poetry have emerged. Furthermore, this abstract thought has itself become the predominant driving force for the coevolution of the human brain, and the content of those thoughts is the basis for human motivation.

Two writers have drawn from these scientific data to make humanistic and theological sense of the human mind. Merlin Donald (1991) traces the evolution of human culture as we evolved from the australopithecines. He describes three radical transitions: in the first, our bipedal ancestor *Homo erectus* acquired a mimetic culture which represented knowledge by intentional mime. In the second, *Homo sapiens* developed spoken language and a mythic culture. Finally humans moved to a theoretic culture in which human biological memory was inadequate to store and understand our collective knowledge; so we developed elaborate symbolic systems of cuneiform, alphabets, mathematics, and art. James Ashbrook has drawn from the neurological work of MacLean and others to locate religiosity in the emotional interconnections of humans with each other, and in the imaginative narrative by which humans bridge the gap to the divine. For Ashbrook the reality of religion rests in the twin aspects of meaning making and object seeking:

> Religious understanding in its unconscious roots suggests there is "more" to God than rationalization of feelings. In its conscious reaches there is the "more" of imagination and mystery. . . . With such a background of knowledge and understanding I link the cry for the other and the bio-cultural womb of human development. Meaning-making arises from the basic experience of separation from a loved object, suffered by all mammals, and, in general terms from the experienced gap between ourselves and our environment. We fill this gap with transitional objects and symbols that reassure us of a basic continuity in ourselves and in the world. These objects and symbols also serve the neurognostic cognitive function of demonstrating what the world is like and what we need to know. Thus we live by faith, as manifested in our pattern-making capacity, and not by literal sight. (Ashbrook 1994)

It is my task to illuminate the reality of those brain images, to ask what stock can be placed in their content, and to ask how we might be

constrained or motivated to act on them. My answer will arrive in the form of a metaphor and a simile. We are a *Homo religiosus*, connected with each other by our narratives about what is ultimately significant. We take these images seriously and feel motivated to act upon them because they are real in important senses: as really as the fly is food to the frog, just as really the fly is a living thing to *Homo religiosus*.

DATA

With this as our starting point, let us examine some of the data in light of what we think religion is. William James, in his 1901–1902 Gifford Lectures, wrote "Were one asked to characterize the life of religion in the broadest and most general terms possible, one might say that it consists of the belief that there is an unseen order, and that our supreme good lies in harmoniously adjusting ourselves thereto. This belief and this adjustment are the religious attitude in the soul. . . . All our attitudes are due to the objects whether really or ideally" (James [1902] 1990, 36, 42). I wish to extend William James by offering a neuroscientific justification of the reality of religious objects in an order that is not unseen but is precisely that order seen by human beings and technically by *Homo religiosus*.

The data are addressed by three questions:

1. How does the brain work? The brain constructs reality by bottom-up, genetically provided mechanisms.
2. What is our heritage? Our genealogy traces our origins to archaic hominids that were kin to Mitochondrial Eve and the Neanderthals, and to their great-grandmother, australopithecine Lucy. The evolutionary precursors of contemporary human brains are correlated with cognitive and cultural evolution, which has been studied and recently popularized by historians of religion and cognitive scientists.[1]
3. How do we interpret these data? Or what is the myth of our origins? We analyzed these data by extrapolating between what we know about our neurological and cultural ancestors, our cousins the great apes, and ourselves as know by linguists, neurologists, and creative expressors of human experience. From this I conclude that we remain fundamentally a *Homo religiosus*, and that there is a naturalistic justification for the reality of our interpretation of ourselves as integral with ecology (which also can be referred to as "Nature").[2]

1. HOW DOES THE BRAIN WORK? The brain's workings are best explained by looking at the paradigmatic system about which we know the most, the visual system. This précis is based on the 1981 Nobel Prize lectures of Hubel (1981) and Wiesel (1981). They showed that the neu-

rons of the mammalian visual system are connected so as to construct perceptual categories such as line, orientation, movement, and depth. This means that there is not a Platonic line that is eternal, ideal, and more real than any material manifestation; rather line is a perception that is constructed by brains like ours. Furthermore, Hubel and Wiesel showed that there are "critical periods." That is, there are genetically determined times when the brain must receive appropriate sensory stimulation in order for its neuronal connections to be formed so as to accurately perceive the world around it. This means that bipolar ways of thinking about nature versus nurture are both passé and misleading.

Does a worm to every other brain look the same? In a word, No. In frogs and birds visual information courses from the retina to a structure called the optic tectum. The information is processed in a straight-through manner that produces an image that looks to us like a mosaic. Furthermore, frogs have a flicker-fusion rate that is eight times faster than ours. Hence even without the help of binocular vision they discriminate fine movement much better than we do. Frogs and birds are keenly aware of distance and movement. They are so aware that a frog can catch a fly with its tongue and a bird in flight can catch an insect. These same maneuvers would appear comical if attempted by humans. Mammalian brains, beginning in the retina itself, are hardwired much differently, so they not only discriminate but also accentuate borders. Although our optic nerves send a few branches to a brain structure that corresponds to an optic tectum, the vast majority of the fibers from the optic nerve terminate in a multilayered structure called the lateral geniculate nucleus. This structure processes the information and sends it to a multilayered primary visual cortex. This in turn processes the information and sends it to an association cortex.

Kuffler (1953) showed that two categories of information leave the retina: They are tiny fields of on-center with off-surround (like stars in the night sky) and off-center with on-surround (like periods on a page). Hubel (1981) and Wiesel (1981) showed that in cats and monkeys, this information is processed in the lateral geniculate and cortex into the fundamental categories of light or dark lines, of precise length, of precise orientation, moving in precise directions. These most rudimentary categories of mammalian vision are not found in bird brains. Charles Gross, Edmund Rolls, and their collaborators (cited in Kandel, Schwartz, and Jessel 1991) have shown that single cells in the primary visual cortex of monkeys respond to monkey and human faces. Colwyn Trevarthen (1990) has found the human face (a particular complex of these lines) to be a fundamental category of meaning in the human infant. And more recently, researchers have demonstrated that specific cells in the primary visual cortex can respond to "illusory contours," that is, they describe

borders where no contrast exists (Shapley et al., reported in Winkelgren 1992). Most of these authors have correlated the appearance of these categories with precise (within days) genetically programmed stages of neurological development following birth. Jerrison (1976) concludes from neuroscientific studies that we know unequivocally that all species have brains which *make* meaning. But as we see, the categories of meaning depend upon brain structure. Hence the meanings made are not the same. Neuroscience is leading us not away from, but toward, asking about the kinds of meanings humans make.

2. OUR HERITAGE IS THE STORY OF THE EVOLUTION OF THE HOMINIDS, AND THE EMERGENCE OF SAPIENCE AND CULTURE. We look to the tortuous stories of hominid beginnings just as we would to any family tree, trying to understand why we are as we are. The hominid family originated 10 to 5 million years ago from a single species, according to the proponents of Mitochondrial Eve. As with other evolutionary families, we diverged into a number of variations. A number of hominid species coexisted at given times much as several species of primates coexist in African forests today. The current scientific literature on hominid ancestry is proliferating, and scientific debates are raging over exact dating, numbering, taxonomy, and theories about what happened to various hominid species.[3]

It is safe to say that there have been at least three hominid species, and quite possibly more than six. The first apes lived some 30 million years ago, and the common ancestors to African apes and to our lineage of hominids lived 10 million years ago. From them we diverged into the modern apes, whose bodies and brains have remained virtually unchanged, and into the australopithecines. Our roots trace from the genus *Australopithecus.* Most scholars agree that the genus *Homo* came from them. Here is a brief description of the family story from one species of *Australopithecus* through the three primary species of hominids, including modern *Homo sapiens.* The story is of a genus whose bodies attained upright posture. It eventually left its niche to live in hostile environments. Furthermore, the hominid line evolved a larger brain much faster than any mammal had done before. The bearer of that brain eventually became a holistic and symbolic thinker.

Australopithecus afarenis. *A. afarenis* lived from 4 to 3 million years ago. It flourished just after the common ancestor of us and the apes had lived. *A. afarenis* was a short-statured, bipedal species that moved from the tropical rain forests to the tropical savanna. Lucy, as she has been named, had a brain size of 400 cm^3 and an encephalization quotient (EQ) of 2.5.[4] Modern chimpanzees, orangutans, and gorillas have equivalent brain sizes. Therefore for our purposes we can approximate Lucy's

intellectual capacity by looking at the tremendous literature that exists on monkeys, chimpanzees, and other apes.

Homo habilis. *H. habilis*, which lived from 2.3 to 1.7 million years ago, is traditionally the first species called human: *Man the toolmaker.* Modern biology recognizes tool use by crows, sea otters, and regularly by chimpanzees. But it also recognizes a qualitative difference in the human use of and dependence on tools. Habilines were omnivores that displayed a tremendous increase in intellectual capacity with their brain sizes of 650–800 cm^3 and EQ of 3.1. *H. habilis* (*habilis*: hand or able) used stones to chip tools. The way habilines used tools, and their tool kits, indicate an ability to conceptualize that chimpanzees do not display. Furthermore, we can tell from those kits and chips that most habilines were right-handed, just as we are today. Since handedness is a function of the brain's lateralization, their right-handedness further indicates a brain becoming more like ours.

Homo erectus. *H. erectus* lived from 1.8 million years ago until 0.5 million years ago. This was the tropical human who eventually moved out of the tropics to the colder climates in the modern country of Georgia. It is generally believed that a continental shift of Africa separated these hominids from their home in the tropical forests and sent them to a new environment on the plains. The plains exerted a tremendous selective pressure that resulted in upright posture, with its attendant shift of the skull to facilitate distant vision. With upright posture came major shifts in the pelvic anatomy to support the new weight. But upright posture also produced a birth canal that did not fully accommodate childbirth. When a species pays a terrible price of infant and maternal mortality, evolutionary biologists are led to ask, What was purchased? The answer is a much larger brain. The pressure of the new environment selected a brain size of 850–1,000 cm^3, with a tremendous EQ of 3.3. *H. erectus* made and used more sophisticated tools, used fire, and developed a significantly more complex social structure.

Homo sapiens. *H. sapiens* comprises anatomically modern humans, who have lived from 80,000 years ago until the present. They have enjoyed a tremendous increase in cranial capacity, with a brain size of 1,100–1,400 cm^3 and an EQ of 5.8. With this newfound intelligence came a florescence of cultural artifacts. Most notably, the creative explosion of cave art by our Cro-Magnon ancestors thirty thousand years ago marks the unmistakable appearance of human fine art, symbolic thought, storytelling, and social life. Two striking contrasts mark how far we had come: The engraved figures and ornamented tool work is of a dramatic quality far beyond that of the chipped tools used by the habilines. The

other is our recognition of the significance of death.

Homo sapiens neanderthal. *H. sapiens neanderthal* is seen by many paleontologists as an extinct local side branch of our immediate lineage. *Neanderthal* lived from one hundred and thirty thousand to thirty thousand years ago. The name comes from the European valley of that name. They came across the northern and southern Mediterranean regions into modern day Saudi Arabia, Israel, and Iran. Enjoying a brain as large as or perhaps even larger than our own, they made magnificent tools using locally obtained materials. They lived in caves sometimes, constructing cooking hearths, and they also camped in the open. Over a period of a few thousand years, we displaced them from their niche, apparently because our brains were better wired for modern human living. Missing from their behavioral repertoire were elaborate burial of their dead, bodily ornamentation, subtle tools made from multiple materials obtained from distant sources, complex hunting methods, complex use of fire, art, musical instruments, and symbolic notation. But their burial practices have captured the imagination of historians of religion, who mark them as the harbingers of modern religions.

Historians of religion, including Mircea Eliade and Joseph Campbell, have told and popularized the story of *Homo religiosus* (Eliade 1978, 1959 inter alia; Campbell 1968, 1977, 1988 inter alia). Campbell identified *Homo religiosus* on the basis of these Neanderthal burial sites, first dating from seventy thousand years ago. Skeletal remains of Neanderthals show two things clearly. First, Neanderthals did inter their dead. Second, they cared for their living. Remains of a youth and of one forty-year-old man who had suffered major skeletal injuries show that Neanderthals nurtured and cared for their people in ways that were unprecedented in our lineage. But what rightly impresses Eliade and Campbell is that by the unprecedented act of burying their dead, Neanderthals recognized a significance in death. Jane Goodall reports tremendous depression in chimpanzees following the death of a loved one (Goodall 1986). She shows a photograph of a mother chimpanzee whose infant had died of polio. In obviously deep grief, she carried her dead infant to Goodall. She eventually returned to the forest, dropped her infant, and, still grieving, returned to follow Jane Goodall. However deep and genuine are the depression and grief, chimpanzees do not inter their dead. The larger-brained *H. sapiens* do inter or bury their dead, ascribing a symbolic significance to death beyond their personal feelings and the physical needs of protection from predators. While Eliade's findings of universal categories and intentional obscuring of genuine differences in hominid species may not have withstood anthropological critique, and while Campbell's discovery of Freud in every cave may not make postmodern, decon-

structionistic sense, they both have clearly demarked the emergence in our species of a fundamentally religious character.

The key to the hominid story is that with each major increase in the functional ability of a hominid species, there is a major increase in cranial capacity.[5] Each hominid takes its name from its new proficiency: able tool user, erect explorer, and wise deliberator. The significance of each new ability is understood better in terms of neuroanatomy than in terms of the skeletal anatomy of each hominid. In the details of this story one can see an emergent human character: intelligent, conscious, imaginative, and religious.[6] Significant events of the human phylogeny are not merely coincidental with but are correlated with significant increases in the size of the cortex during the recent evolution of the human brain. Consider that *Homo erectus* was not kicked out of the Garden of Eden. She was a tropical species that deliberately strode out, leaving the tropics thousands of miles behind her, overcoming her environment for thousands of years by using her intellect. Consider that with the last great increase in brain size, our archaic brothers interred their dead and later created and decorated tools, drew art, and made music. As anatomically modern *Homo sapiens sapiens* evolved, the human realities of intellect, consciousness, and religiosity emerged. The neurological seat of none of these realities can be defined, for they are not specific activities. The most reductionistic statement that can be made about them is that they are methods of handling knowledge as a whole. While their emergence is correlated with the evolution of the cerebral cortex, this does not necessarily imply that the cortex is the seat of the soul. It does mean that a functioning cortex (and subcortical structures) is necessary for intelligent, conscious, religious activity. But most significantly it took a being that understands itself as intelligent, conscious, aesthetic, and religious to turn its vision back on the empirical book of nature, to bring its values to its inquiry, and to see a real unity in ultimate terms.

How do we interpret these data? We interpret them by connecting clusters of points of information. The five clusters are

1.	Australopithecine Lucy	Neurological precursors of human brains
2.	Nonhuman primates	Their brains and expressions
3.	Bones, artifacts	Biological and cultural record of our ancestry
4.	Mitochondrial Eve	150,000 years ago; together with archaic *Homo sapiens*, including *H. sapiens neanderthal*
5.	Modern humans	Brain damage, linguistics, creative expressions of human experience

The story of our origins and the myth of what we are fundamentally is a narrative, a human construction of all that we know. Every month information on DNA, skeletal remains, and site artifacts fills the pages of scientific journals, and modifications of our ideas of our evolution from the australopithecines are hotly debated. From Charles Darwin through modern textbooks of psychology, we have accumulated a rather good idea about the cognitive strategies of monkeys and the great apes, together with precise maps of their brains. The bones and artifacts, the burial sites and cave paintings, provide a concrete record of our ancestors, a record whose interpretation remains ambiguous but exciting. And from the neurological archives on brain-damaged patients, from linguistic studies of normal and impaired children and adults, and from poetic and artistic expressions of consciousness, we have technically precise accounts of human experience. It is from all these and more that we must draw to paint the picture of the reality of human thought.

What did Neanderthal and Mitochondrial Eve think? We don't know exactly what. But from these data we surmise that she had available to her the functional categories which characterize holistic, symbolic thought:

topic / comment
old / new information
given / new information
rheme / theme
figure / ground
static / dynamic element
primary / secondary topicalization

We also know that the perceptual functions of a nonlinguistic brain are fundamentally different from those of a linguistic brain. We know that since she did not write, she authored neither *Wuthering Heights* nor *Middlemarch*. He painted, but not the Mona Lisa. She almost certainly sang, but mercifully not "Like a Virgin." As the hominid descended from Lucy to Eve, her prefrontal cortex coevolved with her creative thought, and her appreciative consciousness of life and death, animus of animals, good and evil, and the beautiful and the ugly emerged. Hence she also became able to act on each of these things in itself as a basis of motivation for her actions. It is also now clear that a Darwinian struggle for existence is insufficient as a driving force for the evolution of such a brain.[7]

The modern hypothesis is that the mechanism is *coevolution*, where the evolution of the brain is driven by feedback of emerging linguistic, historical, and religious functions. But the defense of these hypotheses is a matter best left to their authors.[8]

SUMMARY AND CONCLUSION

We have looked at three bodies of data: (1) The brain constructs reality by bottom-up, genetically provided mechanisms. (2) Our genealogy traces our origins past Mitochondrial Eve to her great-grandmother, Australopithecine Lucy. (3) The evolutionary precursors of contemporary human brains are correlated with cognitive and cultural evolution, which has been studied and recently popularized by historians of religion. These data are analyzed by extrapolating between what we know about our neurological and cultural ancestors Lucy and Eve, our cousins the great apes, and ourselves as known by linguists, neurologists, and creative expressors of human experience. From this I conclude that we remain fundamentally a *Homo religiosus*, and there is a naturalistic justification for the reality of our interpretation of ourselves as part of ecology (a.k.a. Nature). How should we think about the significance of this for the future?

First, from our knowledge of how the brain constructs reality, we may conclude that there are realities that are not material: They include social reality, psychological reality, and metaphysical reality. It is a fundamental mistake to try to reduce them to material reality.

Second, I have gone out on a short limb and claimed that *Homo religiosus* emerged as recently as Neanderthal. I based this on burial sites dating from some seventy thousand years ago. Neanderthal is the first neuroanatomically modern *sapiens*, which means Neanderthal had virtually all of the brain that we enjoy, although it may have differed in some details.[9] And I believe that the interpretation of death as a meaningful event is a religious view that is correlated (and not merely coincidental) with the evolution of the neocortex.

Third, and most important, this excursion in evolutionary biology has told us the same thing that humanists and modern theologians have told us: We are makers of meaning. It follows from the biology that we had to be the religious human being that we are today before we could look at the text of human natural history and interpret it in terms of Ultimate Reality. This means that we construct reality with the brains that we have. These brains enable us to see things differently than bird brains enable them to see. We see worms not as food, but *as living things*. With James Ashbrook (1994) we see "life in every cell." Or with Paul MacLean, we see the purpose of family and connections emerging through evolutionary process and flourishing in human beings.

If we knew everything there is to know about the structural and biochemical information of the brain, from these material data alone we still could not predict self-reflexive phenomena like consciousness and language. Nothing about the therapsid (mammal-like reptile) brain considered without the knowledge of primate brains would predict that

human consciousness would emerge millions of years later. On the other hand, the meanings that are constructed by human intellect illuminate the significance of what was there and evolving in ultimate terms. Harry Jerrison (1976) found in the paleoneurological record that mind was emerging and that reality is a creation of meaning makers. The meanings made are "as real, in a fundamental sense, as the immediately experienced [material] real world." MacLean found the ultimate significance of reptilian communication displays and of primate separation calls when he interpreted the meaning of the human family way of life, on the one hand, with its deep pain of human loneliness and separation from loved ones, "in the end, the utter isolation of death," and on the other hand, "our greatest warmth of companionship . . . that seems to be goading us toward communication with other beings in the universe" (MacLean 1985, 415).[10]

In short, I have claimed that everything we have to say about material reality is theorizing that is done by human makers of meaning. Statements about other realities, especially ultimate statements, cannot be logically derived from material reality only. As religious beings, we interpret in critical, nonmaterial terms what is ultimately and absolutely coherent and real. Borrowing terms which were shared by Wolfhart Pannenberg, Charles Hartshorne, Paul Tillich, G. W. F. Hegel, and Plato, we would say that religious beings take concepts of absolute reality, absolute entity, and the ground of being itself and interpret the material, psychological, and social realities that we see in the largest possible terms — the largest possible whole. These religious concepts form the critical principle that unifies our percepts into an understanding of what is ultimately real. In the end this religious understanding is a hermeneutic of the text of nature and human ecology that shows us what is most real.

Finally, we are ontologically the religious savants of the living world. Our capabilities of language, history, future, and gestalt are linked to, but not reducible to, particular structures and functioning of the peculiarly human brain. Once we had these tools we used them: A. H. Maslow said, "If the only tool I have is a hammer, I treat the world as a nail" (quoted in Ornstein 1973).

As the bird brain can construct no lines because it has no lateral geniculate nucleus, so a fly can be only food to the frog but not a living thing because the frog has no cortex. And although the chimpanzee knew and grieved for her dead infant, it never occurred to her to bury the infant—precisely because it *could* not occur to her.

Once *Homo sapiens* was neurologically capable of understanding particulars in relation to wholes, of imagining realities other than as they are, and of seeing material realities in terms of significances that ex-

ceeded their Cartesian limits, *Homo sapiens* thenceforth *did* so. We became scientific and aesthetic, mathematical and musical, moral and religious. We have never been naively realistic. We came already equipped with more access to meaning than mere social pride and prejudice. *Homo religiosus* has human ecology.

What stock can be placed in modern constructions of nature and of human cultural systems? First, we know that the brain that makes this science was naturally selected. Hence what it does has a fundamental root in reality and is fit for a real environment. Second, we know that our images of an ultimately inseparable human and natural ecology and our projections of the future of that ecology are in themselves sufficient motives for human action. Less optimistically, we know these Janus figures have other faces. We know that the specific content of our brain's theories and imaginations is not subject to natural selection because the environments of these constructs changes too quickly for genetic mechanisms to operate. We also know that although our most noble dreams and aspirations can motivate us, they do not always motivate us. Regardless of how realistically our brains may scientifically describe and ideally prescribe our future, these ideas do not constrain us to act in a way that will naturally select a sustainable future.

Much work remains to be done. I have shown that only because William James was ahead of his time was he unable to prove that the unseen order is seen by *Homo religiosus*. If hope is one of those emergent gestalts of human cognition, which combines a sense of future, an imagination of things as other than how they are immediately present to the senses, and a belief "that our supreme good lies in harmoniously adjusting ourselves thereto," then hope itself is a real motive for the future of *Homo religiosus*. The way we must, with Nature, cocreate a sustainable future is by elevating to normative power our enduring (but not fool's) hope, our rapidly evolving scientific visions of material reality, and our ambiguous and ambivalent visions of psychological and social realities—all these percepts unified into an understanding of what is ultimately real. This is what narrative does. In the end, this religious narrative is opaque to us as a story, but it is the hermeneutic principle of the text of human ecology that we live by.

For *Homo religiosus*, hundreds of millions of years of negotiating with nature the matrix of her anatomically modern brain has earned her (to borrow from Virginia Woolf) £2,000 per year and a room of her own in which to contemplate things in themselves. There she may contemplate the precious and few scientific questions and write about them as they really are. Ultimately our hope depends on the power of her myth.

NOTES

1. Mircea Eliade coined the term *Homo religiosus* to cover all the archaic hominids and Cro-Magnon *Homo sapiens* and to define a kind of culture which is now archaic. Tom Lawson has used psychology to talk about religion. And Robert N. McCauley has used anthropology to criticize Eliade in *Rethinking Religion: Connecting Cognition and Culture* (Lawson and McCauley 1990). Merlin Donald has offered a gracefully written and most insightful and comprehensive account in *Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition* (1991).

2. "By ecology, we mean the body of knowledge concerning the economy of nature—the investigation of the nature—the investigation of the total relations of the animal both to its organic and to its inorganic environment; including above all, its friendly and inimical relations with those animals and plants with which it comes directly or indirectly into contact—in a word, ecology is the study of all the complex interrelations referred to by Darwin as the conditions of the struggle for existence" (Ernst Haeckel [1870] quoted in Ricklefs 1976). To conceive a whole, called *Nature, Environment,* or *Ecology,* requires holistic thinking, or the ability to form gestalts. It is this ability that emerged from the evolution of the *Homo sapiens* brain and is a fundamental ability that is necessary to evaluate things in terms of ultimate significance. This is the essence of *Homo religiosus.*

3. My account is drawn from many sources. Primarily I draw from and highly recommend evolutionary biologist Roger Lewin's very accessible *Human Evolution* (1993) and Ian Tattersall's *The Human Odyssey* (1993). The latter is a beautifully illustrated book based on the spectacular new Hall of Human Biology and Evolution at the American Museum of Natural History. Further perspective and profitable reading come from the authoritative *Cambridge Encyclopedia of Human Evolution* (1992; ed. Jones, Martin, and Pilbeam), and from the anthropological synthesis in Richard Klein's *The Human Career* (1989).

4. *Encephalization quotient:* A way of comparing brain sizes across species which have different body sizes. EQ is a ratio of brain weight to body weight.

5. *Anatomy and Physiology:* The law that a form underlies every function is a metaphysic and a fundamental principle of modern biology. A correlation of form and function, in the strong sense of a cause-and-effect relationship, constitutes an adequate explanation of biological phenomena.

6. *Emerge:* Many authors speak of "emergent properties" such as "consciousness." What does it mean to emerge? "1. To rise by virtue of buoyancy from or out of a liquid. 2. To come forth into view, issue, appear from concealment. 3. An unforeseen occurrence. 4. *Science.* That which is produced by a combination of causes, but cannot be regarded as the sum of their individual effects; opposed to resultant." (*Oxford English Dictionary,* 2d. ed., s.v. "Emerge.").

7. Karl Popper, in *The Logic of Scientific Discovery* (1972), has reasoned that scientific theories are necessarily "underdetermined" and that scientific facts are necessarily "overdetermined." This is why the ultimate causes of evolution (survival of the fittest) may not adequately account for particular phenomena, such as why the hominid brain evolved the way it did. Rather two species may be fit for survival, but the proximal causes of evolution (local conditions) may account for particular traits. Popper's insight into the nature of facts and theories in science might predict corresponding kinds of errors if a theorist relied too much on facts and proximate causes, or on theories and ultimate or distal causes. Geneticists and sociobiologists may concentrate too much on theory and distal causes. They commit errors of underdeterminism by concluding that the human organism is essentially a "carrier of the genes" or a "reproduction machine." The fundamental theoretical problem for the sociobiologists then becomes accounting for the fact of altruism in the species. Humanists and neuroscientists may concentrate too much on particular facts and proximal causes. They commit errors of overdeterminism by concluding that a human being is essentially linguistic, historical, poetic, esthetic, or religious. The fundamental theoretical problem for the humanist is to show how this essence is natural. It appears to me that the best solution is a scientific theory of coevolution.

8. Unquestionably the biologically most cogent account is Terrence Deacon's "Brain-Language Coevolution" (1992). This paper and Deacon's forthcoming paper in *Zygon* argue for using small steps in constructing evolutionary cause and effect.

9. This statement brings to a head the problem which has been raging again for the last five years: Are we distinct from Neanderthal? Evolutionary biologists generally assert that even if we are distinct, Neanderthal is neuroanatomically modern. That said, some evolutionary neurobiologists believe that there were small differences in the brain connections which enabled us to outcompete Neanderthal.

10. "Daddy, is God real or is he part of people's imagination?" my eight-year-old daughter asked. "I am having a hard time praying: When I pray, nobody ever answers."

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