Perspective

THE SCIENCE OF CONNECTIVENESS

PART II: MAPPING BEYOND SPACE-TIME

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ABSTRACT

This is the second in a series of three articles that will outline a proposed scientific model with the goal of stimulating a new vision toward resolving the Mind-matter question and acknowledging an underlying connectiveness in the universe. Scientific is understood to mean that the "parts" or links already exist as useful concepts in the scientific community. The model being proposed assumes that everyday reality is not simply "out there" nor is it "within." Rather, it is suggested that everyday reality is a "perception" we construct from aspects of the "unity" within which we are immersed. Part I presented the basic assumptions of the model and introduced the model by exploring aspects of a reality that extends beyond our limited concepts of three dimensional space plus time.[1,2] The power of symbolic patterns in the physical for serving the role of mediator between the happenings in the physical (or outer reality) and the mental (or inner reality) was emphasized.

Part II, *Mapping Beyond Space-Time*, discusses a process of interfacing between Mind and matter consistent with the concepts of quantum physics. Emphasis is placed upon the quantum feature of non-locality and upon twistor theory. The issues of causality and reproducibility in science are discussed. The article concludes with a description of the dynamics of the process—how the interplay takes place and works. This includes an outline of other symbolic tools of mathematics such as chaos theory that permit extending our three dimensional thinking.

In Part III the authors will explore the relationship of their model to human experience.

KEYWORDS: Causality, connectiveness, consciousness, maps, mathematics, metaphysics, mind, non-local, physics, quantum, reality, symbol

PUTTING PHYSICS INTO PERSPECTIVE

Before we discuss "mapping beyond space-time," let us review the process by which modern science describes or "maps" the physical reality within space-time. Modern physics rests upon the foundation of mathematics, a symbolic language. But, what is mathematics and why does it work? Indeed, what is the foundation upon which this "magical" mathematics rests? If we cannot answer these questions our scientific explanations, *i.e.*, our scientific maps, of the universe are based ultimately upon things we do not understand.[3] These questions remain unanswered by modern science, yet are a key in the quest to arrive at a deeper understanding of the universe. In our model we attempt to address these questions.

Symbols (including mathematical symbol systems) are defined as "meaningful" patterns for an individual experiencing them. Since symbols are patterns that are experienced and expressed in our physical world, they occur in space-time. In Part I, in agreement with Drs. Carl Jung and Wolf]gang Pauli, we have defined the orderings beyond space-time as archetypes or archetypal patterns, *i.e.*, formless forms. The linkage in our physical world via which we access and express archetypal knowledge is symbols. This process creates the dynamism of the whole. The patterns of our bodies including our DNA and the patterns in our brains are part of the feedback access/receive process. Sometimes an individual's symbol system can not express or communicate an experience of the realms of mind and spirit, *i.e.*, the spaceless and timeless realms of archetypal patterns, then the experience is considered ineffable. However, these experiences may have a profound effect on a person's life.

We contend that our scientific symbol system known as mathematics, when it is applied to the higher dimensional symmetry spaces, is in fact mapping characteristics of the archetypal order beyond space-time. Thus, the abstract spaces of mathematical physics are not really "abstract" but correspond to a reality that we can experience via mind and spirit. A key goal of our model is to demonstrate that a mathematical, and hence symbolic, basis already exists in mainstream physics for unfolding the physical world of space-time from this "reality" beyond space-time.

THE ROLE AND IMPORTANCE OF MODELS

We are attempting to present an all-encompassing picture of reality that goes beyond the physical world of form and includes realms of experience that are not normally thought to be directly related to the physical. This picture of the realms beyond space-time specifically includes the realm of Mind. (The reader is reminded that the upper case "M" denotes Universal Mind while the lower case "m" denotes individual mind.) The picture is *holistic* in that its parts are interrelated and interdependent. But unlike a painting or photograph where the intent of the artist can be grasped at once, we are limited to a verbal, linear, sequential presentation which is rather typical of scientific discourse.

It needs to be emphasized that models serve as the primary means by which all cultures, not just our own Westernized version, understand their various realities, with *tradition* being the mechanism cultures employ to maintain the continuity of the models. The enormous inertia of social systems guarantees a high degree of stability for models that "resonate" deeply with the human experience. But ideas, philosophies, and explanations that are "ad hoc" tend to have a much shorter half-life.

The tradition of science, with its built-in system of checks, balances, and continual refinements, has demonstrated an unsurpassed ability to provide our culture with highly pragmatic pictures and models of physical reality that reach beyond our unaided senses. Although instruments have extended the senses so that we can comprehend structures far removed from our immediate perception, such instruments are themselves constructed in accordance with the pictures of these deep realities. As we discussed in the preceding section, mathematics is the symbol system through which the mind probes these realities and gives them their structure and coherence. So it is the combination of mathematical models and instrumentation that gradually evolve the scientific worldview.

DESCENT TO THE BOTTOM OF SPACE-TIME

Our description of how the physical world connects to the mental realm begins here in space-time with familiar structures like organisms and cells. These are

microscopic in size and require magnification in order to be seen. The simple laws of geometrical optics allow one to make direct inferences about what is observed through the microscope's eyepiece.

Descending to the next level of smallness, we encounter molecules and atoms. These can be made visible if the wavelength of the illuminating radiation is comparable to the size of the object being observed. This requires special instruments like the electron microscope and modification of the simple classical rules of optics to include quantum effects. Even though the magnification required may approach 100 million times in order to resolve an individual atom, there is still a one-to-one correspondence between the displayed image and the inferred shape.

It is when we leave this level that our pictures of small objects can no longer be obtained through magnification. This is because the rules for observation are drastically altered—quantum mechanics (QM) takes over the model building process. The concepts of particle, location, indeed, measurement itself lose the preciseness they enjoy in the large-scale, classical world.

It is important that readers have some familiarity with quantum concepts, since they figure in our model in a crucial way. For this reason we will digress briefly and mention four of the main implications of quantum theory that are relevant to the model:

1. **The physical world operates according to probabilities rather than as clockwork.** Once a physical system is described in accordance with the QM rules, the mathematics generates a "wave function" (expressed in terms of space-time variables) which contains all the information that can be obtained by a "measurement" on the system. But rather than predicting a specific result of a measurement the wave function only yields the *probabilities* for a whole spectrum of possible results.

2. **Matter is mostly empty space.** For an atom, the size of its nucleus would be like a flea in the center of the vast space of the New Orleans Astrodome. The electron cloud surrounding the atomic nucleus strongly resists compression; thus atoms take up space even though the constituent particles of the atom are no larger than mathematical points. This example of the vast difference between the ordinary experience of percep-

tion and the picture provided by mathematics brings into sharper focus the problem of what is meant by the term "real."

3. **Exact simultaneous measurement of certain pairs of variables of a physical system is impossible.** This is the conclusion represented in Heisenberg's famous "uncertainty principle." Specifically, the principle refers to pairs like position and momentum, or energy and time. The impossibility is not merely a result of an inherent "clumsiness" in the measurement process but is built into the system in such a way that a choice made to determine one quantity with precision automatically reduces the precision in the measurement of the other.

4. **A physical system, once separated, retains a "connectedness" through the quantum wave function.** This is, perhaps, the most bizarre and controversial of the predictions of quantum mechanics since it implies linkages that transcend space, time, and the conventional interactions of the four basic force fields. But considerable experimental effort has confirmed that "local" connections are inadequate to explain reality; this justifies incorporating "non-locality" into our model. A more comprehensive discussion of non-locality appears below in connection with the detailed description of the model.

This descent into the world of the ultimately small was quantitatively illustrated in Part I, Figure 2. The journey takes us past the level of elementary particles another 18 orders of magnitude to the Planck length of 10^{-33} centimeters, the bottom of space-time, where the concepts of measure, length, and location lose their scientific meaning due to quantum uncertainty and fluctuation. Between elementary particles and the Planck length lies the "quantum vacuum" a sea of essentially infinite energy that underlies our physical world of form. Figure 1 is a pictorial representation of this journey that illustrates archetypes as a further extension of the descent. Right now our main purpose is not to study the scenery, only to reinforce the idea that the journey takes place completely *in the mind.* The objects encountered on the way are as real as the mathematics which gives them their existence and the models which reveal their "shapes."

As suggested above, the durability and persistence of a model depend on how deeply it resonates with the human experience. In science and mathematics models survive through experimental testing combined with the complex

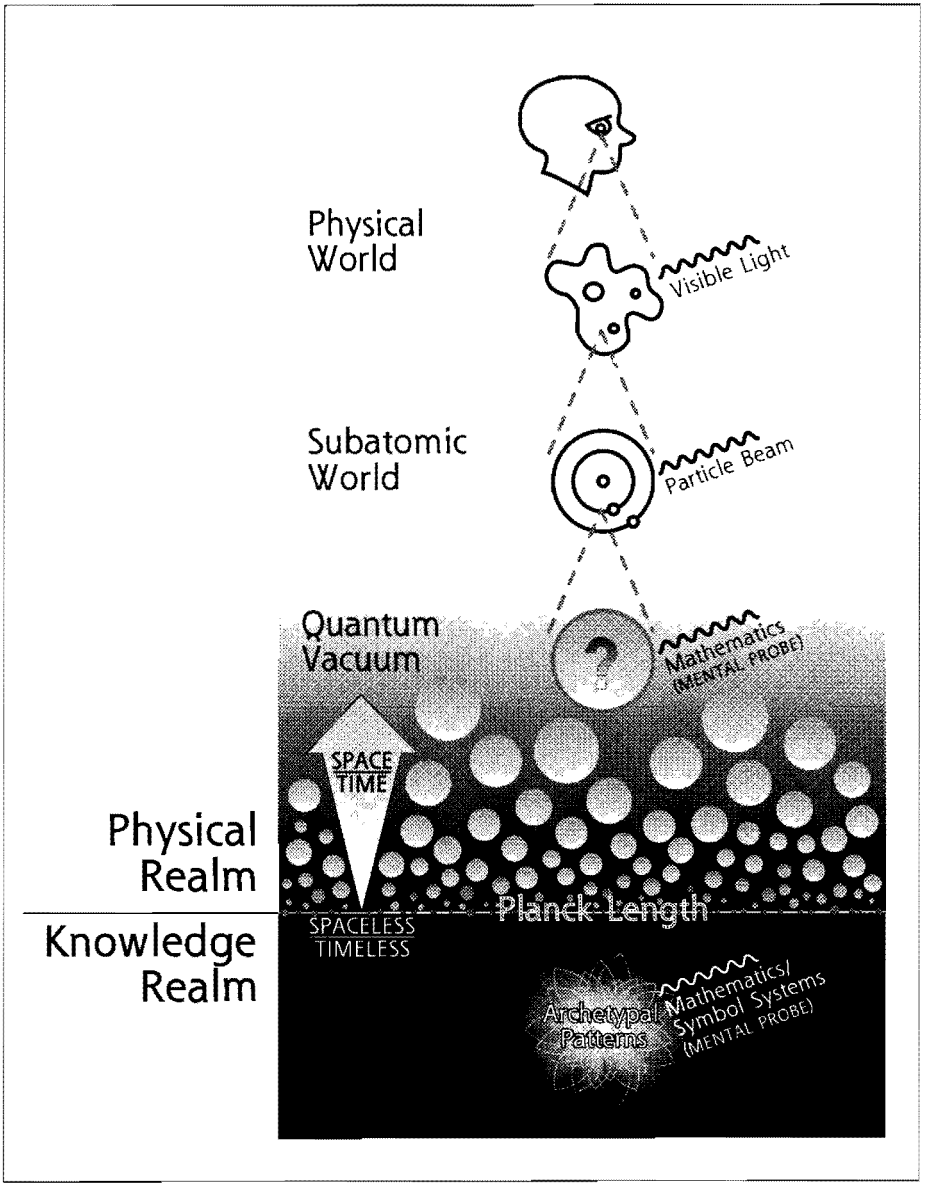

Figure 1. *Pictorial representation of the descent into the world of the ultimately small and beyond. From the spaceless-timeless "knowledge realm" of archetypal patterns, the physical world of three dimensional space and time begins to manifest at the Planck length.*

sociological process of scientific debate. The battle over "cold fusion" illustrates just how complex (and rancorous) this process can become. Fortunately, nature eventually settles the arguments—*if* we are clever enough to ask her the right questions.

EXTENDING THE MODEL

What happens when technology is unable to build an instrument that can probe into a realm that the mind asserts is *there*? For example, the high energy physics community would like to build a Superconducting Super Collider to study particles and processes that are important in developing the "Theory of Everything." Unfortunately, while the technology is available, Congress says the money isn't. As another example, consider the question of life in other parts of the universe. Again, technology can't get us there. However, science fiction, with its warp drives and time machines, proves that the mind can still "boldly go where no one has gone before." In other words, the absence of hard data does not preclude the creation of models, only that they become more difficult to defend when they are challenged.

Our model is a case in point. The existence of Mind as a realm having properties rather different from those of physical matter is not a difficult concept. After all, this is the basis of the famous "Cartesian split," now over three centuries old, which serves as the core belief for objective science—the belief that there are no observer complications in experiments. What may be difficult to comprehend is the idea that the contents of Mind have a *connection* to the world of matter; i.e., the Cartesian split is only an approximation, not an absolute truth. Therefore, the issue that must be addressed is what is the nature of this connection between the contents of Mind which are spaceless and timeless and objects in the physical world which are space-time limited?

In dealing with this and other related philosophical matters, we have chosen to construct our model from concepts *as close to the scientific mainstream as possible.* The reasons for this choice should be readily apparent to anyone who has tried to present new ideas to audiences grounded in western paradigmatic thinking. Not only are we interested in communicating clearly with as wide

an audience as possible, we would hope that these ideas resonate strongly with people who appreciate the scientific process and its complexity. Our model takes scientific concepts beyond the point where *direct* experimental testing through physics is possible. Nevertheless, we believe that sufficient hard data are available from other areas of human experience to make a strong case for the mind-matter connection.

Alternative Approaches

Over the years there have been numerous models proposed that embrace a scientific base which address the mind-matter interface and the role of consciousness. Some of these models invoke spaceless-timeless realms, others do not. A review of consciousness models for the years 1975-1990 was published as a two part series in *The Journal of Mind and Behavior*.[4] The review covers the work of David Bohm, Robert John and Brenda Dunn, J.C. Eccles, Henry Stapp, A. Goswami, Saul-Paul Sirag, R.W. Sperry, G. Bateson, and others. Two related models outside the scope of the review are the work of William Tiller on a lattice model of space[5] and an interpretation by Thomas Bearden of an expanded version of electromagnetic theory that relies upon the "scalar waves" of Nicola Tesla.[6]

Special Considerations

Before getting into the details of our model, it is useful to list several phenomena that present severe challenges to the accepted scientific paradigm. It is our belief that these and related phenomena should be comprehended by an expanded view of reality.

1. Non-local connections.

2. Healing and other such beneficial person to person effects that transcend distance.

3. Phenomena commonly known as psi, *i.e.*, psychokinesis, telepathy, clairvoyance or remote viewing, and precognition.

4. Information storage in physical materials as manifested in psychometry, homeopathic remedies, crystals, and sacred relics.

5. The sporadic, inconsistent, and often irreproducible nature of these kinds of phenomena.

DETAILS OF THE MODEL

Implications of Non-Locality

Erwin Schroedinger, one of the principle architects of quantum mechanics, called non-locality "quantum theory's most distinctive feature, the place where it differs most from classical expectations." Unlike all conventional interactions which drop off with distance and cannot travel faster than light, the quantum linkage due to non-locality is as strong at a million miles as at a millimeter, and its changes are transmitted instantaneously—considerably faster than the speed of light.[7]

In 1964 John Stewart Bell proposed a crucial test between the predictions in quantum theory of non-locality and those of any theory based on the concept of local reality. This test, known as Bell's Theorem, did not propose an experimental situation in which non-local interactions are directly observed. Instead, Bell invented a simple argument that could be tested experimentally that would *indirectly* demonstrate the necessary existence of non-local connections.[8]

Local reality means that effects that are strong within a given region of space fall off outside, so that it makes sense to divide the world into separate, self-contained systems that interact by forces and signals that fall off rapidly with distance. Thus, the idea of non-locality is shocking, because for hundreds of years scientists have said that if anything moved it was because something else acted on it. Non-locality suggests that distant systems can be connected in a totally new way—a way in which distance no longer seems to matter.

The experimental results are now in, and most physicists are well satisfied that quantum theory has been confirmed and local reality ruled out. The tests of

Bell's theorem demonstrate that the quantum linkage is real and provide the key evidence in physics pointing to a connection beyond space-time. Whether we like it or not, nature has chosen to include this instantaneous linkage into her creation of reality.[7] These careful experiments were carried out by Alain Aspect and others and have shown that quantum systems are correlated in ways that defy explanation in terms of any connections, interactions, fields, pushes, or pulls that would have any meaning in conventional physics.[9-11] Today, the only possibility for continuing to believe in a local-reality theory is to suppose that the Bell correlations are somehow the result of a physical interaction or signal that passes between the detectors at a speed that is faster than light.[12] This would be in direct violation of the theory of relativity.

It is interesting to note that most physicists accept non-locality as a confirmation of quantum theory. However, it still remains a black sheep of the quantum family, and physicists avoid drawing too much attention to its bizarre implications. Most prefer to *assume* that non-local influences occur only at the particle level, although quantum physics itself provides no rationale for this assumption. In fact, quantum physics is now being successfully applied, not only to the particle level, but to atoms, to bacteria, and even at the cosmological level.[13,14] We have, therefore, taken the position that non-locality pervades all phenomena and that the world could be filled with innumerable non-local influences even at the macroscopic level of human experience.

Non-locality forces physics to deal with a troublesome dilemma. On the one hand is the undisputed success of quantum theory, based on fundamental interactions that propagate with the speed of light. On the other hand are the Bell correlations that are instantaneous and which could stretch undiminished across the galaxy. Clearly, the grab-bag of conventional explanations does not contain the material for modeling this strange behavior of nature. The theory must be capable of representing particles in space-time while *simultaneously* manifesting non-local features. The connection between our space-time world and the mental realm must be a one-step process in any model of reality.

The Penrose Twistor

Bell's theorem and the necessity of non-local reality have not had nearly the impact on physics that one might imagine, given the startling implications of

the theorem and its experimental tests. Ballentine has charted more than two decades of citations to Bell's landmark paper showing a gradual rise to about 33 per year.[15] This "ho-hum" response is easily explained by realizing that to the great bulk of practicing physicists quantum mechanics is a calculational tool that works exceedingly well for certain kinds of problems, but as a guide for the formation of a philosophy or worldview it may be subject to too many differing interpretations.[16]

Nevertheless, to those having philosophy as a passion and who see quantum mechanics as the window to the basic structure of the universe, Bell's theorem may indeed be "the most profound discovery of science."[17] Those working in this area, in particular those concerned with developing some kind of "theory of everything" or TOE as it is called by physicists, must somehow resolve the dilemma mentioned above. We note in passing that "theory of everything" is a "tongue in cheek" phrase in physics and should not be interpreted too literally. However, the search for the TOE is taking science into new territory and has helped contribute to our supply of ideas for this model.

There are three principal approaches being undertaken to the TOE which are potentially capable of providing mathematical pictures of "the other side" of space-time and of how our physical world unfolds or is "created" from beyond space-time. They are called superstring theory, knot theory, and twistor theory. The theory we wish to elaborate upon in connection with our model is twistor theory, a creation of Roger Penrose, mathematician and theoretical physicist at Oxford and author of the highly acclaimed book *The Emperor's New Mind.*[18]

It may be only coincidence that Roger Penrose was developing the beginnings of twistor theory about the same time that Bell published his famous theorem. But over the three decades since that time twistors have received even less public notice than has Bell. For example, Barrow's 1991 book makes no mention of twistors while giving considerable coverage to superstrings.[19] This apparent neglect could be attributed to the somewhat radical approach that Penrose and his colleagues have taken as well as the difficult mathematics that must be mastered in order to deal with twistor space.[20] The latter problem may be responsible for the dearth of literature on twistor theory for physicists who want to explore its features without too many mathematical accouterments.

Fortunately, Pear[21] has helped fill part of this gap with a non-mathematical survey of twistors, and we have relied heavily on his work in order to provide this brief description of how they relate to the non-locality issue.

Twistors are inherently non-local in their structure. This is because they are designed not to embody space-like dimensional qualities; instead they combine quantum mechanical angular momentum (spin) and relativistic linear momentum (speed of light). As a result twistor space, which is made up of these objects, has the property of defining direction but not separation or distance. Non-locality is therefore an intrinsic and natural property of twistor space.

However, space-time is where we live, and it is also the abode of the conventional fields and formulas of physics. In order to take advantage of the power of the twistor formalism, the physics of space-time can be taken over into twistor space (and vice versa) by means of a set of mathematical rules called the Penrose transform.[20] When the transform is applied to the space-time manifold it turns out that a "null line" or ray of light in this manifold corresponds to a point in twistor space. In other words, the points of twistor space can be thought of as encoding global or large-scale knowledge about space-time. Bell's quantum connection, therefore, finds a natural home in twistor space. *The deeper structures of reality do indeed lie outside of space-time.*

To resolve the "dilemma" on how to represent the physical world of space-time while simultaneously manifesting non-local effects our model utilizes two rather specialized subjects in physics which we have not needed to discuss up to now. The following two points will help set the stage:

1. Alfred North Whitehead (1861-1947), philosopher and mathematician, has proposed a "process" model of the world which is regarded as one of the major philosophical works of modern times.[22] Stapp[23] has argued that this model provides a natural theoretical setting for quantum theory. "The basic elements of the model are events that actualize, or bring into existence, certain definite relationships from among a realm of possibilities or potentialities inherent in the set of prior events." The Whitehead model is also in accord with the idea that "actualization" is brought about by mind or consciousness as part of a feedback loop.

2. The Unification Program for the forces of physics is driven by the belief that the forces are "gauge fields" and have their roots in an underlying "gauge symmetry" in abstract mathematical spaces[19] (which our model places in realms beyond space-time). These forces have an interesting commonality, in that they each obey a universal speed limit—the velocity of light. We propose that this common feature can be attributed to an origin for these forces of physics in an archetypal pattern beyond space-time.

Combining these two points leads to a picture of the physical world continuously "unfolding" or evolving out of the non-local knowledge realm of archetypal patterns at the finite rate of the speed of light. (This picture is not unlike that proposed by David Bohm[24,25] with his implicate and explicate orders.) Thus quantum connectedness, *which is intrinsic to the realm beyond space-time,* is compatible with the realm of matter with its universal speed limit.

An analogy may help illuminate this picture. Consider a loom which has a human operator watching the pattern unfold. The machinery of the loom runs at a fixed speed, but the operator has the ability to change the pattern at any time so that it conforms better to what she has in mind. Thus, there is continuous feedback between what is unfolding and what has already been created. *The weaving of the fabric of reality involves this continuous back and forth exchange between space-time and the higher realms.*

Additional Mathematical Connections

There is one more link in the chain that needs to be discussed in connection with the details of the model. This remaining link bridges the gap between twistor space and still higher dimensional spaces. The needed connection is provided by fiber bundle theory. This is a branch of pure mathematics called differential geometry. Bergman[26] provides this description of these geometrical structures:

> Given a manifold, such as space-time, called the *base* manifold, one attaches new manifolds to each point. These attached manifolds, all identical, are the *fibers.* They may have any dimensionality, not necessarily that of the base manifold. Each fiber can be subjected

> to mappings, or transformations on itself, which maintain the fiber's essential properties. . . Given a fiber and its permitted self-mappings, one may introduce a connection that establishes 'corresponding' points on fibers at nearby points.

Fiber bundles fit into twistor theory in an essential way. Ward and Wells provide an extensive review of the mathematics that connects fiber bundles to twistor space.[20] Twistor space by itself is adequate for certain of the internal symmetries of elementary particles but not general enough to handle the quantum forces that operate between the particles. Fiber connections introduced at each point of twistor space, give it a much richer geometrical structure. Figure 2 schematically illustrates this model. It shows how mathematical links serve as connectors between the knowledge realm which includes mind and the physical realm of matter. Note that the association of mathematical hyperspaces with Mind is unique to this model and would not be regarded as orthodox science. However, we believe that the evidence and arguments arrayed in these articles uphold this hypothesis.

BEYOND THE EDGES OF THE MAP

Mathematics has taken us in a step by step fashion from the familiar structures of space-time to the sub-levels of Mind. It is tempting to push the process even further. Mathematics, being the study of pure patterns, is ideally suited for exploring and mapping these deeper aspects of nature. The branch called group theory is particularly suited for describing ordinary processes like rotation as well as the abstract symmetries involved in elementary particle interactions. Because group theory has this ability to span structures and relationships from the simple to the infinitely complex, it may well be the mathematics for representing the basic archetypes that shape the physical world.

Maps made in this fashion can provide guidelines for thinking as well as for human experience. However, there is a problem in this upward projection to more encompassing realms of the hierarchical structure of nature. We believe that the most such maps can do is to provide us with *aspects* of that reality since we are exploring a reality from which space-time emerges as a projection.

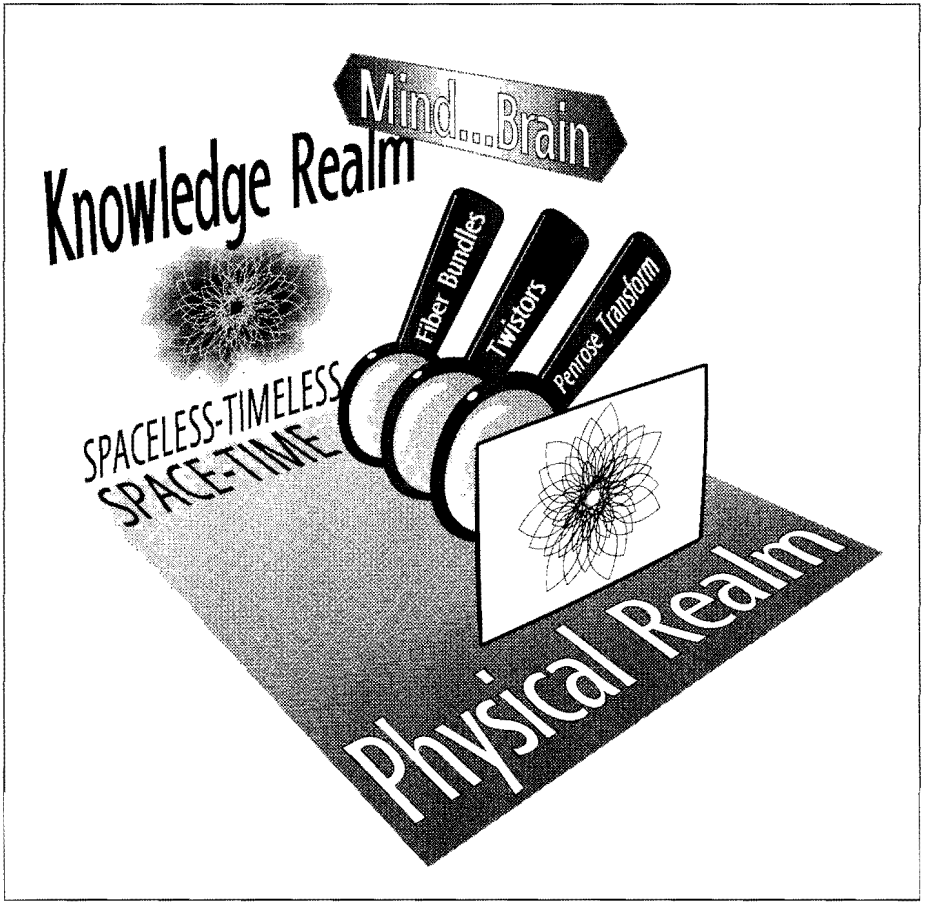

Figure 2. *Schematic illustration of the model for the connection between the realms of Mind and matter (mind/brain). From the physical world of space-time, we can use mathematical symbol systems (Penrose transforms, twistors, and fiber bundles) to understand our linkage to the spaceless-timeless "knowledge realm," yet always with a loss of its full beauty.*

A simple illustration points up the difficulty inherent in this process. Given a set of blueprints for a house it is possible for one experienced in interior design to imagine what any given room would look like when completed, even to the point of describing the furniture in the room. But the architect and

home owner may have completely different views of this level of detail. In other words, *the shape of the structure does not necessarily determine its contents.*

ISSUES RELATED TO THE MODEL

CAUSALITY

Cause and effect are the heart and soul of scientific explanation. You kick the ball and it moves; or you listen to TV advertisements day in and day out, and they cause a change in your beliefs and actions. If other conditions are identical, the principle of causality states that the same cause always produces the same effect. In modern science causality has traditionally been used as a litmus test to judge whether an explanation or model is "scientific." However, quantum effects at the microscopic level, particularly non-locality, have raised serious questions about the universality of this limited concept of causality.

To understand how our model treats causality we will need to review the history of the concept of causality. The earliest and most systematic codification of the meaning of causality in the West was the teaching of Aristotle who elaborated upon the scattered ideas of Plato. In the Aristotelian teaching of causes there were four causes. Two causes of "being": 1) the *material cause* that provides the passive receptacle upon which the other causes act, and 2) the *formal cause* that contributes the essence, idea, or quality of the thing concerned. Then there were two causes of "becoming": 3) *efficient cause* which represented the external compulsion that bodies had to obey, and 4) the *final cause* that represented the goal to which everything strove and which everything served. After the Renaissance there was a major shift in the thinking about causality due to the emergence of science. Science only considered the *efficient cause* since it was mathematically expressible in the science of the time and could lead to the harnessing of nature. Science took the *material cause* for granted in connection with all natural happenings and ignored the *formal* and *final causes* because they were considered beyond the reach of physical experiment.[27]

In our model we expand the current scientific understanding of causality and reinstate the four causes of Aristotle. The first two causes of being are consid-

ered to originate beyond space-time. The *material cause* represents the reality beyond space-time to which everything in the physical is linked. The *formal cause* corresponds to the archetypes which provide the essence behind the patterns and symbols of the physical world. The two causes of becoming in our model represent effects within space-time. The *efficient cause* corresponds to traditional science but is expanded to include effects due to causes originating in the mental. The *final cause* refers to the effects of a "higher ordering principle" originating beyond space-time that establishes the interconnectiveness in the physical reality. This involves the concepts of love, compassion, and appreciation and will be discussed in Part III of this series.

Reproducibility

Consistent reproducibility is treated by modern science as if it were an absolute law of nature. Nowhere is this felt more keenly than in the field of parapsychology. The following observation was published by three researchers in the field:

> Perhaps the most frequent (and valid) criticism of parapsychology is that significant experimental results are not repeatable upon demand. Indeed, many observers of parapsychology, both within and outside the field, claim that the repeatable parapsychological experiment simply does not exist. This criticism is not unique to parapsychology, of course; the lack of replicable experiments is ubiquitous to virtually all the social and behavioral sciences.[28]

We suggest that reproducibility is an *artifact* that appears in the so-called "hard sciences" because of the simplifying assumption that space-time forms a *closed* manifold.[29] Under our expanded science, "real" effects that could originate beyond space-time may not be consistently reproducible. For example, religious miracles and medical "spontaneous" remissions would need to be evaluated on this broader scientific basis. We postulate that experiments involving significant components originating beyond space-time require a closed manifold that extends beyond space-time to be consistently reproducible. Since we are now dealing with the realms of mind and spirit, this appears to require changes in belief systems plus a degree of

mental and emotional management that most individuals do not possess. However, there is ample evidence over history that "unexplainable" reproducible effects in the physical may be possible.

Inter-System Coupling and Intention

Non-locality is closely related to the issue of reproducibility. We agree with John Stewart Bell, Nick Herbert, and others who state that non-local linkages underlie everyday reality.[8] Thus, we may ask: if a quantum connection of some kind is established by every interaction, then why aren't all human beings experiencing this unity? One reason for this apparent absence of unity might be that, although the strength of the quantum correlations does not diminish with distance, there appears to be a form of "coupling coefficient" associated with each connection. The coupling coefficient represents a measure of the degree to which one system influences another.

We believe that this coupling coefficient can be affected by human intention in several ways. It can be strengthened by repeated interactions or diluted by irrelevant interactions. Clarity and sharpness of focus as well as the removal of negative outside influences would tend to improve the coupling. One could also speculate that any intense emotional process would initiate a persistent quantum linkage between people.

Furthermore, in metaphysical traditions some of the admonitions in the practices have greater meaning if we assume that they involve quantum linkages, *i.e.*, linkages to the spaceless-timeless reality of Mind. For example, the stressing of secrecy in the ancient traditions could reflect a recognition that the effectiveness of the process would be diluted by irrelevant or hostile mental interactions at the mental and emotional level. The emphasis on daily meditative practice could follow from the recognition of the need to maintain and strengthen the quantum linkage. Finally, at the foundation of many great religions is the practice of sincere heart-felt love and compassion. In Part III we will suggest a scientific rational for why love provides an enhancement of coupling coefficient to permit increased feedback of holistic knowledge from the connectiveness inherent in the realms beyond space-time.

THE DYNAMICS OF FORM

Our model proposes a reality from which form in space-time emerges as a dynamic projection—a creative holomovement in the words of Dr. David Bohm. In this concluding section we bring up several topics that show how certain mathematical symbol systems embody *process* as well as *form*. This should help emphasize the point that our minds engage us in a complex, dynamical "dance" back and forth between the two sides of the permeable space-time boundary. In fact, the word "dance" is an apt metaphor for what we are trying to express, where *form, process,* and *meaning* are so closely intertwined.

Another illustration provides a supportive perspective. "Sprinkle sand over the surface of a metal plate; draw a violin bow carefully along the plate boundary. The sand particles will toss about in a rapid dance, swarming and forming a characteristic pattern on the plate surface. This pattern is at once both form and process."[30]

The features that are present in these two examples span a range from static form at one extreme to kinetic-dynamic process at the other extreme. These features or aspects arise out of a whole that is being generated and sustained by a motivating "energy/intelligence" that is of a different quality than the features themselves.

DISTINCTION AND SELF-REFERENCE—THE CREATION OF FORM

Mathematicians have been exploring the fabric of form based upon a formless space beyond dualities, before any distinction has been drawn. Thus, both "the unmanifest" and a creative process from which form arises can be symbolically described. The approach is as follows. In order for any universe to come to observe itself and therefore learn, even through intuition, it must somehow split itself into that which is seen and that which sees. This process involves both distinction and self-reference—two inseparable and hence conceptually identical ideas. The starting point for this process is "the unmanifest" called the "Void" in metaphysics. The Void is the opposite of (and hence the support for) *Everything That Is*, and hence it can

also be called the *All.* Mathematicians conceptualize this "empty set" by first framing nothing and then *throwing away the frame!* [31]

An entire universe of forms comes into being with the making of one distinction. It is this simplicity of distinction that underlies the dynamics of nature, life and movement—the binary choice of yes-no, true-false, over-under, inside-outside, etc. What the mathematicians are saying is that this simplicity boils up from the realm of the Void/All via archetypal patterns into the complexity of the geometry and topology of the perceived world. They have demonstrated "how a rich world of periodicities, waveforms and interference phenomena is inherent in the simple act of distinction."[30] All from framing nothing!

Distinction, therefore, implies the more complex and dynamical processes of self-reference, feedback, and learning. Since our model assumes an interconnected unity in a hierarchy of levels, it then represents a cosmos that is learning through a multiplicity of feedback paths, both in nature and in human beings. The mathematical subjects discussed below supply further clues as to how the dynamics of the feedback process between Mind and matter might be taking place.

Waves

In the example of the sand particles on the metal plate, we note that the static form of a pattern and the kinetic-dynamic process are being generated and sustained by an essential periodic vibration. In science once a phenomenon can be recognized as "wave-like," then a great deal about that phenomenon can be predicted even though the mechanism by which the waves are generated is not clearly understood. By the use of mathematical "transforms" it is possible to symbolically span beyond space-time.

Complex Numbers

Complex numbers, a branch of mathematics, illustrates another transformation process and provides a glimpse of an additional possible dynamic relationship between Mind and matter. The complex number system with its "imaginary"

square root of -1 was invented to accommodate the needs of mathematicians but soon found a host of applications in physics and engineering. Imaginary numbers serve as a kind of "rotator" which moves a quantity into another "realm." The very names for the two kinds of numbers ("real" and "imaginary") suggest this sort of action. Thus, in relativity theory, time is wedded to space by making it imaginary. Also in applications involving time-varying quantities, such as electromagnetic theory, fluid mechanics, aerodynamics, and waves, complex numbers play a major role in simplifying the mathematics.

But for our purposes the most interesting feature is shown by Kauffman[32] to be the fact that the self-reference process is precisely mirrored by the formalism of complex numbers. It should be no surprise, therefore, that quantum mechanics, the only branch of physics that incorporates the observer as an integral part of the system, can not be formulated correctly *without complex numbers.*

Complexity and Chaos Theory

A mathematical symbolic representation of the process for the manifestation of 3D-form (in*form*ation) in space-time may be the new science of complexity that includes chaos theory as a subset.[33] Our model would suggest that microscopic fluctuations at the edge of the quantum vacuum eventually appear as a macroscopic expression in the physical—that the system effectively acts like a "pump" that brings microscopic fluctuations up to a macroscopic expression. In deterministic chaos theory there is great sensitivity to initial conditions. Hence, our model might explain why decisions/choices that originate beyond space-time in the knowledge realm could produce a "power of mind over matter."

The unpredictability inherent in chaos theory is due to these initial choices/decisions which set the constraints upon the process. Nevertheless, behavior does appear to settle into a particular "chaotic" pattern. This pattern is known as a "strange attractor" since although the same combination of variables never occurs twice the system behaves as though attracted by some strange influence. *In fact, we could postulate that a higher dimensional attractor might correspond to an archetype.* Such an archetype might tap the infinite reservoir

of energy in the quantum vacuum and thereby constitute a model for the "life" process.

Fractals and Scaling

The strange attractor is a fractal.[34] Feedback and self-reference are related to fractals which can be expressed as mathematical recursive forms.[32] The unimaginably detailed structures created by fractal geometry have been found to succinctly describe complex natural objects and processes.[35] Even a landscape with all its complexity can be generated with fractal mathematics.

Fractals exhibit "scaling properties" which result in self-similarity among scales. This means, for example, that one can take a section of coastline (a fractal) and magnify it, obtaining a result that is equally plausible as a stretch of coastline. Hence, for patterns in the physical world that can be represented as fractals, their coupling to the archetypal counterparts in the spaceless-timeless realm would appear to be independent of their physical size. In other words, for feedback from an appropriate archetype, it makes no difference if the physical pattern is on the scale of the solar system, a mountain range, a tree, a crystal, the DNA molecule, or the spin structure of an atomic nucleus. An important characteristic of fractals is that a small change in the generating form creates a corresponding change in the fractal pattern everywhere, and *at every scale.* Thus, the mathematics of self-similar fractals could be representing a key organizing principle in nature—one that creates a type of "holographic" universe.

Interpretation

This discussion of the dynamics of the Mind-matter linkage has focussed on several kinds of mathematical ideas. Since we have described the linkage itself in terms of the symbolic systems of mathematics, it is natural to describe other aspects of the process in more or less the same way. However, we are not able to be very specific on how these other mathematical processes might integrate into the general dynamical picture. At the present time the best we can do is obtain hints and glimpses about what may be going on. However, the various

kinds of mathematics described do have a common feature. They are self-referential with the inherent power of *transformation* to realms beyond space-time. Perhaps this feedback mirroring process via mathematical symbols is bringing us into contact with some more encompassing archetypal pattern that is behind the emergence of the physical out of these higher realms.

We wish to emphasize an important point about symbols. When the symbols associated with any form of language including mathematics are discussed, they, of necessity, consist of patterns in our physical world. Hence, a symbol represents a pattern *within* our three-dimensional space. As discussed in Part I,[36] symbols serve the role of mediator between the happenings in the physical or outer reality and the spaceless-timeless or inner reality. Therefore, we have used the terms archetypes or archetypal patterns to define the order and symmetries *beyond* space-time.

In Part III we will integrate the key concepts from Parts I & II and address their implication for human experience and energy medicine.

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REFERENCES AND NOTES

1. R. L. Shacklett & W. C. Gough, The Unification of Mind and Matter: A Proposed Scientific Model, Dec. 29, 1991, Report of the *Foundation for Mind-Being Research*, 442 Knoll Drive, Los Altos, CA 94024.
2. W. C. Gough & R. L. Shacklett, Physics, Parapsychology and Religion—Part I: The Reality Beyond Space-Time, Part II: The Quantum Linkage, Part III: The Human Implications, *Journal of Religion and Psychical Research* 16, 2,3,4 (1993).

3. J. D. Barrow, *Pi in the Sky: Counting, Thinking, and Being* (Claredon Press, Oxford, 1992), pp. 1-2.
4. J. E. Burns, Contemporary Models of Consciousness: Part I & Part II, *The Journal of Mind and Behavior* 11, 2 (1990), pp. 153-172 & 12, 3 (1991), pp. 407-420.
5. W. A. Tiller, A Lattice Model of Space, *Phoenix: New Directions in the Study of Man* II, 2 (1978), pp. 27-47. (This Journal is no longer operational, but copies of Tiller's articles can be obtained from: Librarian, Fetzer Foundation, 9292 West KL Ave., Kalamazoo, MI 49009.)
6. T. E. Bearden, On Rotary Permanent Magnet Motors and 'Free' Energy, *Raum und Zeit* 1, 3 (1989), pp. 43-53.
7. N. Herbert, Notes Toward 'A User's Guide to the Quantum Connection', *Psychological Perspectives* 19, 1 (1988), pp. 56- 63.
8. N. Herbert, How Bell Proved Reality Cannot Be Local, *Psychological Perspectives* 19, 2 (1988), pp. 313-319.
9. A. Aspect, P. Grangier & G. Roger, Experimental Tests of Realistic Local Theories via Bell's Theorem, *Phys. Rev. Lett.* 47 (1981), pp. 460-463.
10. A. Aspect, P. Grangier & G. Roger, Experimental Tests of Realization of Einstein-Podolsky-Rosen-Bohm Gedankenexperiment: A New Violation of Bell's Inequality, *Phys. Rev. Lett.* 49 (1982), pp. 91-94.
11. A. Aspect, J. Dalibard & G. Roger, Experimental Tests of Bell's Inequalities Using Time-varying Analyzers, *Phys. Rev. Lett.* 49 (1982), pp. 1804-1807.
12. F. D. Peat, *Einstein's Moon: Bell's Theorem and the Curious Quest for Quantum Reality* (Contemporary Books, Chicago, IL, 1990).
13. S. W. Hawking, *A Brief History of Time* (Bantam Books, New York, 1988).
14. M. Kafatos & R. Nadeau The Conscious Universe: Part and Whole in Modern Physical Theory (Springer-Verlag, New York, NY, 1990), pp. 37-38, 83-84.
15. L. E. Ballentine, Foundations of Quantum Mechanics Since the Bell Inequalities, *American Journal of Physics* 55, 9 (1987), pp. 785
16. N. Herbert, *Quantum Reality: Beyond the New Physics* (Doubleday, New York, NY, 1985).
17. H. P. Stapp, Bell's Theorem and World Process, *Nuovo Cimento* 29B (1975), p. 270.
18. R. Penrose, *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics* (Oxford Univ. Press, New York, NY, 1989).
19. J. D. Barrow, *Theories of Everything: The Quest for Ultimate Explanation* (Oxford University Press, New York, NY, 1991).
20. R. S. Ward & R. O. Wells, Jr., *Twistor Geometry and Field Theory* (Cambridge University Press, New York, 1990).
21. F. D. Peat, *Superstrings and the Search for the Theory of Everything* (Contemporary Books, Chicago, IL, 1988).
22. A. N. Whitehead, *Process and Reality* (Macmillan, New York, NY, 1929).
23. H. P. Stapp, Whiteheadian Approach to Quantum Theory and the Generalized Bell's Theorem, *Foundations of Physics* 9, 1/2 (1979), p 1.
24. D. Bohm, *Wholeness and the Implicate Order* (Routledge & Kegan Paul, London, 1980).
25. D. Bohm & B. J. Hiley, *The Undivided Universe: An Ontological Interpretation of Quantum Theory* (Routledge, London, 1993).
26. P. G. Bergmann, Unitary Field Theories, *Physics Today* 32, 3 (1979), p. 44.
27. M. Bunge, *Causality and Modern Science: Third Revised Edition* (Dover Publications, New York, NY, 1979), pp. 31-33.

28. D. I. Radin, E. C. May & M. J. Thomson, Psi Experiments with Random Number Generators: Meta-Analysis Part I, *Research in Parapsychology 1985* (1986), pp. 14-17.
29. W. C. Gough, Book Review—Too Hot to Handle: The Race for Cold Fusion, *Fusion Technology* 22 (Aug. 1992), pp. 188-191.
30. H. Jenny, *Cymatics* (Basilius Presse, Basel, 1974). [Quoted in Kauffman & Varela, p. 171), (following reference)].
31. L. H. Kauffman & F. J. Varela, Form Dynamics, *Journal of Social and Biological Structures* 3 (1980), pp. 171-206.
32. L. H. Kauffman, Self-Reference and Recursive Forms, *Journal of Social and Biological* Structures 10 (1987), pp. 53-72.
33. R. Lewin, *Complexity: Life at the Edge of Chaos* (Macmillan, New York, NY, 1992). See Figure 10, p. 189.
34. J. Gleick, *Chaos: Making a New Science* (Penguin Books, New York, NY, 1987), pp. 139-140.
35. H. Peitgen & D. Saupe, Eds. *The Science of Fractal Images* (Springer-Verlag, New York, NY, 1988).
36. W. C. Gough & R. L. Shacklett, The Science of Connectiveness Part I: Modeling a Greater Unity, *Subtle Energies* 4, 1 (1993), pp. 57-76.

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