

THE HUMANIZING BRAIN: AN INTRODUCTION

by James B. Ashbrook† and Carol Rausch Albright

Abstract. The rediscovery of the sacred needs to take into account the neural underpinnings of faith and meaning and also draw on the insights of the emerging discipline of complexity studies, which explore a tendency toward adaptive self-organization that seemingly is inherent in the universe. Both neuroscience and complexity studies contribute to our understanding of the brain's activity as it transforms raw stimuli into recognizable patterns, and thus "humanizes" all our perceptions and understandings. The brain is our physical anchor in the natural environment—and its human capacities orbit us into the emerging world of culture (including religion), which provides a template for the brain's function of making sense of an ambiguous reality. The humanizing brain holds together scientific causality and religious meaning, working both bottom-up (linking the physical and the experiential) and top-down (beginning with the whole of things, or God). These processes we know as "mind" (experienced as intentionality, subjective consciousness, empathy, imagination, memory, adaptability). We maintain that such processes are not only subjective but built into "the way things really are." Thus, they carry the most privileged information about the nature of reality to which we human beings have access. For not only are we humans observers and logicians, but we are embedded in the larger reality; and as we strive to make sense of it all, we become both *Homo sapiens* and *Homo religiosus*.

Keywords: brain-mind; complexity theory; God; meaning; neurobiology; religious faith.

James B. Ashbrook† was Professor Emeritus of Religion and Personality at Garrett-Evangelical Theological Seminary, Evanston, Illinois. He died on January 2, 1999. Carol Rausch Albright, a scholar and writer, is Co-Director of the Southern Region of the John Templeton Foundation Science and Religion Course Program; her mailing address is 5415 S. Hyde Park Avenue, Chicago, IL 60615, and her e-mail address is Albright1@aol.com. This article is taken from their book *The Humanizing Brain: Where Religion and Neuroscience Meet* and is used with permission of its publisher, The Pilgrim Press, 700 Prospect Avenue East, Cleveland, OH 44115.

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INTRODUCTION: TOWARD A NEUROBIOLOGY OF MEANING

In a surprising turn of events, people are calling for a rediscovery of the sacred. The pieces of life lie scattered across the landscape of existence. Only a recovery of a deep sense of inherent order and wonder can bind up the brokenhearted.

We join that rediscovery process, but with a unique approach. We explore the neural underpinnings of our human need for meaning. These brains of ours make us unique in the world—yet their operation also demonstrates our kinship with the rest of the universe.

Aldous Huxley once observed that we “ought to be able to talk about a mystical experience simultaneously in terms of theology, of psychology, and of biochemistry” (cited in Taylor 1979, 17–19). We assume there are correlates among physiological activities, cognitive processes, and symbolic cultural expressions (Cacioppo 1992; Cacioppo and Tassinari 1990; Cacioppo and Berntson 1992; Tillich 1963). We explore possible cultural parallels, symbolic affinities, and central tendencies in relation to neurophysiological processes.

To this task we also bring insights contributed by the emerging discipline of complexity studies. *Complexity* in this context does not mean “complication.” Complexity here refers to the insight—across the spectrum of the sciences—that a tendency toward *adaptive self-organization* is inherent in the way the universe is put together. A complex system is organized within itself and adapts continually to its environment.

The human brain is the most complex entity, for its size, that we know of in the universe, and for that reason we see it as a premiere expression of the central tendency toward complexification in our universe. We believe that explorations of the nature of our brain can help us better to understand “the ways things really are”—in our brain and in our world.

In this exploration, we keep in mind that there are many ways to describe reality, and no one way is privileged to the exclusion of other ways. Perhaps, in the end, the languages people use are the languages with which they are most comfortable and in which they are most competent. Our own most comfortable language is religious, in accents of the Judeo-Christian tradition that has shaped our life experiences. Our secondary languages are those of the sciences, particularly cognitive neuroscience. The languages of other religious traditions and other disciplines are the “native tongues” spoken by some. We believe that these many languages are basic to knowing what matters to us as human beings, and we use them in our exploration here.

For us, religion expresses human meaning and human meaning seeking. Religion expresses humanity’s drive to make sense of its changing, challenging, confusing world. The era of the brain opens up a fresh perspective on this seeking of meaning. New imaging technology is now catching

the brain in the very act of thinking; new analytical techniques provide a better picture of how it all operates. Historian of science Anne Harrington refers to this as “the neurobiology of meaning” (Gewertz 1995).

We write with the conviction that humanity is finding ways to heal the disruptions in its midst. The splits between religion and science, between inner experience and objective observation, between imaginative interpretation and empirical explanation have been the curse and the grandeur of the modern era. But we believe these splits are at last on the threshold of being modified. The rediscovery of the sacred carries a new wealth of possibilities.

BRAIN RESEARCH AND RELIGIOUS UNDERSTANDINGS. In this book we explore ways in which the workings of the brain correspond with people’s understanding of the divine. People have described God as ever present, God as nurturing, God as meaningful, God as purposeful. We correlate these perceptions with various features of the brain’s operation. Some would take these correlations as evidence that the concept of God is a mere projection of human experience. We readily acknowledge that the brain necessarily “humanizes” all perceptions, indeed all cognition. The brain transforms raw stimuli into recognizable patterns. It does so because we humans have an inborn need to make sense of experience, to look for relationships, to identify causes and effects. (Figuring these things out has, of course, helped the species survive and multiply.)

Along with a constructionist view of reality, we also take the stance of a critical realist. We argue that the brain’s perceptions do tend to have referents in reality, and this also applies to our religious perceptions. Further, believing that our universe has evolved, we place our speculations in a framework of evolution. We claim that human thought and our ideas about religion and God are there because they have survival value, and that they have this value because they contain elements of truth.

In what follows we relate various images of God and religion to the evolution of the brain and the varied ways in which it works. Our approach, therefore, is one of convergence and overlap among technical disciplines. We combine the languages of religion, whether understood in broad cultural terms or in narrower theological categories, with neuroscience talk to make sense of religion. As an additional help, we draw on the insights of the new discipline of complexity. We are not out to convert anyone. Rather, we use these various languages to help seekers and believers like ourselves understand the mystery of meaning more fully.

Neurophysiologist Rodney Holmes points out that we must think of the human being as *Homo religiosus*. We are, and apparently always have been, creatures who respond to a larger meaning-making universe than we ourselves can create. Archeological evidence of religious observances indicates that we have been religious for as long as we have been *Homo sapiens*,

perhaps longer—even in the clouded past of our pre-*Homo sapiens* ancestors (Schmitz-Moormann 1995).

God-talk is really human-talk, since it is we who are conversing. In another sense, though, we can distinguish human-talk. Human-talk focuses on the mechanisms, the motives, and the meanings of human persons and human communities. We use it to explore the ramifications and implications of the human context for religious meaning.

Despite insistence to the contrary, all theology uses other languages in order to express the mystery of the universe. No talk of God can be without reference to that which we know directly. What we know directly is always inseparable from the culture of which we are a part. We cannot know or speak of God as something—a Being, even Being itself—without connection to human consciousness. That makes the issue of God and religion an interpretive one—a matter of framing experience and evidence in meaningful ways.

In technical terms, theology is a hermeneutical discipline. It uses whatever data are available to describe God and what God is about. Those data come from nature, from human relationships, and from historical events. The data people choose are somewhat arbitrary. They grow out of people's own particular interests, background, and competencies. Even so, everyone attempts to make sense of as much information as possible. In short, everyone interprets experience. We ourselves have been molded and taught by the Judeo-Christian tradition—its historical accounts, reflections, metaphors, and myths. In our discussion we will refer particularly to key accounts from this tradition because of the weight they have inevitably assumed in our own “humanizing” of experience. Without them, *we* could not be ourselves.

We assume that the human brain bridges the imaginative and the physical realms in ways that are uniquely personal. Therefore, we believe neuroscience deserves more attention in this task of “making sense of God” than physics or philosophy. Physics is more physical and rational but less personal; philosophy is more rational and personal but less physical. Only studies of the brain-mind require us to explore both the physical and the personal simultaneously. The phrase “making sense” embraces both symbolic thought and the apparatus for processing that thought. We make sense with our mind and we make sense with our body, particularly its brain. Neither mind nor body makes sense by itself!

We believe that the brain reveals a basic and universal structure that underlies all belief systems. It matters not whether those systems and world-views are explicitly religious. The “new brain”—technically the neocortex—found in primates, especially humans, creates culture. Culture is the system of information passed from one generation to the next, not by genetic inheritance but by teaching. We ourselves find it clarifying to distinguish between that deep and necessary subcortical structure undergirding

meaning seeking—technically the old brain—and the surface and necessary cortical expressions of culture with which we surround ourselves.

UNRULY MYSTERY. Despite ancient and widespread perceptions of the divine, the reality of God remains elusive. Humans seek God's presence even as they fear God's absence. We see religion as attempting to bridge this gulf, to hold us steady even if God seems unavailable. Religious practices provide useful guidance. They represent the "well-winnowed wisdom" that has evolved through eons of time (Campbell 1974; Burhoe 1981). Religion presents ways of behaving and relating that enable people to live together in relative harmony and productivity. (The exception comes when people confuse *their* understanding of God with *God*, thereby engaging in such fanatical behavior as heresy hunts, political persecutions, and assassinations.)

We believe an expanded religious understanding can hold promise for the future. From the farther reaches of the globe to the most intimate alleys of the neighborhood, people shudder with the violence of extremism. Religious fanaticism saturates that extremism even as political ideology justifies it. At the same time—from a growing commitment to nurturing nature to the intense longing for personal centering—people search for spiritual roots. The forces of disruption struggle with the drive to connect. Religion, like the city of Jerusalem itself, both tears people apart and draws people together. While the outcome is uncertain, the dynamic is clear. We must rediscover the sacred if we are to deal constructively with the politico-religious issues of our time.

LINKING THE EXPERIENTIAL AND THE EMPIRICAL. We start with the whole. Think of the whole as the gestalt of grace, the universe in which we find ourselves, the universe of influences of which we are a part and with which we interact. That means we start with religion and that with which religion deals, namely, God. This is an orientation, varied as its expressions are, that assumes the relatedness of regularities and a relatability of emerging possibilities. We live in an open system, self-organizing in its creative processing (Davies [1987] 1989). Looking to the past, we draw upon the religious traditions we have inherited. Looking to the future, we see religion affirming the venturing, the risking, the yet-to-be-realized surprises of life itself.

We want to be up-front about our own vantage point. We resist the religious forces of ideological restriction. Such restriction interprets religion in a doctrinaire way. Its propositions are absolute. It designates who and what are "right" and who and what are "wrong." It obsesses over what is "orthodox" and what is "heretical."

We ourselves have been shaped by the time-tested character of the more generative aspects of the Judeo-Christian tradition. While we take the

empirical evidence of the neurosciences with utmost seriousness, we recognize that our orientation is derived from this religious tradition. In contrast to an absolutist view of tradition, we want to reenliven religion. We conceive of this reenlivening as shifting from religious ideas back into human experience. Most of all, we hope to return to religion's sensibility by means of the explanatory evidence of the neurosciences, enriched by emerging insights into complexity and self-organizing systems. We believe such evidence can bring a sense of humanity's place in the web that holds the universe together in fragile elegance.

Russian neurophysiologist A. R. Luria rejects reducing "the whole wealth of human behaviour [i.e., the phenomenon of human consciousness] to associations of separate elementary events . . . rather [the explanation lies] in its inclusion in a rich net of essential relations" (Luria 1987). At the level of the individual, this net forms the many facets of character and activity. In groups, complexity increases geometrically, drawing upon coincidences of time, place, and ideas. At a high level of complexity, symbolic affinities mark periods in history with culturally significant styles. We speak of the High Middle Ages or the Enlightenment. These styles are found in a period's architecture, sculpture, painting, literature, music, and ideas (Fleming 1974).

For us, starting with religion—with a sense of the whole, a sense of the sacred rather than the parts—takes account of more facets of human experience than a reductionistic analytic process. The awareness of the parts provides focus for the sense of the whole, yet by themselves the parts never add up to a sense of the whole.

Between the atomic particles of the microcosm and the astronomical possibilities of the macrocosm we discover ourselves as human creatures. We are personal beings in a physical universe. The biological information carried by the complexity of molecules contains vital information about life as a whole. As philosopher of science Holmes Rolston, III, writes, "The whole organic program is inlaid into nearly every cell. . . . The whole script perfuses all the parts, but the secret is a secret of the whole, not of any mere part, even if it is stored in all the parts" (Rolston 1987, 85).

In citing this scientific perspective, we are equally conscious of the religious perspective of an Augustine:

You [O God] are not scattered but reassemble us. In filling all things, you fill them all with the whole of yourself.

Is it that because all things cannot contain the whole of you, they contain part of you, and that all things contain the same part of you simultaneously? Or does each part contain a different part of you, the larger containing the greater part, the lesser parts the smaller? Does that imply that there is some part of you which is greater, another part smaller? Or is *the whole of you everywhere, yet without anything that contains you entire?* (Augustine [c. 400] 1991, 4, Bk. 1, Ch. 3, emphasis added)

We find this reflection of Augustine an experiential window on the same

reality that Rolston describes through an empirical window. The part carries the secret and specific ordering of the whole even though the secret ordering is more of the whole than of any particular part.

In holding together scientific causality and religious meaning, we propose that the humanizing brain mediates between them. More specifically, we understand the brain-mind as an information system that operates both bottom-up—from molecules to neurons to personalities—and top-down—from culture to values to consciousness. Such a view allows us to consider information processing as a way to make sense of biochemical, cognitive, and cultural affinities and differences. Explanation and experience are complementary perspectives.

In a generally accurate depiction, historian Lancelot Whyte claimed European thinkers fall into two camps: “the one seeking order, similarities, and unity (often called ‘mystical’ or ‘religious’) and the other seeking differences among particulars (the ‘tough’ thinkers or scientists). The first seek comfort in feeling a unifying order, the second in defining particulars” (Whyte 1973).

There are, however, many exceptions to this generalization, notably among theoretical physicists, who often appreciate the particulars while also seeking order and theoretical beauty in ways reminiscent of mysticism. To Albert Einstein, for example, “The aim of science . . . is a comprehension, as *complete* as possible, of the connection between the sense experiences in their totality, and, on the other hand, the accomplishment of this aim *by use of a minimum of primary concepts and relations* (seeking, as far as possible, logical unity in the world picture)” (Einstein 1954, 293).

To explore a neurobiology of religion puts us on the side of those “seeking . . . a unifying order.” At the same time we take seriously those “defining particulars.”

UNITING WITH NATURE. In its larger ramifications, such an approach shares an affinity with an ecologically based ethics. Cultural geographer I. G. Simmons points the way to this valuing when he writes: “The core of the new environmental behaviour then becomes an awareness of self in which we no longer stop at the boundary of our skins nor indeed perhaps at the limit of our tentacular reach for resources. Instead we are to *see ourselves as united with the rest of the universe in a ground of being*” (Simmons 1993, quoted by Gold 1995, 74, emphasis added).

What environmentalists are espousing in relation to the natural environment, we are espousing in yoking religion’s meaning and neuroscience’s investigations. That is, *theo* refers to God, and *God* refers to mystery and meaning, the ground of humanity itself. At the same time, *logos* refers to an understanding, an ordering, an intelligibility in that mystery (Tillich 1948, xiii). In this sense, our conviction about religion is a conviction that this universe, while mysterious, also possesses an inner logic. While we

make this as a statement of faith, scientists and religionists alike make similar statements of faith (see for example Davies 1992; Barbour 1990; Hefner 1993).

THE LOGIC OF MYSTERY. We propose that humanity can key in to this inner logic of mystery through the brain and its mind! We agree with physicist Paul Davies's insistence that our human "presence in the universe represents a *fundamental* rather than an *incidental* feature of existence" (Davies [1987] 1989, 203, emphasis in original).¹ For the human brain-mind is the most highly developed known expression of the increase of self-organization and complexification toward which the entire universe seems to tend.² We humans represent the implicit oneness of a self-organizing system.³ The self-organizing system operates both in ourselves and in the universe. That is why the religious concept of God most fully expresses what this exploration is about. It points to—hints at—some ultimate significance beyond that which the vocabulary of self and society or of nature and history can capture.

SYMBOLIZING THE INACCESSIBLE AND INEXPRESSIBLE. We cannot put the dimension of depth—the gestalt of grace and the elegance of the whole—into words. It simply is inaccessible to adequate conceptualization. Further, it is inexpressible in that it is beyond description. Our only recourse is to express that "depth" in symbol and metaphor.⁴ The word *God* refers to a "depth" and "wholeness" *unlike anything that we humans know or can know*. Certainly it is beyond our ability to discriminate and label.

Through the centuries, people have reported a sense of the presence of a supreme being. Yet to describe that being stretches human capacities beyond their limits. So people have had to resort to analogy to describe God. We draw on everything that we know through lived experience. All that is built into our very being, into our soul, discloses our knowledge of God.

We understand religion as a means of humanizing the mysterious "Ground of Being," to use Tillich's phrase. That brings God within human understanding. In turn, new understandings of the brain provide new awareness of the structure, the processes, the activity of seeking for meaning and for the ultimate. So, in the era of the brain, religion finds its logos, its inner logic, in terms of the accumulating evidence of neuroscience.

The human brain specializes in humanizing the context in which it emerges. It interprets the world in human terms. Everything that matters in life arises from this orientation. Humanity finds itself in the world. That means personal relatedness, personal pain, personal aspirations, personal observations, personal memories. Out of this raw material, the meaning-seeking brain constructs meaning. Religion in its basic sense means concern with the whole of things—with God.

The concept of the humanizing brain⁵ offers a perspective for integrating notions of ourselves and our place in the universe. This perspective deals with *nature as the context* of life, *history as the content* of humanity, and *God as the criterion* of what matters in the life of humanity. It provides explanatory support for the wisdom of the ages, primarily as we have received that understanding through the religious traditions. Increasingly we humans can specify what goes into making sense of God.

As people know more “of what” life consists, so they learn more “how” to live that life. In understanding the humanizing brain, they can discern clues to more genuine human community. Like the universe that fostered it, the brain is organized through patterns of complexity and interdependence. Knowledge of the brain’s development demonstrates that relatedness is the primary reality that liberates rather than constricts. We now know that the universe does not consist of independent and discrete entities. Instead, the universe exists as an ever more intricate network of interdependence, a differentiating complexity in an ever-expanding self-organization of possibilities.

For us, the Godlike and the humanlike are not substantial, demonstrable entities. We do not equate either with any specific physical reality. That would be a literal reductionism, contrary to all that we understand about God, ourselves, and the universe in which we live. Reality itself is not a static entity. Rather, reality is a dynamic process, a process of differentiating and integrating at every level of complexity, from subatomic particles to the cosmos—including mental processing. We believe God to be integral to these processes while also, in the language of gestalt psychology, providing their supporting context.

THE SELF-EVIDENT DYNAMIC SOURCE OF ALL. In understanding God and religion, we align ourselves with the experiential tradition of Augustine. Its truthfulness has stood the test of experience. “Where then,” he asked in his *Confessions*, “did I find you [O God] to be able to learn of you? . . . *There is no place*, whether we go backwards or forwards; there can be no question of place. O Truth, *everywhere you preside over all* who ask counsel of you” (Augustine [c. 400] 1991, 201, Bk. 10, Ch. 26, emphasis added).

In a footnote to this reflection, editor and translator Albert C. Outler added: “When [God] is known at all, God is known as the Self-evident. This is, of course, not a doctrine of innate ideas but rather of the necessity, and reality, of divine illumination as the *dynamic source* of all our knowledge of divine reality” (Augustine 1955, n. 28, 224).

In developing this assumption of God being the dynamic source of all, Augustine provides a classic expression. He refused to confuse the parts with the whole, the figure with the ground: “And what is the object of my love? I asked the earth, and it said: ‘It is not I.’ I asked all that is in it; they

make the same confession. . . . ‘We are not your God, look beyond us.’ And I said to all these things in my external environment, ‘Tell me of my God who you are not. . . .’ And with a great voice they cried out: ‘He made us’ (Ps. 99:3)” (Augustine [c. 400] 1991, 183, Bk. 10, Ch. 6).

Here, then, is the basic assumption in understanding God. God is the “self-evident” and “dynamic source” of *all reality* as experienced and expressed by human beings. There is *no* place, *no* entity, *no* tangible reality that encompasses all that the concept of God represents. Yet the dynamic differentiating and integrating process is active in every place, in every entity, in every tangible reality.

We believe that “in God all holds together,” to use the language of the letter to the Colossians (1:16–18, NRSV).⁶ We describe how that reality is evident in what we know of the universe and of ourselves as part of that universe.

In the brain’s materiality—its physical matter, its anatomical structures, its biochemical processes—the brain provides the most empirical anchor of intentionality, or what many take as “higher-order consciousness.” Intentionality involves learning and memory, anticipating and evaluating, consciousness of being conscious. This empirical anchor does not make the brain a computer nor the world “a piece of computer tape.” Rather, this empirical view takes “intentionality into the picture,” as neuroscientist and Nobel laureate Gerald M. Edelman argues (Edelman 1992, 68, 112).

At the same time, in the brain’s cognitive representations—its perceptual processes and pattern making, its imaginative constructing and symbolizing—the mind presents the most experiential source of meaning seeking. Further, in the integrating core of the old cortex—the limbic system—the brain balances what is novel and creative with what is necessary and adaptive. And the still older brain that we share with reptiles propels us toward behaviors necessary to sustain this materiality. These behaviors involve food seeking, safety seeking, and mate seeking. We humans are made to create a niche for ourselves in a universe not of our own making. We live in a reality in which “all holds together.” And we are even cocreators of the social and cognitive structures that hold all together.

With that conviction that “all holds together,” this book presents evidence of how the brain works to make sense of religion and God. God is that ultimate reality with which religion deals. Faith takes on new clarity when informed by knowledge of how we make meaning and how we maintain and enhance that meaning. In understanding the brain, we seekers may come to understand how we become the human beings that we are—our genetic inheritance, our cultural variations, and our divine destiny.

Now, with the sophisticated tools of neuroscience, inner experience is more accessible to empirical investigation. New technologies are catching the mind in the very act of processing and thinking. This development in

no way reduces the mind's mystery; it only enhances how awesome human-centeredness really is. The very brain seen in the PET scan has a "subjective value-belief system" that shapes culture and events and even its own biochemistry, according to Nobel laureate Roger W. Sperry (1991).

We humans are embedded in the universe. We depend on it for our every breath. The rules that govern its operation govern our own functioning as well. Thus the mystery of the brain reflects the mystery of the universe. Such was the conviction of Santiago Ramon y Cajal, the "maestro" of the microscopic study of the brain (Feindel 1975, xxvi). The mystery of the universe inevitably leads us to speculate about the mystery of God. But we speculate about the mystery of God only because our minds are oriented to the making of meaning with one another. We constantly search for what makes sense of our reality.

Because we are humanizing creatures, ultimate concern about God requires ultimate concern about humanity. In like manner, ultimate concern about humanity leads to ultimate concern about God. *It is the humanness of our brain that shapes all that matters to us, whether we call that God or Nature or Life or History or Fate or Destiny or Evolution.*

In the past, the relationship between religion and science has focused on the context of nature and the working of God (Barbour 1974, 1990; Rolston 1987; Breed 1992; Gilkey 1993; Jones 1994). As the human sciences have joined the conversation, that conversation now includes discussions of the significance of humanity (Arbib and Hesse 1986; Gerhart and Russell 1984; Hefner 1993). Within the last two decades neuroscience has emerged as a bridge between the physical and the human sciences.⁷ This bridge provides new possibilities for exploring and understanding religion.

The bridge may be examined through the concept of mind. When neuroscience refers to the *cortical* and to the *subcortical* structures, the *mental* contents being discussed are the *conscious* and *nonconscious*, respectively. Both kinds of mental content have correlates in the brain. These terms parallel religion's reference to "the *experience of the numinous*," that is, the consciousness of the nonconscious, the holy mystery at the heart of a world that we experience, in the first instance, as material.

At the conscious level people put experience into words. Such conceptualizing reflects cultural conditioning. We make explicit what is beyond the capacity of language to capture. At the nonconscious, subcortical level we take in and transform stimuli into a nearly infinite range of possibilities.

Recognition of subcortical processing reminds us of the "inexhaustible depth" of human experiencing. So, too, recognition of the whole brain and its neocortex emphasizes humanity's humanizing intentionality. Through our brain's activities, we humans become cocreators of a universal context of relationality.

To symbolize God in personal language does not make "God" into an

object about which to argue. In Tillich's words, objects taken from a realm that is lower than the personal cannot symbolize "the depth of being." Lower than the personal means "from the realm of things or sub-personal living beings [including reptiles and other mammals]. . . . [Instead, God] is a symbol, not an object, and it never should be interpreted as an object . . . it is one symbol beside others indicating that our personal center is grasped by the manifestation of the inaccessible ground and abyss of being" (Tillich 1959, 131–32).

A commitment to God, thereby, construes ultimate mystery "as human-affirming, human-sustaining, and human-enhancing," to cite theologian Gordon Kaufman (1993, 424). We align ourselves with those who find that humanizing focus in the Christian tradition. Because of that humanizing focus, we always understand God "in the light of Christ—the paradigmatic image of the human." Christ provides a principal "clue to what is really going on in the world (what 'God is doing') that is of ultimate importance to men and women" (Kaufman 1993, 418). As Kaufman puts it, "By invoking the name 'God,' then, we mean to be focusing our consciousness on that process of or pattern in events (whatever it may be) which is at once creative and directional and unifying, which brings all that is into being and binds it into a *universe*—an ordered world that can sustain the web of life as a whole, and human historical existence within that web" (Kaufman 1993, 418).

With Kaufman we believe that the symbol "God" expresses "the ultimate mystery of the cosmic ecosystem of which we are part (God's 'transcendence') and the cosmic evolutionary-historical trajectory toward humanization (God's 'humanness')." The reality of living in a meaning-making universe is that it *is* "creative and directional and unifying" (Kaufman 1993, 424).

In subsequent chapters we will set about making sense of mystery, of religion's God in terms of where and how religion and neuroscience meet. Lest we appear to be innocents abroad, uncomprehending of a world that inflicts suffering and tragedy, we acknowledge that pain is part of the picture. Here we sketch how we develop these ideas in more detail.

OVERVIEW. Part 1 of this book lays out a possible neurobiology of faith by linking the physical and the experiential. The brain is a humanized brain in two respects: It seeks out and responds to the human face; and it pulls together and organizes a variety of perceptions and memories. Humanity is oriented to human reality and motivated to make sense of what it observes. Thus, we suggest that the humanized brain is necessarily a humanizing brain. The mind-producing brain compels us to deal with our universe as a humanlike reality.

In the past, the idea that the universe is humanlike (as well as physical) has had a bad press. People ridiculed it as "anthropomorphism"—the

creation of a universe—even of a God—in our own image. Isaiah attacked the House of Jacob for filling the land with idols and bowing “down to the work of their hands, to what their own fingers have made” (Isa. 2:8, NRSV). Enlightenment thinkers—influenced by scientific discoveries like Isaac Newton’s (1642–1727), the rationalism of René Descartes (1596–1650), the empiricism of Francis Bacon (1561–1626) and John Locke (1632–1704), and such writings as David Hume’s (1711–76) and Ludwig Feuerbach’s (1804–72)—rejected conceiving everything in terms of ourselves (Guthrie 1993, 62–90). Modern iconoclasts such as Friedrich Nietzsche (1844–1900), Karl Marx (1818–83), and Sigmund Freud (1856–1939) mocked the position. Today, postmodern perspectives remind us of the constraints of contexts, the pluralism of perspectives, and the constructions of the mind. Even so, all theories of projection must account for that screen upon which the projection is directed. Meaning embraces meaning making as well as meaning discovery!

When we refer to the brain as expressing the origin and destiny of reality, we assert that the evolutionary emergence of the brain reflects a basic dynamic within the physical universe. In its exquisite complexity the brain is the product of basic trends, basic forces of *what is*. That implies the evolutionary tendency is to ever greater complexification as part of a meaning-discovering process. We discern change from a universe “without form and void” to the formation of stars, heavy elements, molecules, planets. The appearance of life heralded a shift from stellar and planetary evolution to *adaptive systems* able to respond to their environment in ways that further their survival and that of their progeny.

We propose that the concept of “mind” bridges the complexities of the physical universe and the complexities of the human world. The brain-mind is by far the most elegant and complex adaptive system (for its size) that we know of in the universe. In that sense, the destiny of evolving reality—so far—could be the humanizing brain. Because of that brain, we humans carry the responsibility and the burden of contributing to the outcome of the evolution still to come; *we have become cocreators* (cf. Hefner 1993). Thus the brain of *Homo sapiens* reflects something basic to the setting in which it finds itself. It seems that, in an important sense, the humanizing brain mirrors the universe that births it.

It appears that the brain-mind evolved as it did because the world in which we humans find ourselves evolved as it did. Our brain equips us—imperfectly, but amazingly well, considering the options—to perceive our world in its important dimensions. We can discern its tangibility, its wondrous order, its emotionality and directionality, even its unpredictability. In turn, we have important impacts on our world. Further, we and our world share a certain directionality that points to a shared and open future. The overarching reality of the world we perceive, and with which we interact, may thus be perceived as God’s world.

In part 2 we set forth our constructive attempt at connecting neuroscience and religion. We draw on neurophysiologist Paul D. MacLean's classic view of a triune brain, with three anatomical and functional sectors—three minds, if you will—as clearly suggestive of various ways of understanding God's ways of being God. While we are cognizant of recent findings that whole brain interaction helps to support the various functions that MacLean describes, we still find his design to be an extremely helpful heuristic. And while we acknowledge that the brain necessarily humanizes all of its perceptions, we suggest that these perceptions of the nature of God are worth taking seriously. The elegant human brain interfaces with the world on many fronts, and the experiencing mind provides people with both the pain and the grandeur of being human. We suggest that the accuracy of its perceptions is to be taken seriously, and those perceptions include not only scientific findings but also the religious intuitions that have characterized our species from the beginning.

The sensory-based “reptilian brain,” found in reptiles, birds, and mammals, attends to what matters for surviving and thriving. It is “present” in its environment without qualification. It reminds us of perceptions of God expressed through the structures of concrete reality, of a God whose “eye is on the sparrow.”

The personal attachments, emotional responsiveness, and meaningful memory enabled by the “old mammalian brain” are consistent with the widely expressed views of God as nurturer, as love, as provider of meaning for our lives.

The new brain—the neocortex—seems to employ an ordering and organizing power that uncannily resembles the order in the universe. The pattern-making consciousness of the cognitive brain suggests God's creative power in ordering a universe whose vastness exceeds our comprehension. Its linguistic abilities interpret the “Word of God.”

The frontal lobes of the new brain support the ability to empathize with others. They also have the capacity to construct scenarios, to prioritize, and to guide us toward our goals. They suggest a God who knows our needs better than we do ourselves—and has a purpose with intentions for the universe and for the individuals within it.

We trace the emotional impetus for meaning making to the mammalian cry of separation (MacLean 1985; 1987). Either mothers or infants voice that cry upon finding themselves at an uncomfortable distance from each other. Infants must learn to comfort themselves in such times of separation. Beginning in infancy, we learn to live in an intermediate realm between what we need and what we find responds to that need. According to British psychiatrist D. W. Winnicott (1965; 1971), we learn to fill that space with “transitional objects” and symbols. Beginning with toys and blankets, progressing to other possessions and to productive and creative activity, we find and construct substitute symbol-objects. Humans find

meaning through attachment to their loved ones, and also to these potentially valuable substitutes.

Because no love is perfect, transitional objects become the raw material of meaning making and meaning discovery. As with the significant caregiver, so with God—we are both separated and connected. So we learn to use transitional objects to hold the world together when God seems absent. Because of these we come to know that we live by faith and not by sight!

Males and females tend to experience meaning making differently. Both their brains and their upbringing differ in characteristic ways. Other genetic and temperamental factors also color experience. These characteristics influence the ways humans seek for meaning. Thus, different genes and experiences make for different realities. These different realities help to explain the difficulties people have in connecting with each other and comprehending each other's experience. At the same time these differences contribute to a richness in human ways of perceiving and construing reality.

Life exists on the cusp between order and disorder. This is a state of tumultuous potential necessary for new order to emerge. Even “the best and the brightest” cannot manage the powerful forces of life and death, or the contingencies of planetary evolution. We are partners, not owners, in an unfolding drama. While we believe in a loving, gracious, and beneficent context for human life, we also recognize the presence and threat of that which is not loving, not gracious, and not beneficent. For a host of reasons the brain can lose its adaptability, turning integrative cooperation into destructive dysfunction.

In this era of the brain, religion finally rests on the fact that we humans in our own ways embody and express the presence of that which is greater than ourselves. God is other than anything we can imagine. We live in a universe that gives birth to humanizing. This is why religion and neuroscience meet. In the meeting we discern clues to the “really real.”

“MIND” AS BRIDGE BETWEEN RELIGION AND NEUROSCIENCE:
THE BRAIN AS PHYSICAL AND RELATIONAL

The *humanizing* brain reflects *and* expresses both what is outside us—what we receive through perception and sensation—and what is inside us—what we experience and interpret. The human brain, in short, is “the ultimate receiver and analyzer” of what matters to us (MacLean 1990, 570). Here we explore implications of that anthropomorphic position.

As used here, the concept “mind” refers to the human and the human-like features of the brain, whether in humans or in animals. The primary features of mind (especially in human brains) are intentionality and subjective consciousness, reinforced by empathy, rationality, imagination, memory, and adaptability. Whenever the concept “mind” is used in

relation to the brain, it “humanizes” the meaning of *brain*; and whenever the concept “brain” is used in relation to the mind, it “concretizes” the meaning of *mind*. “Mind,” therefore, can serve as a bridge between religious convictions and neuroscience investigations. While not dichotomizing brain and mind, physicist Paul Davies observes that

mind—i.e., conscious awareness of the world—is not a meaningless and incidental quirk of nature, but an absolutely fundamental facet of reality. . . . We human beings are built into the scheme of things in a very basic way.

Our mental processes have evolved as they have precisely because they reflect something of the nature of the physical world we inhabit. (Davies 1992, 16, 24)

The humanizing brain potentially carries the most privileged information about the nature of reality to which we have access.

In understanding what matters most in the universe—that is, in our religious thought—we rely on the humanizing brain. Along with anthropologist Stewart Elliott Guthrie, we submit that “religion consists of seeing the world as humanlike” (Guthrie 1993, 4). Because the world is ambiguous and undeveloped, says Guthrie, we are constantly needing to interpret it. Because of our mind-brain, our interpretations of what matters most are necessarily humanlike: that is, our humanized brain creates a humanizing and humanlike universe.

A CONNECTION BETWEEN BRAIN AND UNIVERSE. Origen, the great third-century Christian theologian of Alexandria, and Bernard of Clairvaux in the twelfth century spoke of the mystical marriage of the Logos and the soul (Tillich 1968, 63, 68). Logos points to the ordering and orderly structure of the universe. Soul identifies the core of human dignity. In some mysterious way, such thinkers believed that the universe reveals itself in humanity, the macrocosm-in-the-microcosm. So we, too, believe.

In a slightly different way, William James (1842–1910) raised the similar issue of the connection of brain and universe:

Is the Kosmos an expression of intelligence, rational in its inward nature, or a brute external fact pure and simple? If we find ourselves, in contemplating it, unable to banish the impression that it is a realm of final purposes, that it exists for the sake of something, we place intelligence at the heart of it and have a religion. If, on the contrary, in surveying its irremediable flux, we can think of the present only as so much mere mechanical sprouting from the past, occurring with no reference to the future, we are atheists and materialists. (James [1890] 1904, 8)

The biblical narrative of the tower of Babel (Gen. 9: 1–11) points to the fragmentation that follows in the wake of single language, a single viewpoint, a single hegemony. A single perspective generates competing perspectives. But hierarchical power marginalizes others and so distorts the depth of reality, the deep structure of what matters most. People then live in a universe that is *not* “an expression of intelligence, rational in its inward nature.”

In contrast, the biblical narrative of Pentecost (Acts 2:1–13) points to the differentiating that comes with multiple languages, multiple points of view, multiple possibilities. In that situation every culture carries something of all cultures. No culture expresses the whole of reality. Instead, we live in a universe that *is* “an expression of intelligence, rational in its inward nature.” (That is not to say that the universe is paradise. Moral decisions by moral agents inject good and evil into human history.)

Pentecost reminds us that we can hear each other speaking of the really real “in our own languages.” From a nontheological, biological perspective, linguist Steven Pinker speaks movingly of the same universal reality of the really real. He summarizes his convictions about the “language instinct.”

Most of the differences among races, he argues,

are adaptations to climate: melanin protects skin against the tropical sun, eyelid folds insulate eyes from dry cold and snow. But the skin, the part of the body seen by the weather, is also the part of the body seen by other people. Race is, quite literally, skin-deep, but to the extent that perceivers generalize from external to internal differences, nature has duped them into thinking that race is important [and that certain cultures are more advanced than other cultures]. The X-ray vision of the molecular geneticist reveals the unity of the species. (Pinker 1994, 430)

Then Pinker highlights the “X-ray vision of the cognitive scientist”:

“Not speaking the same language” is a virtual synonym for incommensurability [not having any common quality], but to a psycholinguist, it is a superficial difference. *Knowing about the ubiquity of complex language across individuals and cultures and the single mental design underlying them all, no speech seems foreign to me, even when I cannot understand a word.* The banter among New Guinean highlanders in the film of their first contact with the rest of the world, the motions of a sign language interpreter, the prattle of little girls in a Tokyo playground—I *imagine seeing through the rhythms to the structures underneath, and sense that we all have the same mind.* (Pinker 1994, 430, emphasis added)

Whether people use religious language or nonreligious language, what they say expresses humanity’s capacity to make sense of the sensory and the symbolic. Every culture exhibits that capacity. Likewise, our actions are inescapably relational, regardless of how they are motivated or understood. Here, in truth, is the mystical marriage of the Logos and the soul! We all engage in humanizing reality!

BETWEEN NATURE AND MEANING. Because we are human we find ourselves in a unique position in nature. Like frogs and cats and monkeys and plants and rocks, we are *part of* a natural setting. It is physical, an extension of both time and space. But unlike frogs and cats and monkeys and plants and rocks, we are *apart from* this natural setting. Because of our cognitive ability, we create and imagine new relationships, new possibilities—for ourselves and our world.

By virtue of living in a human universe, humans experience both the realism of being *part of* the natural order and the meaningfulness of being *apart from this natural order*. The nervous system differentiates experience and integrates it at the same time. It combines multiple inputs with imagined scenarios. This dialectic makes for unsuspected possibilities—and also accounts for predicted actualities. The combination both *reflects* an orderly environment and *creates* a recognizable world. We make sense of reality in terms of our own sensibility.

The human brain embodies two evolutionary pushes: the one toward complexification and the other toward adaptation. In turn, the human brain exerts the emerging pull that makes us unique among creatures.

In other words, our brain is the *physical* anchor that immerses us in the natural environment. At the same time its *human* capacities orbit us into an emerging world of culture. Culture has the potential to develop beyond anything we can imagine. The physical brain orients us to the physical environment in specific ways; so, too, the cognitive brain orients us to the human world in specific ways.

Neuroscience is in a pivotal, somewhat privileged position between the most specific chemical and physical processes and the most sweeping cosmic and psychically significant processes. To use the language of traditional disciplinary concerns, neuroscience resides between physics and metaphysics. Neuroscience is disclosing how the brain works, in health and disease. New therapeutic interventions can prevent disorders or enhance creativity. Finally, neuroscience is helping us know who we are as human beings and whether the humanizing brain has survival value. Thus neuroscience deals with both the most particular and the most inclusive.

Many scientists remain skeptical of a yoking of science and religion; others believe deeply in a God-oriented universe. For instance, Ilya Prigogine, awarded a Nobel Prize in 1977 for his work on the thermodynamics of systems far from equilibrium, identifies a “growing coherence” between what we know of humanity and what we know of nature. He describes “a new synthesis, a new naturalism,” in which “science . . . appears to lend credibility to mystical affirmation.” He speaks of “a kind of ‘convergence’ between the interests of theologians, who held that the world had to acknowledge God’s omnipotence by its total submission to Him, and of physicists seeking a world of mathematizable processes” (Prigogine and Stengers 1984, 47, 22, 49).

The new naturalism shifts our perspective from nature as static to nature as dynamic. We now view reality as “being” *and* “becoming.” Rather than being opposed to each other, permanence and change “express two related aspects of reality” (Prigogine and Stengers 1984, xxx, 36, 303, 310). Matter is not inert, but “active,” “capable of organizing itself and producing living beings” (Prigogine and Stengers 1984, 82).

Regardless of skepticism or openness, the Big Questions continue to

hold center stage. Where we humans have come from and where we are going are now explored through questions about “the instability of elementary particles,” “the evolving universe,” or “the incorporation of irreversibility into physics,” to name a few (Prigogine and Stengers 1984, 309). As quantum cosmology probes our origin, so neuroscience explores our destiny.

We find that emerging theories of complexity and self-organization link cosmic origin and human destiny (see, for example, Prigogine and Stengers 1984; Davies [1987] 1989, 1992; Barton 1994; Kauffman 1995). Our origin, as Stuart Kauffman, a leading thinker in complexity theory, puts it, lies in “natural expressions of matter and energy coupled together in non-equilibrium systems which increase beyond various thresholds of complexity.” The collective result is a living system. Although its parts “are just chemical,” according to Kauffman, the beautiful order is “spontaneous, a natural expression of the stunning self-organization that abounds in very complex regulatory networks. . . . Order, vast and generative, arises naturally.” The abundance of life was “bound to arise, not as an incalculably improbable accident, but *as an expected fulfillment of the natural order.*” That natural fulfillment encourages us to believe that “*we truly are at home in the universe*” (Kauffman 1995, 20, 24, 25, emphasis added).

Because *Homo sapiens* is *Homo religiosus*, we are in fact “at home in the universe.” In sketching sources of religion we intend to keep before us this basic humanizing brain.

SOURCES OF RELIGION. A quick survey of nonreligious theories about the sources of religion identifies three main clusters of ideas. One suggests wish fulfillment in the face of fear. Another identifies social solidarity in the presence of fragmentation. A third advances religion as providing a plausible interpretation of ambiguous reality (Guthrie 1993, 10–38).

Ludwig Feuerbach (1804–72) has been singularly significant in exploring and attacking religion in the modern era. In his view, religion came about because of deficiencies or lacks in individual human lives. To compensate for these lacks, people developed religious ideas that expressed emotional attitudes and ideas about what humanity ought to be. Feuerbach regarded statements about God as projected statements about human beings. People attributed these ideas to an imagined deity. In other words, “God as a mind ‘beyond’ human reason is an objectification of human intelligence stripped of all accidental imperfections” (Feuerbach 1957, 19). Thus, “religion is the dream of the human mind.”

Man’s being conscious of God is man’s being conscious of himself, knowledge of God is man’s knowledge of himself. By their God, you know men, and by knowing men you know their God; the two are identical. God is the manifested inward nature, the expressed self of man; religion is the solemn unveiling of man’s hidden treasures, the reflection of his most intimate thoughts, the open confession of what he secretly loves. (Feuerbach 1957, Ch. 2, 10–11)

According to Feuerbach, what humanity previously regarded as God “is now recognized as something human.” “God is merely the projected essence of Man” (Feuerbach 1957, 65).

Object relations theory provides a conceptual instrument with which to explore, elaborate, and explain this anthropomorphic view of God and the humanizing brain (Greenberg and Mitchell 1983; Mitchell 1988; Merkur 1990). From a psychodynamic orientation, British psychiatrist D. W. Winnicott contends that “man continues to create and recreate God as a place to put that which is good in himself, and which he might spoil if he left it in himself along with the hate and destructiveness which is also to be found therein” (Winnicott 1963, 94, quoted by Spero 1992, 188). The God-image provides an abstract generalization capable of bearing all that one can imagine that is worthwhile and cherished. Such generalization avoids the pitfall of an idolatry that would locate all that is good in any particular human being, even Jesus as Savior,⁸ or in any particular religion or culture.

The phenomena explored by object relations theorists undeniably play a role in the development of religious consciousness (Rizzuto 1979; McDargh 1983; Meissner 1984). They are probably a necessary segment of the road toward spiritual maturity. They do not, however, account for all the twists and turns in this road. For one thing, in their emphasis on individual development, such theories take too little account of the larger world in which humans must find their place.

Anthropologist Clifford Geertz takes a more integrated view of religion. He sees religion as a synthesizing of a people’s ethos and worldview, a fitting together of how they believe things are and how they believe things should be. With that understanding, he defines religion as “(1) a system of symbols which acts to (2) establish powerful, pervasive, and long-lasting moods and motivation in men by (3) formulating conceptions of a general order of existence and (4) clothing these conceptions with such an aura of factuality that (5) the moods and motivations seem uniquely realistic” (Geertz 1973, 90).

In essence, he construes religion as purposeful. It energizes people to believe the universe to be coherent and meaningful (Geertz 1973, 87–125; cited in Guthrie 1993, 27). Instead of detachment, there is commitment; instead of analysis, there is encounter (Geertz 1973, 112). Mystical encounters and practical actions intermingle (Geertz 1973, 120). It does appear that human beings are basically *Homo religiosus*. We are symbolizing, conceptualizing, meaning-seeking animals (Frankl 1978).

The drive to make sense of experience, to give it form and order, is evidently as real and “as pressing as the more familiar biological needs,” Geertz adds.⁹ And this being so, it seems unnecessary to continue to interpret symbolic activities—religion, art, ideology—as “nothing but” thinly disguised expressions of something other than what they seem to be: at-

tempts to provide orientation for an organism that cannot live in a world it is unable to understand (Geertz 1973, 140–41).

Taking this insight a step further, such symbolizing—humanizing—capacity may in fact be as basic to the biological needs of *Homo sapiens* as “the more familiar” ones. Biogenetic structuralists refer to this genetic predisposition as “the cognitive imperative” or “the primal urge to know” (Laughlin, McManus, and d’Aquili 1990, xii).

Human and humanlike reality, or anthropomorphism, therefore, results from our inherent drive to find that pattern that makes the most sense of the most data. Anthropologist Stewart Guthrie states the case succinctly:

The most important pattern in most contexts is that with the highest organization. The highest organization we know is that of human thought and action. Therefore we typically scan the world with humanlike models. Scanning the world with humanlike models, we frequently suppose we find what we are looking for where in fact it does not exist. This is most apparent when we are most aware of ambiguities (a sound in the night, a shadow on our path, an unexpected death); but such cases are not aberrant. All perception is interpretive and all interpretation follows a pattern: *we look first for what matters most.* (Guthrie 1993, 90, emphasis added)

As we have described in the previous chapter, what matters most to us humans is the human face and our relatedness with one another. *An anthropocentric perspective is unavoidable. But this acknowledgment does not automatically negate the validity of what is perceived.* A case can be made that reality *is* of a piece with the human brain and its perceptions. Reasons for this assertion are developed in the sections that follow.

THE UNAVOIDABLE SUBJECTIVE BRAIN. Those working in the natural sciences take pains to distinguish between what is objective and what is subjective, what is true and what might be only meaningful. Their goal, since Francis Bacon (1561–1626) in the late sixteenth and early seventeenth centuries, has been to erase every subjective feature in the pursuit of objective reality (Guthrie 1993, 158–61). In this schema, impersonal, objective, explanatory, causal knowledge matters more than anything that is personal, subjective, experiential, meaningful.

But as Paul MacLean insists, they “cannot avoid the realization that in the final analysis, everything reduces to subjectivity and that there is no rigorous way of defining a boundary between the subjective and what is regarded as objective” (MacLean 1990, 570). By the very nature of things, everything (the so-called objective world and our subjective world) must be processed by the “soft brain.” Internal relations between ourselves as subjects capable of being objects of reflection and all else as objects reflect the brain-mind as intricately involved in both receiving and creating what matters to us as part of a dynamic universe. We filter everything through the lens of what matters to us.

Unavoidably, the brain humanizes what it perceives. Perception is

always selective. It is influenced by what “fits” an individual’s patterns of thought. All perceptions necessarily have a human bias. “Because human manifestations vary widely, and because a human presence is so important, we superimpose widely different human forms on widely different phenomena” (Guthrie 1993, 140).

A Holistic Orderliness. The humanizing brain reflects and expresses what we receive from the outside and what we experience from the inside. The human brain, as we are insisting, receives and interprets what matters to us as we humans together seek to find our place in this universe (MacLean 1990; Burhoe 1981). Its mapping of external reality goes beyond apprehension of sensory data.

The brain also calculates the relationships and interactions of objects with their surroundings. These functions, which involve computation and prediction, are carried out at both nonconscious and conscious levels. In conjunction with the frontal cortex, the nonconscious cerebellum contributes to computation and prediction (MacLean 1990, 545–52). The cerebellum is located at the back base of the brain, adjacent to the brain stem. Traditionally, researchers regarded the function of the cerebellum as simply the coordination of motor functions, but more recent research, on which MacLean builds, shows that its neurocircuits include processes used in planning, prediction, and implicit memory.

More specifically, the cerebellum functions “according to some inherent algorithms . . . [and] ‘a kind of built-in calculus.’” Algorithms “link problems, input data, and solutions” (Vandervert 1988, 321, quoted in MacLean 1991, 20). It would seem that the highly developed technology that can put people on the moon, launch probes into space, or estimate how old a geological deposit might be result from the neocortex’s capacity to make explicit the implicit calculus of the cerebellum.

The cerebellum, along with the primal or instinctual brain, takes account of locality, particularity, context. Think of the behavior of a physical system. It is “determined entirely by the forces and influences that arise in its immediate vicinity” (Davies 1992, 158). Similarly, through collaboration of the cerebellum with other parts of the brain, linear systems—the sequencing of step-by-step contingencies—are inseparably linked with non-linear and local effects—all-at-once intelligibilities. Mathematical physicist Paul Davies refers to the result as “holistic orderliness,” or something like “a principle of maximum diversity” (Davies 1992, 170, 198).

At the very least—and this is not so “least”—an organizing brain-mind reflects a reality capable of being organized. In the precise language of Jewish psychotherapist and theologian Moshe Halevi Spero, we may discern “a structure-creating God, a structure-bound world, and a structure-deducing human being” (Spero 1992, 187). The biblical writers witness to that fundamental worldview by telling a story of God creating the world and

all that is therein. Their intent was theological rather than scientific. They portrayed a “world [that] is orderly, purposeful, good, and dependent on God” (Barbour 1994, 6).

This depiction of God and humanity in terms of neuroanatomy underscores our point about the humanizing brain. We do not need to fall into an intellectualistic Neoplatonism about humanity’s presence in the created world. We do not need to fall into the anthropocentric trap of “attributing to things and events only those characteristics relevant to human needs and interests.”¹⁰ *The human brain is orderly and purposeful precisely as the universe is orderly and purposeful.*

The “maestro” of the microscopic study of the brain, Santiago Ramon y Cajal (1852-1934) linked the universe and the human brain. He claimed, “As long as the brain is a mystery, the universe, [which is] the reflection of the structure of the brain, will also be a mystery” (quoted by Feindel 1975, xxvi).

Bracketing the central issue of “mystery”—that of the brain and that of the universe—MacLean paraphrases Ramon y Cajal’s statement by saying “the universe” reflects “the structure of the human brain” (MacLean 1992, 57). In any event, the whole of experience and its interpretation certainly “is dependent on the structure and function of one’s own brain” (MacLean 1992, 57). What we humans know of the universe depends on what we generate in our brains—by inventing technological instruments, by assigning emotional meanings, by constructing interpretive impressions, and by drawing conclusions. “We can never hope to discover more about it [the environment] than is provided by the brain’s built-in neural networks” (MacLean 1992, 66).

ORGANIZED COMPLEXITY IN NONPERSONAL REALITY. It may seem that the physical realm per se offers the most promise of objectivity—that human penetration and calculations here approach an approximate absolute-ness. Emotional meaning is minimal. The hope and faith of scientific research has traditionally been that the physical realm possesses a repeatable order that follows rules comprehensible to the human brain/mind. And in fact, “even though chaos is rather common,” notes physicist Davies, “it is clear that on the whole the universe is far from being random. . . . It possesses a subtle kind of complexity that places it part way between simplicity on the one hand and randomness on the other (Davies 1992, 136).

The absence of emotion or the minimal presence of emotion suggests that the cognitive processing of such “organized complexity” takes place not only below the neocortex but also below and apart from the limbic system, the locus of emotional meaning. However, the notion that absolute physical knowledge is available, while often attributed to “science,” actually went out with the nineteenth century—certainly with the demise of modernity.

Quantum Theory. Today, scientific thinking cannot ignore quantum theory, including the uncertainty principle. This principle holds that the more fuzzy the momentum of an electron, the clearer is its position. Conversely, the fuzzier the position, the clearer its momentum. The upshot of such observational difficulties, according to philosopher Holmes Rolston, III, is an issue of instrumentation. That is, the quest to build “more precise measuring instruments to gain access to formerly inaccessible data . . . has become also a *mental one*.” Macroscopic models fail to describe the microscopic world nonsymbolically. “What started as an empirical cloudiness is now a theoretical epistemic indeterminacy,” claims Rolston (1987, 45–47).

Thus, since early in the twentieth century, quantum theory has denied *on principle* that any epistemological certainty is possible at the subatomic level. “Oh well,” said advocates of cause-and-effect relations, “quantum theory doesn’t apply at levels higher than the subatomic.” Now, chaos theory and, in particular, complexity theory are muddying these waters.

Chaos Theory. This thinking refers to phenomena in which cause and effect do have a linear relationship but the causes are so subtle, so many, and so interrelated that it is impossible to know what they are. A familiar example is the “Chinese butterfly effect.” In this example, a butterfly in Beijing flaps its wings, creating a bit of turbulence in the air. This turbulence, in turn, has other consequences, which give rise to other effects—including rain in Chicago two weeks later. If the butterfly in Beijing had not flown when it did—but all other events had been the same—the entire chain of events would not have taken place as it did. Chicago would have had sunshine instead of rain.

Complexity Theory. Of course, all other events never are the same. This fact is what complexity theory addresses. In *complex* phenomena, there are a number of decision makers or natural causes acting in parallel. They interact with one another, and then each adapts to the actions of the others. These adaptations, in turn, create more new situations. Again, everything must readapt to the changes. Furthermore, there are adaptations at various levels—for example, at the levels of molecules, cells, and organisms—and the levels also interact with one another. Continual co-adaptation leads to more intricate interrelationships and the emergence of novel situations.

A complex system never reaches equilibrium; it is always in a state of flux. One of the keys here is that certain parts of the system *actively adapt*; they are not simply passive subjects of cause and effect. This power for change within the system is called *autocatalyzing*. Since new organizational structures originate within the system, the system is called *self-organizing*. The novelty that continually results is called *emergence*.

Complexity thus has several hallmarks: highly dispersed agents, acting in parallel; a rich web of interactions; and coadaptation leading to coevolution, self-organization, and the perpetual emergence of novel phenomena (Waldrop 1992, 145, 253, and *passim*).

We see these *complex adaptive systems*, as they are termed, at many levels of experience. The economy may be one example. Many different individuals decide to buy or sell, work at one thing or another, import or export. These decisions affect business conditions, which in turn influence high-level corporate decisions as well as individuals. The adaptations they make may lead to the emergence of new products, new corporations, or new ways of doing business—which in turn have other outcomes. All the decisions continue to be made in parallel; various levels continue to affect other levels. Novelty continues to emerge, and the system is never at rest.

We see complexity in ecosystems, computer phenomena—and activities of the human brain. In the brain, for example, various events activate *cell assemblies*. Each cell assembly has as many as ten thousand neurons distributed over a large part of the brain. They communicate with each other across their synapses; each of the neurons has as many as ten thousand synapses (Waldrop 1992, 160). The signals of one neuron may thus affect many other neurons, which adapt in turn, leading to unpredictable, novel phenomena. These interactions never reach complete equilibrium; something new is always taking place. These complex systems operate at all levels of the brain. We find them in the conscious processes of the neocortex, in the emotions of the limbic system, in dreaming (Hobson 1994), and in the unconscious processes that precede consciousness or coordinate muscular activity, even breathing.

Yet, there is in complex adaptive systems an element of stability. Certain rules of interaction remain the same over time. Certain elements, certain players, change little or not at all. Thus, a final hallmark of complex adaptive systems—including the brain—is that *they exist at the interface between stability and instability*. This mix of the stable and the unstable, of causality and chance, is a requirement for the emergence of the novel. Because these conditions exist in the brain-mind, it is possible for the new and undetermined to emerge.

In the ubiquity of complex, dynamic systems, one may see a model of human interaction with all levels of our world. In size, humans stand at the midpoint. We are about as many orders of magnitude larger than subatomic particles as we are smaller than the cosmos. The particle, the cell, the brain, the political-economic system, the ecosystem, the solar system, the cosmos—all roil in continual interaction with levels above and below, catalyzing self-organization at ever more complex levels.

British astronomer James Jeans, writing in 1931, had an intuitive grasp of the realities of complex adaptive systems when he argued: “We discover that the universe shows evidence of a designing or controlling power that

has something in common with our own individual minds—not, so far as we have discovered, emotion, morality, or aesthetic appreciation, but the tendency to think in the way which, for want of a better word, we describe as mathematical” (Jeans 1931, 137, quoted in Davies 1992, 203). “Whether one wishes to call that deeper level ‘God’ is a matter of taste and definition,” observed physicist Paul Davies. However, he concludes, as we have already noted, that mind is “an absolutely fundamental facet of reality. That is not to say that we are the purpose for which the universe exists. Far from it. . . . [Rather] we human beings are built into the scheme of things in a very basic way” (Davies 1992, 16).

We will unbundle some of these claims later. For now let us consider the fact that the human mind, for its size, is the most complex entity in the known universe. If the universe is structured as a self-organizing, complexifying system, then we may see the human brain as one of its premier expressions. Processes of interactive complexity expressed by the brain’s billions of synapses play out an ever-changing symphony of organized and reorganized thoughts and actions. The ongoing processes of the universe are clearly manifest in the human brain, the humanizing brain.

As astronomy has found millions of galaxies in a cosmos of unimaginable scope, the perceived place of humans has shrunk to minute proportions. We seem as specks of protoplasm—meaningless, futile bits of life lost in space. But in light of such new insights, the human brain may not be so insignificant. In fact it may be a harbinger of a novelty to come, on a time scale measured in eons. The brain may be our best exemplar of the built-in nature of the cosmos.

No particular brain-mind carries the whole of reality. No individual brain—of premier, of president, of pope, or of Jesus, Muhammad, or Buddha—can be taken as the final criterion of meaning seeking. Instead, the brain-mind of humanity as a species contains evidence of—and contributes to—the way things really are. The human brain is the locus of our reality: the initiating alpha and the culminating omega of meaning seeking.

PERSONAL REALITY AND RELATIONAL LOGIC. The brain-mind, in truth, bears the weight—the glory—of the universe. Yet *Homo religiosus*—the creature who carries knowledge of the whole—ever searches to find ways to make that knowledge explicit. The old mammalian brain and the neocortex, discussed in later chapters, combine to transform nonpersonal reality into personal reality, a human and humanlike universe. The brain develops both emotional meaning and cognitive coherence. The whole brain and the whole of reality are intimately intertwined. Grand as the universe may be, the world in which we live and the ways in which we engage that world, according to biogeneticist Lindon Eaves and theologian Philip Hefner, “demand personal language” (Hefner 1993, 85).

The Ultimately Personal. We are joining the human and the universal—the part and the whole. We find precedent for that linking in the Alexandrian theologian Origen in the third century and in the mystic Bernard of Clairvaux in the twelfth century, as we have already indicated. Each expressed the idea of the creature carrying knowledge of the whole: the mystical marriage of the Logos and the soul (Tillich 1968, 63, 68).

This metaphorical yoking evokes the wise ordering of the universe in terms of the christological vision. The letter to the Ephesians gives us a glorious expression of that vision: “With all wisdom and insight [the God and Father of our Lord Jesus Christ] has made known to us the mystery of his will . . . to gather up all things in him, things in heaven and things on earth” (Eph. 1:8b–10, NRSV), or, we might add, the many agents interacting in the complex systems of the universe.

Physicist/philosopher Ian Barbour lifts up a comparable interactive view of the universe. He describes reality in terms of process: “The world is a community of interdependent beings rather than a collection of cogs in a machine” (cited in Davies 1992, 182).

Soul, for example, connotes the core of what humanity can uniquely call its own (Ashbrook 1958, 1991, 1992), the identity and spirituality of each individual human being. In each person, accumulated complexification contributes to an identity that may be understood as that person’s unique “soul.” The soul, far from being a nonmaterial entity, bears and expresses the unique stamp of each person’s mind-brain. Thus, in some mysterious way, the universe reveals itself in humanity, and humanity seeks to understand its origin and destiny in the universe.

The Judeo-Christian scriptures wrestle with this interface between the human and the ultimate. The Old Testament views God as humanlike. God scoops up clay as a potter. God breathes breath into the clay as in cardiopulmonary resuscitation. God walks in the garden. God talks with a terrified couple. God is zealous, even jealous, over infidelity. The instances of God being humanlike are endless. The New Testament also proclaims God as human. The Word becomes flesh, incarnate. God opens the eyes of the blind, feeds the hungry, liberates the oppressed, dies on a cross, turns the world upside down.

The Image of God. There have been many interpretations of the concept of the image of God (*imago Dei*). To us, the notion that humans reflect the *image and likeness* of God refers neither to physical appearance nor to gender. Instead, it refers to the complex adaptive behavior by which humankind, through relationships and activities, may manifest God’s liberating transformation on earth (Gen. 1:28; note Metzger and Murphy 1991, 3). Masculine domination, with its exclusivity, privilege, and superiority (Schüssler Fiorenza 1994, 131), has no ontological justification in the notion of humanity being created in the image of God. Thus, in

biological terms there is no permanent justification for masculine domination in understanding the brain-mind of males and females.

What, then, can we say about God and humanity?

A Humanlike God. The brain “humanizes” reality. How we humans orient ourselves to what is, how we organize what we perceive, how we interpret what matters, how we cocreate new, emergent phenomena—each of these issues rests on our needs for order, relationality, meaning, understanding. Strategies for understanding order change over time. We reinvent them to accommodate new developments in scientific knowledge (Kuhn 1970), new economic realities, new forms of political organization. Understand we must. And because we are inevitably symbolizing, conceptualizing, meaning-seeking beings, “we need to give more attention to how people define situations and how they go about coming to terms with them,” according to anthropologist Clifford Geertz (1973, 141).

We humans use certain basic strategies for defining situations: anticipation, purpose, organization, integration. We rely on processes that are both piece-by-piece and all-at-once, both a bottom-up way of organizing experience and a top-down variety of causal relationships. At the culmination of his career, Nobel Prize-winning neuroscientist Roger Sperry advocated a view of brain activity that included both tendencies. He observed that “conscious experience appears in the causal chain of brain activity at upper (i.e., cognitive) levels of brain processing in the form of irreducible emergent properties”—in other words, top-down (Sperry 1991, 243; see also Sperry 1993).

Brain-cell excitation, in this view, no longer waits solely on biophysical forces but also obeys a higher command involving subjective feelings, wants, choices, intentions, moral values, and all other things of the mind (Sperry 1991, 247). These include “beliefs that concern life’s purpose and meaning, beliefs about God and the human psyche, and its role in the cosmic scheme” (Sperry 1991, 240). “This reciprocal, two-way control in opposing directions is not in conflict because different forms of causation are operating in the upward and downward directions” (Sperry 1991, 247).

Ian Barbour likewise rejects a solely bottom-up view of causal relationship when dealing with “organisms and human beings.” He insists, “we need to speak of top-down causality . . . [because] events at higher levels or organization in integrated systems impose constraints and boundary conditions on events at lower levels without violating the physical and chemical laws applicable at those levels” (Barbour 1994, 7). The universe in which we live, of which we are a part and whose future we influence, is a changing, adapting, ever complexifying whole, not foreign to humanity as a species.

RELATIONAL REALITY. The modern worldview, from which many of us are just emerging, was mechanistic. It placed humanity in a bottom-up reality in which people, like molecules and cells, were controlled by deterministic forces of cause and effect. In such a setting, to be humanlike was to be alien.

Despite our generation's best efforts at impersonal rationality, however, we find ourselves to be both stable and unstable, predictable and novel, adaptive and creative. In the postmodern world, we may again feel at home. We have a place in this world, for we are like it. As "created co-creators," to use the powerful phrase of theologian Philip Hefner, we may indeed reflect the "image of God." To turn the issue around, God may be apprehended through the image of humanity.

This section has been advocating a view of reality mediated by the lens of the human. While such a view suggests anthropomorphism, it actually goes beyond that. It suggests that reality itself is *actually* humanlike. Put another way, the human brain-mind and the larger reality share a fundamental likeness. People can only perceive things in a humanlike way—and any reality that we perceive must of necessity be humanlike. Though one may argue that humans construct not only reality but God, one may go a step further and contend that such constructs are not inaccurate. The inner representations of God and reality and their outer referents are intricately related. They reflect each other.

The painter-sculptor-architect-poet Michelangelo (1475–1564) has shaped Western culture's image and interpretation of God and the God-like as much as any other single person.¹¹ His work reflects traditional Hebrew-Christian theology and Neoplatonic philosophy (Fleming 1974, 191–94). To Michelangelo, humanity held a "supreme place in the universal scheme of things," and the artist's figures mediate between the human and divine spheres.

In the Sistine Chapel ceiling fresco, Michelangelo thematized the creation of the world, the fall of humanity, and humanity's ultimate reconciliation with God. The depiction of God shifts from a patriarchal human figure in the *Creation of Eve* to a cosmic spirit discerned as "a swirling abstraction in the realm of pure being." This may have referred to the Neoplatonic goal of the union of the soul with God, with the soul portrayed as ascending into the pure light of knowledge and the freedom of infinity. As Pico della Mirandola put it, in this view humanity "withdraws into the center of his own oneness, his spirit made one with God" (quoted in Fleming 1974, 194).

In Michelangelo's depiction of the Creation we see God and humanity juxtaposed in a way "unrivaled by any other artist" (see figure 1) (Janson 1967, 360). An earthbound Adam and an energized God, rushing through the heavens, are about to activate the divine spark—the soul, the breath of life—as the index fingers of God's right hand and Adam's left hand are

almost touching. The God of creation is an intentional God.



Fig. 1. *The Creation of Adam* by Michelangelo. From Alinari/Art Resource, New York. Reprinted by permission.

The artist depicts God as a dynamic older man, with flowing hair and a crisp beard, surrounded by celestial beings. “Adam strains not only toward his Creator but toward Eve, whom he sees, yet unborn in the shelter of the Lord’s left arm” (Janson 1967, 360). Some interpreters have suggested that the figure is not Eve, but Wisdom (Miller and Christensen 1991, 1111), an idea that can be linked with Logos/Sophia as a male/female personification of divine Wisdom (see Schüssler Fiorenza 1994).

For almost five hundred years this imaginative view of God has influenced the way we Westerners have conceived of God. Then in October 1990, in *The Journal of the American Medical Association*, physician Frank Lynn Meshberger published an interpretation of Michelangelo’s Adam based on neuroanatomy. In it he brought together the energizing God and the humanizing brain. He contended that in depicting the creation of Adam the artist had “encoded a special message” based on his belief that “the ‘divine part’ we ‘receive’ from God is the ‘intellect.’”

In addition to the main characters of God and Adam, Meshberger believed that there was a third “main character.” This previously unrecognized “character” is the image of the human brain. Figures 2 and 4 show the human brain; figures 3 and 5 show Michelangelo’s outlines of God.

A close examination of the Sistine Chapel ceiling reveals that, unlike almost all the other figures depicted there, this image of God is set against a contrasting area of abstract shape. Meshberger shows that the overall impression of this background, as well as detailed portions of it, are “compatible with a brain.”

Meshberger concludes that this is no accident. Because of Michelangelo’s

intimate knowledge of anatomy, he knew very well how a brain was constructed. Michelangelo meant to portray that “what God is giving to Adam is the intellect, and thus man is able to ‘plan the best and highest’ and to ‘try all things received’” (Meshberger 1990, 1841).

It is true that much religion consists of prejudices projected into the heavens. The God we humans conceptualize sometimes supports the narcissistic wishes of our hearts and the ethnocentrism of our communities. Yet, built into our brains is the necessity for relatedness to one another and the drive for the seeking of meaning. God beyond God—beyond narcissistic and ethnocentric projection—combines transcendence and immanence, otherness and relationality, elusiveness and interaction. What matters most to our existence consists of a relationship between ourselves and all that we know of the universe of influences in which we find ourselves. We have been created by that which is not of our own doing and yet we are co-creators with that which has brought us into being.

Since we are created in the image and likeness of God, we have the ability to think and imagine and decide—yes, and the ability to distort and destroy. Yet we can get outside our own individualistic perspectives. We can look back on our involvement. We can ask questions. We can obtain evidence. We can weigh alternatives. We can anticipate consequences. We can interrupt a strict reptilian stimulus-response reaction by taking into account other values and other perspectives. The yardstick by which we measure life is within us yet beyond our capacity to capture rationally. The Ground of Being is always more than we can comprehend and other than we can articulate. God is always more than our idea of God.

If God were nothing more than the projection of human wishes, we would be caught in the quicksand of our own subjectivity. There would be no way of breaking out of self-centeredness. There would be no way of breaking out of ethnocentrism. If the only reality were the reality of our own creation, it would be impossible to discern anything other than what we wished to see. God’s will would be nothing more than our own whims.

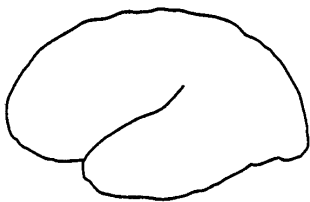


Fig. 2. An outline of the human brain (left hemisphere).



Fig. 3. Michelangelo's outline of God in context.

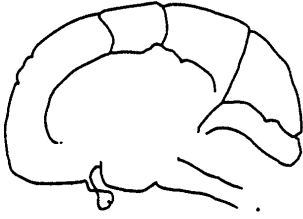


Fig. 4. An inner outline of the human brain.

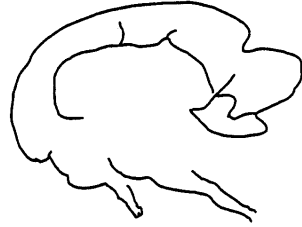


Fig. 5. Michelangelo's outline of God.

From Frank Lynn Meshberger, "An Interpretation of Michelangelo's Creation of Adam Based on Neuroanatomy," *Journal of the American Medical Association*, vol. 264, no. 14 (October 1990), 10:1837–41. Copyright 1990, American Medical Association. Reprinted by permission.

But God is more than we can imagine and other than we can conceive. God is not simply a mirror reflecting the image of any particular person or any particular culture. Because God is the truth about the whole of reality, reality eventually shows up our distortions and projections. Falseness cannot be consistently maintained or elaborated. Misperception breaks down—whether in the faulty foundation of a building or the faulty foundation of a racist and sexist society. There is a judgment, an accounting, a reckoning—however it may be said—that is inescapable. The wheels of the really real grind exceedingly slowly, but they do grind, and they grind exceedingly fine.

We as individuals may never let go of our notions about God. But the fruits of such conceits finally show them up as a distortion of the God who makes us relationally in God's own image. The human face of God is always more than and other than any particular face, but we can only imagine the humanlike quality of God through the lens of our own humanness.

NOTES

The Humanizing Brain may be ordered from the Pilgrim Press, 700 Prospect Avenue East, Cleveland, OH 44115, 800-537-3394.

1. Here, and in excerpted material throughout the article, the reader will find forms of the word *man* or the masculine pronoun that are intended to refer to all human beings. We have opted not to mark such appearances with *sic* because of the distraction created by overusing this device.

2. Paul Davies describes patterns, novelty, creativity, and uncertainty as part of the "propensity for self-organization" at every level of the universe. He rejects the term *predestinist* because of its assumption of "inevitable outcome of the operation of the laws of nature." Instead, he prefers the term *predisposition*: "nature has a predisposition to progress along the general lines it has . . . [which includes] the existence of complexity and organization at all levels, including human consciousness." "Creation is not instantaneous; it is an ongoing process. The universal has a life history . . . [like an unfolding flower] a pre-existing plan or project which the universe is realizing

as it develops," a "cosmic blueprint," if you will (Davies [1987] 1989, 201, 203, 200).

3. We caution the reader that by complexification we do not mean a process by which the world necessarily gets "better and better." It is a morally neutral process whose outcome *can be affected* by moral agents.

4. The word *symbol* comes from a Greek word meaning "to throw a token." We throw out symbols as tokens of larger ideas. They thereby point beyond themselves toward a greater structure in which they participate. The word *metaphor* also comes from the Greek and means "to transfer." Metaphors are images that bridge different meanings by showing a likeness between them. That transfers meaning from one object to another, thereby suggesting new and different understanding (Pearce 1992, 155).

5. We are indebted to Professor Rachel M. Caldwell, Director of the Division of Arts and Humanities, Rogers State College, for the phrase "the humanizing brain."

6. NRSV denotes the New Revised Standard Version of the Bible.

7. Like every generalization, broad categories such as "neuroscience" and "religion" obscure as much as they clarify. Our reference to neuroscience graphically illustrates the case of saying too much and informing too little. As a reflection of the accelerating importance of neuroscience research, the United States Congress declared the 1990s to be the "Decade of the Brain." During this era, research has emerged in a range of disciplines from molecular biology to behavioral analysis to consideration of consciousness. While we recognize the basic importance of a cellular and molecular approach to the function of the nervous system (for instance, Changeux 1985; Nicholls, Martin, and Wallace 1992) in which an understanding of neurons, synapses, neurotransmitters, and their properties is basic to understanding higher brain functions, our competence and interest are directed more to "the new cognitive neuroscience" (for instance, Gardner 1985; LeDoux and Hirst [1986] 1990; Kosslyn and Koenig 1992) in which attention is directed to how the brain thinks and perceives, to "cognitive psychology" (for instance, Medin and Ross 1990), functions of the mind (for instance, Trevarthen 1990), neuropsychology (for instance, Kolb and Whishaw [1981] 1985), to "the neuropsychology of consciousness" (for instance, Milner and Rugg 1992) and "the psychology of consciousness" (for instance, Farthing 1992), and to language itself (for instance, Lakoff 1987; Pinker 1994) as "a human instinct, hard-wired like web spinning in spiders."

8. Although Jesus as the Christ symbolizes—incarnates—the eternal God for Christians, the New Testament witnesses to the rejection of that absolutizing by virtue of the crucifixion. Tillich (1957) contends that precisely because Jesus gave up the claim to ultimacy we have a criterion of ultimacy. In the Fourth Gospel, Jesus declares, "Who believes in me *believes not in me* but in him who sent me" (John 12:44, emphasis added).

9. In contrast to Geertz's position, in the early 1980s anthropologist Victor Turner confessed to the limitation of anthropological axioms that "express the belief that all human behavior is the result of social conditioning" ([1983] 1993).

10. For instance, "we see in wildflowers only those patterns reflecting light visible to humans, that is, that between infrared and ultraviolet, and we assume we see all there is to see about flowers. In contrast insects, whose view of flowers is privileged by highly evolved relations with them, see flower patterns visible by ultraviolet as well" (Guthrie 1993, 81).

11. The poet-painter William Blake (1757–1827) followed Michelangelo's lead in his own memorable image of God in *The Ancient of Days*, in which the muscular figure, using his left hand rather than his right, symbolically represents the Lord as the Architect of the Universe (Janson 1967, 467–68).

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