

TOWARDS A QUANTITATIVE MODEL OF BOTH LOCAL AND NON-LOCAL ENERGETIC/INFORMATION HEALING

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Introduction

This paper is only my personal perspective and not a general review. Much of the background data on which I will build is referenced in recent publications.⁽¹⁻³⁾ Here, I will relate this prior work specifically to the topic of energetic/information healing. By use of this label, I am referring to healing via the use of various fields as distinct from the use of particular chemicals. The discrimination and detailed nature of the specific fields involved are largely unknown to us at the present time but their presence is not. What is important to us is that they can be intentionally sculpted by the healer to have a pattern, and thus information, as well as amplitude, and thus energetic power.

As a first example to illustrate this differentiation from allopathic practice, I will consider the practice of placing colloidal silver particles in a beaker of water that contains abundant bacteria. It is well known that doing this will kill the bacteria. What is not so well known is that the bacteria will also be killed by placing these same colloidal silver particles in a nearby gas-discharge tube, and focusing the electromagnetic (EM) emissions from the tube onto the beaker. Using the tube without the silver particles does not kill the bacteria. We can deduce from this that⁽¹⁾ physical contact between the silver and the bacteria is not a necessary condition for killing the bacteria and (2) the electromagnetic information pattern inherent in silver, when entangled with the gas discharging tube electromagnetic (EM) carrier wave and transported to the bacteria, is both a necessary and sufficient condition to kill the bacteria. From this, we would conclude that we also kill the bacteria if we optically combine the outputs from several light sources, each with a key frequency present as peaks in the EM emission spectrum of silver and also properly adjust the relative amplitudes of these different light sources to match the EM spectrum of silver, while focusing this combined beam on the beaker of water.

Via this simple example, we see that it is the specific EM information pattern (inherent in the EM spectrum always being emitted from silver) that is harmful to the bacteria and not the actual physical contact with silver. Expanding this vital "information: concept" a little, our general present-day experience with transforming one verbal language or computer language to another shows us that the same basic information pattern (the same meaning) can exist in many different formats. Nature expresses itself via a variety of conventionally understood energies and a variety of presently not understood subtle energies

(vacuum energies). [Entangling/encoding Encoding – use both] specific information patterns with carrier waves of such energies and delivering them to some location is what a healer must do to produce change at that location. To speed up the process of such change, the healer must increase the power level of the intervention.

The foregoing assumes that the inherent noise level in the healer has been greatly reduced by inner self-management practices, otherwise this noise will also be amplified. As in any type of communication system, it is the ratio of intended signal to noise that is important.

The second example relates to a particular healer who was extensively studied by Elmer Green in his copper wall apparatus.^(2,4) Elmer and his associates at the Menninger Clinic devised a simulated healing experiment involving an accomplished healer inside a specially designed environment within a larger room. The healer, wired to a variety of electrophysiological measurement instruments, stood or sat on an electrically insulated framework placed within four large, square copper walls, one in front, one behind, one above and one below. (See Figure 1). Electrically insulated electrometers simultaneously recorded

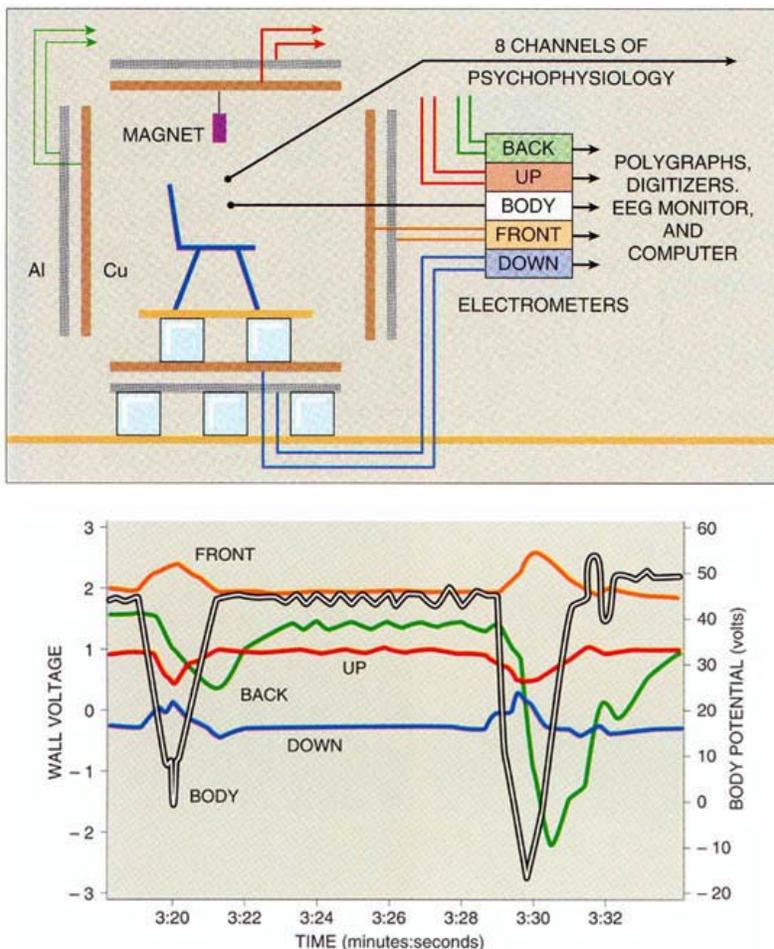


Figure 1

In the copper-walled meditation room, four pairs of insulated copper and aluminum panels float in electrical space around a research chair, which also floats electrically, insulated from the "down" panel by glass construction blocks. Signals from the subject's body and from the four copper walls are fed into electrometers, and data from all channels are forwarded to polygraphs, digitizers, and a computer. The graph shows an example of simultaneous body and wall potentials.

the voltages of these four walls plus that from an electrode placed on the healer's earlobe.

Instead of showing the 10 or 15 millivolt (mV) baseline reading with 1 mV ripples that are typical of the human body, the healer's body voltage often plunged by ~30 to 300 volts and then returned to baseline within ~0.5 to 10 seconds. This astoundingly large body voltage pulse is about 100,000 times normal, and correlated pulses of 1 to 5 volts appeared on each of the four copper walls. In a 30-minute session, this healer manifested 15 of these anomalously large pulses.

From this experiment, I generated a theoretical model of a nonobservable subtle energy pulse emitted at some location in the healer's body, transduced through a series of stages to become a magnetic vector potential pulse (which is a recognized potential in current electrodynamics) and ultimately manifesting as an electric field acting to cause an electric dipole to form at some location in the body. (There is a standard mathematical connection between this electric field and the magnetic vector potential pulse.)^(2, 5) Using this quantitative approach, I was able to make an analysis of the data from the 15 pulses.

In 13 of the 15 pulses, the place of origin was predicted⁽⁵⁾ to be the lower abdomen. The dipole was predicted to extend from the ear (negative charge end) to the feet (positive charge end). Interestingly enough, there is an acupuncture meridian that extends from the soles of the feet to the shoulder region in all humans. It was also possible to show that only a very small electric current need flow (~nanoamperes) for a very short time (~0.1 second to several seconds) to achieve this result. Such a small current is much less than that typically observed (~1000 nanoamperes) when any two different acupuncture points are electrically connected.

What I deduced from this study was that (1) the healer's intention to heal can manifest ultimately as large, observable electric voltage pulses in physical reality (2) some medium exists that couples the nonobservable subtle energy pulse to an observable physical energy; and (3) a precise mathematical analysis could be generated to concretize this elusive concept.

The third and final illustrative energy/information example involves Eeman's relaxation circuit⁽⁶⁾ and Cayce's radial appliance device⁽⁷⁾ body circuit during treatment - in contrast to the geometrical field polarities as measured by Becker.⁽⁸⁾ We start this discussion by noting that the properties of all physical substances appear to arise from two distinctly different levels or bands of physical reality:⁽¹⁻³⁾ (1) the coarse particulate level (primarily of electric charge origins) and (2) the fine information wave level (primarily with magnetic charge origins).^(9,10) In our normal electromagnetic (EM) Gauge symmetry state, called the U(1) state, the former has a magnitude much larger than the latter. At an elevated EM Gauge symmetry state, such as the SU(2) state, measurement can show them to be of comparable magnitudes. (See further discussion of these states in my article in the previous issue IJHC.)⁽¹⁾

It can be demonstrated that the acupuncture meridian/chakra system in the human body has an EM Gauge symmetry state approaching the SU(2) state

while the rest of the body appears to be at the normal U(1) state. Since the SU(2) state has an appreciably higher thermodynamic free energy level than that of the U(1) state, the acupuncture meridian/chakra system in all humans serves as a thermodynamic free energy pump to drive seemingly all chemical, electrical and optical processes needed for life function in the physical body.^(1-3, 9-11) Because of this, we can expect the human body to exhibit two types of geometrical field polarity: (a) an electric potential pattern, which is fairly easy to measure by present day instruments⁽⁸⁾ as it constitutes the body's coarse particulate substance electric polarity pattern, and (b) the magnetic potential pattern, which constitutes the body's fine information wave substance polarity pattern and is not so easy to measure using our available instruments. Connecting points of opposite polarity on the body's surface via suitable conducting wires will enable small currents to flow between such points. Such currents can be of an electrical or magnetic nature or both and they tend to restore harmonious balance between these two levels of substance in the physical body.

Perhaps most important to appreciate is that the patterns existing at the fine information wave level are the ones that determine whether or not the coarse particulate level exhibits the presence of developing pathology; i.e., they are the precursors and templates for observable change in the physical body.

The DC electric potential polarities for the human body, as determined by Becker,⁽⁸⁾ are quite different than the polarities determined by Eeman.⁽⁶⁾ or by this author,⁽²⁾ or as reported by Patten,⁽¹²⁾ who replicated and extended Eeman's research on body polarities. These latter polarities are probably of a magnetic potential nature and they are all consistent with each other as well as with the body connections to be used with the Cayce radial appliance device (CRA).⁽⁷⁾

From the structural and material design, the CRA system acts as an electrical capacitor with the glass and carbon being dielectrics while the 1060 steel plus copper plates act as electrodes. The differential body voltage between the acupuncture points of the two body connections is what charges up the capacitor system leading to a small electrical leakage current into the body which, in turn, moves the different quadrants of the body system towards electric balance. On the other hand, the 1060 steel electrodes have beneficial properties of magnetic coercivity and magnetic permeability.^(13,14) Thus, they could act to influence the magnetic current flow (perhaps Qi flow) between the acupuncture points of the two body connections.

Picturing the Whole Person

My working hypothesis is that an appropriate reference frame for interpreting what we call the expressions of nature is schematically given by Figure 2. This reference frame consists of (1) a unique Biconformal base-space (BCBS) comprised of two, reciprocal, 4-dimensional subspaces, one of which is distance-time, and this constitutes a specific

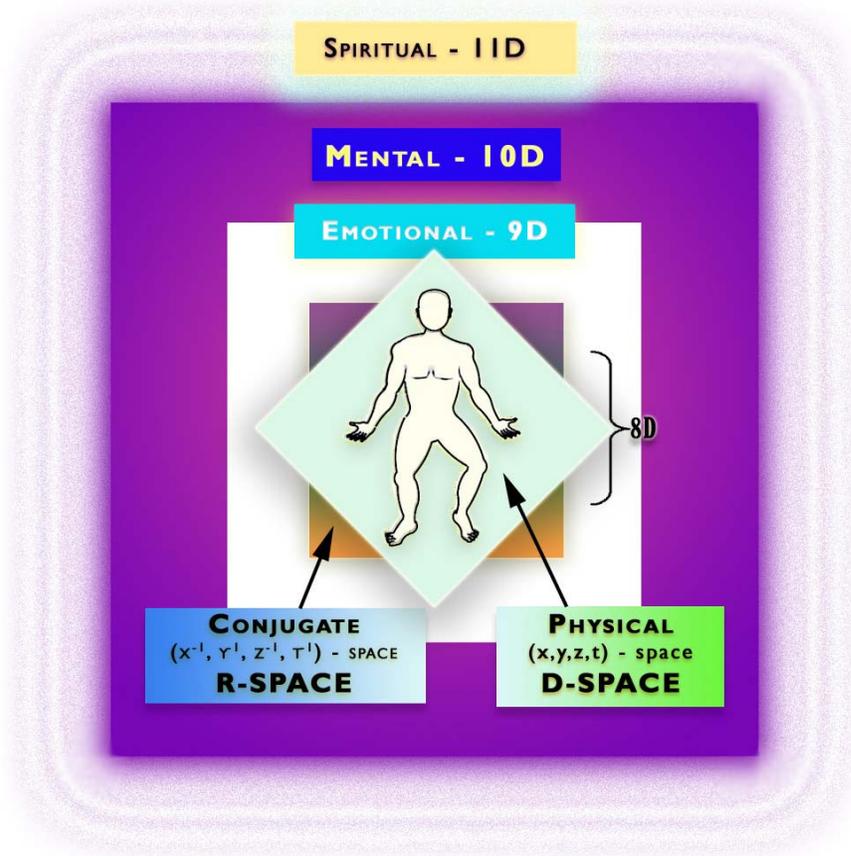


Figure 2

A visualization of dual four-space frames imbedded in three higher dimensional frames.

member of the general 8-Dimensional space; (2) an embedding 9-dimensional space, the domain of emotion, which contributes a specific energy substance labeled “deltrons” to the electric and magnetic monopole substances of the BCBS so that they can be coupled even though one travels at $v < c$ while the other travels at $v > c$ (3) a further embedding 10-dimensional space, the domain of mind, whose internal structure when activated can broadcast wave patterns that ultimately materialize as events in the distance-time domain of the BCBS’ and (4) this 10-dimensional framework which is a framework for creating an infinite variety of relative universes is, in turn, embedded in the still higher dimensional domains of spirit and these domains constitute the absolute universe [insofar as we can comprehend it and include it within current models]. It is specific intentions, from the domains of spirit, that imprint highly correlated specific patterns on the domain of mind, so as to, in turn, generate event materialization in distance-time.

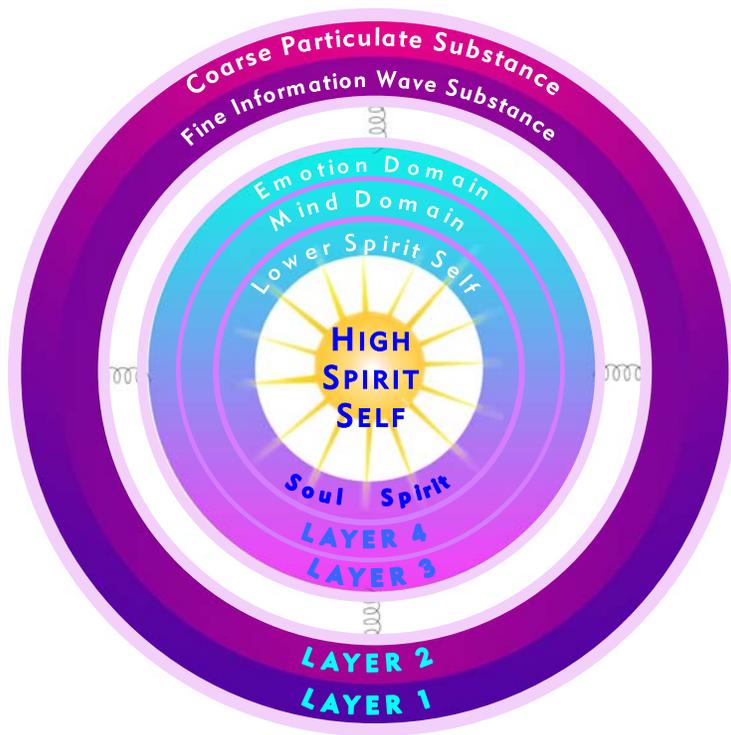


Figure 3
The whole person, biobodysuit metaphor. Each layer has unique substance and infrastructure. The outer 2 layers constitute temporal physical reality. The middle shell is non-temporal and could be called the soul. The layer infrastructures and the coupling between layers largely determine the state of wellness of the whole person.

A companion “biobodysuit” format to the structural schematic of Figure 2 is provided by Figure 3. This is a substance schematic with each layer containing an abundance of essential infrastructure. The outer two layers constitute physical reality and are comprised of (1) the coarse, electric monopole-generated, particulate substance, and (2) the fine, magnetic monopole-generated, information wave substance. These are the layers we take on during human embryo development and shuck off after the physical death process. These two outer layers are coupled to the higher dimensional vehicle of the “soul” by at least the deltron field,⁽¹⁾ with this vehicle consisting of emotion domain infrastructure, mind domain infrastructure and a portion of one’s spirit self. The more infrastructure development that occurs in these layers during successive re-embodiment experiences in the physical, the more can one’s high spirit self enter the soul body and thereby the more conscious does the being become. This high spirit self is an essential part of the spectrum that we refer to as God⁽¹⁵⁾ and we might choose to call it our God-Self.

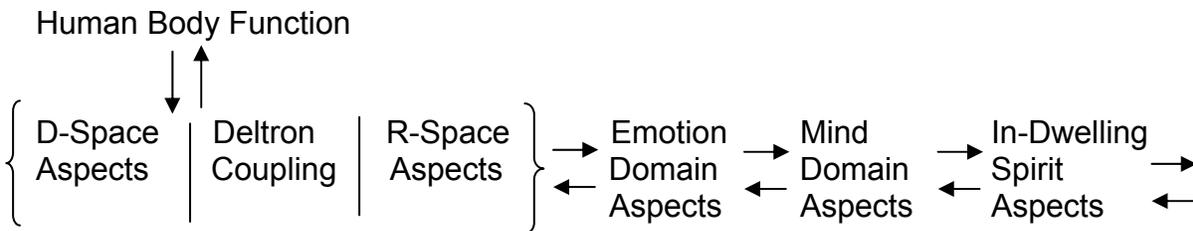
The fine physical body, a frequency domain body (also called the etheric or R-space body) is the template for changes in the coarse physical body, a distance-time body (also called the D-space body). However, the two are coupled via whatever level of deltron activation is present, so there is feedback from the D-space body influencing the R-space body. Depending on the dietary and other life-style habits at the D-space level, the R-space level can develop defects and become degenerative so that this two-leveled physical body can develop pathologies. Inputs from the spiritual, mental and emotional levels of self, which

are also frequency domains, can modulate this degenerative process and health process at the two physical levels of the human biobodysuit. It is both conscious and unconscious intentions and attitudes that affect the magnitude of this modulation. At present, most people tend to think that degeneration is the result of aging rather than the other way around as I have proposed above.

Possibilities for Local Healing Processes

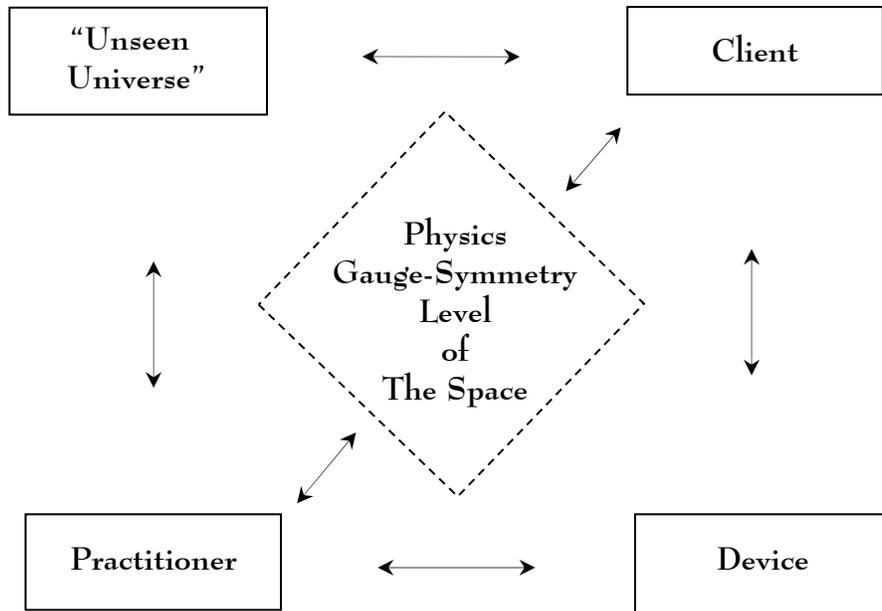
From the previous section, when one wants to evaluate a particular human's state of body function from a wellness/pathology ratio perspective, one must deal with the following reaction equation (Figure 4) in its entirety.

Figure 4. Proposed biobodysuit homeostasis reaction



Here, for a high state of wellness, a wholesome balance between the various energies present within each aspect, and for the coupling energies between the different aspects, must exist. Except for the D-space aspects, one is dealing with some spectral distribution (amplitude vs. frequency) that is ideal for a particular energy and significant departures from this ideal profile is an indication that a defect state exists from which some type of visible pathology will eventually emerge. One can expect that errors in a particular infrastructure circuit for that particular layer of the biobodysuit is what generates a significant departure in the ideal spectral distribution for that layer. Thus, a healer needs to be at least loosely aware of such an overall picture.

Figure 5. Schematic illustration of the five key interactive elements involved in any human exchange



Healers also needs to be at least loosely aware that any interactions between themselves and patients occur within a framework like that illustrated via Figure 5. Their intention to facilitate healing in the patient will be more successful if they open a channel within themselves to allow abundant healing energies to flow from the “unseen universe” to the patient via the presence of a raised EM Gauge symmetry space linking the healer to the patient. The general intention of the healer would be to facilitate energetic and infrastructure change via the following reaction equation (Figure 6):

Figure 6. Proposed homeostasis reaction equation between essential universe qualities

$$\text{Mass} \begin{matrix} \rightarrow \\ \leftarrow \end{matrix} \text{Energy} \begin{matrix} \rightarrow \\ \leftarrow \end{matrix} \text{Consciousness} \begin{matrix} \rightarrow \\ \leftarrow \end{matrix} \text{Love}$$

Here, Einstein provided us with the quantitative relationship between the first two terms. We will probably discover the quantitative relationship between the second and third terms sometime in this or the next century. The last term is the force of all creation and I cannot even guess how long it will take us to awaken to the quantitative connection between the last two terms. However, centering one’s

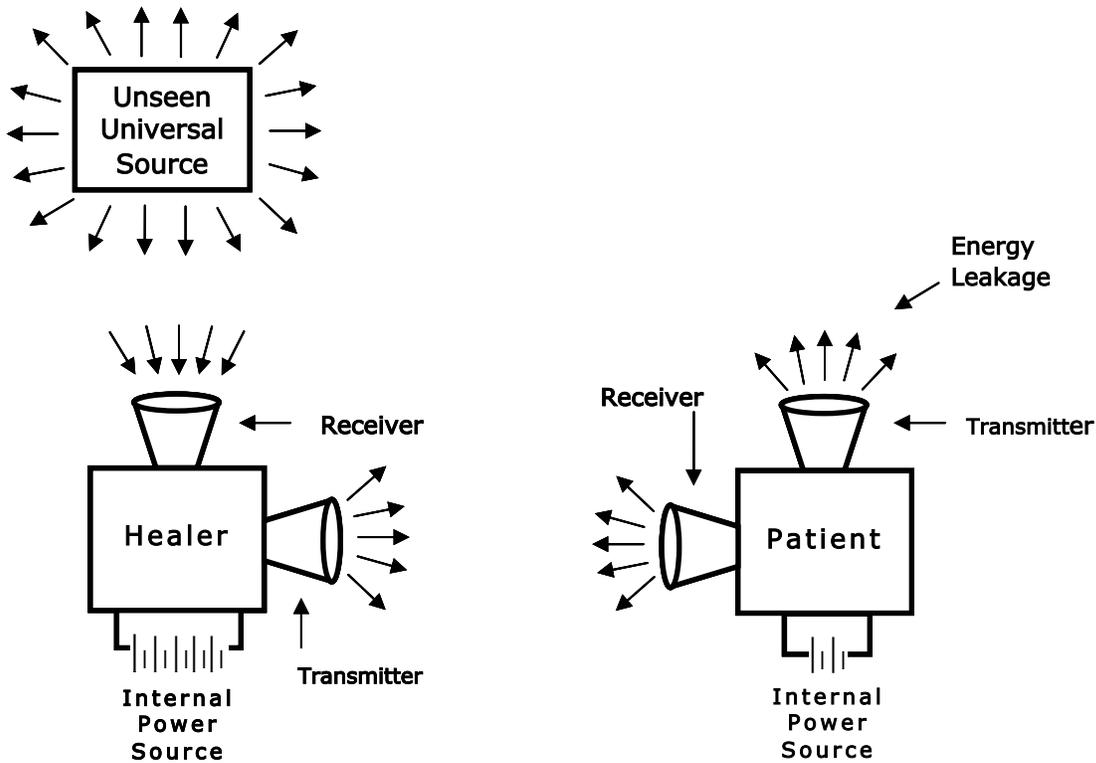
consciousness within a framework of love, nurturing, caring, etc., can allow the healing process to unfold from right to left in the above equation even when we don't consciously know the quantitative connections.

From all of the foregoing, a partial list of necessary requirements for one to be an effective local healer would seem to be the following:

- (1) To have a compassionate and loving heart;
- (2) To have developed suitable biobody-suit infrastructure for the generation of specific field spectral patterns that can be entangled with a carrier wave and delivered to the nearby patient;
- (3) To have developed sufficient robustness to this particular system that the broadcast power level can be high and controllable; and
- (4) To have developed the capacity to be an effective channel or conduit for higher dimensional energy to flow into the healer as well as out of the healer.

An example to illustrate the importance of item (4) above comes from some old Russian data.⁽¹⁶⁾ It has been known for a long time that, for a healthy person, the electrical resistance of a particular acupuncture meridian on the left side of the body, R_L , is equal to that for the identical point on the right side of the body, R_R , so that $\Delta R = R_L - R_R \approx 0$. For an unhealthy individual, $\Delta R \neq 0$ and, as the magnitude of ΔR increases, the level of pathology increases.⁽²⁾ The Russian experiment took a patient with pathology and measured the pattern of $|\Delta R|$ -values for several meridian points before and after treatment by a healer. They also measured the $|\Delta R|$ -values for the identical points on the healer before and after treatment by the healer. What they discovered was that (a) before the healing session, the $|\Delta R|$ -profile for the patient consisted of large values but for the healer consisted of almost zero-values, and (b) immediately after the healing session, all the $|\Delta R|$ -values for the patient were reduced but for the healer they were all increased.⁽¹⁶⁾ Thus, if the relaxation times for the healer's $|\Delta R|$ -values to return to zero are not small, the inflow of the transferred energy spectrum from the unseen universe will be insufficient to keep the healer from developing the patient's pathology. Thus, the picture to be generated from this example is that of a transmitter/receiver system with interconnecting conduits of sufficient conductivity that large power levels of the particular energy involved can readily flow through the system. The electromagnetic analogy forms a most useful metaphor for this process and it is illustrated in Figure 7.

Figure 7. Schematic illustration of radiantly connected power sources during any healing process



An antenna system is a useful analogue for either transmitter or receiver in Figure 7 and the acupuncture meridian/chakra system is the best candidate for both. With the acupuncture points (several thousand major points on the surface of the human body) acting as the active element of the antenna, the meridian/chakra system can act as an exquisitely rich, multi element, phased array.⁽²⁾ Even with a fairly small signal fed to each point, a collective coherent signal at power levels a million-fold higher could, in principle, be generated a meter from the body. Again, Russian investigators, training individuals to perform psychokinesis, found that mental concentration techniques could be utilized to increase the “effective” voltage difference between symmetrical left & right side acupuncture points on the hands from ~50 millivolts to ~ 500 millivolts.⁽²⁾ Thus, biofeedback techniques might be utilized to train healers to become more powerful and effective.

The foregoing illustrates that, in both the healer’s and patient’s bodies, electrical signals, correlated with subtle energy signals, are detectable via monitoring of their acupuncture meridian systems. The carrier wave in this case is expected to be electromagnetism with a photon that travels at $v = c$.

One should also be able to detect, with suitable instrumentation, simultaneous magnetic signal correlations at these same points and at chakra

loci In this case, the carrier wave is expected to be magnetoelectrism with a different kind of photon that travels at $v = c^2$.⁽³⁾

Possibilities for Non-Local Healing Processes

Everything that applies to the previous section also applies in non-local healing. It is mainly the channel of signal propagation and the basic energy field carrying the information pattern that are different. In addition, patient locator links are necessary. Let us see how all this can, in principle, come about via our Biconformal base-space (BCBS) reference frame for interpreting nature's expressions about physical reality.

Because the two subspaces are reciprocal to each other, a quality in one subspace mathematically has a conjugate equilibrium quality in the other, which is given by a deltron empowered Fourier transform of the initial quality and vice versa.⁽³⁾ Such mathematics suggest several things about our physical world. First, it means that there can be no point-like objects in D-space, and that all humans are interconnected to some degree. This is so because any quality at a point in D-space has its equilibrium value given mathematically by an integral over all of R-space, and the conjugate quality at a point in R-space has its equilibrium value given mathematically by an integral over all of D-space. Thus, a particular quality at a point in D-space has a mathematical contribution coming, via R-space, from every other point in D-space. This means that all qualities in D-space are extended far beyond a single point. The degree of this extension and connectedness depends intimately on the deltron activation function that is present. Second, the Fourier transform of an object in D-space has a very important property. This is that, if one takes a unique \underline{D} -space object at a particular four space coordinate, $\underline{s}_4 = (x,y,z,t)$, and translates it to a quite different location denoted by $\underline{s}'_4 = (x',y',z',t')$, then the R-space Fourier transform (the wave amplitude spectrum as a function of frequency, \underline{k}_4) for the object located at the new location, $A'(\underline{k}_4)$ is just the old value, $A(\underline{k}_4)$, for location, \underline{s}_4 multiplied by a specific, frequency dependent phase-factor $\Theta(\Delta\underline{s}_4, \underline{k}_4)$

$$A'(\underline{k}_4) = \Theta(\Delta\underline{s}_4, \underline{k}_4) A(\underline{k}_4)$$

The underlines on \underline{s}_4 and \underline{k}_4 indicates that they are vectors and that they must be treated as such in the mathematics.

What this means for the phenomenon of remote viewing is that the subconscious mind of the viewer, given both \underline{s}_4 and \underline{s}'_4 (in terms of their x,y,z and t components), can calculate $\Theta(\Delta\underline{s}_4, \underline{k}_4)$ and deconvolve it mathematically from $A(\underline{k}_4)$. This is just like bringing the scene located far away at \underline{s}'_4 , through the vector displacement $\Delta\underline{s}_4 = (\underline{s}_4 - \underline{s}'_4)$, so as to place it right in front of the viewer so that the details are easy to recognize.

At this juncture, it is perhaps important to acknowledge that our brains do this sort of thing all the time. Karl Pribram⁽¹⁷⁾ has written extensively on the brain processes involved in imaging "outside" information. If one shines a uniform disk of light onto the eye, the first place that the brain accesses this information is via the interneurons of the cortical columns in the cerebral cortex. Pribram has

experimentally accessed this information and shown it to look remarkably like the Fourier transform for a uniform disc-shaped object. This strongly suggests that the basic input data recognized by the brain is in the R-space format, perhaps because this frequency format is ideal for subsequent brain processing and brain perception. Of course, it also means that an inverse Fourier transform processor must also exist in the brain in order for the information to be converted to the D-space format, which is what we think we perceive.

Our conscious self is always inside the biobodysuit interpreting the various neural and other sensory data streams that reach the brain. From these interpretations, based on a great deal of subconscious information processing, we form a picture of what is “outside” our biobodysuit. In this information processing, a great deal of mathematical manipulation of data seems to occur subconsciously.; Thus, the challenges of the previous paragraph, (1) accessing the $A'(\underline{k}_4)$ profile, (2) separating out the $\Theta(\Delta\underline{s}_4, \underline{k}_4)$ profile to reveal just the $A(\underline{k}_4)$ profile and (3) providing the inverse Fourier transform of $A(\underline{k}_4)$, are not insurmountable – they just need to be reliably and reproducibly learned at the unconscious/conscious levels.

The phenomenon of distant healing is much like that of remote viewing except that, instead of just operating in the R-space receiver mode, one must also add the R-space transmitter mode. Then, everything follows pretty much as outlined in the previous section. Such healing seems to be a latent ability in all humans. Practice, practice, practice is required to reliably and reproducibly build these particular infrastructure circuits to a robust state in our biobodysuits.

Conclusions

Based on a particular Biconformal base-space (BCBS) reference frame imbedded in several higher dimensional domains, it is possible to develop a schematic model for the whole person wherein both local and non-local energy/information healing may occur. This type of healing treatment operates on the information wave substance residing in the physical vacuum with signal transfer from the healer to the patient occurring via the reciprocal space (R-space) portion of this BCBS for non-local healing. The altered amplitude spectrum of this information wave substance domain restores harmony between the fine physical layer and the coarse physical layer of what we call the physical body and then, visible pathology starts to disappear. The mathematical relationships involved in this BCBS should eventually allow this model to become fully quantitative and predictive. This mode., at present, is of a purely classical nature and no quantization has been added although this can be done in a relatively simple way. Thus, quantum mechanics, as it is presently used, is not a necessary condition for local and non-local energy/information healing. (This is so because non-local forces and associated phenomena are a natural property of our particular BCBS and not of the quantum nature of energy exchange. It is just that the present formulation of quantum mechanics entangles everything so one cannot clearly see how the non-local effects actually arise. Separating out the BCBS portion allows some clarity to appear.).

References

1. W.A. Tiller, "Conscious Acts of Creation: The Emergence of a New Physics", The On-line, International Journal of Healing and Caring, 3 (2003) No. 1.
2. W.A. Tiller, Science and Human Transformation: Subtle Energies, Intentionality and Consciousness (Pavior Publishing, Walnut Creek, CA, 1997).
3. W.A. Tiller, W.E. Dibble Jr., and M.J. Kohane, Conscious Acts of Creation: The Emergence of a New Physics (Pavior Publishing, Walnut Creek, CA, 2001).
4. E.E. Green, P.A. Parks, P.M. Guyer, S.L. Fahrion and L. Coyne, "Anomalous Electrostatic Phenomena in Exceptional Subjects", *Subtle Energies*, 2 (1993) 69.
5. Tiller, W.A., Green, E., Parks, P. and Anderson, S., "Towards Explaining Anomalous Large Body Voltage Surges on Exceptional Subjects: Part 1, The Electrostatic Approximation", *Journal of Scientific Exploration*, 9, (1995) 331.
6. L.E. Eeman, Co-Operative Healing: The Curative Properties of Human Radiations, (Frederick Muller Ltd., London, 1947) pp 34-37.
7. D.G. Richards, D.L. McMillin, C.D. Nelson and E.A. Mein, "Improvement of Circulation Using the Cayce Radial Appliance", *Subtle Energies*, 7, 1 (1996) pp 1-18.
8. R.O. Becker and G. Selden, The Body Electric (William Morrow and Company, Inc., New York, 1985) p 98.
9. W.A. Tiller, "Subtle Energies and Their Roles in Bioelectromagnetic Phenomena" in Clinical Aspects of Bioelectromagnetic Medicine, Eds. P.J. Rosch and M. Markov (Marcel Dekker, Inc., New York, 2003).
10. W.A. Tiller, "Electromagnetism vs. Bioelectromagnetism", *Ibid.*
11. W.A. Tiller, W.E. Dibble, Jr., and C.T. Krebs, "Instrumental Response to Advanced Kinesiology Treatments in a Conditioned Space", to be published in *Subtle Energies and Energy Medicine*, 2003.
12. L. Patten and T. Patten, Biocircuits: Amazing New Tools for Energy Health (H.J. Kramer, Inc., Tiburon, CA, 1988).
13. J.D. Livingston, Driving Force (Harvard University Press, Cambridge, MA, 1996). p 101.

14. C. Kittel, Introduction to Solid State Physics (John Wiley & Sons, Inc., New York, 1953) p 180.
15. E.E. Green, The Ozawkie Book of the Dead (Philosophical Research Society, Los Angeles, CA, 2001).
16. W.A. Tiller, "Some Energy Field Observations of Man and Nature", in Galaxies of Life: The Human Aura in Acupuncture and Kirlian Photography, eds., S. Krippner and D. Rubin (An Interface Book, New York, 1973) p 70; Fig. 69.
17. K. Pribram, Brain and Perception, Holonomy and Structure in Figural Processing (Lawrence Erlbaum Associates, Hillsdale, NJ, 1991).