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THE NEUROBIOLOGICAL BASES OF MYTH AND CONCEPTS OF DEITY

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It has become apparent that belief in a God, in organized religion, and indeed in many cults purporting to serve demonic agencies, powers, or other supernatural forces has not evaporated over the three-hundred-year span since the inauguration of the Age of Reason. This phenomenon in itself is somewhat startling since most interpreters of science from the seventeenth-century *philosophes* onward have assured us that such belief is merely the vestige of primitive customs bound to pass with the advent of sufficient knowledge derived from science, its appropriate dissemination, and the demonstration to mankind of the power of that knowledge in a flowering technology. During the past three centuries scientific knowledge indeed has blossomed, has been disseminated to the masses via huge programs of compulsory public education in western Europe and America, and has been manifested in a mind-boggling technology reaching to the moon and interplanetary space.

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Nevertheless, our generation has witnessed a resurgence of satanic cults, a belief in astrology so pervasive that it extends to all classes of society, movements reinvigorating traditional, established religions such as the charismatic movement, the cursillo movement, etc., and the importation of popularized Eastern mysticism into the West, often as a barely discernible version of the original. What then are we to say of the forces which cause such a resurgence, which appear to snatch the victory from the hands of reason just at the moment of her greatest triumph? Numerous sociocultural theories have been advanced to explain the sudden success of belief in the supernatural. Careful examination, however, will show that such beliefs were never absent from Western society. The apparent, current proliferation of these belief systems appears to represent only the most recent crest of a continuous sine wave describing the waxing and waning fortunes of belief in the supernatural in the West over the past three hundred years. The best that sociocultural explanations can do is to describe the shape of the curve, so to speak. They do not explain the origin of the essential element, that is, the belief in the supernatural itself. That such belief may satisfy certain cultural needs which are felt more acutely under particular social circumstances I do not doubt for a moment. That social circumstances account for the capacity for and impetus toward belief in the supernatural itself has to me never been convincingly demonstrated.

The thesis of this paper is that belief in supernatural powers, gods, or demons, like all other universal human behaviors embedded within a cultural context, derives its source from the functioning of neural structures, which evolved and became progressively elaborated because of the adaptive advantage they conferred on their bearers. Those who are familiar with some of my previous work may be aware that I have designated such an organization of neural tissue a "neurognostic structure." This term has caused some controversy. Since I am not concerned here with the theory of biogenetic structuralism, I will avoid the term altogether. For the purposes of this paper I shall refer to such organization of neural tissues as "neural operators." Each operator shall be considered as having a specific functional capacity accounting for one of the operations of the neocortex of the brain. Thus each structure or connected set of structures which forms a single operator will be viewed as an independent functional unit for the purposes of this discussion. Of course it is a truism that every area of the brain is either directly or indirectly modified by just about every other area of the brain by a complex web of interconnections. The holists who emphasized this fact since the 1930s are loathe to localize cortical functioning in any particular part

of the brain. That each area of neocortex is more or less dependent upon the whole for appropriate functioning I do not dispute. But that certain specific areas appear to be more intimately involved in certain functions (always admitting that they need input in modification from many outside sources) appears to be supported by most recent investigators and allows one to consider certain structures or sets of structures as primarily corresponding to certain specific functions, all due caveats being made with respect to the necessity of reciprocal interconnections between other neural structures and those comprising these semiclosed systems.

What I would like to do in this paper is first to describe the probable neuroanatomical structures of the major cognitive operators with which I shall be concerned. Second, I should like to present a model which derives the nature and necessity of myth formation from certain of these operators. Third, I shall present a model based on recent neurophysiological research which explains the necessary generation of concepts of deity, powers, spirits, or demons both from the internal dynamic of myth formation and from the functioning of specific cognitive operators.

Before considering the nature of the biological basis of the generation of myths and concepts of supernatural causal agencies I must describe the cognitive operations which pertain to myth formation and concepts of deity and supernatural powers. I shall attempt to relate these operations to the neuroanatomical structures which recent investigation seems to indicate are the primary loci of these operations.

Cognitive Operations and the Neural Operators Subserving Them

When I use the term "cognitive operator" I am using the term "operator" analogously to the way it is used in mathematics. For example, a mathematical operator can be looked upon as the means by which certain mathematical elements are made to relate to one another in specific ways. Similarly a cognitive operator represents a neural structure which processes sensory input by relating various elements in ways specific to that operator. For the purposes of this discussion I will describe six operators: (1) Described in its simplest form, the holistic operator permits reality to be viewed as a whole or as a gestalt. (2) The causal operator permits reality to be viewed in terms of causal sequences of abstract elements. (3) The abstractive operator permits the formation of a general concept from the perception of empirical individuals. (4) The binary operator permits the extraction of meaning by ordering abstract elements into dyads in-

volving varying degrees of polarity so that each pole of the dyad derives meaning from contrast with the other pole. (5) The formal quantitative operator permits the abstraction of quantity per se from the perception of empirical individuals, generating arithmetic and mathematics. (6) The value operator permits an affective valance to be assigned to various elements of perception and cognition.

I shall present now an anatomical model for each of these six operators, based on recent neurophysiological research, thus attempting to localize these operators in terms of specific neuroanatomical structures. This will permit a consideration of the morphological evolution of these structures in a phylogenetic perspective.

Those familiar with Charles Laughlin, Jr.'s, and my book, *Biogenetic Structuralism,* may be already familiar with some of this material.[1] I apologize for this, but it is necessary to reemphasize certain points before we can go on to the proper subject of this paper.

It has been known for a long time that the parietal lobe on the nondominant side is concerned with the perception of spatial relationships. Recent experiments with animals as well as observations of humans who have had their corpus callosum and anterior commissure sectioned to prevent the spread of epilepsy have supported strongly the early clinical observations of neurologists that the parietal lobe on the nondominant side is involved intimately in the perception of spatial relations. Indeed most of the recent evidence indicates that this perception is of a holistic or gestalt nature.[2]

It is of more than passing interest that specific areas on the opposite or dominant side are related to the performance of mathematical operations (specifically the angular gyrus) and to the performance of certain basic logical-grammatical operations, particularly the perception of opposites and the ability to set one object over against another to emphasize its full semantic properties. These and other basic logical-grammatical functions are related to areas of the parietal lobe adjacent to the angular gyrus and proximate to the anterior margin of the occipital lobe on the dominant side. Lesions of this area in man prevent the generation of antonyms as well as the use of the comparative degree of adjectives. In short, such lesions prevent the formation of abstract dyadic oppositions or polarities, which is a function basic to human cognition and which I will consider later in relation to the generation of myths.[3] N. Geschwind has called this area on the dominant side the inferior parietal lobule.

This area in man is comprised of the supramarginal and angular gyri as well as certain adjacent areas. It can be visualized best as the area of overlap among the somaesthetic, 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. I often have used the analogy that it is as if three computer systems, one for each of the three major sensory modalities mentioned, were hooked into one another and the information from each became available to all. Such a system allows to be set up classes of objects which are vastly more inclusive than any classificatory system possible within each individual sensory modality. That this area of the brain may subserve conceptualization became powerfully supported by the evidence of Geschwind in his now classic monograph.[4] Soviet researchers refer to roughly the same area as simply the parietooccipital area, and A. R. Luria also notes that it is involved intimately in the formulation of basic logical-grammatical categories.[5] He and others have shown that destruction of parts of 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 on the dominant side not only may underlie conceptualization but may be responsible for man's proclivity for abstract antinomic or binary thinking.

Such considerations lead me to postulate that the formal quantitative, binary, and abstractive operators tentatively can be localized roughly in the area that Geschwind calls the inferior parietal lobule. If one wished to risk a greater specificity one could ascribe the formal quantitative operator primarily to the angular gyrus, the binary operator to the supramarginal gyrus, and perhaps the abstractive operator to a region somewhat more occipital, although we must bear in mind that these areas are interconnected intimately and might be viewed more profitably as a single region, as Geschwind proposes.

The point of all this is that it is probably no coincidence that those neural structures which appear to generate gestalt spatial perception via the nondominant parietal lobe are homologous to those structures on the dominant side which underlie mathematical, logical, and grammatical relationships. It is certainly no news that mathematics and mathematical operations appear to derive from the quantification of spatial properties. It is my contention that basic logical-grammatical operations are likewise so derived. If one considers the holistic perception of spatial relationships as the more primitively evolved or more "basic" function of the parietal lobe one can postulate easily that this has been preserved or even elaborated in man on the non-

dominant side. Modification on the contralateral, or dominant, side has been in the opposite direction, that is, breaking down the spatial gestalt into various composite units and relationships. This goes along with our contention that the evolution of the hominidae is marked most characteristically by the evolution of analytic cognitive processes which permitted the evolution of abstract thought and problem solving. Such analytic processes most probably involved a modification and elaboration of the most primitive gestalt operations on what we now call the nondominant side into what we recognize as the analytic functions which we associate with the dominant hemisphere of the brain. Such elaboration of function, and probably also of microstructure, was just that—a modification of more primitive functions. The analytic functions of the dominant side do not arise out of nothing but are related intimately to the more primitive operations preserved on the nondominant side. Thus one can postulate that the parietooccipital area on the dominant side developed not so much to perceive spatial relationships in their total configuration as to perform the operation which we now would call the division of space into coordinate axes, and furthermore it developed the capability of defining axes in terms of the polar termini of each axis. In this second operation one can perceive the basis of conceptual dyadic opposition beginning to derive from the evolution of an analytic perception of space.

I have proposed tentatively the loci of the analytic operators (i.e., binary, abstractive, and formal quantitative operators) to be in various areas of the parietal lobe on the dominant side. This same discussion (citing the evidence of R. W. Sperry, M. S. Gazzaniga, C. Trevarthen, etc.) leads me to localize the synthetic or holistic operator in the parietal region of the nondominant side. As noted earlier, this operator permits the perception of reality as a whole or single-perceived unity. As we shall see later, the function of the parietal lobe on the nondominant side (i.e., holistic operator) becomes of crucial importance as one means of the immediate perception of deity.

Let us now consider the nature of the causal operator. There is considerable neurophysiological evidence that the ordering of events in time, or more properly into a temporal sequence (since time probably has no ontological reality outside of the neural events which constitute the perception of it), is a result of the reciprocal interrelationship between those parietal areas and the anterior convexities of the frontal lobes via evolved fiber tracts.[6] It has long been known that the anterior portions of the frontal lobes particularly on the dominant 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 appears 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 myelinization corresponds with the development of Jean Piaget's formal operations and the perfection of linguistic ability.

At this point one can see that cognitive operators—or, if one wishes to be more precise, the neural structures which operate on quanta of experience to organize them in specific ways—produce what I have called cognitive structures. Cognitive structures are simply the subjective manifestation of ways in which reality is organized by the operators. In other words, depending upon which operator is functioning, the world is perceived in terms of synthetic unity, abstract causal relationships, relationships of binary opposition, etc.

I must emphasize here that in ordinary, day-to-day cognitive functioning all these operators function in concert, each relating its function to that of the others in order to abstract maximal meaning from experience. In other words, the brain operates as a functional unit. Predominant function of any single operator to the exclusion of the others is a rare, although as we shall see not an altogether impossible, event.

I would argue that the apparent multiplicity of relationships between elements generating cognitive structures can be reduced to a relatively small list of ultimately basic analytic relationships, including (1) inside-outside, (2) above-below, (3) left-right, (4) in front-behind, (5) all-nothing, (6) before-after, (7) simultaneous-sequential, etc. These relatively few basic spatial-temporal relationships can be enriched by combining them with an affective or emotional valence. Thus, for reasons which I do not have the space to go into here, "within" is usually identified with good and "without" with bad, "above" with good and "below" with bad, "right" with good and "left" with bad, "in front" with good and "behind" with bad, "all" with good and "nothing" with bad, etc. These affective valences are not absolute, and the reverse of any of them may appear. It is interesting, however, how frequently the relationships just mentioned do in fact culturally receive the affective valence stated. I feel that there is a reason for this association which involves issues of simple preservation, "above" usually being safer than "below" and therefore good, "within" being usually safer than "without" and therefore good, "in front" being usually

safer than "behind" and therefore good, etc. Nevertheless, I must reiterate that these associations are not absolute and the reverse associations theoretically can occur and occasionally in fact do occur.

Instead of embarking on the nearly impossible task of listing all the possible complex relationships that can exist between elements of a cognitive structure, I have chosen to attempt to reduce them to a handful of simple spatial-temporal relationships. I feel that it can be demonstrated practically that all complex relationships, whether they be mathematical, logical, or grammatical, can be reduced to either one or a combination of the basic spatial-temporal relationships which I have just considered. This is true with respect to all relationships with the single exception of the category already briefly alluded to, that is, affective or emotional relationships. These latter represent feeling states and are of crucial importance since they in one way or another enter into moral and value judgments. On the most primitive level they can be resolved into whether a stimulus is positive or aversive for an organism. Simply put, that which is good is that which provides either immediate or delayed gratification for the organism; that which is bad is that which the organism experiences as unpleasurable or not conducive to survival. As with the spatio-temporal relationships, the basic affective relationships can be elaborated into a number of subtle feeling states and can be related to perception and cognition in various ways. The neurophysiological substrate for such affective-cognitive-perceptual linkages is undoubtedly the numerous connections known to exist between various limbic structures and either the secondary sensory association areas (in the case of perceptions) or the inferior parietal lobule (in the case of cognition).

Neurophysiological Basis for the Generation of Myth

For the purposes of this presentation I shall consider a myth as performing two distinct but related functions. First, a myth presents a problem of ultimate concern to a society. This problem is presented always in antinomic form, that is, in terms of juxtaposed opposites such as life-death, good-evil, heaven-hell, etc. Second, once the existential problem is presented in the myth it is solved by some resolution or unification of the seemingly irreconcilable opposites which constitute the problem.

The ability to create a myth problem involves at least four critical operators, that is, the holistic operator, abstractive operator, causal operator, and binary operator. In other words, myths are couched in terms of named categories of objects which we call concepts or ideas. Myths, like all other rational thoughts, involve causal sequences. Myths involve the orientation of the universe into multiple dyads of

polar opposites. This last 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 C. G. Jung to Claude Lévi-Strauss to such a degree that other aspects of myth structuring often have been neglected.[7]

At this point I must return briefly to a topic which elsewhere I have called the cognitive imperative for a fuller understanding of the generation of myth. The abstract problem solving which the evolution of the interior parietal lobule, the anterior convexity of the frontal lobes, and the language areas 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 them. Such problem-solving ability enhanced human adaptation in any environment. It is not surprising therefore that once these neural systems evolved they rapidly spread over the globe. In the aggregate these neural systems represent man's 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 H. M. Adler and V. B. O. Hammett, by O. J. Harvey, D. E. Hunt, and H. M. Schroder, Solomon H. Katz's and my 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 reflexively, confronts a stimulus whose source is not known with the question "What is it?"[8] Affective responses such as fear, happiness, sadness, etc., and motor responses are clearly secondary to the immediate cognitive response. In all cases the immediate attempt of the human organism in the face of a strange stimulus is the attempt to organize it within a known framework. It is this universal adaptive drive related to abstract problem solving that I have called the cognitive imperative.

I should note that such cognitive organization of external stimuli into a linear, causal, verbal mode of consciousness is an effect of the neural mechanisms I have just described operating 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 H. Terzian and C. Cecotto, G. Rosadini and G. F. Rossi, G. Alema and Rosadini, and O. R. Hommes and L. H. H. M. Panhuysen.[9] In summary, these workers have demonstrated that an intracarotid injection of sodium amytal on the dominant side of the brain, which interferes with the

verbal and analytic functions that I 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 a word, 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 this is that man is driven to understand the world around him. He cannot do otherwise. He has no choice in the matter whatsoever. All the higher cognitive functions that I have described necessarily operate on incoming data, that is, percepts are categorized, organized, and modified into concepts, and concepts and percepts are both organized in causal chains and arranged in terms of antinomies of polar dyads. All this represents the function of the operators I have just described operating on input at various levels of sensory integration. Strips of reality which can be understood within the bounds of given data are so understood, and a model of reality is so constructed. However, if the data available do not explain any unusual phenomenon 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 those elements which are not derived from observed data or which are not immediately inferable from such data.

At this point I should discuss man's ability to think in terms of abstract causality. I already have 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 I have referred 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, I postulate that if the initial terminus is not given by sense data then the causal operator grinds out an initial terminus automatically. Here again we may note how Western science differs from the more usual form of human cognizing. Science refuses to postulate an initial terminus or first cause of any strip of reality unless it is observed or can be inferred immediately 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 I am implying is that gods, powers, spirits, personified forces, or any other causative construct is generated automatically by the causal operator. As I noted in a previous paper in speaking of Western science, I 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. 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 produced automatically by the causal operator is Aristotle's First Cause Uncaused.

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, so 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 or operators which I considered above. Since it is highly unlikely that man ever will know the first cause or every strip of reality observed, it is highly probable that man always will generate gods, powers, demons, or other entities as first causes to explain what he observes. Indeed man cannot do otherwise. Myth problems are structured either socially or individually according to the analytic and verbal mode of consciousness of the dominant hemisphere primarily. Myth problems involve the codification of unexplained reality in terms of causal sequences and in terms of antinomies or polar opposi-

tions, such as good and evil, life and death, change and permanence, etc. These antinomies always represent a problem of ultimate existential concern in myth structuring.

The second aspect of myth is to resolve these antinomies cognitively—and hence solve the problem. I will suggest only that such solutions as are exemplified by resolution of the god-man antinomy by a solar hero, a Christ figure, or a divine king are effected by a subtle shift in cognitive dominance from the major hemisphere to the minor hemisphere of the brain. By now the work of Sperry, R. D. Nebes, J. E. Bogen, Gazzaniga, and others involving asymmetry of function of the two cerebral hemispheres has become fairly well known.[10] In summary, there is good evidence that the cognitive operators which I have been considering as necessary for the structuring of the myth problem evolved within the hominid line primarily as functions of the major or dominant hemisphere. As I have noted, the major hemisphere not only apparently contains the code for the surface structure of language but appears to be primarily responsible for linear, analytic, or logical thinking. The cognitive operations that I have been considering up to now (conceptualization, abstract, causal thinking, and antinomic thought) represent the evolution of major hemisphere function. Sperry, Bogen, Gazzaniga, etc., present compelling evidence that the minor hemisphere subserves equally important although hitherto ignored functions of a synthetic or holistic character. As I have noted, this hemisphere and particularly its parietal lobe apparently is related to gestalt perceptions, on the perception of incoming sensory input as a whole rather than as a string of associated elements. I propose that the cognitive assimilation of logically irreconcilable polar opposites presented in the myth structure—such as god and man in a solar hero or a Christ figure—represents a shift of predominating influence from the major hemisphere, which subserves the presentation of the myth problem in terms of the higher cortical functions I described above, to a predominant influence of the minor hemisphere, which allows the antinomies to be perceived as a cognitive unity.

Suffice it to say that what I have been describing represents only the cognitive resolution of the myth problem. I have not in any way considered the neural basis for the affective or emotional discharge frequently accompanying such a cognitive resolution. In other words, I have presented a neural model which explains the internal cognitive dynamics of myth structure, without considering the frequent concomitant limbic discharge which is at the heart of the "religious experience." This phenomenon involves the integrated activation of "lower" neural functions—often deriving from a ritual or some other

marked context in which the myth is presented. I considered this problem in an Institute on Religion in an Age of Science talk several years ago.[11]

The Neurological Basis for the Concept of Deity

By now it should be clear that the concept of some form of supernatural (inferred rather than naturally observed) power, be it God, demons, spirit, or whatever, is required by the internal dynamics of myth. I have noted already that myths are structured in terms of pairs of binary opposition, one polarity usually consisting of man and supernatural force. This supernatural force is essential to give man the power to resolve the other polarity, which is the problem of the specific myth. The problem can be the life-death polarity, health-sickness, good-evil, or any other existential polarity. Usually it is logically impossible for the problem to be resolved. Obviously man as a single agent cannot resolve what is beyond his capacity. The internal dynamics of myth therefore require the counterbalance to man by a polar opposite or "being of power." The presumptive relation of man and the power being as man's relation to some sort of god-king or divine man then permits the resolution via this divine and human personage of the existential problem presented by the other existential polarity. As we have seen, however, the concept of a god or power being arises not only because of the internal dynamics built into the binary structure of myth by the binary operator but also from the necessary operation of the causal operator. Again I would propose that this is simply the way the operators work. We have no choice over their internal dynamic. This dynamic represents necessary neurological functioning, the subjective correlates of which necessarily are produced, namely, power beings or gods. Thus the traditional proofs given for the existence of God, the *quinque viae* of Saint Thomas, are subtle elaborations of argumentation via abstract causality. They represent various approaches to the application of the causal operator to the entirety of physical reality.

I noted above that when the causal operator was applied to a limited strip of reality, the initial cause of which is not given in the environment, the operator automatically produces a causal being to explain that strip of reality. Such beings derived their essential causal characteristic from the operator itself and are constructed in their details from elements preserved in the memory banks. The result is the generation of a limited god or of a spirit or demon. However, one is capable of applying the causal operator to the totality of reality at a given moment. This subtle application of the causal operator to the whole of reality will generate the subjective sensation of the pure

operation of causality or the affirmation of the absolute cause of the world.

Many people assume that the traditional arguments for the existence of God from efficient causality refer to a regress through time to the cause of the first "big bang." Although this certainly is one approach, it represents a rather naive, eighteenth-century approach and was certainly not that of medieval theologians. Aquinas, for example, maintained that in theory there is absolutely no reason why the universe could not be eternal. He maintained, however, that in such a case it is eternally caused. His own belief was that the universe was created at a moment in time to agree with the biblical account. But he was very specific that in principle the universe could be eternal and this would not in any way negate the argument from causality. His application of causality therefore was atemporal and represented his experiencing of the application of the causal operator to material being as such. Of course the mere fact that he could conceptualize "being as such" represents the application of the abstractive operator not to any specific series of empirical individuals but to all empirical individuals, thereby achieving the total functioning of the abstractive operator.

Although it is not the point of this paper to demonstrate that metaphysics arises from the application of various cognitive operators to the totality of physical reality as opposed to the strips and bits of physical reality on which they ordinarily operate, nevertheless I would present the very real possibility that metaphysics and all the major metaphysical questions derive their absolute generality from the subjective experience of what I would call the total functioning of various cognitive operators. By total functioning of cognitive operators I simply mean that they operate indiscriminately and simultaneously on all material reality. Since they operate on the totality of reality without attention to individuation or empirical individuals, one could maintain that metaphysical problems involve formulations derived from the subjective experience of various cognitive operators operating on minimal or no content, when content is described as the normal empirical individual entities in the environment which are experienced in day-to-day living. This is in no way meant to be an attack upon metaphysics since I would maintain that the validity of such usage of the cognitive operators is in principle capable of being neither affirmed nor denied.

There appears to be another source for the concept of deity besides the application of the causal operator to either various strips of reality or to the totality of reality. This involves the subjective experience of the almost pure functioning of the holistic operator. In normal

awareness it is very difficult for the holistic operator to function alone. All the operators apparently function in concert so that the entire neocortex is operating constantly in tandem, processing information both synthetically and analytically. In certain cases, usually produced by altered physiological states such as I have described in previous works, the holistic operator can be made to function briefly in an absolute sense so that the entire universe is perceived as a unity.[12] When this occurs even the self-other polarity is dissolved and the experience so often described by mystics in both the East and the West is obtained. Once again this experience represents the subjective awareness of a cortical operator in its pure form that is devoid or almost devoid of individuated content. This state of awareness is so ineffable as to be affirmed to represent the only actual reality, and the consciousness of nonholistic, individuated experience is affirmed to be only illusory by those individuals who have attained the holistic state.

To paraphrase Ken Wilber the core insight of this holistic experience is that man's innermost consciousness is identical to the absolute and ultimate reality of the universe, known variously as Brahman, Tao, Tathagata, Christ, Dharmakaya, Allah, the Godhead, or absolute Mind, to name but a few.[13] The mystical tradition arises from this experience and asserts in one way or another that

> Mind is what there is and all there is, spaceless and therefore infinite, timeless and therefore eternal, outside of which nothing exists. In the words of the founder of quantum mechanics, Erwin Schroedinger . . . : "The only possible alternative [to the plurality of souls hypothesis] is simply to keep to the immediate experience that consciousness [i.e., Mind] is a singular of which the plural is unknown; that there *is* only one thing and that what seems to be a plurality is merely a series of different aspects of this one thing, produced by a deception; the same illusion is produced in a gallery of mirrors, and in the same way Gaurisankar and Mt. Everest turned out to be the same peak seen from different valleys."
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> Or from the Ch'an Master Huang Po . . . : "All the Buddhas and all sentient beings are nothing but the One Mind, beside which nothing exists. This Mind, which is without beginning, is unborn and indestructible. It is not green or yellow, and has neither form nor appearance. It does not belong to the categories of things which exist or do not exist, nor can it be thought of in terms of new or old. It is neither long nor short, big nor small, for it transcends all limits, measures, names, traces, and comparisons. Only awake to the One Mind."
>
> On this level, man is identified with the universe, the All—or rather, he *is* the All. According to the *psychologia perennis,* this level is not an abnormal state of consciousness, nor even an altered state of consciousness, but rather the *only real* state of consciousness, all others being essentially illusions. To paraphrase Shakara . . . : Now I shall tell you the nature of this Absolute Mind. If you recognize it, you will be freed from the bonds of ignorance, and attain

liberation. There is a self-existent Reality, which is the basis of our consciousness of ego. That Reality is the Witness of the states of ego consciousness and the bodily coverings. That reality is the Knower is all states of consciousness. . . . It is your real Self. That reality pervades the universe, but no one penetrates it. It alone shines. Its nature is eternal Mind. It knows all things, from the ego to the body. It is the Knower of pleasure and pain and of the sense-objects. This is your real Self, the Supreme Being, the Ancient. It never ceases to experience infinite joy. It is always the same. It is Mind itself.

In short, man's innermost consciousness—known variously as the Atman, Pneuma, Adam-Kadmon, ruarch adonai, Purusa, al-insan al-Kamil, the Christ, Tathagatagarbha—is identical to the ultimate reality of the universe. Thus, to quote Schroedinger . . . again: "Inconceivable as it seems to ordinary reason, you—and all other conscious beings as such—are all in all. Hence this life of yours you are living is not merely a piece of the entire existence, but is in a certain sense the *whole*. . . . Thus you can throw yourself flat on the ground, stretched out upon Mother Earth, with the certain conviction that you are one with her and she with you. You are as firmly established, as invulnerable as she, indeed a thousand times firmer and more invulnerable."

This, then, is the Level of Mind, of cosmic consciousness, of man's Supreme Identity.[14]

I maintain that this mystical tradition arises from the experience of the total functioning of the holistic operator.

For any operator to function in an absolute fashion (i.e., upon all of individuated experience) is difficult, and particularly difficult for the holistic operator so to function. Nevertheless, when various alterations in autonomic tuning, which Barbara W. Lex has considered in detail in other papers, obtain via mediation or ritual performance, such an effect can be achieved. Of the high literate religions, Judaism, Islam, and Christianity appear to derive a concept of deity primarily via the application of the causal operator in an unlimited or unrestricted sense. This of course corresponds more with the Western emphasis on causality and on reasoning via causality. Oriental religions, particularly Hinduism and Buddhism, derive a concept of deity or absolute being from application of the holistic operator. It should be noticed, however, that in all the high literate religions elements from both modes of thinking are present and often mingled in the same person. Mystics of all religions achieve an immediate sense of God via the total application of the holistic operator to reality. Combinations of both approaches are noted in most of the great Western theologians. Of all the great Western approaches to a demonstration of God, however, probably only Saint Anselm of Canterbury derived his formal presentation almost purely by the application of the holistic operator. Even then his position was couched in terms of a "proof." No Buddhist worth his salt would ever speak of a proof. By definition the experience is beyond words, which are highly analytical and represent functioning of the opposite hemisphere of the brain.

Some Epistemological Considerations

An initial reaction to this paper on the part of a Western audience might be that it represents a kind of materialistic reductionism. After all, we are trying to explain the variety of religious experience, to quote William James, in terms of some very elementary neurological processes. But the problem of what to accept as the base of reality is present even with this kind of approach. This type of analysis represents par excellence the functioning of the dominant analytic hemisphere. So long as one is in this state, in which most of us almost always are, then such a reductionism is possible. The question of the validity of the perception of the world during altered states of consciousness such as during the absolute functioning of the holistic operator remains still unanswered. We cannot affirm with certainty the state of external reality even given ordinary consciousness.

In other words, we are quite incapable of knowing whether the world perceived as individuated experience represents the world outside us. The certainty of the existence of an absolute state by those who have experienced it appears to be of the same order of magnitude as the certainty that we possess in daily life of individuated external reality. Since we cannot even bridge the gap between external reality and our knowing in states of ordinary consciousness, what indeed can be said in any meaningful sense about the validity of the awareness of being in those states of immediate experience of absolute unitary being? Our only recourse is to state that we spend most of our time in what we call ordinary consciousness (by frontal ordering of experience) and the experience of absolute unitary being is indeed atemporal, that is, without a sense of the passage of time or at least with an extremely distorted sense of duration. So whatever criteria we use to judge one state of awareness are not applicable to the other state because we really are dealing with two separate worlds. Even the criterion of time does not apply to the experience of unitary being, and so we are left with a logically irreconcilable problem. Even in regarding the world of ordinary consciousness as being in some way real, we must be vividly aware that it is real to us only insofar as it is structured by the analytic mode of thinking generated by the dominant hemisphere. Analysis within that mode points to physical structures such as the minor parietal lobe which can interpret being as unitary, although this state is an infrequent one when interpreted according to one of the categories of everyday consciousness, which is temporal duration.

Careful analysis of this predicament even from the point of view of acceptance of the epistemological validity of everyday consciousness would lead one to suspect that the unitary experience of reality and

the individuated experience of multiple reality both represent transformations of reality and that reality, whatever that may be, is in fact unthinkable simply because it is beyond the categories of thought. The operators, whether synthetic or analytic, simply appear to be pointing—to use a metaphor—toward what cannot be said or even thought. We are simply at the limits of the capacity of the machinery.

This of course is the heart of the Buddhist paradoxes. Being and nonbeing are one. The all and the nothing are equivalent. Fullness and the void are but two aspects of the same reality. To the casual observer, these paradoxes appear to be nonsense. But when viewed from an awareness of the tendency of the central nervous system to process information yielding on the one hand individuated experience and on the other hand the experience of unitary being, these basic religious paradoxes perhaps have some sort of ultimate truth.

To attempt an analysis such as I have attempted in this paper requires a belief in the priority of individuated experience in which of course all of science as well as common sense resides. In making these closing comments I am not negating the truth of this analysis but merely pointing to the extreme difficulty of defining truth in all its aspects and to the mystery of reality which has always underlain the appearances of things.

NOTES

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10. See n. 2 above.

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12. Ibid.

13. Ken Wilber, "Psychologia Perennis: The Spectrum of Consciousness," *Journal of Transpersonal Psychology,* no. 2 (1975), pp. 105–32.

14. Ibid., pp. 106–8.