THE BIOPSYCHOLOGICAL DETERMINANTS OF RELIGIOUS RITUAL BEHAVIOR

by Eugene G. d'Aquili and Charles Laughlin, Jr.

The persistence of religious or cultic ritual in the twentieth century has presented a problem for many thinkers. Until recently, the eighteenth-century Enlightenment view was still prevalent, namely, that, with enough education, ritual, magic, and associated phenomena would simply disappear. It has become increasingly obvious recently that this simply is not the case. Far from diminishing in frequency, various forms of religious and quasi-religious ritual have burgeoned within the last ten years. The phenomenon is clearly with us, and some attempt must be made by scientists of various disciplines to understand the causes, functions, and persistence of religious ritual among human societies. It is generally recognized that some form of religious ritual is a universal phenomenon. Furthermore, Lex cites Bourguinon's data in which she identifies trance states or other forms of dissociative phenomena associated with rituals in 437 out of 488 societies for which there was relevant ethnographic information.[1] This means that, in almost 90 percent of societies around the world for which there are available data on the subject, some sort of altered states of consciousness manifest themselves in one way or another as a part of ritual behavior. This indicates not only that ritual behavior is universal among human societies but that some form of dissociative state is associated with cultic rituals in nearly all societies. Therefore, in attempting to analyze religious ritual, it becomes obvious from the outset that we are dealing with a true cultural universal similar to marriage, warfare, or even language.

Historically, analysis of religious ritual has been marked by two

Eugene G. d'Aquili, M.D., assistant professor of psychiatry, University of Pennsylvania, and Charles Laughlin, Jr., associate professor of anthropology and linguistics, State University of New York at Oswego, presented this paper at the Twenty-first Summer Conference ("Science, Religion, and Social Change in the Light of New Understandings of Man") of the Institute on Religion in an Age of Science, Star Island, New Hampshire, July 27–August 3, 1974.

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characteristics. First, there has been a nearly universal attempt to restrict the analysis of ritual to *Homo sapiens.* Anthropologists for the most part have tried to separate human ritual behavior, and particularly religious ritual, from "ritualized behavior" of other species. An example of this attitude was given by Edmund Leach at a conference on ritual in 1966. He stated: "The ethologists are consistent with one another; Professor Hinde's definition will serve for all: 'ritualization refers to the evolutionary changes which the signal movements of lower vertebrates have undergone in adapation to their function in communication.' Such a definition has no relevance for the work of social anthropologists. Unfortunately, although ritual is a concept which is very prominent in anthropological discourse, there is no consensus as to its precise meaning."[2]

A second characteristic of the traditional anthropological approach to human ritual is that attempts are almost always made to explain its cause in terms of its function within a social group. For example, an attempt might be made to explain the cause of human religious ritual as an efficient mediator of social power within a human population. This kind of analysis, most often identified with the British structuralist-functionalist school, confuses social function with efficient cause. It may be very true that a social institution such as religious ritual may subserve multiple social functions. It is not necessarily true that one or even all of those social functions explain the existence of the institution in terms of that institution's efficient cause. In other words, those factors that bring an institution into existence may be very different from those factors which later serve to preserve it in a society.

In the last few years a few authors have begun to attempt an approach to cultural universals which includes biological, and particularly neurobiological, analysis as well as the more traditional sociocultural one in order to explain universal sociocultural phenomena. Chapple was the first to enter the field in any kind of a systematic way with his *Culture and Biological Man.*[3] We have addressed ourselves to the problem of the evolution of cultural universals in terms of the neuroevolution of higher nervous functions.[4] Recently, Lex brilliantly analyzed ritual trance states in terms of variations of neural tuning within the autonomic nervous system.[5] She has thus extended the neurobiological analysis of cultural institutions from our previous focus on higher cortical functions to include "lower" neural functions as well. We shall have occasion to refer to her work briefly in this section and more extensively in the section "Religious Ritual and Cerebral Asymmetry" below.

This paper represents an extension of our previous work in that it

is a first attempt at a comprehensive analysis of a *specific* universal cultural institution, namely, religious ritual with its attendant mythologizing. When we state that a phenomenon such as religious ritual is universal, we do not mean to imply that it must necessarily exist in every human society on earth. But if it can be demonstrated to exist in the vast majority of human societies distributed throughout the globe, this is sufficient for us to call it a cultural universal. It is our contention that social institutions which exist in the vast majority of human societies have strong, although not necessarily immediately obvious, neurobiological determinants. Their very universality depends on the universality of the neurobiological systems out of which they have developed and become culturally elaborated. To push the argument one step further, such neural systems must have had highly adaptive significance in order for them to have a worldwide distribution among human populations. These considerations inevitably bring problems of hominid evolution and human adaptation to the physical environment into such an analysis of sociocultural universals. We have termed such a neurobiological approach to social institutions "biogenetic structuralism" and have dealt with the theoretical bases of this theory elsewhere.[6] Since the terminology of biogenetic structuralism is not familiar to all, we will attempt to avoid any specialized terminology in this paper. The theory presented here is nevertheless a biogenetic structural analysis of a human universal, namely, religious ritual.

Biogenetic Structuralism

Before we proceed with a consideration of religious ritual, we briefly list the tenets of biogenetic structuralism as an aid to understanding our theoretical position:

1. Behavior of any higher organism, including *Homo sapiens,* is a part of a process of equilibration between the organism's central nervous system and the organism's environment. *For the purposes of quantifiable science,* there exists no level of phenomenal reality intervening between *Homo sapiens* and his environment. From the point of view of empirical science, all other asserted levels of reality, although perhaps useful, have an analytic status only.
2. Much human behavior we are accustomed to calling cultural, learned, superorganic, uniquely human, institutional, etc., actually consists of variant manifestations of universal structural models. These models have no epiphenomenal existence but, rather, are phenotypic expressions formed by fields of neural connections located primarily in the brain.

3. These models are determined in part by DNA coding and in part by modification of neural and/or molecular structure by sensory input. These models, whether inherited or acquired, are comprised of dendritic/axonic/synaptic, as well as molecular, structures. Like any other aspect of the phenotype, neural models are vulnerable to natural selection and reflect detailed patternings specific to the species.
4. The information coded in the neural models is termed *neurognosis. Neurognosis* and the neural structures are mutable and form an open system through the *empirical modification cycle* (EMC). The EMC is comprised of somatosensory input and behavior output. It is through the EMC that neurognosis is modified and elaborated. In the case of at least some neurognostic models and classes of models, the EMC is regulated by genetically determined ontogenesis, producing stages, lineal progressions, and "critical periods" in the development of the models.
5. Many of the culturological concepts commonly used in anthropology, sociology, and psychology—concepts like thought, reason, cognition, mythologizing, sciencing, structuring, etc.—refer to behavioral or subjectively reportable equivalents of neurophysiological processes of association. These processes are neurognostically structured and tend, again, to be specific to the species.
6. Most neurophysiological processes, including those comprising "higher cognition" in man, take place outside the bounds of awareness. Awareness is an experiential by-product of neurophysiological processing rather than an ontologically independent phenomenon.

From this brief presentation of our theoretical background, it should be obvious that we will not be content to analyze ritual only in terms of its social functions, and most especially we will not attempt to analyze religious ritual separate from its phylogenetic or evolutionary base. We would be the first to agree that cultic ritual as practiced by *Homo sapiens* has many unique characteristics. However, as we shall see, these unique characteristics, although they are an integral part of ritual as performed by man, can be viewed as being derived from other neurobiological systems which had selective advantages totally separate from those of ritual behavior. These unique elements of human ritual, particularly the myth structure or cognitive matrix in which ritual is embedded, appear to have been, as it were, grafted onto the mainstream of the evolution of ritual behavior. While it is dangerous not to perceive the unique aspects of human ritual, particularly as exemplified in religious ritual, it is even more dangerous to ignore those aspects of human ritual which man has in common

with other species. Tinbergen has strongly argued for the importance of homologous features in the study of origins of communicative behavior.[7] To refuse to consider human ritual behavior within an evolutionary perspective is to commit the rankest of anthropocentrisms.

The Evolutionary History and Definition of Ritual

Let us turn now to a consideration of ritual behavior across species lines. A major problem for any organism whose adaptation depends on cooperation with one or more conspecifics is to decrease the distancing between itself and others so that some form of cooperation can be achieved. A number of ethologists, such as Lorenz, Tinbergen, and Lehrman, have observed that a certain amount of distancing is normally maintained among vertebrates probably in order to preserve the integrity of the individual's survival functions.[8] Jay, Chance, and others have noted the importance of "social space" among nonhuman primates.[9] Much has recently been written about personal space in man. There is increasing evidence that most vertebrates under normal conditions maintain a degree of distance or separateness. Most frequently this distancing is spatial, but it may also be relational in terms of hierarchy within a group. This usually adaptive distancing becomes maladaptive if two or more animals must cooperate in a task, the most basic of which is copulative function. Some way must be found to circumvent the problem in order to permit greater spatial or relational proximity. One way in which this is achieved is by the performance of ritual behavior by one or more members of the group. Lorenz, Lehrman, Tinbergen, and others have noted that this ritual courtship behavior prior to coition is common among many species and seems to permit the elimination of the distancing between the two individuals, allowing coition to take place.[10] Ritual behavior prior to cooperative group action is also extremely common. Lorenz makes the important point that ritual behavior appears to be the trigger for much of the cooperative behavior within species for which cooperative behavior is essential for survival. More importantly, Lorenz sees these same functions operative within culturally elaborated religious rituals in man. He notes: "In cultural ritualization, the two steps of the development leading from communication to the control of aggression and, from this, to the formation of a bond, are strikingly analogous to those that take place in the evolution of instinctive rituals. . . . The triple function of suppressing fighting within the group, of holding the group together, and of setting it off, as an independent entity, against other, similar units, is performed by the developed ritual in so strictly analogous a manner as to merit deep consideration."[11]

At this point one must ask what is meant by ritual behavior. We define ritual behavior as a sequence of behavior which (1) is structured or patterned and conforms to the characteristics of a Markov chain; (2) is repetitive and rhythmic (to some degree at least), that is, it tends to recur in the same or nearly the same form with some regularity; (3) it acts to synchronize affective, perceptual-cognitive, and motor processes within the central nervous system of individual participants; and (4), most particularly, it synchronizes these processes among the various individual participants. Manley has considered this synchronizing function of ritual in the black-headed gull in some detail.[12] It appears—from the work of Schein and Hale with the domestic turkey, Tinbergen with three-spined sticklebacks and queen butterflies, and Rosenblatt with cats[13]—that there is something about the repetitive or rhythmic emanation of signals from a conspecific which generates a high degree of arousal of the limbic system of the brain.[14] With respect to this rhythmic quality of ritual, Lorenz notes: "The display of animals during threat and courtship furnishes an abundance of examples, and so does the culturally developed ceremonial of man. The deans of the university walked into the hall with a "measured step'; pitch, rhythm and loudness of the Catholic priests chanting during mass are all strictly regulated by liturgic prescription. The unambiguity of the communication is also increased by its frequent repetition. Rhythmical repetition of the same movement is so characteristic of very many rituals, both instinctive and cultural, that it is hardly necessary to describe examples."[15]

Walter and Walter and Gellhorn and Kiely have shown that such repetitive auditory and visual stimuli can drive cortical rhythms and eventually produce an intensely pleasurable, ineffable experience in man.[16] Futhermore, Gellhorn and Kiely cite evidence that such repetitive stimuli can bring about simultaneous intense discharges from both the sympathetic and parasympathetic nervous systems in man. When one considers the evidence taken from the animal literature together with the limited studies that have been done on man,[17] one can infer that there is something about repetitive rhythmic stimuli which may, under proper conditions, bring about the unusual neural state of simultaneous high discharge of both autonomic subsystems. Three stages of tuning of the sympathetic-parasympathetic are recognized.[18] In the first stage, response in one system increases while at the same time reactivity in the other system decreases. If augmented reactivity of the sensitized system continues, the second stage of tuning is reached after stimuli exceed a certain threshold. At this point not only is inhibition of the nonsensitized system complete, but also stimuli which usually elicit a response in the nonsensitized system

instead evoke a response in the sensitized system. Behaviors resulting from this second stage of tuning are termed "reversal phenomena." If stimulation continues beyond this stage, increased sensitization can lead to a third stage in which reciprocal relationship fails and simultaneous discharges in both systems result.

Normally, either the sympathetic or the parasympathetic system predominates, and the excitation of one subsystem normally inhibits the other. In the special case of prolonged rhythmic stimuli, one can postulate that the simultaneous strong discharge of both autonomic systems creates a state of stimulation of the median forebrain bundle generating not only a pleasurable sensation but, under proper conditions, a sense of union with conspecifics. The simplest paradigm to explain the situation in man is the feeling of union that occurs during orgasm. During orgasm, as during other states we shall consider later, there is intense simultaneous discharge from both of the autonomic subsystems.

Hence, we are postulating that the various ecstasy states, which can be produced in man after exposure to rhythmic auditory, visual, or tactile stimuli, produce a feeling of union with other members participating in that ritual. In fact, the oneness of all participants is the theme running through the myth of most human rituals. Although it is very difficult to extrapolate from a human model to an animal model, it is probable that some sort of analogous affective state is produced by rhythmic, repeated ritual behavior in other species. This state may vary in intensity, but it always has the effect of unifying the social group.

Put simply, there is increasing evidence that rhythmic or repetitive behavior synchronizes the limbic discharges (i.e., the affective states) of a group of conspecifics. It can generate a level of arousal which is both pleasurable and reasonably uniform among the individuals so that necessary group action is facilitated. We must note at this point that we have said nothing about the communication aspect of this rhythmic signaling. There is a great body of evidence that many of these rhythmic stimuli serve as communication. The position of most ethologists is that rhythmicity evolved in lower animal species in the service of communication. However, many ethologists maintain that the rhythmicity evolved an autonomous effect of its own separate from its signaling function. Thus, Lorenz states: "Both instinctive and cultural rituals become independent motivations of behavior by creating new ends or goals towards which the organisms strive for their own sake. It is in their character of independent motivating factors that rituals transcend their original function of communication and become able to perform their equally important secondary tasks of

controlling aggression and of forming a bond between certain individuals."[19]

It is our feeling that it is by no means certain that rhythmicity first evolved in the service of signaling and only secondarily evolved its function of affective arousal. One may just as well maintain that the affective arousal is primary and that signaling became grafted onto the already present rhythmicity, utilizing those very patterns of rhythmicity as signals. Whether signaling or affective arousal was first in the evolutionary sequence, however, is relatively unimportant. What is important is that we can distinguish two very clear aspects of ritual behavior, one involving affective arousal as a result of rhythmic stimuli and the other involving communication utilizing patterns of rhythmic stimuli. What we are suggesting in this paper, on the basis of the behavioral observations of the ethologists we have cited, is that the rhythmic quality in and of itself produces positive limbic discharges resulting in decreased distancing and increased social cohesion. Even at the level of birds, the communication quality of the signaling can be regarded as added on to the primary effect of the rhythmicity on the central nervous systems of the animals involved. Certainly, in man the communication quality of many aspects of ritual becomes very important and can enhance, or on occasion suppress, the immediate neural effect of rhythmic or periodic stimuli. Likewise in man, the cognitive, as opposed to the simply perceptual, aspects of ritual behavior become extremely important. But the basic and relatively simple effect of ritual, that is, limbic synchronization among conspecifics, is just as present in human ritual behavior as it is among animals.

So as to remove some confusion in our use of the concept of ritual, we agree with Smith in excluding many specialized communicative displays among animals from the definition of ritual.[20] Specialization of behavior for the function of communication is now termed "formalized" behavior as opposed to the traditional ethological term "ritualized." Such formalized behaviors are stereotyped and elicit a specific response. That response (from a conspecific) depends on what the formalized signal is. These displays may be intensely agonistic. We are excluding formalized agonistic behaviors from consideration as ritual. They are usually structurally distinct from ritual in that they do not exhibit the same degree of sustained rhythmicity or periodicity. Sustained rhythmic behavior generally seems to produce one primary response, that is, synchronized positive limbic discharges among members of the group. It is only those formalized behaviors which exhibit a high degree of rhythmicity that we are considering as ritual behaviors. These are usually the same behaviors which serve as the stimuli for decreased distancing among conspecifics.

In higher organisms, which require experiential input from their social environment for the adaptive potential of ritual behavior to reach fruition, ritual carried out by adult members of the group has the secondary effect of conditioning or socializing the young. A consideration of the adaptive significance of ritual becomes more complicated in this case, for the problem of obtaining social cohesion as an adaptive response arises anew with each generation. The process of socialization involves both passive and active components on the part of the young. The young passively perceive innumerable occurrences of a repetitive ritual during which they learn to associate (1) the set of stimuli requiring or initiating the ritual, (2) the precise sequencing of behavioral events comprising the ritual, (3) affective states linked to the ritual behavior, (4) significant perceptual entities emphasized through the orientation of ritual participants, and (5) group task-oriented behavior subsequent to the ritual. In higher organisms, especially among the primates, the young may enact the ritual during peer-group play and thus further concretize the neural associations on which adequate functioning of adult ritual depends.

Man and Religious Ritual

Thus far we have presented a model based on both ethological and human evidence which attempts to present a final common denominator of ritual behavior based on the exigencies of survival and crossing species lines. Let us now consider the problem of religious ritual in man. In order to do so, we will have to leave briefly the theme that we have been considering up to this point in order to consider some aspects of ritual which appear to be unique to human religious ritual. However, we shall return to our common biological theme toward the end of this paper.

The aspect of human religious ritual which appears to be distinctively human is that ritual is always embedded in a myth or, as we have called it elsewhere, in a cognitive matrix. The myth structure presents a problem which needs to be solved. It is the function of religious ritual to solve the problem that is presented in the myth. Thus, if man is at the mercy of certain forces of nature, man must first elaborate a cognitive structure which explains what those forces are, why they are affecting him, and, most importantly, how he can control them. This explanation generally takes the form of an elaborate story which has the universal characteristic of employing powers, demons, personified forces, gods, or a high god as an integral part. The forms that this personified power may take are as varied as the human imagination and environment of individuals may suggest. We have elsewhere suggested that one of the distinctive characteristics of *Homo*

sapiens is the drive to organize unexplained external stimuli into some coherent cognitive matrix.[21] That matrix may be a primitive myth structure or Western science. The latter is a special case of the former in which the latter utilizes certain formal restrictions on imaginative explanations.

This ordering of external percepts into some sort of coherent world view in the form of a myth either may be a social phenomenon, that is, arising out of and communicated among the members of the group or may be an individual phenomenon appearing in the uncensored dreams, daydreams, or fantasy life of the individual. In any case, the myth represents certain existential problems which somehow must be resolved. The resolution of such problems takes the form, in almost all societies, of the group or its representative priest uniting with a personified force or god in some way so that the society may gain some measure of control over the forces controlled by that god. We are aware that Lévi-Strauss, as well as other structuralists, maintains that the resolution of the problem presented by the antinomies takes place cognitively within the structure of the myth itself.[22] Thus, for example, the concepts of a Christ figure or a Solar Hero represent cognitive solutions within the myth to the problem presented by the basically antinomous myth structure. Although this may be so, we feel that the classical structuralists have tended to deemphasize the role of ritual in favor of analyzing the internal dialectics of structures. Although there is evidence supporting the contention that antinomies are cognitively resolved within the myth, we contend that the only resolutions which are psychologically powerful to both individuals and groups are those which have an aspect of existential reality. We will attempt to show in this paper that such a powerfully affective resolution arises primarily from ritual or meditation and rarely from a cognitive fusion of antinomies alone, although such a cognitive fusion may be a necessary precursor in human religious ritual. Ritual aims at uniting opposites in an effort to gain control over an essentially unpredictable universe. The *ultimate* union of opposites which is the aim of all human religious ritual is the union of contingent and vulnerable man with a powerful, possibly omnipotent, force. In other words, we propose that man and a superhuman power are the ultimate poles of much mythic structure, and that polarity is the basic problem that ritual must solve existentially. Side by side with this basic antinomy are usually other correlative antinomies which frequently must be resolved according to the specific myth before the basic god/man antinomy can be resolved. Such polar opposities include heaven/hell, sky/earth, good/bad, left/right, strong/weak, as well as an almost endless series of other polarities which recur in human myths.

Since we have stated that we are attempting in this paper a hypothesis which bases human religious ritual in part at least on the evolution of the central nervous system, and since the structure of human religious ritual behavior correlates directly with its mythic structure, we must explain, or at least attempt an explanation, of how it is even possible for man to form myths.

Myths

The ability to create a myth involves at least three critical, higher cortical functions. They are conceptualization, abstract causal thinking, and antinomous thinking. First, all myths are couched in terms of named categories of objects which we call concepts or ideas. Second, all myths, like other products of rational thoughts, involve causal sequences. Third, myths involve the orientation of the universe into multiple dyads of polar opposites. This latter quality is also present in everyday thought but is more markedly obvious in myth structures. Indeed, it is this quality of human thought which has entranced psychologists and anthropologists from Jung to Lévi-Strauss to such a degree that other aspects of myth structuring have often been neglected.

At the risk of appearing oversimplistic, we suggest that all of these higher cortical functions involve in one way or another a specific area of the brain. This area in man is comprised of the supramarginal and angular gyri as well as certain adjacent areas. It can best be visualized as the area of overlap between the somesthetic, visual, and auditory association areas. It is, as it were, an association area of association areas. It allows for direct transfer across sensory modalities without involvement of the limbic or affective system. It is as if three computer systems, one for each of the three major sensory modalities mentioned, were hooked onto each other and the information from each became available to all. Such a system allows classes of objects to be set up which are vastly more inclusive than any classificatory system possible within each individual sensory modality. Ever since Goldstein's work in the 1930s, it has been felt that this area of the brain is intrinsically involved in conceptualization. After a period of research neglect, this position has become powerfully supported by the evidence of Geschwind in his now classic monograph "Disconnexion Syndromes in Animals and Man."[23] Geschwind refers to this general area of the brain as the inferior parietal lobule. Soviet researchers refer to roughly the same area as simply the parieto-occipital areas, and Luria notes that it is intimately involved in the formulation of basic logical grammatical categories.[24] Luria and others have shown that destruction of parts in this area of the brain inhibits the use of the

comparative degree of adjectives. In other words, one object is not able to be set off against another object in one-to-one comparison. Therefore, such statements as "larger than," "smaller than," "better than," etc., become impossible for patients with lesions in portions of this area. Furthermore, such patients are not able to name the opposite of any word which is presented to them.

Although not conclusive, such evidence indicates that the inferior parietal lobule not only may underlie conceptualization but may be responsible for man's proclivity for abstract antinomous thinking. Of course, a devastating lesion which destroys most or all of this area not only wipes out antinomous thinking but drastically interferes with concept formation as well. The intellectual sequelae of such a lesion are profound.

Furthermore, there is increasing evidence that the reciprocal connections between the anterior convexity of the frontal lobe on the dominant side and the inferior parietal lobule, all taken together, are intimately related to abstract causal thinking.[25] It has long been known that the anterior portions of the frontal lobes, particularly on the dominant (usually the left) side, are involved in ordering not only sequential movement but perceptual and cognitive elements in both space and time. Lesions of the anterior convexity of the frontal lobe and/or its connection with the inferior parietal lobule interfere drastically with causal thinking.

It is impossible during this presentation to trace the evolution of conceptualization, language, causal thinking, and antinomous thinking. We have attempted to do this elsewhere, and would refer those interested to our *Biogenetic Structuralism*.[26] We are aware that such a brief presentation opens one to the charge of being a naive localizer of cerebral functioning. We are also fully aware of the problems of attempting specific and exact localization of higher cortical functions.

Nevertheless, it appears to be true that, phylogenetically, with the evolution of the inferior parietal lobule, the anterior convexity of the frontal lobes, and their reciprocal interconnections, man "the culture bearer" began to develop. It is interesting that ontogenetically these areas of the brain are the last to myelinate, and their myelination corresponds with the development of Piaget's formal operations and the perfection of linguistic ability. We are not claiming that these areas are the sole explanation for spoken language. Other areas of the brain needed to evolve as well in order for spoken language to develop. But these areas (anterior convexity of the frontal lobe, the inferior parietal lobule, and their interconnections) appear to be involved in the critical elements of myth structuring, that is, conceptualization, abstract causal thinking, and abstract antinomous think-

ing. As LeGros Clark and others have pointed out, the posterior and inferior areas of the parietal lobe are much enlarged in the endocasts of *Australopithecus* over homologous areas of the nonhominid primate brain.[27] This expansion took place at the expense of the occipital cortex, causing the latter to curve inward medially. This area of the australopithecine endocranial casts appears to represent the evolution of what we call the inferior parietal lobule in *Homo sapiens.* It is true that this structure is present in rudimentary form in the chimpanzee, and it is undoubtedly this structure that is responsible for the cross-modal transfer which lies at the basis of the chimpanzee's now proven ability to develop a simple nonverbal language. But this structure does not operate spontaneously in the chimpanzee, and the latter's nonverbal linguistic ability appears to develop primarily, or possibly solely, under laboratory conditions. It appears that, with the development of the australopithecine grade, this area of the brain became sufficiently developed to appear obvious on endocranial casts. But the inferior parietal lobule did not reach its modern level of gross morphologic development until the advent of the genus *Homo.* Nevertheless, it is clearly discernible in *Australopithecus.*

This finding, coupled with the fact that the anterior convexity of the frontal lobes had evolved to essentially modern proportions relative to the brain/body ratio in *Australopithecus,* makes it reasonable to infer that the australopithecine hominid ancestor of man was probably capable of rudimentary spontaneous conceptual thinking and abstract causal thinking. Furthermore, if we are to believe Luria's findings concerning the antinomous function of this area of the brain,[28] *Australopithecus* was probably ordering his world in terms of some sort of conceptual opposites. Not only are these faculties essential for mythmaking and its attendant ritual behavior, but, as we pointed out elsewhere,[29] they are the minimal requirements for the development of culture. In spite of the small brain of *Australopithecus,* one should not be suprised to find primitive lithic industries associated with him, since he apparently had the requisite neural organization for abstract problem solving and toolmaking no matter what the size of his brain.

The question arises whether it is probable that *Australopithecus* developed myth structures and religious ritual perhaps a million years ago or more. In theory, the minimal neural requirements were present for these behaviors. It is conceivable that a mythic structure could be developed in terms of abstract symbols other than verbal language. However, we feel that it is unlikely that any elaborated myths and their consequent rituals developed in the absence of spoken language. It is clear from the ethological data that vocal sym-

bols seem to be the most easily produced and developed and the least easily misunderstood. We feel that it is improbable that the australopithecines possessed speech even though they were capable of a certain degree of abstract thought. We base this contention on the findings of the endocranial casts. *Australopithecus* shows minimal development of the inferior frontal convolution, where Broca's area would be located in the genus *Homo,* as well as minimal development of the middle temporal convolution, where Wernicke's area is located in *Homo.* In our view, this makes it very improbable that the australopithecines possessed anything like fluent verbal language. Although myth structure and ritual, as we have said before, are theoretically not completely dependent on verbal language, the latter is sufficiently important in the development and elaboration of myths that we regard it as unlikely that the australopithecines either elaborated myths or practiced religious ritual.

With the advent of the genus *Homo,* however, the story becomes quite different. *Homo erectus* shows considerable elaboration of the inferior frontal convolution and middle temporal convolutions as well as further development of the inferior parietal lobule. Whereas we consider it improbable that *Australopithecus* was a mythmaker and religious ritual practicer, we think it probable that *Homo erectus* was both. We do not wish at this time to get into the controversy about the significance of the recent Leakey finds from East Rudolf. If indeed the skull that Leakey found represents the genus *Homo,* then we simply push the cognitive, mythic, and ritual functions back from about seven hundred fifty thousand years ago to approximately two million years ago. In any case, we doubt that many physical anthropologists would disagree that even if *Homo* were present on earth two million years ago he had still most probably evolved from an australopithecine-like creature. The later australopithecine types and *Homo* probably evolved from a common, early australopithecine ancestor. Whenever it occurred, with the advent of the genus *Homo* we get our first approximation of what we would probably recognize as human intellectual functioning, including both speech and the various abstract thinking faculties we have discussed above.

The Cognitive Imperative

At this point we must return briefly to a topic we mentioned in passing above, that is, what we call the cognitive imperative. The abstract problem solving which the evolution of these neural structures made possible was highly adaptive to man in any environment. It permitted man to look for the causes of the phenomena which were occurring around him and to attempt to control or adapt to them.

Such problem-solving ability enhanced human adaptation in any environment from the arctic to the tropical. It is not surprising, therefore, that once these neural systems evolved they rapidly spread over the globe. In a paper such as this it is not possible to trace in detail the evolution of each of these neural mechanisms and the probable original selective pressures on them. Suffice it to say that in the aggregate these neural systems represent man's highest and most universal adaptive capability. Their importance for survival is demonstrated by man's almost instinctive need to order unknown or unexplained stimuli into some sort of cognitive framework. Work by Adler and Harvey, Hunt, and Schroder, and Solomon Katz's and our own work involving people's responses to the Philadelphia Earthquake, as well as numerous other studies by cognitive psychologists, all support the hypothesis that man automatically, almost reflexly, confronts an unknown stimulus by the question, What is it?[30] Affective responses such as fear, happiness, sadness, etc., and motor responses are clearly secondary to the immediate cognitive response. This appears to be true whether a person has normal intellectual functioning, is grossly psychotic, or has minimal to moderate brain damage. In all cases, the human organism in the face of an unknown stimulus immediately attempts to organize it within a known framework.

It is this universal adaptive drive related to abstract problem solving that we call the cognitive imperative. We should note that such cognitive organization of external stimuli into a linear, causal, verbal mode of consciousness is an effect of the neural mechanisms, the evolution of which we have just described, all operating primarily within the dominant hemisphere of the brain. It is this lineal analytic and verbal form of cognition which precisely constitutes man's most efficient form of adaptation to his environment. That there is a drive for organizing data in this distinctively human manner, together with an affective reward, is supported by the experiments of Terzian and Cecotto, Rosadini and Rossi, Alema and Rosadini, and Hommes and Panhuysen.[31] In summary, these workers have demonstrated that, among other things, an intracarotid injection of sodium amytal on the dominant side of the brain which interferes with verbal and analytic functions that we have been discussing, and which prevents the organization of percepts into an analytical and verbal mode, results in a dramatic reaction involving a sense of guilt, nothingness, indignity, worries about the future, a sense of loss of mastery over the environment. In brief, such a chemical inhibition of the functions of the dominant hemisphere (analytic functioning) results in depression. On the other hand, injection of sodium amytal into the carotid artery on the nondominant side in effect releases the dominant analytic side

from certain inhibiting influences and yields a state of very clear euphoria.

In the face of such evidence, it is hard to deny the biological importance of ordering sensory data within an analytic framework. It is not hyperbole to speak of it as a cognitive imperative. The point of all of this is that man is driven to understand the world around him. He cannot do otherwise. He has no choice whatsoever in the matter.

All the higher cognitive functions that we have described necessarily operate on incoming data, that is, percepts are categorized, organized, and modified into concepts, and concepts and percepts are both organized into causal chains and arranged in terms of antinomies or polar dyads. Strips of reality which can be understood within the bounds of given data are so understood and a model of reality is so contructed. However, if the data available do not explain any unusual phenomena, the machinery of the brain is *not* turned off. It still automatically constructs models of reality deriving their elements from constructs of juxtaposed material drawn from the various sensory memory banks. It is here that Western science differs from myth formation. Ideally, Western science imposes a limitation of the functioning of the machinery of the brain. It systematically refuses to include in a model of reality elements which are not derived from observed data or which are not immediately inferable from such data.

At this point, we should discuss man's ability to think in terms of abstract causality. We have already discussed the relationship of the anterior convexity of the frontal lobe to the inferior parietal lobule in terms of the ability to juxtapose concepts in linear sequences. For convenience, we refer to the anterior convexity of the frontal lobe, the inferior parietal lobule, and their reciprocal interconnections as the "causal operator." In other words, the causal operator operates on any given strip of reality in the same way that a mathematical operator functions. It organizes that strip of reality into what is subjectively perceived as causal sequences back to the initial terminus of that strip. In view of the apparently universal human trait, under ordinary circumstances, of positing causes for any given strip of reality, we postulate that if the initial terminus is not given by sense data, the causal operator grinds out an initial terminus automatically.

Here again, we note how Western science differs from the more usual form of human cognition. Science refuses to postulate an initial terminus or first cause of any strip of reality unless it is observed or can be immediately inferred from observation. Under more usual conditions, the causal operator grinds out the initial terminus or first cause of any strip of reality. This is a mental construct drawn from elements encoded in memory and characterized by the nature of the

operator itself. That is, the construct causes or in some sense has the power to generate the strip of reality. What we are implying is that gods, powers, spirits, personified forces, or any other causative construct is automatically generated by the causal operator. Note that in speaking of Western science we have not been speaking of Western scientists. The restrictions imposed on human thought are of a social and contractual nature in Western science. However, the brain of the scientist functions no differently from anyone else's brain. Although he may reject the idea of gods, spirits, demons, or any other type of personified power, he nevertheless experiences them in his dreams and fantasy life. Any practicing psychiatrist or clinical psychologist can point to these phenomena in the fantasy life of the most rational man. The causal operator simply operates spontaneously on reality, positing an initial causal terminus when none is given. When the strip of reality to be analyzed is the totality of the universe, then the initial terminus or first cause which is automatically produced by the causal operator is Aristotle's First Mover Unmoved.

If the foregoing analysis is correct, then human beings have no choice but to construct myths to explain their world. The myths may be social in nature or they may be individual in terms of dreams, daydreams, or other fantasy aspects of the individual person. Nevertheless, as long as human beings are aware of the contingency of their existence in the face of what often appears to be a capricious universe, they must construct myths to orient themselves within that universe. This is inherent in the obligatory functioning of the neural structures we considered above. Since it is highly unlikely that man will ever know the first cause of every strip of reality observed, it is highly probable that man will always generate gods, powers, demons, or other entities as first causes to explain what he observes. Indeed, man cannot do otherwise. Myths are structured, either socially or individually, according to the analytic and verbal mode of consciousness characteristic of the dominant hemisphere. Myths involve the codification of unexplained reality in terms of antinomies or polar opposition and in terms of causal explanatory sequences.

The development of these higher cortical functions of the dominant hemisphere may be regarded as a blessing insofar as they allow man abstract problem solving, an adaptation mechanism in any environment. They can also be regarded as a curse. Because man can think abstractly and causally, he can transcend his immediate perceptual field. From experience, he can postulate probable events under given circumstances. Most of all, these functions make him acutely aware of his own mortality and of the contingency of his existence in an unpredictable world. This is the basis of the existential anxiety that

all men bear with them. It is to relieve this "curse of cognition," this existential anxiety, that man first seeks mastery over his environment by attempting to understand it. He organizes reality into a cognitive framework. Often this framework is a myth.

But in and of itself, this organization of reality into mythic structures does not give man genuine control over the overwhelming forces of nature which confront him. Satisfying the cognitive imperative, although necessary, is not sufficient. Since man obtains mastery of his immediate environment by motor action, he attempts to achieve mastery over disease, famine, and death by some form of motor activity as well. It is thus that religious ritual necessarily arises out of the structuring of a myth. It can be argued that religious ritual is in practice no more effective in overcoming the grim forces of man's existential situation than cognitive organization.

In an attempt to explain the persistence of religious ritual, Skinner and other behaviorists have proposed a model based on irregular scheduling of rewards. In other words, if a ritual is performed often enough, a famine may be relieved in the natural course of events and the ritual takes the credit for it. It is certainly known from animal experimentation as well as observation of human behavior that chance rewards often sustain a behavior which is causally linked to the reward only in the mind of the subject. But religious ritual has a persistence and intensity which seem to transcend the Skinnerian model of random scheduling of rewards. What really appears to maintain the force and persistence of religious ritual is the ineffable experience, the intense positive affect experienced by a participant, associated with the resolution of the crucial antinomy, usually the resolution of the God/man antinomy. How elements that are intrinsically opposite can at the same time be merged, and how this experience is joined with an ineffable affective experience, we will now attempt to delineate.

Religious Ritual and Cerebral Asymmetry

Over the last eight years or so, the work of Sperry, Gazzaniga, and Bogen, Nebes and Sperry, Gazzaniga, Gazzaniga and Hillyard, Bogen, Levy-Agresti and Sperry, and others has strongly pointed to what appears to be a rather startling situation in neuroanatomy and neurophysiology.[32] Until these workers performed their experiments on split-brain animals and studied split-brain conditions in human beings, it had always been assumed that the higher cortical functions we have been considering above, namely, language ability, conceptualization, abstract causal thinking, and certain basic logical processes such as abstract antinomous thinking, were pretty much all that

was important in terms of higher cortical functioning. It was known since the middle of the nineteenth century that, for the most part, these functions are lateralized to one hemisphere of the brain, termed the dominant hemisphere. One can understand the prejudices regarding the prominence of these functions. Since they underlie abstract problem solving, and, to a great extent, most of human culture, they were considered of paramount importance. The nondominant or minor hemisphere was usually ignored and even allotted the status of a vestigial organ. By severing the connections between the two hemispheres in animals—that is, by severing the corpus callosum, the anterior commissure, and the optic chiasm—these workers were able to demonstrate that both sides of the brain could be taught different tasks and could respond differently to the same stimuli under appropriate conditions. To speak anthropomorphically, it was as if these animals possessed two minds or two spheres of consciousness or awareness.

The studies with relationship to man were much more dramatic. It soon became clear that individuals who had lesions of the corpus callosum to prevent the spread of epilepsy also acted as if they had two minds or spheres of consciousness, each totally independent of the other. This had not been noted before because tests of the nondominant or minor hemisphere were usually given in terms of verbal questions requiring verbal answers. Since such verbal ability is almost completely lateralized to the dominant hemisphere, it is impossible to get accurate information concerning the minor or nondominant hemisphere, because both sides of the brain were functioning essentially independently in these patients. Through tests designed not to require verbal responses, it became possible to study functions of the minor hemisphere in split-brain patients. At the risk of oversimplifying the situation, it appears that the dominant hemisphere, as has been known for many years, is responsible for analytic, causal, verbal thought and probably for discrete perception. In other words, the neural mechanisms we have been discussing above function primarily within the dominant or major cerebral hemisphere.

What is new is the discovery that the so-called nondominant or minor hemisphere has extremely important nonverbal, nonanalytic functions. First of all, it is related to the perception of visual-spatial relationships. Over and above this, there is good evidence that it perceives the world not in terms of discrete entities but in terms of gestalts, or nondiscrete, holistic perceptions. The perception of wholeness or unity which this hemisphere controls is extremely important to this discussion. Furthermore, there is evidence that the

minor hemisphere may be chiefly responsible for creative or artistic ability.

Levy-Agresti and Trevarthen are obtaining evidence that in the normally functioning individual both hemispheres operate in solving problems via a mechanism of reciprocal inhibition controlled at the brain-stem level.[33] Put simply, the world is approached by a rapid alternation pattern of functioning of each hemisphere. In other words, one is flashed on and then turned off, the second flashed on and then turned off, the first flashed on, etc., in rapid alternation. The rhythm of this process, and whether one side or the other tends to predominate in this process, may account for various cognitive styles, from the extremely analytic and scientific to the extremely artistic and synthetic. There is some evidence reviewed by Lex that this duality of cerebral functioning may parallel the duality of autonomic functioning considered in the first part of this paper.[34]

Actually, it is easier conceptually to integrate the two modes of consciousness into a more general duality of patterning within the central nervous system. Lex does this by utilizing Hess's model of an energy-expanding or *ergotropic* system and an energy-conserving or *trophotropic* system operating in a complementary fashion with the human organism.[35] In this model, the ergotropic system consists of not only the sympathetic nervous system, which governs arousal states and fight or flight responses, but also any energy-expanding process within the nervous system. Conversely, the trophotropic system includes not only the parasympathetic peripheral nervous system, which governs basic vegetative and homeostatic functions, but also any central nervous system process which maintains the baseline stability of the organism. Thus, the ergotropic-trophotropic model represents an extension to the central nervous system of the sympathetic-parasympathetic peripheral nervous functioning. We are presenting an extended model, for which Lex presents tentative evidence, according to which the minor or nondominant hemisphere is identified with the trophotropic or baseline energy state system and the dominant or major hemisphere, which governs analytical verbal and causal thinking, is identified with the ergotropic or energy-expending system.

Alteration in the tuning of these systems from the peripheral autonomic level to the cerebral level has been offered as an explanation for various altered states of consciousness by varying investigators, including Gellhorn, Gellhorn, and Kiely, and Ornstein.[36] These investigators present evidence that at maximal stimulation of either the trophotropic or ergotropic system there is, as it were, a spillover into

the opposite, complementary system. It has been postulated that the rhythmic activity of ritual behavior supersaturates the ergotropic or energy-expending system to the point that not only is the trophotropic system simultaneously excited by a kind of spillover but, on rare occasions, may achieve nearly maximal stimulation of the trophotropic system as well so that, briefly at least, both systems are intensely stimulated. The positive, ineffable affect which this state produces was alluded to in the first part of this paper.

In man, concomitant with the simultaneous stimulation of the lower aspects of both systems, we propose that their cerebral representations, that is, both hemispheres of the brain, may function simultaneously. Cognitively, this is manifested by the presentation of polar opposites by the analytic hemisphere (i.e., the presentation of a problem to be solved in terms of the myth structure) and the *simultaneous* experience of their union via the excitation or stimulation of the minor hemisphere. This could explain the often reported experience of the resolution of unexplainable paradoxes by individuals during certain meditation states or during states induced by some ritual behavior. In one of the few experiments carried out in any kind of controlled manner on the experiences of meditation, Deikman notes that one of the phenomena common to all subjects is what appears to be a simultaneity of conflicting perceptions during relatively advanced meditation states:

> The subjects' reports indicated that they experienced conflicting perception. For example, in the third session, subject B stated, about the vase, "it certainly filled my visual field" but a few minutes later stated "it didn't fill the field by any means." In the seventh session referring to the landscape he commented, ". . . a great deal of agitation . . . but it isn't agitating . . . it's . . . pleasurable." In general, subjects found it very difficult to describe their feelings and perceptions during the meditation periods—"it's very hard to put into words," was a frequent comment. This difficulty seemed due in part to the difficulty in describing their experience without contradictions.[37]

It appears that during certain meditation states and ritual states, logical paradoxes or the awareness of polar opposties as presented in a myth appear simultaneously both as antinomies and as unified wholes. This experience is coupled with the intensely affective, "oceanic" experience which has been described during various meditation states as well as during certain parts of ritual. During intense meditative experiences, such as yogic ecstasy and the *unio mystica* of the Christian tradition, the experience of the union of opposites, or *conjunctio oppositorum,* is expanded to the experience of the total union of self and other, or, as it is expressed in the Christian tradition, the union of the self with God.

We would like to note what appears to be a different, neurophysiological approach to essentially the same end state between meditation and ritual behavior. In both cases, the end point appears to be the unusual physiological circumstance of simultaneous strong discharge of both the ergotropic and trophotropic systems involving changes in the peripheral autonomic system and the onset of intense and unusual affective states coupled with the sense of union of logical opposites, usually the self and a personified force or God. It appears that during meditation one begins by intensely stimulating the trophotropic system. There is a marked decrease of sensory input—the attempt to banish all thought and desire from the mind and the attempt to maintain an almost total baseline homeostatic state with only enough intrusion of the ergotropic system to prevent sleep. The spillover in the case of meditation is from the trophotropic to the ergotropic side with the eventual result in strong discharges from both systems.

Ritual behavior apparently starts from the *opposite* system. It is embedded in a mythic system. Ritual is always performed to solve a problem presented by and to the verbal analytic consciousness. The problem may be between good and evil, life and death, or the disparity between God and man. The problem may be as simple as the disparity between man and a capricious rain god or as subtle as the disparity between man's existential contingent state and the state of an all-knowing, all-powerful, unchangeable "ground of being." In any case, the problem is presented in the analytic mode which involves ergotropic excitation. Like all other animals, man attempts to cope with the environmental situation via motor behavior. The motor behavior man chooses goes back far into his phylogenetic past. It is usually a repetitive motor activity with visual, auditory or other sensory stimulus feedback, which, as we have seen in the first part of this paper, strongly drives the ergotropic system. Even the cadence and chanting of words contributes to this repetitive quality. The slow rhythmicity of a religious procession or the fast beat of drums or rattles all serve to drive the ergotropic system.

With prayers and chanting, this system is often driven in two ways. The myth may be presented within the ritual prayer, thus exciting by its meaning the *cognitive* ergotropic functions of the dominant hemisphere. The rhythmicity of the prayer or chant, by its very rhythmicity, drives the ergotropic system independent of the meaning of words. If the ritual works, the ergotropic system becomes, as it were, supersaturated and spills over into excitation of the trophotropic system, resulting in the same end state as meditation but from the opposite neural starting point.

The difference between meditation and ritual is that adepts at meditation are often able to maintain an ecstatic state for prolonged periods of time. The ecstatic state and sense of union produced by ritual usually is very brief, lasting usually only a few seconds; it has been described as no more than a shiver running down one's back at a certain point. However, this may be repeated at numerous focal points during the ritual. Furthermore, the ecstatic states produced by ritual, although they are usually extremely brief, seem to be available to many or most participants. The ecstatic states derived from meditation, although they may last for hours or even days, require years of practice and intense discipline.

In any case, this unusual physiological state, produced by both approaches, produces other aesthetic-cognitive effects besides a sense of union of opposites. Numerous reports from many religious traditions point to the fact that such states yield a feeling not only of union with a greater force or power but an intense awareness that death is not to be feared, accompanied by a sense of harmony of the individual with the universe. This sense of harmony with the universe may be the human cognitive extrapolation from the more primitive sense of union with other conspecifics which ritual behavior also excites in prehuman animals.

In point of fact, this feeling of union with conspecifics carries through to human ritual as well. Even if it is elaborated on a higher cognitive level, producing a feeling of harmony with the universe (and a lack of fear of death), most human religious rituals also produce an intense feeling of union with the other participants. This oneness has contributed to the feeling of "a holy people," "a people of God," "a people set apart."

Thus we see that the phylogenetic origins of ritual carry through in an unbroken line to the most complex human religious rituals. However, to these primitive functions is grafted as it were, other adaptive functions, namely, those of higher cognition. Man is not simply the sum of neural mechanisms, independently evolved under various selective pressures. Rather, man functions as an integrated whole. Although his higher cognition may have evolved as a very practical, adaptive, problem-solving process, it carried with it, indeed it requires, the formation of myths which present problems for which the ancient rhythmic motor behaviors help generate solutions. In other words, when ritual works (and it by no means works all the time), it powerfully relieves man's existential anxiety, and, at its most powerful, it relieves him of the fear of death and places him in harmony with the universe. It is no wonder that any behavior so powerful has

persisted throughout the ages. Indeed, it is likely to persist for some time to come.

To summarize this rather complex argument, we are simply stating, given an organism which has evolved the neural mechanisms for abstract thought involving causal and antinomous thinking as a highly adaptive trait, that that organism must necessarily utilize those functions in an attempt to explain his existential situation. Such explanation involves the obligatory structuring of myths, complete with the organization of the world into antinomies and with the positing of initial causal termini of strips of observed reality which man calls gods, spirits, demons, etc. These functions are not a matter of choice but are necessarily generated by the structure of the brain in response to the cognitive imperative. Once the problem is presented in myth form, man, in common with all animals, attempts to solve it (i.e., to adapt to the environment) via motor action. In the presence of these circumstances, and with the inherited ancient ritual mechanisms still intact, this latter becomes the motor vehicle by which the problem is solved. Indeed, ritual behavior is one of the few mechanisms at man's disposal which can possibly solve the ultimate problems and paradoxes of human existence. Thus, although ritual behavior does not always "work," it has such a powerful effect when it does work that it is unlikely ever to pass out of existence within a social context no matter what the degree of sophistication of the society. Religious ritual behavior may take new forms within the context of highly developed Western technological societies. But whether in new form or in old, it is much too important to the psychological well-being of a society for it to lapse into oblivion.

Some Ontological and Epistemological Considerations

This essentially ends what has necessarily been a rather sketchy outline of a theory of the evolution of religious ritual, which takes into account the evolution of multiple interrelated neural subsystems. At this point, many individuals are often tempted to ask ultimate-type questions. Does this theory reduce religious ritual and myth to neuropsychology, or does it support some sort of ontological reality for religious ritual and for a belief in some sort of god?

Biogenetic structuralism could be used to argue either position. The former stand could strongly be argued since biogenetic structuralism employs a neuroreductionistic methodology in approaching cultural institutions. The latter position could be argued from the biogenetic structuralist principle that the subjective representations of reality must in some sense be isomorphic with external reality in order

for an organism to survive. In this case, one could argue that, if man experiences states in which the universal is perceived as whole, in which God is perceived in an immediate and very real fashion, this may perhaps indicate an ontological reality corresponding in some sense to the neuropsychological process.

The question seems to be in principle unanswerable. There are some reflections, however, which this paper brings to mind. If one accords ontological reality to the world as it is perceived under normal conditions (i.e., via the consciousness arising from the preponderance of major hemisphere activity) simply because it appears so real, then one must accord reality on the same basis to those experiences of wholeness and harmony arising from states of predominating function of the minor hemisphere simply because they are invested with the same or, at times, an even greater degree of reality. Many individuals describe meditative experiences or experiences during religious ritual as being more real than the reality of the situation in which they are explaining it.

Obviously, it is naive to assume the ontological reality of any state simply because it appears real. The sensation of reality is inescapably a subjective one. It is essentially a psychological phenomenon. The so-called philosophical problem of the bridge, which states that we cannot know whether the world as experienced really exists "out there," is generally couched in terms of the consciousness arising out of a preponderance of major hemisphere activity. But the same epistemological problem applies to the consciousness generated when the minor hemisphere predominates. If experience of the world as a mechanistic causal chain is very real during most states of consciousness, the experience of it as a whole organismic reality is just as real under the altered states of consciousness discussed in this paper. The epistemological problem is exactly the same for both states of consciousness. One may, if one chooses, refer a certain ontological validity to the effects of ritual behavior and to the basic structural elements of myth.

Of course, one may just as well say that the entire complex is reducible to neuropsychology. There is no answer from the verbal analytic mode one way or the other. Each position is an ontological statement based on the belief in the primacy of the reality of perception during one mode of consciousness or the other.

And yet an answer of sorts may be available to these ultimate questions if one abstains from analyzing the functions of the minor hemisphere in terms of the functions of the major hemisphere as we have just done. If one accepts the internal logic of the minor hemisphere on its own terms, it may provide answers which are beyond words.

Perhaps to some philosophers this may sound like an attempt to resurrect Saint Anselm's ontological proof for the existence of God. We do not know if it is. Nor do we have any answers for the philosophical problems we have raised. But if the basic question of duality of consciousness continues to stand up to further investigation, then the epistemological and ontological status of the products of consciousness generated by minor lobe preponderance is certainly a question for both theologians and philosophers to consider.

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