

ESSAY

Archetypes, Neurognosis and the Quantum Sea

CHARLES D. LAUGHLIN

*Dept. of Sociology & Anthropology, Carleton University,
Ottawa, Ontario, Canada K1S 5B6*

Abstract — C.G. Jung left a great deal of ambiguity surrounding the ontological status of the archetypes and the collective unconscious. He did so because of the inadequacy of the science of his day. Modern developments in the neurosciences and quantum physics — especially the new physics of the vacuum — allow us to develop Jung's understanding of the archetypes further. This paper analyzes the salient characteristics of Jung's concept of the archetype and uses modern biogenetic structural theory to integrate archetypal psychology and the neurosciences. The paper reviews some of the evidence in favor of direct neurophysiological-quantum coupling and suggests how neural processing and quantum events may interpenetrate.

In religious matters it is a well-known fact that we cannot understand a thing until we have experienced it inwardly, for it is in the inward experience that the connection between the psyche and the outward image or creed is first revealed as a relationship or correspondence like that of *sponsus* and *sponsa*.

— C.G. Jung, *Psychology and Alchemy*

Individual consciousness is only the flower and the fruit of a season, sprung from the perennial rhizome beneath the earth; and it would find itself in better accord with the truth if it took the existence of the rhizome into its calculations. For the root matter is the mother of all things.

— C.G. Jung, *Symbols of Transformation*

Introduction

Carl Jung left a great deal of ambiguity surrounding the ontological status of the archetypes and the collective unconscious. He did so, I believe, for very good reasons that had to do with the unavailability in his day of the requisite neurophysiology and physics upon which to ground his understanding. In this paper I want to draw a correspondence between Jung's archetypal psychology (as James Hillman, 1985 calls it; see also Griffin, 1989) and an equivalent concept in a theoretical approach to the grounding of experience in neurophysiology we call "biogenetic structuralism." I wish to suggest a solution to

the ontological problem of the archetypes by availing myself of a certain combination of modern neuroscience and the quantum physics of the vacuum.

I will begin by analyzing some of the salient attributes of the archetypes as formulated by Jung, and then draw a correspondence between the archetypes and our own notion of how the brain develops knowledge we call "neurognosis". I will then describe a recent perspective on the quantum physics of the vacuum — the so-called zero point energy sea — and discuss the possible relationship between brain functions and quantum events. I will end with a discussion of the implications of this view for the ontology of the archetypes. All references are to Jung's oeuvre, unless otherwise noted.

The Archetypes

As most readers will know, Carl Jung was struck by the importance of universal patterns in the ideation and imagination of his patients, in myth and other literature, and especially in his own experience. He first came to the idea of dream symbolism as reflections of primordial material in the unconscious during a trip he took with Freud in 1909 (1965 [1961], pp. 158-161).¹ And he parted company with Freud largely because of his teacher's inability to drop his positivist and materialist conditioning when dealing with material from the unconscious (1970 [1955/56], p. 473; Dourley, 1984, p. 38) and to transcend his involvement with the subjective aspects of dreams and other symbolic products of unconscious processes (1956 [1912], pp. xxiii-xxvi).

Jung felt that it was fundamentally important for psychology to recognize that the individual human experience is produced by the development of instinctive structures that are essentially archaic, transpersonal, and even transcultural (1956 [1912], pp. 3-6; 1969d [1919]; see also Edinger, 1972; Neumann, 1969:270). He borrowed his earliest term for these structures, "imago", from Freud, and of course transformed its meaning from that of a constellation of images, ideas and emotions formed in early childhood to that of an independent constellation of primordial material inherited from the distant evolutionary past (ibid, p. 44n). He later termed these structures² the *archetypes* (1968b [1936/37], p.43), and the total collection of these structures the *collective unconscious*:³

[The] personal unconscious rests upon a deeper layer, which does not derive from personal experience and is not a personal acquisition but is inborn. This deeper layer I call the *collective unconscious*. I have chosen the term "collective" because this part of the unconscious is not individual but universal; in contrast to the personal psyche, it has contents and modes of behavior that are more or less the same everywhere and in all individuals. It is, in other words, identical in all men and thus constitutes a common psychic substrate of a suprapersonal nature which is present in every one of us.

— Jung 1968b [1934]:3-4

Jung's conception of the archetypes underwent alteration over the course of the half century between the time of his trip with Freud and his death in 1961. It is thus a mistake to take his definition of the archetypes from any one era as the definitive one. Rather, it is far more illuminating to track the development of his ideas as his own psychological and spiritual understanding unfolded. Yet certain attributes of the archetypes remained fairly consistent throughout his writings. I want to both analytically isolate these attributes as they relate to the fundamental ontological problem and trace some of the changes that occurred in Jung's thinking relative to them, for these matters will be important when we come to consider the archetypes from a more modern perspective.

Archetypes As Evolutionary Structures

Human archetypes are the result of the evolution of the structure of the human psyche. Over and over again Jung emphasized that the archetypes are part of human inheritance. They are extraordinarily stable and enduring structures (1970 [1955/56], p. 463) that form the fundamental organization of the psyche, that arise anew in every human incarnation, and that are akin to the instincts (1956 [1912], p. 178; 1954a [1931], pp. 44-46; 1968a [1944], p. 137; 1968b [1934], p. 5; 1968c [1936/37], p. 42; 1969a [1946], p. 200; 1969d [1919]); 1958 [1948], p. 130; 1970 [1955/56], p. 336n).

The archetypes themselves may well have changed during our evolutionary past — there is really no way to know for sure (1953 [1943/45], p. 368) — but in their present form they encode the recurrent experiences of human beings over countless millennia and across all cultural boundaries (1970 [1955/56], p. 390). In some instances the archetypes encode recurrent experiential material from our pre-hominid animal past (1953 [1943/45], p. 96).

Archetypal structures underlie all recurrent, "typical" (panhumanly typical, not culturally or personally typical) ideas, images, categories, situations, and events that arise in experience. They contain no inherent content, but exist "at first only as *forms without content*, representing merely the possibility of a certain type of perception and action" (1968c [1936/37], p. 48; emphasis Jung's). Archetypes may manifest as "*a priori*, inborn forms of 'intuition'" (1969d [1919], p. 133). And as the instincts impel us to act in a distinctly human way, so do the archetypes impel us to perceive and understand the events we instinctively respond to in a distinctly human way (1970 [1955/56], p. 87). For Jung instinct and archetype are two sides of the same unconscious functional coin:

Just as we have been compelled to postulate the concept of an instinct determining or regulating our conscious actions, so, in order to account for the uniformity and regularity of our perceptions, we must have recourse to the correlated concept of a factor determining the mode of apprehension. It is this factor which I call the archetype or primordial image. The primordial image might suitably be described as the *instinct's perception of itself*, or as the self-portrait of the instinct, in exactly the same way as consciousness is an inward perception of the objective life-process. Just as conscious apprehension gives our actions form and direction, so unconscious apprehension

through the archetype determines the form and direction of instinct.

—Jung (1969d [1919], pp. 136-137; Jung's emphasis)

Thus the archetypes may be characterized as being instinctual, a priori "meaning" and the collective unconscious as containing both the instincts and the archetypes, for the bivalent system they represent is a "collective" (*i.e.*, panhumanly universal) phenomenon (1969d [1919], pp. 133-134).

The ubiquitous activity of the archetypes in the functioning of the psyche is an important factor in understanding Jung's conception of the evolution of consciousness and the unconscious, for most discussions of the archetypes, including his own, tend to emphasize a handful of relatively dramatic forms; *e.g.*, the Wise Old Man, the anima and animus, etc. These few forms are those that arise in dreams and myths, whereas most archetypes mediate the very mundane functioning of cognition and activity in everyday psychological life. The total range of archetypes are the source for human beings everywhere of typicality in experience (Hillman, 1985, p. 12).

Archetypes and Their Transforms

Jung made a point of emphasizing that we cannot apprehend the archetypes directly. All that we can know are the manifest archetypal images and ideas that arise in the symbolism of our own experience, or that we deduce from the ideas and images found in texts and other traditional symbolic forms (1968d [1936], pp. 56-57; 1969a [1946], p. 213). Moreover, the archetypes are not material that was once conscious and somehow lost either in early childhood, or in some archaic hominid age. Rather, the archetypes have never been conscious during the course of either ontogenesis or phylogenesis (1968c [1936/37], p. 42; 1969a [1946], p. 210).

Yet these perpetually unconscious archetypal structures lay behind and generate the symbolism that is so essential to all mythological and religious systems and are responsible for the patterned similarities among these (1969a [1946], p. 206; Edinger, 1973, p. 4). The archetypes produce such distinctive and universal motifs as the incest taboo, the unity of opposites, the King, the Goddess, the Hero, and so on. And it is clear in Jung's treatment that actual engagement with the archetypes is a dynamic and developmental process, involving both the assimilation of archetypal contents into consciousness and, as a consequence, the transformation of the archetypes themselves (1968b [1934], p. 5).

James Hillman (1985, p. 13) and others (*e.g.*, Griffin, 1989, p. 40) have rejected Jung's distinction between the archetypes as unknowable structures in themselves and archetypal images and ideas as knowable transformations (or "contents") of those structures. They do so on the dubious grounds that, if the "archetypes in themselves" are in principle unknowable, then how can we

know anything about them? But this is a serious error that further confuses the underlying ontological difficulties with the notion of archetype. Moreover, it is a view that is both over-rationalized and phenomenologically naive.

It is quite clear from Jung's own discussions that the attributes of the archetypes are known through reflection upon their various transformations — upon their manifestations in dreams, fantasies, projections onto the world, mythology and so on — a methodology not unfamiliar to students of other schools that attempt to define structure, such as those of Claude Levi-Strauss and Jean Piaget. For example, as Jung points out, "We must, however, constantly bear in mind that what we mean by 'archetype' is in itself irrepresentable, but has effects which make visualizations of it possible, namely, the archetypal images and ideas" (1969a [1946], p. 214), and "Man knows no more than his consciousness, and he knows himself only so far as this extends. Beyond that lies the unconscious sphere with no assignable limits, and it too belongs to the phenomenon of Man" (1970 [1955/1956], p. 368), and again, "The archetype as such is a psychoid factor that belongs, as it were, to the invisible, ultraviolet end of the psychic spectrum. It does not appear, in itself, to be capable of reaching consciousness. I venture this hypothesis because everything archetypal which is perceived by consciousness seems to represent a set of variations on a ground theme" (1969a [1946], p. 213; see also 1969a [1946], p. 231; 1968 [1944], p. 218). In addition, we never come to the end either of the transformations of which any archetype is capable, or of our knowledge or explication of any archetype (1968e [1940], p.160).

Archetypes As Transpersonal Experience

It is critical to understand that Jung's whole approach, whether in the consulting room or in his own spiritual work, was essentially phenomenological (see Dourley, 1984, p. 39; 1993, p. 16). The archetypes are not merely theoretical concepts, but are derived from direct empirical observation of patterns in our own experience (1968d [1936], p. 56). We know the archetypes, not by merely thinking about them, but by experiencing their myriad activities in the arena of our own consciousness and then reflecting upon them (1968b [1934], p. 30). Indeed, there is no other way of coming to know the archetypes in any personally meaningful way.

What makes the activity of the archetypes distinctive in human affairs is the sense of profundity and numinosity that commonly accompanies their emergence into consciousness (1969a [1946], p. 205; 1970 [1955/56], pp. 390, 524). Their numinosity is derived from the fact that they store up and are conduits for affective and libidinous energies from lower levels of the psyche (1956 [1912], p. 232). So numinous and transpersonal are the symbolic eruptions of archetypal processes that the experience of them may lead to fascination and faith (1956 [1912], p. 232), and even to states of possession and over-identification with the imagery (1968b [1934], p. 39; 1968a [1944], p. 36; Edinger, 1972, p.7). At the very least such experiences are affectively gripping

and tend to dominate one's attention for a time until an interpretation of them is assimilated into the conscious ego — an essentially hermeneutic process not unlike that advocated by phenomenologist and theologian, Paul Ricoeur.

Archetypes in Development

We should make it clear that the archetypes are not solely an adult phenomenon. They are present from the beginning of life and, indeed, are the only foundation of childhood psychic development (1954b [1928], p. 52; 1968e [1940], p. 160). Another way to say this is that the ego — "the complex factor to which all conscious contents are related" (1959 [1951], p. 3) — is the result of the archetypes coming to know themselves. This is the *uroboros* motif that Erich Neumann (1969, p. 10) placed at the center of the evolution and development of consciousness; the self-devouring archetypal ground of all experience.

Although his views about child consciousness may be considered quaint⁴ in light of experimental findings in modern developmental psychology, Jung was aware that a child's experience is thoroughly archetypal:

The child's psyche, prior to the stage of ego-consciousness, is very far from being empty and devoid of content. Scarcely has speech developed when, in next to no time, consciousness is present; and this with its momentary contents and its memories, exercises an intensive check upon the previous collective contents.

— Jung 1954a [1931], p.44)

Although he rarely concerned himself with the issue, Jung clearly had a developmental framework in mind when discussing the nature of the archetypes — especially in his earlier formulations (see 1969b [1931]). It is the unfolding collective unconscious and its nascent archetypal structures that produces the highly mythological contents of children's dreams (1954a [1931], p. 45). And eventually this unfolding landscape of archetypal material participates in a developmental dialogue with the emerging conscious ego that becomes the *sine qua non* of the process of individuation (1953 [1943/45], p. 172-173; Edinger, 1973; Dourley, 1984). "In this way the conscious rises out of the unconscious like an island newly risen from the sea" (1954b [1928], p. 52).

Neumann (1969) picked up on the developmental thread in Jung's thinking (Jung, 1953 [1943/45]) and, with the latter's full approval (see Jung, 1969c), constructed a thoroughly developmental account of the archetypal imagery in mythology. Assuming that ontology recapitulates phylogeny, Neumann (1969, p. xvi) — in a somewhat Piagetian manner — examined the stages of development of consciousness as reflected in the world's various mythological systems for clues as to the stages in the evolution of consciousness.

Archetypes As Organs

Neumann, like Jung before him, treated archetypes as at least analogous to physical organs (Jung, 1968e [1940], pp. 160-161; Neumann, 1969, p. xvi), and spoke of them as such. The archetype is as much an organ to the psyche as the liver is to metabolism. And as organs, archetypes develop during the course of life.

Edward Edinger (1985, pp. 98-99) borrows the alchemical term "coagulation" (another organic metaphor) for the process by which archetypes become activated in childhood and subsequently distorted and limited in their functions due to assimilation of their material by the developing ego. The archetypes express themselves in emerging consciousness as images and ideas, and these transformations are actively assimilated into the conscious ego in such a way as to produce feedback which constrains further transformations. The process by which the ego assimilates essentially transpersonal, panhuman material gradually lessens the mysterious and numinous qualities of archetypal eruptions. It is an active process of perception, much like that modeled by J. Gibson (1979) and by our own group (see McManus, 1979).

Indeed, the process of assimilation may become so active that the ego over-identifies with and feels responsible for producing these materials. Those of us who have spent time in spiritual movements may recognize the common phenomenon of individuals who over-identify with and personalize essentially transpersonal experiences (see Neumann, 1954, pp. 336-337 on "secondary personalization;" and Edinger, 1972, pp. 7-16 on "inflation" of the ego). For Jung, this over-identification of ego with transpersonal experience may also account for certain dynamics of psychosis.

The Ontological Status of the Archetypes

As noted above, Jung appeared to be undecided in his own mind about the question of the ontological status of the archetypes (see *e.g.*, 1968d [1936], p. 58; see also Dourley, 1993); and this state of affairs has led to considerable controversy. But I believe that the ambiguity was necessitated by Jung's inability to scientifically reconcile his conviction that the archetypes are at once embodied structures and bear the imprint of the divine; that is, the archetypes are both structures within the human body, and represent the domain of spirit. Jung's intention was clearly a unitary one, and yet his ontology seemed often to be dualistic, as well as persistently ambiguous, and was necessarily so because the science of his day could not envision a non-dualistic conception of spirit and matter.

Jung's dualism is apparent in his distinction between the archetypes and the instincts which required for him a polarization of the psyche into those products derived from matter and those derived from spirit. He imagined the psyche as the intersection at the apex of two cones, one of spirit and the other of matter (1969a [1946], p. 215). One passage is worth quoting at length because

it signifies better than any other of Jung's treatments the essential ontological dualism with which he was encumbered:

Just as the "psychic infra-red", the biological instinctual psyche, gradually passes over into the physiology of the organism and thus merges with its chemical and physical conditions, so the "psychic ultra-violet", the archetypes, describes a field which exhibits none of the peculiarities of the physiological and yet, in the last analysis, can no longer be regarded as psychic, although it manifests itself psychically. But physiological processes behave in the same way, without on that account being declared psychic. Although there is no form of existence that is not mediated to us psychically and only psychically, it would hardly do to say that everything is merely psychic. We must apply this argument logically to the archetypes as well. Since their essential being is unconscious to us, and still they are experienced as spontaneous agencies, there is probably no alternative now but to describe their nature, in accordance with their chiefest effect, as "spirit",... . If so, the position of the archetype would be located beyond the psychic sphere, analogous to the position of physiological instinct, which is immediately rooted in the stuff of the organism and, with its psychoid nature, forms the bridge to matter in general. *In archetypal conceptions and instinctual perceptions, spirit and matter confront one another on the psychic plane.*

— Jung (1969a [1946], pp.215-216; *emphasis added*)

Jung certainly did not intend to produce a dualism between psyche and the material world, for he held that these are but two aspects of the same reality. Indeed, he would make statements denying that archetypes were anything other than our experience of the instincts; *e.g.*, "There is, therefore, no justification for visualizing the archetype as anything other than the image of instinct in man" (1959 [1951]). Yet he fervently wished to avoid the two snares of physiological reductionism, which was on the rise in psychology with the writings of Wundt and other behaviorists, and materialism, which had been on the increase in scientific thinking since the 19th century. He felt strongly that Freudian psychoanalysis had become muddled by this kind of self-limiting and anti-empirical thinking.

But the ground [Freud's] cleared extended only so far as certain basic physiological concepts permitted, so that it looked almost *as if psychology were an offshoot of the physiology of the instincts*. This limitation of psychology was very welcome to the materialistic outlook of that time, nearly fifty years ago, and despite our altered view of the world, it still is in large measure today. It gives us not only the advantage of a "delimited field of work", but also *an excellent excuse not to bother with what goes on in a wider world.*

— Jung (1968d [1936], p.55; *emphasis added*)

Jung was not advocating an extension of the material world by way of a simplistic epiphenomenalism. Thus there is not the problem of causation that usually attends epiphenomenalistic theories of mind and body. As he wrote, "The

archetype is pure, unvitiated nature, and it is nature that causes man to utter words and perform actions whose meaning is unconscious to him..." (1969a [1946], p. 210). Causation may flow from the natural, archetypal structures to thought, speech and action, all within the same body (1953 [1943/45], p. 93n; 1968d [1936], p. 58). The archetypes, as structures, are also a system of limitations upon human experience. That is, they not only cause thoughts, images and actions, they are sets of limiting factors on the general range of experiences that may arise within the consciousness of an individual (1956 [1912], p. 294).

The archetypes are at least semi-autonomous for Jung, so causation from consciousness back to the archetypes (so to speak) is constrained by the fact of the unconscious nature of archetypal processing (1953 [1943/45], p. 96). The unconscious, and especially the collective unconscious, is partially free from the intentionality of consciousness. Yet, as we have seen above, the process of assimilation of archetypal materials by the ego does exercise a limiting effect upon subsequent transformations produced by the archetypes. And the role of the ego in generating distinctions and discriminations among archetypal elements arising in consciousness is fundamental to the effect of the archetypes on experience.

David Ray Griffin (1989) is one of those latter day "archetypal psychologists" who would have us dispense with the distinction Jung insisted upon between the archetypes *per se* as hidden structures and the archetypal images and ideas as transformations of those structures in consciousness. As a consequence, Griffin creates all sorts of problems making sense of the causation involved (see *ibid*, pp. 40-41). I am ignoring his philosophical analysis of causation here because it does not apply to Jung's ideas as I read them. Jung was quite emphatic that archetypes cause the transformations that arise in consciousness. It is also quite clear to me that Jung consistently avoided claiming a pure Platonic, epiphenomenal status for either the archetypes or the collective unconscious. Thus he had no more of a problem attributing causation to the archetypes than to any other physiological structures. It is no more problematic to say that an archetype causes an image, or that an image is the ego's apprehension of the archetype, than to say that the physiology of the hand causes grasping, or that the physiology of the stomach causes digestion — or for that matter, that structures in the amygdala cause fear.

It seems to be true that Jung was more inclined to think of the archetypes in biological terms in his earlier writings, while being more inclined to speak of the spiritual dimension in his later works. He early-on wrote that the archetypes are "ever-repeated typical experiences" that are somehow impressed upon the materiality of the body — that they had been "stamped on the human brain for aeons" (1953 [1943/45], pp. 68-69). And not in human beings alone are archetypes to be found, but very likely in animals as well (1953 [1943/45], p. 69).

The Archetypes in Summary

Jung was remarkably consistent in many of the attributes he ascribed to the archetypes. The archetypes are structures that are inherited by each individual, regardless of culture. They are instinctual, embodied structures, and yet they are manifestations of spirit taking form in the body. Jung throughout his career considered the archetypes as related to the instincts, even as images and ideas produced by the instincts, and thus he considered the archetypes as having a biological existence of some kind. For instance, in *Aion* (1959 [1951], p. 8), one of his last works, he refers the reader back to his 1919 (1969d [1919]) article on the relations between instinct and the archetypes. One may infer from this reference back thirty years that his views had not substantially altered on this particular issue.

Archetypes form the total ground — the collective unconscious — upon which conscious cultural and personal experience develops. These structures are the products of natural selection, and are the impressions left by recurrent experiences of the species upon the nervous systems of individual human beings. They generate (or "cause") an endless variety of transformations that are experienced as images and ideas had in dreams, fantasies and visions. These images and ideas do bear the mark of personal and cultural conditioning, and the archetypes themselves are involved in the development of consciousness.

The archetypes produce all of the universal material in myth and ritual drama. Archetypal experiences tend to be numinous and transpersonal in their impact upon personal development, for they are the eruption of archaic and timeless meaning into the personal world of the ego. They are archaic in the sense that they have evolved over long periods of time, and are timeless in that they arise anew in the experience of each passing generation bearing recognizably similar patterns.

One has the impression when one tracks the historical progression of the concept of archetype in Jung's writings that there was a clearly greater emphasis upon the transpersonal dimensions of archetypal experiences after his heart attack in 1944 (1965, p. 289) when he was around seventy. This is reflected in his increasing interest in alchemical symbolism, which he first received from Wilhelm in the early 1920s (John Dourley, personal communication), and which he embraced in order to make sense of his own phenomenology. But he nowhere indicates a repudiation of the fundamental biological aspect of the archetypes, their functions and their transformations (see Edinger, 1995, p. 259). Rather, he presumes the biological aspect of their nature as he had more than amply discussed in his earlier writings. What apparently changes in his shift of emphasis to the phenomenology of consciousness is the importance of wholeness and the centrality of the Self (*e.g.*, 1970 [1955/56], pp. 487-505), a theme he continued from his earlier interest in the mandala archetypes and the unity of opposites (*e.g.*, 1968f [1930]).

The Archetypes As Neurognosis

As it stands, Jung's account of the archetypes does not allow a clear and easy engagement with modern physics. This is because Jung avoided fully embodying the archetypes. Biogenetic structural theory however introduces the concept that the archetypes are structures within the nervous system. Of course we have used our own terminology in developing these concepts, but the correspondences with Jung's ideas are evident.

According to biogenetic structural theory, a principal function of the higher processes of the human brain is the development of each individual's *cognized environment*. The cognized environment is the total set of neurophysiological models that mediate all of an individual's experiences. The cognized environment contrasts with an individual's operational environment which includes both the actual nature of that individual as an organism and the individual's external world. As discussed here, the concept of the *operational environment*⁵ has been extended to include the quantum sea. The primordial, biological function of the cognized environment is the adaptation of the individual organism to its operational environment by making sure that the world of experience is adaptively isomorphic⁶ with the world of reality.

Neurognosis

All neurophysiological models comprising the cognized environment develop from nascent models which exist as the initial, genetically determined neural structures already producing the experience of the fetus and infant. We call these nascent models *neurognostic structures*, *neurognostic models*, or simply *neurognosis* (Laughlin, 1991; Laughlin and d'Aquili, 1974, p. 83; Laughlin, McManus and d'Aquili, 1990, pp. 44-75). When we wish to emphasize the neurognostic structures themselves, we tend to mention structures or models. The neurognostic structures correspond to Jung's archetypes. Remember that, although much attention was given to relatively dramatic archetypal imagery in his writings, Jung actually believed that there were as many archetypes as there are species-wide, typical perceptions (1968c [1936/37], p.48). Jung's reference to the essential unknowability of the archetypes-in-themselves also applies to neurognostic structures in our formulation.

When we are speaking of the functioning of these neural structures in producing either experience or some other activity unconscious to the individual, we use the term neurognosis. This usage is similar to Jung's reference to archetypal imagery, ideas, and activities that emerge into, and that are active in consciousness.

Neurognostic Development

And, as with Jung's understanding of the archetype, neurognosis also applies to the genetically conditioned processes of development of neurognostic structures. You will recall that in a certain sense the archetypes are indistin-

guishable from the instincts (1959 [1951], p. 179). Neurognosis, too, refers to both the initial organization and function of neural models, and to the genetically channelled processes of their growth and development, especially in early life. The entire course of what Jung would call "individuation" is highly influenced by neurognostic processes.

The Evolution of Neurognosis

Unlike Jung's uncertainty in the matter, we have concluded that neurognosis (the archetypes) has changed over the millions of years of our species' phylogenesis. We are forced to this conclusion due to:

1. the evidence of dramatic encephalization found in the fossil record of our extinct ancestors (see *e.g.*, Jerison, 1973, 1985; Eccles, 1989; Armstrong and Falk, 1982; Falk, 1992), and
2. the fact that social variation in the development of a system of fundamental, evolutionarily derived structures (*i.e.*, culture) appears to be the primary mode of human adaptation.

The archetypes as structures mediating intuitive and symbolic knowledge are undoubtedly located in the areas of the nervous system that appear to have evolved most dramatically during the course of hominid encephalization and that produce the distinctly human quality of mentation, learning, communication, and social action characteristic of our species today. I am using the term intuition in Jung's sense as meaning "an unconscious process in that its result is the irruption into consciousness of an unconscious content, a sudden idea or 'hunch'" (1969d [1919], p. 132). And, with Jung, I agree that the neurocognitive processes that mediate intuitive "hunches" are largely instinctive operations, or neurognosis.

Culture and Neurognosis

Neurocognitive development is exquisitely ordered by processes inherent to the growth patterns of the organism — an ontogenetic "package" that reflects the path of evolutionary change characteristic of the hominids (Gould, 1977; Piaget, 1971, 1985). There is no such thing as the development of neural tissues that is not constrained and guided by lawful, genetically linked processes. Development is never totally plastic. As Martin Seligman (1975; Seligman and Hager, 1972; Laughlin, McManus and d'Aquili, 1990, pp. 62-64) has shown, the organism must be biologically "prepared" to learn something. That is, the neurognostic structures (*i.e.*, archetypes) must be in place, be of the correct structural configuration and developmentally mature enough to begin to model the aspect of experience they mediate. In Seligman's terms, if the neural tissues are not in place, the organism is "contraprepared" for learning, and thus cannot learn.

There really can be no such thing as pure cultural relativity in either the

structure or function of the processes mediating experience. Certainly there is interpersonal and cross-cultural variance in experience — and in the particular details of experiences. But variance should be understood as "surface" transformations upon universal neurognosis operating in human ontogenesis (see McManus, 1979; Laughlin, McManus and d'Aquili, 1990, Chap. 9), rather than as totally plastic patterns influenced solely by history, enculturation, or linguistic and semantic tradition.

The Transcendental Nature of Neurognosis

The emphasis upon adaptation is important, for we make the fundamental assumption that the operational environment is *transcendental* relative to the capacity of any individual or group to comprehend it. That is, the cognized environment is a system of knowledge about the operational environment, and there is always more to know about the operational environment, or any aspect of it, than can be known. The cognized environment models the operational environment in an adaptively isomorphic way, but there always exists a set of boundaries and constraints to knowledge, a *zone of uncertainty*⁷ (d'Aquili *et al.*, 1979, pp. 40, 171) produced by the limits to spatial discernment and discrimination, complexity of structural organization, and to the capacity to apprehend and anticipate temporal and causal relations. This is the sense of transcendence that one may find in Jung's insistence that the archetypes always transcend their expressions (John Dourley, personal communication).

Lest the reader continue under a false perception, recall that the organism (or Self) is part of the individual's operational environment. And the organism includes the neurognostic structures (or archetypes) themselves. The archetypes then are always transcendental relative to an individual's consciousness (Laughlin, McManus and d'Aquili, 1990, Chap. 9). Recall that Jung laid special emphasis upon the essential unknowability of the archetypes. He was saying in effect that there exists a zone of uncertainty in our knowledge of our own unconscious processes, of our archetypes and of our own Self. The modes available to the archetypes for expressing their nature necessarily condition how we come to know them. Imagery and intuition may be considered both as transformations mediated by, and as points of view upon the archetypes, material upon which knowledge of the unconscious aspects of neuropsychological being may be grounded — again, the *uroboros* motif.

Archetypes, Neurognosis and the Quantum Sea

I am not just attempting to reduce the archetypes to structures in the brain. However, if I left the analysis at this point, then I would surely be guilty of doing something that Jung consistently refused to do, for one will remember that he was also of the opinion that the archetypes are to be considered as the confluence of spirit and matter. But Jung faced a dilemma that we biogenetic structuralists faced until quite recently, a problem I have called the "quantum

barrier." The barrier to which I refer is a conceptual one, of course, and not a characteristic of the real world. It refers to our inability to reconcile what we know about how the brain and consciousness work with accounts by modern physics of quantum reality existing as "wave functions" that are only "collapsed" when "measured" — that is, that the act of observation somehow has a determinant effect upon how the quantum world materializes in our experience.

Jung and the Copenhagen Interpretation

The orthodox story out of quantum theory is that by the time one considers the world at the level of objects, constituent quantum events have been statistically eliminated from consideration by being reduced to classical phenomena (see Herbert, 1985, pp. 158-168 for a more complete description). This so-called Copenhagen account is phenomenologically problematic, at least for a contemplative, Jungian or otherwise. It presumes a schism between experience and reality. It establishes a fundamental dualism between consciousness which operates in a mechanical universe and reality which is organized as a quantum universe — or, if you like, it requires a "bifurcation of nature" (as Alfred North Whitehead used to say) into the world of everyday experience and the world according to science.

By contrast, the experience of a contemplative — and I am including Jung in this category — is one of a continuum of increasing subtlety from awareness of form (termed *rupa* mindstates in Buddhist psychology) through the awareness of the energies that make up experience, but without form (the *arupa* mindstates), to the experience of the Plenum Void (the *nirvana* awareness). There simply is no disjunction between the experiences typical of everyday awareness — experiences dominated by the awareness of objects and relations among objects — and the experience of the Plenum. There is a continuum of experienced subtlety differing in degrees of materialization and level of structure. Experience thus parallels the range of organization of the world from the level of the quantum to the level of gross matter.

Moreover, the Copenhagen account will not allow us to model a conscious brain — quantum universe continuity relationship that can account for, say, the effects demonstrated by researchers on non-local and atemporal causation (Puthoff and Targ, 1976; Puthoff, Targ and May, 1981; Targ and Puthoff, 1977; Jahn and Dunne, 1987). And it will not facilitate an understanding of how the cognized environment has evolved from, within and to know an essentially quantum operational environment.

This was a puzzle for Jung, as he was keenly interested in the emerging results of quantum mechanical research in relation to his concern for "acausality" and "synchronicity" in physical and psychical order (1969e [1952], pp. 516-518). He sensed, I think, the possibility of theoretically bridging from consciousness to cosmos by the proper amalgamation of psychological and quantum mechanical perspectives. As he noted:

Nevertheless, the relative or partial identity of psyche and physical continuum is of the greatest importance theoretically, because it brings with it tremendous simplification by bridging over the seeming incommensurability between the physical world and the psychic, not of course in any concrete way, but from the physical side by means of mathematical equations, and from the psychological side by means of empirically derived postulates — archetypes — whose content, if any, cannot be represented to the mind.

—Jung (1969a [1946], p.231)

Unfortunately for his understanding of quantum physics, Jung was heavily influenced by his friend Wolfgang Pauli (1969a [1946], pp. 229-234) with whom he coauthored a book in 1952 (Jung and Pauli, 1952; translated into English as Jung and Pauli, 1954) that included Jung's now famous synchronicity paper.

Wolfgang Pauli accepted Jung's notion of acausality — that is, the awareness of coincidences that defy explanation based upon local causation (Atmanspacher and Primas, 1995). But Pauli, one of the architects of the Copenhagen interpretation, was also wedded to a dualistic account of consciousness and reality that Niels Bohr's (the Danish physicist who was largely responsible for creating quantum physics) thinking required. A major hindrance was that the Copenhagen account would not allow the insertion of any "hidden variables" into the theory to account for observable effects. It is interesting to speculate that had Jung paid more attention to Albert Einstein (who did entertain hidden variables) rather than to Pauli, he might have had an altogether different slant on physics, but even then he probably would not have reached the kind of sophisticated merger of perceptual psychology and quantum physics that, say, David Bohm's (1965) insights provide for us today. It was Bohm who saw that a more scientific and enlightened view of perception concurs with the context of modern quantum physics better than with the older Newtonian mechanics.

The Physics of the Vacuum

There are, of course, other interpretations of quantum mechanics now available in the literature. Nick Herbert summarizes some of these in his book, *Quantum Reality* (1985). But most of these are irrelevant to the task at hand because

1. Jung had no access to these alternative interpretations and
2. for most physicists practicing even today, the Copenhagen account *is* quantum mechanics.

However, there are certain developments in modern quantum physics that are making it possible for us to better model the "acausal" dimensions of quantum interactions, and specifically with regard to consciousness. I am referring to

the current work on the physics of the vacuum (Boyer, 1985; Greiner and Hamilton, 1980; Saunders and Brown, 1991) with specific reference to the research of Harold Puthoff (1990). As I understand Puthoff's picture of reality, the entire universe is a monad of energy of various densities. There exists a structure of underlying "zero-point" energy that permeates the universe, even pervading the most complete vacuum — a quantum sea as it were.

In the modern view empty space or vacuum is never truly particle or field free, but rather is the seat of continuous virtual particle-pair creation and annihilation processes, as well as so-called zero-point fluctuations of such fields as the electromagnetic field. Originally thought to be of significance only for such esoteric concerns as small corrections in atomic emission processes..., it is now understood that vacuum fluctuation effects play a central role in large-scale phenomena of interest to technologists as well....

— *H.E. Puthoff (1993)*

In a series of studies, Puthoff and his associates (Puthoff, 1987, 1989-91, 1990; Cole and Puthoff, 1993; Haisch, Rueda and Puthoff, 1994a, 1994b) have shown that many of the known results in quantum physics can be traced to underlying zero point energy causation.

The Quantum Brain

A flurry of interest in the relationship between the brain and the "sea" of zero point energy (hereafter termed "the quantum sea" or simply "the sea") permeating the universe (*e.g.*, Beck and Eccles, 1992; Deutsch, 1985; Lockwood, 1989; Penrose, 1989; Stapp, 1993) indicates an increasing concern for the question of how the neurocognitive processes that mediate consciousness may also influence and be influenced by events in the quantum sea. Our suggestion from biogenetic structural theory is that neurognosis operates not only at the level of the organization of neural cells into neural networks, but also at the quantum level by penetrating to and being penetrated by events in the sea. In a sense, neural networks may be "prepared" (in Seligman's sense) to operate as transducers of patterned activity in the quantum sea. Transformations of neural activity may produce transformations in the structure of the sea, and vice versa. Thus local causation based upon biochemical interaction among neural cells may be transformed into non-local causation based upon biophysical activity between cells and the sea.

This suggestion still remains a hypothesis at this time. To my knowledge, no one has unequivocally demonstrated quantum effects of cellular activity. However, there are several promising avenues of research into possible mechanisms — avenues that are sufficiently interesting that they have led a number of serious scholars to consider processes that mediate brain-quantum interaction (see *e.g.*, Beck, 1994; Beck and Eccles, 1992; Conrad, 1994; Deutsch, 1985; Frohlich, 1986; Hameroff, 1994; Josephson, 1982; Lockwood, 1989;

Penrose, 1987, 1989; Wallace, 1993a, 1993b; Walker, 1970, 1973, 1975, 1977). For example, Evan Harris Walker (1977) has suggested that the quantum phenomenon known as "tunnelling" may occur at the synapse, an idea taken up in more detail in Beck 1994 and in Beck and Eccles 1992. "Tunnelling" occurs when an electron penetrates a barrier that classically is impenetrable (see Pethig, 1986, pp. 224-227).

Herbert Frohlich (1968, 1980, 1986; Frohlich and Kremer, 1983) and others (Bond and Huth, 1986) have attempted to demonstrate "coherent" effects in cell membranes related to weak external electromagnetic fields whose effects cannot be attributed to heating the system. "Coherence" is a central concept in quantum physics and refers to events correlated over time or space. This means that in a coherent system, activity at one place in the system is directly connected to activity in another place in the system; or, as Frohlich (1986, p. 243) puts it, coherence "implies that if a certain property is known at a space-time region near (x,t) it is also determined at another, (x',t') . Thus in a coherent wave, for instance, amplitude and phase at (x,t) determine their values at another, (x',t') ."

All objects from simple atomic particles to complex biological organisms are by definition made up of coherent energies. But what is being suggested here is that events in the sea may produce coherence, say, in membrane activity across the entire expanse of a neural network (involving thousands and even millions of cells), or that the activity across a neural network may produce coherence in the vacuum energies beyond the organism. This picture makes it possible to contemplate a continuum of levels of structural organization from the cognized environment down through and into the structure of the sea.

Recognition of the importance of coherence follows in the wake of research into the paradoxical Einstein, Podolsky and Rosen experiment (also called the EPR system). They demonstrated that once two parts of a quantum system are separated, they continue to act as a correlated unity no matter how far they travel from each other. EPR-type systems confound commonsense notions of local causation, for there exists no clear mechanism by which the two parts can "interact" at a distance. It is my presumption, as it is Puthoff's and other zero-point energy physicists', that this wholism is somehow mediated by the structure of the quantum sea.

There is now evidence pointing to the importance of electromagnetic oscillations at the cellular level that are not merely caused by changes in the ambient temperature (see Kaiser, 1978 for a review of non-thermal, electromagnetic oscillations in biological systems and Bischof, 1994 for an excellent history of bioelectromagnetism see also Eichwald and Kaiser; 1993). Frohlich (1986) has hypothesized that coherent oscillations (similar to the so-called "Bose-Einstein condensation") in certain protein structures may be triggered by a common, low energy electromagnetic field, and thus may provide a mechanism for information storage and retrieval over a wide expanse of organic tissue, an inherently quantum process.

Such electromagnetic fields may function in many types of cells, including neural cells, to control physiological processes (*e.g.*, membrane potential, release of neurotransmitters at presynaptic sites, etc.; Bond and Huth, 1986, p. 293; Popp, Li and Gu, 1992). Frohlich (1980) has also suggested that highly polarized membrane components may be deformed by external electromagnetic fields. It is now known that natural and man-made electromagnetic fields have effects upon biological processes (Persinger, 1974, 1980; Grundler, Kaiser, Keilmann and Walleczek, 1992).

One problem in research of this kind has been establishing a mechanism for the coupling of electromagnetic fluctuations to membrane activities without a change in ambient thermal conditions (Bond and Huth, 1986, p. 290; Grundler, Kaiser, Keilmann and Walleczek, 1992). One possible mechanism is the soliton. Solitons were first discovered in the nineteenth century as a property of water waves in canals. Waves propagate down a canal at a constant speed and are the result of equilibrium between the tendency of the wave to peak and its tendency to disperse. The wave reaches a steady state in its trip down the canal. Electromagnetic solitons are energy waves that are related to quantum field excitation and that propagate in a non-linear, steady-state fashion with very little energy loss from one point to another in a system (see Lamb and McLaughlin, 1980 for a review). Theoretically, solitons may encode a great deal of information in a small space with little energy expenditure. Frohlich and others have suggested that solitons may be integral to the functioning of membranes, while Del Giudice et al. (1986) have linked soliton waves with cellular functions.

Another plausible biophysical mechanism of direct consciousness-quantum sea interpenetration is to be found in the coherent properties of microtubules (Hameroff, 1994; Jibu et al., 1994). Microtubules form a protein latticework of cylindrical pathways in the cell that are known to be involved in regulating and organizing the activity of the cell. Jibu et al. (1994) have suggested that the ordered water molecules within the hollow core of these microtubules may manifest a property of "super-radiance" and much like a laser, transform incoherent electromagnetic energy into coherent, non-linear photon pulses within the tubule. Such a pulse would also be a kind of soliton in that it might propagate without energy loss and with little energy requirement. This picture of electromagnetic activity in the structure of the cell is consonant with the suggestion by Fritz Popp and his colleagues (Popp et al., 1984; Gu and Popp, 1993; Popp, Li and Gu, 1992; Ho, Popp and Warnke, 1994) that the regulation of cellular organization in biological systems may be accomplished by a coherent pattern of biophoton emission.

Although there has not yet been a definitive demonstration of direct neural-quantum sea interaction, the evidence is sufficiently suggestive to prompt some authorities to hypothesize that brain-quantum sea interpenetration may operate something like a "quantum computer" (Deutsch, 1985, 1992; Wallace, 1993a, 1993b). That is, information and "computations" may be organized

within the pattern of coherent quantum activities. These "computations" may be detectable by neural networks and used in higher order processing. While I do agree with Penrose's (1989) arguments against narrow AI-type computational models of consciousness, it does seem possible on the strength of parapsychological and ethnographic evidence that information exchange of a broader kind may be occurring between the conscious brain and the quantum sea (see Puthoff, Targ and May, 1981; Walker, 1973, 1975 who relate quantum physical and parapsychological phenomena). And it is clear from my reading of Jung that he may well have agreed.

Conclusion: Archetypes, Neurognosis and the Quantum Sea

A boat may be stored in a creek; a net may be stored in a lake; these may be said to be safe enough. But at midnight a strong man may come and carry them away on his back. The ignorant do not see that no matter how well you store things, smaller ones in larger ones, there will always be a chance for them to be lost. But if you store the universe in the universe, there will be no room left for it to be lost. This is the great truth of things. Therefore the sage makes excursions into that which cannot be lost, and together with it he remains.

—*Chuang Tzu*

His disciples said to him, "When will the Kingdom come?" And Jesus said to them, "It will not come by waiting for it. It will not be a matter of saying 'Here it is' or 'There it is.' Rather, the Kingdom of the Father is spread out upon the earth, and men do not see it."

—*Gospel of Thomas*

What I am suggesting in this study is that the concept of neurognosis (and Jung's archetype) refers not only to the initial organization of the brain during pre- and perinatal life, it also refers to the total pattern of coherent quantum activity represented in all of the neural networks in the brain. My hunch is that we may find that there are a number of mechanisms operating at the sub-cellular level by which the structure of the sea is transduced into patterned neural activity, and vice versa. So in a sense, we may speak of neurognosis as mediator of the structure of the quantum universe and the structure of the individual consciousness.

But caution must be exercised here in order to avoid very common conceptual traps spawned by phenomenological naivete and over-zealous use of technological metaphors for how the human brain works. These are traps with which Jung was all too familiar. One such trap has already been mentioned, that being the view that consciousness is the product of computations. This is a view peppering the cognitive science and artificial intelligence literatures,

and is generally the product of reified computer models of how the human brain works. Another trap is the tendency to reduce consciousness to the quantum mechanical level; *i.e.*, consciousness is quantum coherence of a specific kind. For example, Hameroff (1994, p. 106) writes, "Consciousness is described [in his article] as an emergent macroscopic quantum state driven or selected by neurobiological mechanisms ...with origins in quantum coherence in cytoskeletal microtubules within the brain's neurons."

Another of these traps is the notion that the brain operates like a radio receiver, picking up "spiritual" signals that come wafting in from outside the body (*e.g.*, Popper and Eccles, 1977). This is just one more version of the mind-body dualism that Jung wished to avoid, as do I. The brain-as-receiver notion reflects a basic principle in the evolution of technologies. We humans have a long history of building one thing to do another thing. For instance, we will fashion baskets and pots to hold seeds and carry water. In more modern times we build "hardware" to run "software". But the body and brain do not work that way. The brain is not "hardware" that requires the inputting of "software" in order to operate. Most of the evidence we have on the physiology of the brain suggests that the activity of neural structures (the "hardware") mediates aspects of mind and consciousness (the "software"). With respect to the brain, the "hardware" is the "software". As my friend and colleague John McManus often says, we can simulate the behavior of a duck and end up building an airplane that actually flies, but the airplane tells us almost nothing about the duck.

As I have argued elsewhere (Laughlin, 1988; Laughlin, McManus and d'Aquili, 1990, pp.105-119), the essential attributes of consciousness described by various contemplatives, and available to anyone trained in techniques of mature contemplation — attributes such as intentionality, conceptual-imaginal knowing, the granular quality of sensation, the structure of internal time consciousness, emotion, etc. — may be modeled within the phase space defined by

1. the functional dialogue (*i.e.*, patterns of entrainment) between prefrontal and sensorial cortex,
2. the functional dialogue between left and right cortical hemispheres, and
3. the functional dialogue between the cortex and specific subcortical structures.

Within this functional field arises the shifting, changing network of neural cells that mediate consciousness. And as Lockwood (1989, p. 228) has suggested, our experience of the world occurs as a selection for "designation" by the neural systems mediating consciousness among the eigenstates available in the local environment. My view is that this "designation" occurs at every level of structure from intracellular structures sensitive to quantum coherence through to the most complex level of neural network integration.

Jung's genius was in steering a course between the Scylla and Charybdis of mind-body dualism — that is, between experiential relativism on the one hand

and physical reductionism on the other. It was clear to Jung that an individual's experience is both structured by processes universal to the human psyche, and the manifestation of individuation (Dourley, 1984; Edinger, 1972, p. 5). He was never seduced by the appeal of either pole; ensnared as was, say, Claude Levi-Strauss by structural reductionism (at the expense of the experiential), or James Hillman by experiential relativism (at the expense of the structural).

Henry A. Murray perhaps said it best when he wrote somewhere to the effect that in some ways all humans are alike, in some ways some humans are alike and in some ways no humans are alike. Jung was able to integrate these various points of view into a single perspective on the activities of the human psyche. And where he had scientific or solid phenomenological data to back up his views, he reported them. But where the data were not forthcoming in the science of his day, he often remained purposely self-critical, ambiguous and incomplete in the formulation of his ideas. He was quite conscious of the pitfalls of over-systematized thought, and fully intended his approach to be a dynamic and open-ended course of inquiry.

So it was with his notion of the archetype. He insisted that the archetype is not merely another word for the physiology of the image or thought. While it included the physiological basis of knowledge, the concept was intended to run deeper — deep into the instincts and beyond, outward into the universal ground of existence. The archetype exists as the intersection of spirit and matter. We are now beginning to understand in a scientific way how this intersection might be possible, if by "spirit" we mean the order of the quantum sea. Human experience becomes the localized instantiation of the universal — the transcendental — through the medium of neurognosis. And neurognosis is precisely the local embodiment of the structure of the sea, and at the same time the structures mediating consciousness.

By application of archetypal psychology, and by the current rendition of the biogenetic structural notion of neurognosis, we can see that by implicating neural structures in the mediation of various aspects of consciousness, we do not necessarily imply a reduction of the phenomenon to its neurophysiological foundations. For instance, when Michael Persinger suggests in his book, *Neuropsychological Bases of God Beliefs* (1987), that certain experiences of unity with the Godhead may be mediated by structures in the temporal lobes, such an analysis need not imply a reduction of transpersonal experiences to neurophysiology. Among other things, to reduce these experiences to their neurophysiological foundations begs such questions as the profundity of insight, or the causation-at-a-distance that may accompany such experiences.

On our present account, this kind of analysis may further clarify our picture of how neurognostic, or archetypal structures in the human brain may transduce insights pertaining to the universal structure of the quantum sea. Each human brain may indeed prove to be a microcosm that contains — like the proverbial mustard seed, or the more modern hologram — all the wisdom of

the ages, requiring only the optimal conditions of development for each person to individuate into a sage.

Notes

1. Because the historical development of Jung's concept of the archetypes is important, I will indicate the date of first publication of each reference I use.
2. Jung often spoke of the archetypes as "structures" (see *e.g.*, 1956 [1912], p. 232).
3. He defined the unconscious as "the totality of all psychic phenomena that lack the quality of consciousness" (1969d [1919], p. 133).
4. Jung was wedded to the all-to-common belief that the emergence of consciousness in childhood is somehow linked to the development of speech (*e.g.* 1954b [1928], p. 52). For a more modern view, see Laughlin (1991).
5. We are indebted to Roy Rappaport (1968) for the concepts of cognized and operational environments. Rappaport's (1979, pp. 97-144; 1984, pp. 337-352, also personal communication, May 1993) later writings indicate that the meanings we have constructed for these terms are fairly close to his own. For our own development of these crucial concepts, see Laughlin and Brady (1978, p. 6), d'Aquili *et al.* (1979, pp. 12ff), Rubinstein *et al.* (1984, pp. 21ff), and Laughlin, McManus and d'Aquili (1990, pp. 82-90).
6. We have given a technical definition of "adaptive isomorphism" in d'Aquili *et al.* (1979, p. 17). The term implies that models are partially isomorphic to at least the extent required for survival. "Isomorphic" means that the elements and relations comprising the model are not the same as those of the noumenon being modeled. And just as there is more to a real airplane than there is to a model airplane, so too is there "transcendentally" more to the noumenon than there is to the model — unless, of course, it is the network comprising the model that is itself the noumenon.
7. Edmund Hesserl's term for this is "horizon".
8. See Laughlin, McManus and d'Aquili (1990, pp. 296-333; 1993) for a discussion of mature contemplation and science.

Acknowledgements

This paper originated as a talk before the C. G. Jung Society, St. Paul's University, Ottawa, Canada, 25 November 1994. The research arose as a result of a collaborative project with Harold E. Puthoff of the Institute of Advanced Studies, Austin, Texas, and was funded by the Fetzer Institute. The author wishes to thank John McManus, Bert McInnis and Harold Puthoff for their many insights and suggestions. He also wishes to express his gratitude to his

fellow members of the International Consciousness Research Laboratories (ICRL) group for financial support and for the many discussions that fed this study. And finally, he would like to thank John McManus, Professor John Dourley, Dr. Harold Puthoff, Dr. Brian Josephson and Dr. Sean Kelly for their constructive criticisms of earlier drafts of this paper.

References

- Armstrong, E. and Falk, Dean, Eds. (1982). *Primate Brain Evolution*. New York, NY: Plenum Press.
- Atmanspacher, Harold and Primas, Hans (1995). *The Hidden Side of Wolfgang Pauli: An Eminent Physicist's Astonishing Encounter with Depth Psychology*. (unpublished typescript)
- Beck, Friedrich (1994). Quantum mechanics and consciousness. *Journal of Consciousness Studies*, 1, 2, 53.
- Beck, Friedrich and Eccles, John C. (1992). Quantum aspects of brain activity and the role of consciousness. *Proc. Natl. Acad. Sci. USA*, 89, 11357.
- Bischof, Marco (1994). The history of Bioelectromagnetism. In *Bioelectrodynamics and Biocommunication*. Ed. by Mae-Wan Ho, Fritz-Albert Popp and Ulrich Warnke. London, England: World Scientific.
- Bohm, David (1965). Physics and perception. In *The Special Theory of Relativity*. New York, N.Y.: W. A. Benjamin, 185.
- Bond, James D. and Huth, Gerald C. (1986). Electrostatic modulation of electromagnetically induced nonthermal responses in biological membranes. In *Modern Bioelectrochemistry*. Ed. by Felix Gutmann and Hendrik Keyzer. New York, N.Y.: Plenum.
- Boyer, Timothy H. (1985). The classical vacuum. *Scientific American*, 253, 2, 70.
- Brooke, Roger (1991). *Jung and Phenomenology*. New York, NY: Routledge.
- Cole, Daniel C. and Puthoff, Harold E. (1993). Extracting energy and heat from the vacuum. *Physical Review E*, 48, 2, 1562.
- Conrad, Michael (1994). From brain structure to vacuum and back again: the great chain of being model. *Nanobiology*, 3, 99.
- D'Aquili, E. G., Laughlin, C. D., and McManus, J. (1979). *The Spectrum of Ritual*. New York, NY: Columbia University Press.
- Del Giudice, E., Doglia, S., Milani, M., and Vitiello, G. (1986). Collective properties of biological systems: Solitons and coherent electric waves in a quantum field theoretical approach. In *Modern Bioelectrochemistry*. Ed. by Felix Gutmann and Hendrik Keyzer. New York, NY: Plenum.
- Deutsch, D. (1985). Quantum theory, the Church-Turing principle and the universal quantum computer. *Proceedings of the Royal Society of London, A*, 400, 97.
- . (1992). Quantum computation. *Physics World*, 57.
- Dourley, John P. (1984). Jung and the coincidence of opposites: God, universe and individual. *University of Ottawa Quarterly*, 54, 2, 37.
- . (1993). Jung and metaphysics: A dubious disclaimer. *Sciences Pastorales*, 12, 15.
- Eccles, John C. (1989). *Evolution of the Brain: Creation of the Self*. New York, NY: Routledge.
- Edinger, Edward F. (1972). *Ego and Archetype: Individuation and the Religious Function of the Psyche*. New York, NY: G. P. Putnam's Sons.
- . (1985). *Anatomy of the Psyche: Alchemical Symbolism in Psychotherapy*. La Salle, IL: Open Court.
- . (1995). *The Mysterium Lectures: A Journey Through C.G. Jung's Mysterium Coniunctionis*. Toronto, Canada: Inner City Books.
- Eichwald, C. and Kaiser, F. (1993). Model for receptor-controlled cytosolic calcium oscillations and for external influences on the signal pathway. *Biophysical Journal*, 65, 2047.
- Falk, Dean (1992). *Braindance*. New York, NY: Henry Holt.
- Frohlich, Herbert (1968). Long range coherence in biological systems. *International Journal of Quantum Chemistry*, 2, 641.
- . (1980). The biological effects of microwaves and related questions. *Adv. Electron. Electron Phys.*, 53, 85.

- (1986). Coherent excitation in active biological systems. In *Modern Bioelectrochemistry*, Ed. by Felix Gutmann and Hendrik Keyzer. New York, NY: Plenum.
- Frohlich, Herbert and Kremer, F. (1983). *Coherent Excitations in Biological Systems*. New York, NY: Springer-Verlag.
- Gibson, J. (1979). *The Ecological Approach to Visual Perception*. Boston, MA: Houghton Mifflin.
- Gould, S. J. (1977). *Ontogeny and Phylogeny*. Cambridge, MA: Harvard University Press.
- Greiner, Walter and Hamilton, Joseph (1980). Is the vacuum really empty? *American Scientist*, March-April, 154.
- Griffin, David Ray (1989). Introduction. In *Archetypal Process: Self and Divine in Whitehead, Jung and Hillman*. Ed. by David Ray Griffin. Evanston, IL: Northeastern University Press.
- Grundler, W., Kaiser, F., Keilmann, F., and Walleczek, J. (1992). Mechanisms of electromagnetic interaction with cellular systems. *Naturwissenschaften*, 79, 551.
- Gu, Q. and Popp, Fritz-Albert (1993). Biophoton physics: Potential measure of organizational order. In *Biological Effects of Light*. Ed. by Ernst G. Jung. New York, NY: Walter de Gruyter.
- Haisch, Bernhard, Rueda, Alfonso and Puthoff, Harold E. (1994a). Inertia as a zero-point-field Lorentz force. *Physical Review A*, 49, 2, 678.
- (1994b). Beyond $E=mc^2$. *The Sciences*, 34, 6, 26.
- Hameroff, Stuart R. (1994). Quantum coherence in microtubules: A neural basis for emergent consciousness? *Journal of Consciousness Studies*, 1, 1, 91.
- Herbert, Nick (1985). *Quantum Reality: Beyond the New Physics*. New York, NY: Doubleday.
- Hillman, James (1985). *Archetypal Psychology: A Brief Account*. Dallas, TX: Spring Publications.
- Ho, Mae-Wan, Popp, Fritz-Albert, and Warnke, Ulrich (1994). *Bioelectrodynamics and Biocommunication*. London, England: World Scientific.
- Jahn, Robert G. and Dunne, Brenda J. (1987). *Margins of Reality: The Role of Consciousness in the Physical World*. New York, NY: Harcourt Brace Jovanovich.
- Jerison, Harry J. (1973). *Evolution of the Brain and Intelligence*. New York, NY: Academic Press.
- (1985). On the evolution of mind. In *Brain and Mind*. Ed. by D.A. Oakley. New York, NY: Methuen.
- Jibu, Mari, Hagan, Scott, Hameroff, Stuart R., Pribram, Karl H. and Yasue, Kunio (1994). Quantum optical coherence in cytoskeletal microtubules: Implications for brain function. *BioSystems*, 32, 95.
- Josephson, Brian (1982). Interview. *Omni Magazine*, July, 87.
- Jung, Carl Gustav (1953 [orig. pub. 1943/1451]). *Two Essays on Analytical Psychology*. London, England: Routledge & Kegan Paul.
- (1954a [orig. pub. 1931]). Introduction to Wickes's 'Analyse der Kinderseele.' In *The Development of Personality*. London, England: Routledge and Kegan Paul (Collected Works No. 17).
- (1954b [orig. pub. 1928]). Child development and education. In *The Development of Personality*. London, England: Routledge and Kegan Paul (Collected Works No. 17).
- (1956 [orig. pub. 1912, revised in 1952]). *Symbols of Transformation: An Analysis of the Prelude to a Case of Schizophrenia*. London, England: Routledge and Kegan Paul (Collected Works No. 5).
- (1958 [orig. pub. 1948]). A psychological approach to the dogma of the trinity. In *Psychology and Religion: West and East*. New York, NY: Pantheon Books (Collected Works No. 11).
- (1959 [1951]). *Aion: Researches into the Phenomenology of the Self*. Princeton, NJ: Princeton University Press (Collected Works No. 9).
- (1965 [orig. pub. 1961]), *Memories, Dreams, Reflections*. New York, NY: Vintage Books.
- (1968a [orig. pub. 1944, revised 1958]). *Psychology and Alchemy*. Princeton, NJ: Princeton University Press, (Collected Works No. 12).
- (1968b [orig. pub. 1934, revised 1954]). Archetypes of the collective unconscious. In *The Archetypes and the Collective Unconscious*. Princeton, N.J.: Princeton University Press (Collected Works No. 9).
- (1968c [orig. pub. 1936/1371]). The concept of the collective unconscious. In *The Archetypes and the Collective Unconscious*. Princeton, NJ: Princeton University Press (Collected Works No. 9).
- (1968d [orig. pub. 1936]). Concerning the archetypes, with special reference to the anima concept. In *The Archetypes and the Collective Unconscious*. Princeton, NJ: Princeton University Press (Collected Works No. 9).

- (1968e [orig. pub. 1940]). The psychology of the child archetype. In *The Archetypes and the Collective Unconscious*. Princeton, NJ: Princeton University Press (Collected Works No. 9).
- (1968f [from 1930 lecture]). Concerning Mandala symbolism. In *The Archetypes and the Collective Unconscious*. Princeton, NJ: Princeton University Press (Collected Works No. 9).
- (1969a [orig. pub. 1946]). On the nature of the psyche. In *The Structure and Dynamics of the Psyche*. Princeton, NJ: Princeton University Press (Collected Works No. 8).
- (1969b [orig. pub. 1931]). The stages of life. In *The Structure and Dynamics of the Psyche*. Princeton, NJ: Princeton University Press (Collected Works No. 8).
- (1969c [orig. written in 1949]). Foreward. In *The Origins and History of Consciousness* by Erich Neumann. Princeton, NJ: Princeton University Press.
- (1969d [orig. pub. 1919]). Instinct and the unconscious. In *The Structure and Dynamics of the Psyche*. Princeton, NJ: Princeton University Press (Collected Works No. 8).
- (1969e [orig. pub. 1952]). Synchronicity: An acausal connecting principle. In *The Structure and Dynamics of the Psyche*. Princeton, NJ: Princeton University Press (Collected Works No. 8).
- (1970 [orig. pub. 1955/1956]). *Mysterium Coniunctionis: An Inquiry into the Separation and Synthesis of Psychic Opposites in Alchemy*, Princeton, NJ: Princeton University Press (Collected Works No. 14).
- Jung, Carl G. and Pauli, Wolfgang (1952). *Naturerklärung und Psyche*. Zurich: Rascher.
- Jung, Carl G. and Pauli, Wolfgang (1954). *The Interpretation of Nature and the Psyche*. New York, NY: Routledge.
- Kaiser, F. (1978). Coherent oscillations in biological systems. Parts I and II. *Z. Naturforsch*, 33a, 294, 418.
- Lamb, G. L. and McLaughlin, D. W. (1980). Aspects of Soliton Physics. In *Solitons*. Ed. by R. K. Bullough and P. J. Caudrey. Berlin: Springer-Verlag.
- Laughlin, Charles D. (1988). The prefrontosensorial polarity principle: Toward a neurophenomenology of intentionality. *Biology Forum*, 81, 2, 243.
- (1991). Pre- and perinatal brain development and enculturation: A biogenetic structural approach. *Human Nature*, 2, 3, 171.
- Laughlin, C. D. and Brady, I. A. (1978). *Extinction and Survival in Human Populations*. New York, NY: Columbia University Press.
- Laughlin, C. D. and D'Aquili, E. G. (1974). *Biogenetic Structuralism*. New York, NY: Columbia University Press.
- Laughlin, C. D., McManus, J. and d'Aquili, E. G. (1990). *Brain, Symbol and Experience: Toward a Neurophenomenology of Consciousness*. New York, NY: Columbia University Press.
- (1993). Mature contemplation. *Zygon*, 28, 2, 133.
- Lockwood, Michael (1989). *Mind, Brain and the Quantum*. Oxford, England: Basil Blackwell.
- McManus, John (1979). *Ritual and Ontogenetic Development in The Spectrum of Ritual*. Ed. by E.G. d'Aquili, C. D. Laughlin and J. McManus. New York, NY: Columbia University Press.
- Neumann, Erich (1969). *The Origins and History of Consciousness*. Princeton, NJ: Princeton University Press.
- Penrose, Roger (1987). Minds, machines and mathematics. In *Mindwaves*, Ed. by Colin Blake-more and Susan Greenfield. Oxford, England: Blackwell.
- (1989). *The Emperor's New Mind*. Oxford, England: Oxford University Press.
- Persinger, Michael A., ed. (1974). *ELF and VLF Electromagnetic Field Effects*. New York, NY: Plenum.
- (1980). *The Weather Matrix and Human Behavior*. New York, NY: Praeger.
- (1987). *Neuropsychological Bases of God Beliefs*. New York, NY: Praeger.
- Pethig, Ronald (1986). Ion, electron, and proton transport in membranes: A review of the physical processes involved. In *Modern Bioelectrochemistry* (ed. by Felix Gutmann and Hendrik Keyzer). New York, NY: Plenum.
- Piaget, Jean (1971). *Biology and Knowledge*. Chicago, IL: University of Chicago Press.
- (1985). *The Equilibration of Cognitive Structures: The Central Problem of Intellectual Development*. Chicago, IL: University of Chicago Press.
- Popp, Fritz-Albert, Li, K. H. and Gu, Q. (1992). *Recent Advances in Biophoton Research and Its Applications*. Singapore: World Scientific.
- Popp, Fritz-Albert, Nagl, W., Li, K. H., Scholz, W., Weingartner, O., and Wolf, R. (1984). Biophoton emission: New evidence for coherence and DNA as source. *Cell Biophysics*, 6, 33.

- Popper, Karl R. and Eccles, John C. (1977). *The Self and Its Brain*. New York, NY: Springer International.
- Puthoff, Harold E. (1987). Ground state of hydrogen as a zero-point-fluctuation-determined state. *Physical Review D*, 35, 10, 3266.
- (1989). Source of vacuum electromagnetic zero-point energy. *Physical Review A*, 40, 9, 4857 (1991 errata in *Physical Review A*, 44, 5, 3385).
- (1990). Everything for nothing. *New Scientist*, July 28, 52.
- (1993). *Think-Piece on the Relationship of Zero-Point Energy Research to the Role of 'Metaphysical' Processes in the Physical World*. (unpublished typescript)
- Puthoff, Harold E. and Targ, Russell (1976). A perceptual channel for information transfer over kilometer distances: Historical perspective and recent research. *Proceedings of the IEEE*, 64, 3, 329.
- Puthoff, Harold E., Targ, Russell and May, Edwin C. (1981). Experimental psi research: Implication for physics. In *The Role of Consciousness in the Physical World*. Ed. by Robert G. Jahn. Washington, D.C.: American Association for the Advancement of Science, 37.
- Rappaport, Roy A. (1968). *Pigs for the Ancestors*. New Haven, CT: Yale University Press.
- (1979). *Ecology, Meaning, and Religion*. Richmond, CA: North Atlantic Books.
- (1984). *Pigs for the Ancestors* (second edition). New Haven, CT: Yale University Press.
- Rubinstein, R. A., Laughlin, C. D. and McManus, J. (1984). *Science As Cognitive Process*. Philadelphia, PA: University of Pennsylvania Press
- Saunders, Simon and Brown, Harvey R. (1991). *The Philosophy of Vacuum*. Oxford, England: Oxford University Press.
- Seligman, Martin (1975). *Helplessness: On Development, Depression and Death*. San Francisco, CA: Freeman.
- Seligman, Martin and Hager, J. (1972). *Biological Boundaries of Learning*. New York, NY: Appleton-Century-Crofts.
- Stapp, Henry P. (1993). *Mind, Matter, and Quantum Mechanics*. Berlin, Germany: Springer-Verlag.
- Targ, Russell, and Puthoff, Harold E. (1977). *Mind-Reach*. New York, NY: Delacorte Press.
- Walker, Evan Harris (1970). The nature of consciousness. *Mathematical Biosciences*, 7, 131.
- (1973). Application of the quantum theory of consciousness to the problem of psi phenomena. In *Research in Parapsychology, 1972: Abstracts and Papers from the Fifteenth Annual Convention of the Parapsychological Association*, Edinburgh, Scotland, September 3-5, 1972. Ed. by W. G. Roll, R. L. Morris and J. D. Morris. Metuchen, NJ: Scarecrow Press, 51.
- (1975). Foundations of parapsychological and parapsychological phenomena. In *Quantum Physics and Parapsychology*. Ed. by Laura Oteri. New York, NY: Parapsychology Foundation.
- (1977). Quantum mechanical tunnelling in synaptic and ephaptic transmission. *International Journal of Quantum Chemistry*, 11, 103.
- Wallace, Ron (1993a). Cognitive mapping and algorithmic complexity: Is there a role for quantum processes in the evolution of human consciousness? *Behavioral and Brain Sciences*, 16 (in press).
- (1993b). The algorithmic animal: Complexity, quantum mechanics, and the evolution of consciousness. *Social Neuroscience Bulletin*, 6, 2, 25.