BODY, BRAIN, AND CULTURE

by Victor Turner

Abstract. Recent work in cerebral neurology should be used to fashion a new synthesis with anthropological studies. Beginning with Paul D. MacLean's model of the triune brain, we explore Ralph Wendell Burhoe's question whether creative processes result from a coadaptation, perhaps in ritual itself, of genetic and cultural information. Then we examine the division of labor between right and left cerebral hemispheres and its implications for the notions of play and "ludic recombination." Intimately related to ritual, play may function in the social construction of reality analogous to mutation and variation in organic evolution. Finally, we consider how our picture of brain functioning accords with some distinctive features of the religious systems dominant in human cultures.

The present essay is for me one of the most difficult I have ever attempted. This is because I am having to submit to question some of the axioms anthropologists of my generation—and several subsequent generations—were taught to hallow. These axioms express the belief that all human behavior is the result of social conditioning. Clearly a very great deal of it is, but gradually it has been borne home to me that there are inherent resistances to conditioning. As Anthony Stevens has recently written in an interesting book which seeks to reconcile ethological and Jungian approaches: "Any attempt to adopt forms of social organization and ways of life other than those which are *characteristic of our species* must lead to personal and social disorientation" (italics added).[1] In other words, our species has distinctive features, genetically inherited, which interact with social conditioning, and set up certain resistances to behavioral modification from without. Further, Robin

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Fox has argued: "If there is no human nature, any social system is as good as any other, since there is no base line of human needs by which to judge them. If, indeed, everything is learned, then surely men can be taught to live in any kind of society. Man is at the mercy of all the tyrants who think they know what is best for him. And how can he plead that they are being inhuman if he doesn't know what being human is in the first place?"[2] One of those distinctive human features may be a propensity to the ritualization of certain of our behaviors, from smiling and maternal responsiveness onwards.

Theories of Ritualization

In June 1965, I took part in a discussion on "ritualization of behavior in animals and man" organized by Sir Julian Huxley for the Royal Society and held—perhaps appropriately—in the lecture hall of the Zoological Society of London, near the Mappin Terraces, where the monkeys revel. The "hard core" of the conference consisted of zoologists and ethologists, Huxley, Konrad Lorenz, R. A. Hinde, W. H. Thorpe, Desmond Morris, N. M. Cullen, F. W. Braestrup, I. Eibl-Eibesfeldt, and others. Sir Edmund Leach, Meyer Fortes, and I spoke up for British anthropology in defining ritual, but by no means as unanimously as the ethologists did in defining ritualization. Other scholars represented other disciplines: psychiatrists included Erik Erikson, R. D. Laing, and G. Morris Carstairs. Sir Maurice Bowra and E. H. Gombrich spoke about the ritualization of human cultural activities, dance, drama, and art. Basil Bernstein, H. Elvin and R. S. Peters discussed ritual in education and David Attenborough shared his ethnographic films on the Kava ceremony in Tonga and land-diving in Pentecost, New Hebrides.

The nonethologists generally accepted Leach's position that "it cannot be too strongly emphasized that ritual, in the anthropologist's sense, is in no way whatsoever a genetic endowment of the species."[3] I took up no public position at that time, since I was secretly, even guiltily impressed by the ethologists' definition of "ritualization" which seemed to strike chords in relation to human ritual, summed up by Huxley as follows: "Ritualization is the adaptive formalization or canalization of emotionally motivated behavior, under the teleonomic pressure of natural selection so as: (a) to promote better and more unambiguous signal function, both intra- and inter-specifically; (b) to serve as more efficient stimulators or releasers of more efficient patterns of action in other individuals; (c) to reduce intra-specific damage; and (d) to serve as sexual or social bonding mechanisms."[4] Actually, much of Huxley's definition is better applied analogically to those stylized human behaviors we might call "communicative," such as manners, decorum, ceremony, etiquette, polite display, the rules of chivalry (which inhibit

the infliction on one another of damage by conspecifics) than to ritual proper.

In various publications I have suggested that ritual was "a *transformative* performance revealing major classifications, categories, and contradictions of cultural processes." In these respects it might conceivably fulfil Huxley's fourth function, that of "serving as sexual or social bonding mechanisms," by transforming social and personal life-crises (birth, initiation, marriage, death) into occasions where symbols and values representing the unity and continuity of the total group were celebrated and reanimated. The cultural rituals which seem most to embody something resembling Huxley's definition of "ritualization" are "seasonal, agricultural, fertility, funerary, and healing ones, because they make explicit the interdependence of people with their physical environments and bodies."[5] But as I have written elsewhere, ritual is not necessarily a bastion of social conservatism; its symbols do not merely condense cherished sociocultural values. Rather, through its liminal processes, it holds the generating source of culture and structure. Hence, by definition ritual is associated with social *transitions* while *ceremony* is linked with social *states*. Performances of ritual are distinctive phases in the social process, whereby groups and individuals adjust to internal changes and adapt to their external environment.

Meyer Fortes, William Wyse Professor of Anthropology and Archaeology at Cambridge, influenced by Sigmund Freud, defined ritual at the London conference as "procedure for prehending the occult, that is, first, for grasping what is, for a particular culture, occult (i.e., beyond everyday human understanding, hidden, mysterious) in the events and incidents of people's lives, secondly, for binding what is so grasped by means of the ritual resources and beliefs available in that culture, and thirdly, for thus incorporating what is grasped and bound into the normal existence of individuals and groups."[6] This formulation might well identify psychoanalytical clinical procedure as ritual process. Fortes makes his Freudian affiliation quite clear when he goes on to write that "ritual is concerned with prehending the unconscious (in the psychoanalytical sense) forces of individual action and existence, and their social equivalents, the irreducible factors in social relations (e.g., the mother-child nexus, at one end of the scale, the authority of society at the other). By bringing them, *suitably disguised*, or symbolized in tangible material objects and actions, into the open of social life, ritual binds them and makes them manageable" (italics added).[7]

Unlike Leach, Fortes sees ritual more as the handling of otherwise unmanageable power than the communication of important cultural knowledge. For Fortes irreducible ambiguities and antinomies are

made visible and thus accessible to public and legitimate control—a position to which with important modifications I myself have subscribed—while for Leach the emphasis in ritual is cognitive and classificatory. As he writes, "it is characteristic of many ritual and mythical sequences in primitive society that the actors claim to be recapitulating the creation of the world and that this act of creation is mythologized as a list of names attached to persons, places, animals, and things. The world is created by the process of classification and the repetition of the classification of itself perpetuates the knowledge which it incorporates."[8] Ritual's multicoded redundancies inscribe its "messages" on the minds of the participants. Clearly, the main difference between anthropologists of the Leachian persuasion and the ethologists in their concept of ritualization or ritual lay in the emphasis of the former on ritual as learned, culturally transmitted behavior, intrinsically linked with the development of language, and of the latter on ritual as genetically programmed behavior with important nonverbal components.

The Neurobiology of the Brain: Culturetype and Genotype

The years passed. I continued to treat ritual essentially as a cultural system. Meanwhile exciting new findings were coming from genetics, ethology, and neurology, particularly the neurobiology of the brain. I found myself asking a stream of questions more or less along the following lines. Can we enlarge our understanding of the ritual process by relating it to some of these findings? After all, can we escape from something like animal ritualization without escaping our own bodies and psyches, the rhythms and structures of which arise on their own? As Ronald Grimes has said, "They flow with or without our conscious assent; they are uttered-exclamations of nature and our bodies."[9] I also asked myself many of the questions raised by Ralph Wendell Burhoe in his part of the introduction to this issue of *Zygon*—especially, following Edward O. Wilson, what is the nature of the alleged "chain," and how long is it, by which genes hold cultural patterns, including ritual patterns, to use the idiom of sociobiology, "on leash"? This, it seemed to me, is where the neurobiology of the human brain begins to be relevant.

We shall have occasion to look at the findings of Paul MacLean, the neuroanatomist, again later, but something should be said now about his work on what might be called "archaic" structures of the human brain. His early work dealt with what is called the limbic system, an evolutionarily ancient part of the brain concerned with the emotions, cradled in or near the fringes of the cortex. In a 1949 paper he suggested that the limbic system is "the major circuit that would have to

be involved in psychosomatic diseases, such as gastrointestinal ulcers caused by social or psychological stress, a now widely accepted hypothesis since it has been demonstrated that this system controls the pituitary gland at the base of the brain and the autonomic nervous systems, which in turn control the viscera."[10] He further proposed in 1952 that the frontal lobes of the cerebral hemispheres, shown to be "the seat of the highest human faculties, such as *foresight and concern for the consequences and meaning of events*, may have these functions and others *by virtue of intimate connections between the frontal lobes and the limbic system*" (italics added).[11] Here we see that the highest and newest portion of the cerebral cortex has by no means detached itself from an ancient, "primitive" region, but functions as it does precisely "by virtue of its relationship to the old emotional circuitry."[12] Later, Walle Nauta, a celebrated neuroanatomist, has referred to the frontal lobes as "the neocortex of the limbic system."[13] As Melvin Konner concludes: "Just as other parts of the cortex have been identified as the highest report-and-control centers for vision, hearing, tactile sensation, and movement, so the frontal lobes have emerged as the highest report-and-control center for the emotions."[14] Thus evolutionarily recent and archaic patterns of innervation interarticulate, and the former is pliant to conditioning while the latter is quite resistant.

Paul MacLean's work, and related studies by Jason Brown, raise the question neatly formed by Burhoe: What is the role of the brain as an organ for the appropriate mixing of genetic and cultural information in the production of mental, verbal, or organic behavior? Burhoe raises further important questions: To what extent is the lower brain, including the limbic system and its behavior (to continue the metaphor), "on a very short leash" under the control of the genotype? (Konner uses the term genetically "hard wired.") In other words is genetic inheritance a definitive influence here? The corollary would seem to run as follows: To what extent is the upper brain, especially the neocortex, which is the area responsible in mammals for coordination and for higher mental abilities, on a longer leash in terms of control by the genotype or genome, the fundamental constitution of the organism in terms of its hereditary factors? Does socioculturally transmitted information *take over* control in humankind and, if so, what are the limits, if any, to its control? Does the genotype take a permanent back seat, and is social conditioning now all in all? The picture thus built up for me was of a kind of *dual control* leading to what Burhoe calls a series of symbiotic coadaptations between what might be called culturetypes and genotypes. MacLean's hypothesis about the anatomical relations of the frontal lobes to the limbic system is certainly suggestive here. Subsequently MacLean went further and gave us his model of the "triune

brain." (As we shall see later, J. P. Henry and P. M. Stephens have recently argued that the dominant or left cerebral hemisphere represents a fourth and phylogenetically most recent system peculiar to our species.[15]) According to his model, MacLean sees us as possessing three brains in one, rather than conceiving of the brain as a unity. Each has a different phylogenetic history, each has its own distinctive organization and make-up, although they are interlinked by millions of interconnections, and each has its own special intelligence, its own sense of time and space, and its own motor functions.[16] MacLean postulates that the brain evolved in three stages, producing parts of the brain which are still actively with us though modified and intercommunicating.

The first to evolve is the *reptilian brain*. The is the *brain stem*, an upward growth of the spinal cord and the most primitive part of the brain, which we share with all vertebrate creatures and which has remained remarkably unchanged throughout the myriads of years of evolution. In lizards and birds this brain is the dominant and controlling circuitry. It contains nuclei which control processes vital to the sustenance of life (i.e., the cardiovascular and respiratory systems). Whereas we can continue to exist without large portions of our cerebral hemispheres, without our reptilian brain we would be dead! What MacLean did was to show that this "structure" or "level," as some term the reptilian brain, whether in reptiles, birds, or mammals, is not only concerned with control of movement, but also with the storage and control of what is called "instinctive behavior"—the fixed action patterns and innate releasing mechanisms so often written about by the ethologists, the genetically preprogrammed perceptual-motor sequences such as emotional displays, territorial defense behaviors, and nest-building. According to Brown, reptilian consciousness at the sensory-motor level is centered on the body itself and not differentiated from external space; yet it constitutes, I suppose, a preliminary form of consciousness. The reptilian brain also has nuclei which control the reticular activating system, which is responsible for alertness and the maintenance of consciousness. It is a regulator or integrator of behavior, a kind of traffic control center for the brain. Reptiles and birds, in which the *corpus striatum* seems to be the most highly developed part of the brain, have behavioral repertoires consisting of stereotyped behaviors and responses: a lizard turning sideways and displaying its dewlap as a threat, or a bird repeating again and again the same territorial song. I am not suggesting that mammals have no such behavior—clearly many have much—but rather that birds and reptiles have little else.

MacLean's "second brain" is the one he calls the *palaeo-mammalian* or "old mammalian brain." This seems to have arisen with the evolution of

the earliest mammals, the monotremata, marsupials, and simpler placentals such as rodents. It is made up of those subcortical structures known as the midbrain, the most important components of which are the limbic system, including the hypothalamus (which contains centers controlling homeostatic mechanisms associated with heat, thirst, satiety, sex, pain and pleasure, and emotions of rage and fear), and the pituitary gland (which controls and integrates the activities of all the endocrine glands in the body). The old mammalian brain differs from the reptilian brain generally in that it is, as the neuroanatomist James Papez defines it, "the *stream of feeling*," while the older "level" is the "*stream of movement*." The hypothalamic and pituitary systems are homeostatic mechanisms *par excellence*; they maintain normal, internal stability in an organism by coordinating the responses of the organ systems that compensate for environmental changes. Later, we shall refer to such equilibrium-maintaining systems as "trophotropic," literally "responding to the 'nourishing' (*trophē*) maintenance of organic systems," "keeping them going," as opposed to the "ergotropic" or aroused state of certain systems when they do "work" (*ergon*), "put themselves out," so to speak. These trophotropic systems, in Stevens's words,

> not only maintain a critical and supremely sensitive control of hormone levels [hormones, of course, being substances formed in some organ of the body, usually a gland, and carried by a body fluid to another organ or tissue, where it has a specific effect], but also balance hunger against satiation, sexual desire against gratification, thirst against fluid retention, sleep against wakefulenss. By this evolutionary stage, the primitive mammalian, the major emotions, fear and anger, have emerged, together with their associated behavioral responses of flight or fight. Conscious awareness is more in evidence and behavior is less rigidly determined by instincts, though these are still very much apparent. The areas concerned with these emotions and behaviors lie in the limbic system, which includes the oldest and most primitive part of the newly evolving cerebral cortex—the so-called *palaeocortex*. . . . In all mammals, including man, the midbrain is a structure of the utmost complexity, controlling the psychophysical economy and many basic responses and attitudes to the environment. An animal deprived of its cerebral cortex can still find its way about, feed itself, slake its thirst, and avoid painful stimuli, but it has difficulty in attributing function or "meaning" to things: a natural predator will be noticed, for example, but not apparently perceived as a threat. Thus, accurate perception and the attribution of meaning evidently requires the presence of the cerebral hemispheres.[17]

The *neo-mammalian* or "new mammalian" brain, the third in MacLean's model, corresponds to "the stream of thought" proposed by Papez and achieves its culmination in the complex mental functions of the human brain. Structurally, it is the *neocortex*—the outer layer of brain tissue or that part of the cerebrum which is rich in nerve-cell bodies and synapses. Some estimate there to be 10,000 million cells

(10^{10}). Functionally, it is responsible for cognition and sophisticated perceptual processes as opposed to instinctive and affective behavior.

Further questions are triggered by MacLean's model of the triune brain. For example, how does it fit with Freud's model of the id, ego, and superego, with Carl Jung's model of the collective unconscious and archetypes, with neo-Darwinian theories of selection, and especially with cross-cultural anthropological studies and historical studies in comparative religion? One might further ask with Burhoe: to what extent is it true that human feelings, hopes, and fears of what is most sacred are a necessary ingredient in generating decisions and motivating their implementation? This question is connected with the problem of whether it is true that such information is necessarily filtered through the highly genetically programmed areas in the lower brain, the brain stem, and the limbic systems. Further questions now arise. For example, if ritualization, as discussed by Huxley, Lorenz, and other ethologists, has a biogenetic foundation, while meaning has a neocortical learned base, does this mean that creative processes, those which generate new cultural knowledge, might result from a coadaptation, perhaps in the ritual process itself, of genetic and cultural information? We also can ask whether the neocortex is the seat of programs largely structured by the culture through the transmission of linguistic and other symbol systems to modify the expression of genetic programs. How far, we might add, do these higher symbols, including those of religion and ritual, derive their meaning and force for action from their association with earlier established neural levels of animal ritualization? I will discuss this later in connection with my field data on Central African ritual symbols.

Hemispheric Lateralization

Before I examine some recent conjectures about the consequences for the study of religion of a possible coadaptation of cultures and gene pools, I should say something about the "lateralization" (the division into left and right) of the cerebral hemispheres and the division of control functions between the left and right hemispheres. The work of the surgeons P. Vogel, J. Bogen, and their associates at the California Institute of Technology in the early sixties, in surgically separating the left hemisphere from the right hemisphere to control epilepsy by cutting the connections between the two, particularly the inch-long, quarter-inch thick bundle of fibers called the *corpus callosum*, led to the devising of a number of techniques by R. W. Sperry (who won a Nobel Prize in 1981), Michael Gazzaniga, and others, which gained unambiguous evidence about the roles assumed by each hemisphere in their patients. In 1979, an important book appeared, *The Spectrum of Ritual*,

edited and partly authored by Eugene d'Aquili, Charles D. Laughlin, and John McManus.[18] In an excellent overview of the literature on ritual trance from the neurophysiological perspective, Barbara Lex summarizes the findings of current research on hemispheric lateralization. She writes: "In most human beings, the left cerebral hemisphere functions in the production of speech, as well as in linear, analytic thought, and also assesses the duration of temporal units, processing information sequentially. In contrast, the specializations of the right hemisphere comprise spatial and tonal perception, recognition of patterns—including those constituting emotion and other states in the internal milieu—and holistic, synthetic thought, but its linguistic capability is limited and the temporal capacity is believed absent. Specific acts involved complementary shifts between the functions of the two hemispheres."[19] Howard Gardner, following Gazzaniga, suggests that

> at birth we are all split-brained individuals. This may be literally true, since the corpus callosum which connects the hemispheres appears to be nonfunctional at birth. Thus, in early life, each hemisphere appears to participate in all of learning. It is only when, for some unknown reason, the left side of the brain takes the lead in manipulating objects, and the child begins to speak, that the first signs of asymmetry are discernible. At this time the corpus callosum is gradually beginning to function. For a number of years, learning of diverse sorts appears to occur in both hemispheres, but there is a gradual shift of dominant motor functions to the left hemisphere, while visual-spatial functions are presumably migrating to the right. . . . The division of labor grows increasingly marked, until, in the post-adolescent period, each hemisphere becomes incapable of executing the activities that the other hemisphere dominates, either because it no longer has access to its early learning, or because early traces have begun to atrophy through disuse.[20]

D'Aquili and Laughlin hold that both hemispheres operate in solving problems "via a mechanism of mutual inhibition controlled at the brain stem level. The world "is approached by a rapid functional alternation of each hemisphere. One is, as it were, flashed on, then turned off; the second flashed on, then turned off. The rhythm of this process and the predominance of one side or the other may account for various cognitive styles [one thinks of Pascal's contrast between '*l'esprit de geometrie*' and '*l'esprit de finesse*'], from the extremely analytic and scientific to the extremely artistic and synthetic."[21] These authors and Lex then make an interesting attempt to link the dual functioning of the hemispheres with W. R. Hess's model of the dual functioning of what are termed the ergotropic and trophotropic systems within the central nervous system, as a way of exploring and explaining phenomena reported in the study of ritual behavior and meditative states.[22] Let me explain these terms. As its derivation from the Greek *ergon* ("work") suggests, ergotropic is related to any energy-expending process within the nervous system. It

consists not only of the sympathetic nervous system, which governs arousal states and fight or flight responses, but also such processes as increased heart rate, blood pressure, sweat secretion as well as increased secretion of catabolic hormones, epinephrine (a hormone secreted by the medulla of the adrenal gland, which stimulates the heart and increases muscular strength and endurance) and other stimulators. Generally speaking, the ergotropic system affects behavior in the direction of arousal, heightened activity, and emotional responsiveness, suggesting such colloquialisms as "warming up" and "getting high." The trophotropic system (*trophé*, in Greek, means nourishment—here the idea is of system-sustaining) includes not only the parasympathetic nervous system, which governs basic vegetative and homeostatic functions, but also any central nervous system process that maintains the baseline stability of the organism, for example, reduction in heart rate, blood pressure, sweat secretion, pupillary constriction as well as increased secretion of insulin, estrogens, androgens, and so on. Briefly, the trophotropic system makes for inactivity, drowsiness, sleep "cooling down," and trance-like states.[23]

Developing the work of Hess, d'Aquili and Laughlin propose an extended model, "according to which the minor or nondominant hemisphere [usually the right hemisphere] is identified with the trophotropic or baseline energy state system, and the dominant or major hemisphere [usually the left] that governs analytical verbal and causal thinking is identified with the ergotropic or energy-expending system."[24] They present evidence which suggests that when either the ergotropic or trophotropic system is hyperstimulated, there results a "spillover" into the opposite system after "three stages of tuning," often by "driving behaviors" employed to facilitate ritual trance. They also use the term "rebound" from one system to the other; they find that when the left hemisphere is stimulated beyond a certain threshold, the right hemisphere is also stimulated. In particular, they postulate that the rhythmic activity of ritual, aided by sonic, visual, photic, and other kinds of "driving," may lead in time to simultaneous maximal stimulation of both systems, causing ritual participants to experience what the authors call "positive, ineffable affect." They also use Freud's term "oceanic experience," as well as "yogic ecstasy," also the Christian term *unio mystica*, an experience of the union of those cognitively discriminated opposites, typically generated by binary, digital left-hemispherical ratiocination. I suppose one might also use the Zen term *satori* (the integrating flash), and one could add the Quakers' "inner light," Thomas Merton's "transcendental consciousness," and the yogic *samadhi*.[25]

D'Aquili and Laughlin believe that though the end point of simultaneous strong discharge of both the ergotropic and trophotropic

systems is the same in meditation and ritual, the former begins by intensely stimulating the trophotropic system through techniques for reducing thought and desire in order to maintain "an almost total baseline homeostatis."[26] This results in "spillover" to the ergotropic side, and eventually to strong excitation of both systems. Ritual, on the other hand, involves initial ergotropic excitation. The authors have previously speculated that *causal* thinking arises from the reciprocal interconnections of the inferior parietal lobule and the anterior convexity of the frontal lobes, particularly on the dominant, usually left side, and is an inescapable human propensity. They call this brain nexus "the causal operator" and claim that it "grinds out the initial terminus or first cause of any strip of reality."[27] They argue that "gods, powers, spirits, personified forces, or any other causative ingredients are automatically generated by the causal operator."[28] Untoward events particularly cry out for a cause. Hence "human beings have *no choice* but to construct myths to explain their world," to orient themselves "in what often appears to be a capricious universe." Cause-seeking is "inherent in the obligatory functioning of the neural structures." We are, indeed, back, via neurobiology it would seem, to Aristotle's "first cause that is uncaused" or "Prime Mover unmoved"! We humans cannot do otherwise than postulate first causes to explain what we observe. They write, "since it is highly unlikely that humankind will ever know the first cause of every strip of reality observed, it is highly probable that humankind will always create gods, powers, demons, or other entities as first causes."[29]

Myths present problems to the verbal analytic consciousness. Claude Lévi-Strauss has made us familiar with some of these problems: life and death, good and evil, mutability and an unchangeable "ground of being," the one and the many, freedom and necessity, and a few other perennial "posers."[30] Myths attempt to explain away such logical contradictions, but puzzlement remains at the cognitive left-hemispherical level. D'Aquili and Laughlin argue that *ritual* is often performed situationally to resolve problems posed by myth to the analytic verbalizing consciousness. This is because like all other animals, man attempts to master the environmental situation by means of motor behavior, in this case ritual, a mode going back into his phylogenetic past and involving repetitive motor, visual, and auditory driving stimuli, kinetic rhythms, repeated prayers, mantras, and chanting, which strongly activate the ergotropic system.[31] Ergotropic excitation is appropriate because the problem is presented in the "mythical" analytical mode, which involves binary thinking, mediations, and causal chains arranging both concepts and percepts in terms of antinomies or polar dyads. These are mainly left-hemispheric properties and connect up, in the authors' view, with the augmented sympathetic discharges mentioned earlier:

increased heart rate, blood pressure, sweat secretion, pupilary dilation, increased secretion of catabolic hormones, and so on. If excitation continues long enough the trophotropic system is triggered too, with mixed discharges from both sides, resulting often in ritual trance. Lex writes that "driving techniques [also] facilitate right-hemisphere dominance, resulting in gestalt, timeless, nonverbal experiences, differentiated and unique when compared with left-hemisphere functioning or hemisphere alternation."[32] One solution, if it can so be termed, of the Sphinxian riddles posed by myth, according to d'Aquili and Laughlin, is that "during certain ritual and meditation states, logical paradoxes or the awareness of polar opposites as presented in myth appear simultaneously, *both* as antinomies and as unified wholes" (italics added).[33] There is an ecstatic state and a sense of union, brief in ritual, prolonged in meditation, where culturally transmitted techniques and intense personal discipline sustain the peak experience. One is aware of paradox, but rejoices in it, reminding one of Sören Kierkegaard's joyous celebration of the paradox of the cross as the heart of Christianity.

The problem therefore is resolved in d'Aquili and Laughlin's view not at the cognitive, left-hemispheric level but directly by an experience which is described by the authors as ineffable, that is, literally beyond verbal experession. Presumably the frequent embodiment or embedment of the myth in the ritual scenario, either verbally in prayer or song, or nonverbally in dramatic action or visual symbolism, continues to arouse within the ritual context the "cognitive ergotropic functions of the dominant hemisphere."[34] If the experiences of participants have been rewarding—and ritual devices and symbolic actions may well tune a wide range of variant somatic, mental, and emotional propensities in a wide range of individuals (amounting to the well-known redundancy of ritual with its many sensory codes and multivocal symbols)—faith in the cosmic and moral orders contained in the myth cycle will obviously be reinforced. A. J. Mandell argues in "Toward a Psychobiology of Transcendence" that "transcendent consciousness, suggested by William James to be the primary religious experience, is a neurochemically and neurophysiologically definable state, an imperturbable hypomania. . . . blissful, empathic, and creative."[35]

Play

It is clear that all this refers to the serious work of the brain, as distinct from "play." Full ergotropic, left-hemisphere behavior tends to be dramatic, agonistic behavior. I am not too happy about some authors' tendency to localize mental functions somewhat specifically in cortical regions rather than in interrelational networks, but there does seem to

be, broadly speaking, something in the division of labor between the hemispheres, in the different work they do. The term "ergotropic," as we have seen, is derived from the Greek *ergon*, "work" and *tropos*, "a turn, way, manner." It represents the autonomic nervous system in the mode of work, as a sympathetic subsystem, whereas the trophotropic system (from the Greek *trophē*, "food, nourishment") represents the autonomic nervous system in the mode of sustentation, as a parasympathetic subsystem responsible for producing a balance of functions and of chemical composition within an organism. This too is a kind of diffused work, less focused and mobilized, less intense than the ergotropic functions. But where does "play" play a part in this model? One seldom sees much mention of play in connection with brain neurophysiology. Yet play, as we have seen in the previous essay, is a kind of dialectical dancing partner of ritual and ethologists give play behavior equal weight with ritualization. D'Aquili and Laughlin hardly mention the word.

The hemispheres clearly have their *work* to do, and the autonomic nervous system has its *work* to do. The one makes for social dramas, the other for social routines. Whether normally functioning or intensely stimulated, the components of the central nervous system seem to have clearly assigned, responsible, interdependent roles to perform. One might speculate that at the neurobiological level play might have something to do with the sensitization of neural structures of an interface type, like the limbic system at the core of the brain, which is known to be intimately associated with the expression of emotion, particularly with the experience of pleasure, pain, and anger. We will return to this later.

As I see it, play does not fit in anywhere particular; it is a transient and is recalcitrant to localization, to placement, to fixation—a joker in the neuroanthropological act. Johann Huizinga, and Karl Groos before him, dubbed it a free activity, but Huizinga, Roger Caillois, and many afterwards have commented on the enclosure of playing within frames of "arbitrary, imperative, and purposely tedious conventions."[36] Playfulness is a volatile, sometimes dangerously explosive essence, which cultural institutions seek to bottle or contain in the vials of games of competition, chance, and strength, in modes of simulation such as theater, and in controlled disorientation, from roller coasters to dervish dancing—Caillois' "ilinx" or vertigo. Play could be termed dangerous because it may subvert the left-right hemispheric regular switching involved in maintaining social order. Most definitions of play involve notions of disengagement, of free-wheeling, of being out of mesh with the serious, "bread-and-butter," let alone "life-and-death" processes of production, social control, "getting and spending," and raising the next generation. The neuronic energies of play, as it were, lightly skim over

the cerebral cortices, sampling rather than partaking of the capacities and functions of the various areas of the brain. As Don Handelman and Gregory Bateson have written that is possibly why play can provide a metalanguage (since to be "meta" is to be both beyond and between) and emit metamessages about so many and varied human propensities, and thus provide, as Handelman has said, "a very wide *range* of commentary on the social order."[37] Play can be everywhere and nowhere, imitate anything, yet be identified with nothing. Play is "transcendent" (to use Edward Norbeck's term), though only just so, brushing the surfaces of more specialized neural organizations rather than existing apart from them or looking down from a godlike height on them. Play is the supreme *bricoleur* of frail transient constructions, like a caddis worm's case or a magpie's nest in nature. Its metamessages are composed of a potpourri of apparently incongruous elements: products of both hemispheres are juxtaposed and intermingled. Passages of seemingly wholly rational thought jostle in a Joycean or surrealist manner with passages filleted of all syntactical connectedness. Yet, although "spinning loose" as it were, the wheel of play reveals to us (as Mihaly Csikszentmihalyi has argued[38]) the possibility of changing our goals and, therefore, the restructuring of what our culture states to be reality.

You may have guessed that play is, for me, a liminal or liminoid mode, essentially interstitial, betwixt-and-between all standard taxonomic nodes, essentially "elusive"—a term derived from the Latin *ex* for "away" plus *ludere*, "to play"; hence the Latin verb *eludere* acquired the sense of "to take away from someone at play," thus "to cheat" or "to deceive." As such play cannot be pinned down by formulations of left-hemisphere thinking—such as we all must use in keeping with the rhetorical conventions of academic discourse. Play is neither ritual action nor meditation, nor is it merely vegetative, nor is it just "having fun"; it also has a good deal of ergotropic and agonistic aggressivity in its odd-jobbing, *bricolage* style. As Roger Abrahams has remarked, it makes fun of people, things, ideas, ideologies, institutions, and structures; it is partly a mocker as well as a mimic and a tease, arousing hope, desire, or curiosity without always giving satisfaction.[39] It is as much a reflexive interrupter as an inciter of what Csikszentmihalyi has described as flow states. Like many Trickster figures in myths (or should these be "antimyths," if myths are dominantly left-hemisphere speculations about causality?) play can deceive, betray, beguile, delude (another derivation of *ludere* "to play"), dupe, hoodwink, bamboozle, and gull—as that category of players known as "cardsharps" well know! Actually, Walter Skeat derives the English verb "play" itself from the Anglo-Saxon *plegian*, "to strike or clap"; the Anglo-Saxon noun

plega means not only "a game, sport," but also, commonly, "a fight, battle" (here again with ergotropic implications).

Play, as stated earlier, draws its materials from all aspects of experience, both from the interior milieu and the external environment. Yet, as Handelman writes, it has no instrumental potency; it is, we might put it, a "shadow warrior," or *Kagemusha*.[40] For this very reason, its range of metacommunication is great; nothing human escapes it. Still, in its own oxymoronic style it has a dangerous harmlessness, for it has no fear. Its lightness and fleetingness protect it. It has the powers of the weak, an infantine audacity in the face of the strong. To ban play is, in fact, to massacre the innocents. If man is a neotenic species, play is perhaps his most appropriate mode of performance.

More than that, it is clear, as Konner points out, play is educative. The most intelligent and long-lived mammals have developed it most fully—the primates, the cetacea, and the terrestrial and aquatic carnivores. "It serves the functions of exercise, of learning about the environment and conspecifics, and, in some species, of sharpening or even acquiring fundamental subsistence and social skills." Opportunity for observation of a task in the frame of "play" while or before trying to do it has been "shown to improve the rate of learning it in a number of mammals in experimental settings."[41] Play, then, is probably related to the higher cerebral centers—not forgetting its connection also with arousal and pleasure—particularly in rough and tumble games, where the limbic system is clearly engaged. Yet serious violence is usually controlled objectively and culturally by rules and subjectively by inhibitory mechanisms of perhaps a different type from the Freudian superego or ego-defense mechanisms, although perhaps play does defend consciousness from some of the more dangerous unconscious drives.

Finally, play, like other liminal phenomena, is in the subjunctive mood. What does this mean? The subjunctive designates a verb form or set of forms used in English to express a contingent or hypothetical action. A contingent action is one that may occur but that is not likely or intended. Subjunctivity is possibility. It refers to what may or might be. It is also concerned with supposition, conjecture, and assumption, with the domain of "as-if" rather than "as-is". (Hence, there must be a good deal of left-hemispheric activity in play, linguistic and conceptual activity, but done for its own sweet sake.) "As-is" refers to the world of what culture recognizes as factuality, the world of cause and effect, expressed in the "indicative mood"—which indicates that the denoted act or condition is an objective fact. This is *par excellence* the world of the left cerebral hemisphere. The world of the right hemisphere is, nevertheless, not identical with the world of play either, for its gestalt grasp of things holds for it the sense of a higher reality, beyond

speculation or supposition. Play is a light-winged, light-fingered sceptic, a Puck between the day world of Theseus and the night world of Oberon, putting into question the cherished assumptions of both hemispheres, both worlds. There is no sanctity in play; it is irreverent and is protected in the world of power struggles by its apparent irrelevance and clown's garb. It is almost as though the limbic system were itself endowed with higher intelligence, in a kind of carnivalesque reversal of the indicative situation.

However, since play deals with the whole gamut of experience both contemporary and stored in culture, it can be said perhaps to play a similar role in the social construction of reality as mutation and variation in organic evolution. Its flickering knowledge of all experience possible to the nervous system and its detachment from that system's localizations enables it to perform the liminal function of ludic recombination of familiar elements in unfamiliar and often quite arbitrary patterns. Yet it may happen that a light, play-begotten pattern for living or social structuring, once thought whimsical, under conditions of extreme social change may prove an adaptive, "indicative mood" design for living. Here early theories that play arises from excess energy have renewed relevance. Part of that surplus fabricates ludic critiques of presentness, of the status quo, undermining it by parody, satire, irony, slapstick; part of it subverts past legitimacies and structures; part of it is mortgaged to the future in the form of a store of possible cultural and social structures, ranging from the bizarre and ludicrous to the utopian and idealistic, one of which may root in a future reality, allowing the serious dialectic of left- and right-hemispherical functions to propel individuals and groups of individuals from earth to heaven and heaven to earth within a new indicative mood frame. But it was the slippery Trickster who enabled them to do it, and he/she modestly, in Jacques Derrida's ludic words, "erases the trace."

The experiments of James Olds and Peter Milner, at the California Institue of Technology from 1953 onwards, on stimulating by implanted electrodes the hypothalamus of the brains of rats, including the parts radiating from the hypothalamus like spokes (neural pathways to the olfactory and limbic systems, the septal areas, amygdala, etc.), seem to have a bearing on the pleasures of play, but I have not followed up this avenue of enquiry.[42]

Further Questions on the Brain: Religion, Archtypes, and Dreaming

By indirections we seek out directions. This long digression on hemispherical lateralization, play, and cultural subjunctivity brings me back

to some of Burhoe's questions that have been vexing me. One is How does this picture of brain functioning and of the central nervous system accord with distinctive features of the varied religious systems that have survived to this point in time and exerted paradigmatic influence on major societies and cultures? Here we could profitably compare Eastern and Western religions and their variations. Can some be described as emphasizing in their cosmologies, theologies, rituals, meditative techniques, pilgrimages, and so on, right-hemispherical properties or left-hemispherical dominance? Do some emphasize rituals while others stress modes of meditation and contemplation as their central processes of worship? Again how does this picture fit with descriptions of the varieties of religious experience that have been noted by William James and his successors? Would it be a fruitful enterprise to foster experimental work on the varied genetic and experiential structurings of human brains which might throw light on aspects of religious experience and motivation? We will take a brief look later in this essay at some interesting guesswork by Jungians in relation to this problem. Conversely, can we illuminate, through cross-cultural comparison, the capacity of culturally shaped systems of ritual, symbols, myths, and rational structures to produce viable types of religious experience in the genetically varied population of brains? Here much more detailed descriptive work in the study of different kinds of ritual in a single religious system, as well as cross cultural and transhistorical studies of ritual systems is imperative. So many questions; so few answers. But we can only do fruitful research if we first ask the right questions.

Natually, the findings of neurophysiologists have provoked many speculations from members of other disciplines not directly concerned with the brain and its workings. The notion of the triune brain propounded by MacLean, for instance, has encouraged Jungian psychologists to claim that a neurological basis has been found for the collective unconscious and its archetypes. One Jungian, Anthony Stevens, has been impressed by the work of P. Flor-Henry and of G. E. Schwartz, R. J. Davidson, and F. Maer.[43] The latter showed that human emotional responses are dependent on neuronal pathways linking the limbic system of the midbrain (the old mammalian brain) with parietal and frontal areas of the right hemisphere. Flor-Henry found that this whole complicated right-hemispheric/limbic affectional system is under the surveillance and control of the left, I repeat, of the *left* frontal cortex. This lends additional testimony to the view that the left hemisphere (via the corpus callosum or the large cable of nerve fibers which connect the two cerebral hemispheres, functioning to transmit information between the hemispheres and to coordinate their activities) can repress or inhibit the activities, especially the emotionally

toned activities (which are the vital concern of psychiatrists), of the right. In my discussion of the possible neuronal base of play, you will recall, I guessed at a connection between the midbrain and human upper brain. If Flor-Henry is correct in supposing a left-hemisphere inhibiting effect, might not the propensity to play result from a temporary relaxation of the inhibitory effect, perhaps through the focused cultural means of framing and arousal?

All this leads Stevens to speculate rather interestingly about the relationship of various psychical processes recognized by depth psychology to what is known about the neurophysiology of the brain. His views also bear on the questions I have been raising about the possible nature of religion as at once a supergenetic and a super-individual agency developed from the coadaptation or integration of two semiautonomous systems. These are, in Burhoe's terms, first, basic genetic information and its biological expression, particularly in the lower levels of the brain, whose genetic programs are not so very different from those in protohuman hominids, and, second, the specifically human generation of a living sociocultural system where the learning powers of the upper brain radically modify the common human gene pool, resulting in enormous cultural and phenotypical variation, that is, variation in manifest characteristics. Stevens argues, "While it may well be that psychic processes belonging to the personal 'Freudian' unconscious proceed in the right hemisphere, it seems probable that Jung was right when he guessed that the archetypal systems, if they could be given a local habitation and a name, must have their neuronal substrate located in the phylogenetically much older parts of the brain."[44]

For those who are unfamiliar with Jungian terminology, archetypes (according to Stevens's definition) are "innate neuropsychic centers possessing the capacity to initiate, control, and mediate the common behavioral characteristics and typical experiences of all human beings irrespective of cultural differences."[45] Jung himself, who rejected the view that humankind was a blank slate or a *tabula rasa* on which experience was prenatally[46] and postnatally inscribed, held that our species is *born* with numerous predispositions for perceiving, feeling, behaving, and conceptualizing in particular ways. As he put it:

> There is no human experience, nor would experience be possible at all without the intervention of a subjective aptitude. What is this subjective aptitude? Ultimately it consists of an innate psychic structure which allows man to have experiences of this kind. Thus the whole nature of the human male presupposes woman, both physically and spiritually. His system is tuned in to woman from the start, just as it is prepared for a quite definite world where there is water, light, air, salt carbohydrates, etc. The form of the world into which he is born is already inborn in him as a virtual image. Likewise parents, wife,

children, birth, and death are inborn in him as virtual images, as psychic aptitudes. These *a priori* categories have by nature a collective character; they are images of parents, wife, and children in general, and are not individual predestinations. [This is perhaps Jung's clearest formulation of what he means by archetypes.] We must therefore think of these images as lacking in solid content, hence as unconscious. They only acquire solidity, influence, and eventual consciousness in the encounter with empirical facts which touch the unconscious aptitude and quicken it to life. They are, in a sense, the deposits of all our ancestral experiences, but they are not the experiences themselves.[47]

Archetypes manifest themselves subjectively in such things as dreams, fantasies, writing, poetry, painting and objectively in such collective representations as myths, rituals, and cultural symbols—and in many other modalities. Jung speaks of the Family archetype, the Feminine archetype, the God archetype, the Hero archetype, the Mother archetype, the Masculine archetype, the Wise Old Man archetype, using capital letters to distinguish them from the identically named roles occupied by actual, historical individuals.

Stevens thinks it is impossible to locate any of the archetypes in any precise neurological fashion. Each must have "an extremely complex and widely ramifying neurological substrate involving millions of neurones in the brain stem and limbic system (the instinctive or biological pole) and *both* cerebral hemispheres (the psychic or spiritual pole)."[48] However, E. Rossi, another Jungian psychologist, argues that it is the right hemisphere which principally processes archetypal components, since, "Jung's concepts of archetype, collective unconscious, and symbol are more closely associated with the use of the imagery, gestalt, and visuospatial characteristics of right hemispheric functioning."[49] Rossi also insists that, although the archetype is an imprint or pattern—perhaps a "trace"—which exists independently of the conscious ego, it constantly comes under left hemispheric processing in the form of words, concepts, and language. But when this happens the archetypes, he writes, "take their color from the individual consciousness in which they happen to appear."[50] Thus they are, so to speak, superficially denatured and clothed in the vestments provided by individual memory and cultural conditioning.

It is because of the difficulty of translating right-hemispherical processes into the logical, verbal formulations of the left brain that some emissions into ego consciousness of archetypal images are perceived as numinous, awesome and mysterious, or uncanny, preternaturally strange. They seem to be clad in primordial authority undetermined by anything known or learned. Henry and Stephens consider that both hemispheres are able to suppress communication from the limbic system.[51] We have seen how the left hemisphere may inhibit communication from the right. Henry and Stephens believe that psychic health

and personality integration depend as much on the maintenance of open communication between limbic system and cortex as on interhemispheric communication. They suggest that the neurophysiological function of dreaming is to facilitate integration of processes occurring in the limbic system with those of the cerebral hemisphere. This would fit well with Jung's views as well as with the French sleep expert Michel Jouvet's findings that the low voltage, high frequency EEG waves characteristic of dreaming sleep originate in the brain stem and spread upward through the midbrain to the cortex—perhaps bringing information from various levels of the unconscious.[52] Perhaps dreams, like the ritual symbols I have analyzed, are laminated, accreting semantic layers, as they move from brain stem through limbic system to the right hemisphere before final processing or editing by left-hemispheric processes.

The Composite Brain and the Bipolar Symbol

These findings are interesting when related to my fieldwork among the Ndembu, a matrilineal society of northwest Zambia, during the 1950s. I discovered that what I called dominant or pivotal symbols in their ritual processes were not only possessors of multiple meanings but also had the property of polarization. For example, a tree which exuded a milky white latex was the dominant symbol of the girls' puberty ritual (the novice was laid under a consecrated "milk tree" wrapped in a blanket, where she had to lie motionless throughout a whole long day while initiated women danced around her and the tree). The whole milk tree site, almost *mise-en-scène* was called *ifwilu*, which means "place-of-dying," for it was there that she died from her childhood. At this point she was separated from her own mother, who took a minimal part in the ritual. But the milk tree (*mudyi*) was intimately connected with motherhood. I pieced together its many meanings from talking to many informants during many performances at which my wife and I were present, and have written about this research in several books, including *The Forest of Symbols* and *The Drums of Affliction*.[53] Briefly, the milk tree was said to "be" (more than merely to "represent") mother's milk, lactation, breasts, and nubility, at what could be called the physiological or orectic pole of its meaning. "Orectic" is a term used by philosophers, and was formerly quite popular among psychologists, meaning "of or characterized by appetite or desire."

But the milk tree also "was" the matrilineage of the girl novice; it was where "the ancestress slept, where they initiated her and another ancestress and then another down to the grandmother and the mother and ourselves the children. It is a place where our tribe (*muchidi*) began—and also the men in just the same way."[54] Thus it was more than

a particular matrilineage; it was the principle of matriliny itself. It was even the whole Ndembu nation, one of whose distinctive features was its matrilineal organization. At some episodes of the long complex ritual, the milk tree was also said to stand for women and for womanhood. Another meaning, indexical rather than iconic, represented the milk tree as the relationship between the novice and her own mother in that place and at that time. It indicated that the relationship would be transformed by the performative action, since the daughter was no longer a dependent child but would become, like her mother, a married woman after the ritual seclusion and the coming-out rites were over and was potentially a mother herself. I called this more abstract set of meanings the normative or ideological pole, since it referred to principles of social organization, social categories, and values.

The milk tree also has other denotations and connotations, but it has struck me recently that these layers of meaning might well relate to what is being discovered about the functions of the brain. The orectic pole, referring to physical mothering and lactation, and charged with desire—the novice's desire to be fully a woman, the desire of the mature women to add a recruit to their number, the desire of a lineage for replenishment, the future bridegroom's desire for the novice (represented by the insertion of an arrow presented by the bridegroom into the ground among the roots of the milk tree) and many other modalities of desire—the orectic pole, then, surely has some connection with the functions of the limbic system, the old mammalian brain. This system MacLean calls the visceral brain because of its close connections to control centers for drive and emotion. Structures in the limbic system are believed to be the sites of action of many psychotropic drugs, including antipsychotic tranquilizers (e.g., Thorazine) and hallucinogens (e.g., LSD). In the ritual itself, with its powerful drumming and insurgent singing in which the women lampoon and deride the men, we observe ways of arousing the ergotropic system and the left-hemispheric functions of critical, linear thought. We can also see a triggering of the right-hemispheric apprehensions of pattern and holism by finally including the men in the ritual action and making them part of a scenario in which the novice is borne off to a newly made seclusion hut on the margin of the village, where she will undergo liminal instruction by female elders for many months, before "coming out" in a ritual which is also the precursor of her marriage.

Clearly, too, the normative pole of meaning including the references to matriliny, womanhood, tribal unity and continuity, and the mother-child bond, has connections with upper brain activities involving both hemispheres. One might speculate that the Jungian archetype of the Great Mother and the difficulty, resolved among the Ndembu by prolonged and sometimes painful initiation ritual, of separation from

the archetypal power of the Great Mother is in some way connected with the milk tree symbolism and with the ritual behavior associated with it. It is interesting to me that a dominant symbol—every ritual system has several of them—should replicate in its structural and semantic make-up what are coming to be seen as key neurological features of the brain and central nervous system.

Conclusion

Does the new work on the brain further our species' self-understanding? Clearly an extreme ethological view of human society as rigidly genetically determined is as uninformative as an extreme behaviorist view of the human brain as a *tabula rasa* written on by experience. According to the extreme ecologists, we are "innately aggressive, acquisitive, nationalistic, capitalistic, and destructive."[55] Some of them announce our doom by overcrowding or urge the space race as a means of channelling aggressiveness. Some even give veiled approval to limited war or natural population control by drought, famine, or plague, as the means of securing ecological balance. While B. F. Skinner would modify and adapt us by environmental manipulation, reminding me irresistably of H. G. Wells's *First Men on the Moon* in which the Selenites (the original Moonies), an insect species, were quite literally shaped by biological and psychological techniques to perform the labor appropriate to their caste, some ethologists would argue that our genetics damn us, despite our intelligence and will to survive. Regnarøkr, not Walden II, will be the end of history. Hence the vogue for doom talk about such inevitabilities as ecocide, population explosion, and innate aggressiveness. Surely, a middle path is possible. Cannot we see those modalities of human perception and conceptualization, the lower brain and the upper brain, the archaic and recent systems of innervation as having been for at least several millions of years in active mutual confrontation?

It seems to me that religion may be partly the product of humanity's intuitions of its dual interiority and the fruitful creative Spirit generated by the interplay of the gene pool, as the Ancient of Days, and the upper brain, as Logos, to use the intuitive language of one historical religion, Christianity. The Filioque principle (the Spirit proceeding from the Father *and* the Son), Western Christians might say! Since culture is in one sense, to paraphrase Wilhelm Dilthey, objectivated and crystallized mentality (*Geist*), it may well be that some cultures reinforce one or another semiautonomous cerebral system at the expense of others through education and other modes of conditioning. This results in conflict between them or repression of one by another, instead of free interplay and mutual support—what is sometimes called love.

As you can see, I have been asking questions and making guesses in this paper rather than coming up with answers. My career focus mostly has been on the ritual process, a cultural phenomenon, more than on brain neuroanatomy and neurophysiology. But I am at least half convinced that there can be genuine dialogue between neurology and culturology, since both take into account the capacity of the upper brain for adaptability, resilience, learning, and symbolizing, in ways perhaps neglected by the ethologists *pur sang*, who seem to stop short in their thinking about ritualization at the more obviously genetically programmed behaviors of the lower brain. It is to the dialectic, and even contradiction at times, between the various semiautonomous systems of the developed and archaic structures of innervation, particularly those of the human brain, that we should look for the formulation of testable hypotheses about the ritual process and its role as performing noetic functions in ways peculiar to itself, as a *sui generis* mode of knowing.

Let me conclude by reassuring those who may have obtained the impression that all I am saying is that ritual is nothing but the structure and functioning of the brain writ large, or that I am reducing ritual to cerebral neurology, that I am really speaking of a global population of brains inhabiting an entire world of inanimate and animate entities, a population whose members are incessantly communicating with one another through every physical and mental instrumentality. But if one considers the geology, so to speak, of the human brain and nervous system, we see represented in its strata—each layer still vitally alive—not dead like stone, the numerous pasts and presents of our planet. Like Walt Whitman, we "embrace multitudes." And even our reptilian and palaeomammalian brains are human, linked in infinitely complex ways to the conditionable upper brain and kindling it with their powers. Each of us is a microcosm, related in the deepest ways to the whole life-history of that lovely deep blue globe swirled over with the white whorls first photographed by Edwin Aldrin and Neil Armstrong from their primitive space chariot, the work nevertheless of many collaborating human brains. The meaning of that living macrocosm may not only be found deep within us but also played from one mind to another as history goes on—with ever finer tuning—by the most sensitive and eloquent instrument of Gaea the Earth-spirit—the cerebral organ.

NOTES

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8. Leach, p. 405.

9. Grimes, p. 36.

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13. Walle Nauta elaborated this outlook in "The Problem of the Frontal Lobe: A Reinterpretation," *Journal of Psychiatric Research* 8 (1971): 167-87.

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39. Roger Abrahams, personal communication both in a letter and in an essay.
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44. Stevens (n. 1 above), pp. 265-66.
45. Ibid., p. 296.
46. Experience begins in the womb, and child psychologists hold that communication between mother and child correlates with the development of neuronal pathways in the foetal brain. See for example Colwyn Trevarthen, "Cerebral Embryology and the Split Brain," in *Hemispheric Disconnection and Cerebral Function*, ed. M. Kinsbourne and W. L. Smith (Springfield, Ill.: Charles C. Thomas, 1974), pp. 208-36.
47. Carl Jung, *Collected Works*, vol. 7, *Two Essays on Analytical Psychology* (Princeton, N.J.: Princeton University Press, 1972), para. 300.
48. Stevens (n. 1 above), p. 266.
49. Cited in Stevens (n. 1 above), p. 266.
50. Ibid.
51. Henry and Stephens (n. 15 above).
52. Michel Jouvet, "The Function of Dreaming: A Neurophysiologist's Point of View," in *Handbook of Psychology*, ed. M. S. Gazzaniga and C. Blakemore (New York: Academic Press, 1975).
53. Victor Turner, *The Forest of Symbols* (Ithaca, N.Y.: Cornell University Press, 1967); idem, *The Drums of Affliction* (Oxford: Clarendon Press, 1968).
54. Turner, *Drums of Affliction*, pp. 198-268.
55. A point well made by Steven Rose, *The Conscious Brain* (New York: Vintage Books, 1976), p. 351.