ORIGINAL PAPER

INFORMATION, CONSCIOUSNESS, AND HEALTH

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A 16-year empirical assessment of anomalous human/machine interactions provides strong evidence that consciousness can add information to otherwise random digital strings. A parallel program of remote perception studies establishes the inverse process: the anomalous acquisition of information about distant physical targets. Remarkably, neither of these extraordinary capabilities shows any dependence on either the distance or the time separating the participant from the target. The relevance of these consciousness abilities to human health follows from recognition that physiology entails myriad subtle information processes, all of which involve some degree of randomicity in their normal functions, and thus may be similarly influenced by conscious volition. (Alternative Therapies in Health and Medicine. 1996;2(3):32-38)

Over its long and proliferate history, the family of intellectual and pragmatic endeavors we broadly term science has tended to trade in three conceptual currencies: matter, energy, and information. Although each of these has encompassed a variety of more specific phenomena and topical applications characteristic of particular scientific domains, a similar sequence of attention to them has progressed through most technical fields. For example, early physical science, from the time of the early Egyptians through the Enlightenment, focused mainly on the behavior of tangible substance—its structure, mechanics, and chemical and physical properties. Midway through the 19th century and well into the 20th, the concept of energy in its many forms—mechanical, electrical, thermal, chemical, nuclear, etc—became more central to basic physics and to its associated technologies. Most recently, information has taken center stage, and clearly will dominate physical science and its applications for the foreseeable future.

Superficially, these three currencies might seem distinct, but in fact they are demonstrably convertible, with immense consequences. Einstein's identification of the transmutability of material mass into energy ($E=mc^2$) has impelled much of 20th century physics, and its technological, political, and sociological implications can hardly be overstated. A somewhat subtler equivalence of energy and information is now well established, and will become progressively more important throughout 21st century science and many of its applications.

A similar conceptual genealogy has characterized the evolution of the biological and medical sciences. Early preoccupation with the properties of biological substance—bone, tissue, blood, cell—led inevitably to confrontation of the energetic processes of living organisms: their metabolism, kinesiological dynamics, and immune and restorative activities. Now, of course, the overriding emphasis is on biological information, as manifested in the mechanisms of neurophysiological reaction and communication, genetic coding, brain function, and a host of psychological parameters. To each of these phases the bioengineering, pharmaceutical, and health service communities have responded with a corresponding array of technologies, products, and applications that have had their own major cultural impacts.

The entry of these sciences and technologies into the conceptual kingdom of information brings with it two intriguing problems, neither of which has been adequately acknowledged, let alone addressed. First, there is the self-evident distinction between *objective* and *subjective* information. The former—the hard currency of information generating, processing, and representing devices of all kinds—is completely and uniquely quantifiable and, via the fundamental definitions of contemporary information science, ultimately reducible to binary digits. For example, the *objective* information contained in any given book could in principle be precisely quantified by digitizing each of its letters and every aspect of its syntactical structure, and compounding these in some logical schema. But the magnitude of the *subjective* information the book presents would still depend on the native language, cultural heritage, and degree of interest of its reader, and thus would seem to defy quantization.

Nevertheless, we seem innately driven to attempt some quantitative specification; eg, we might say, "This book is *more*

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interesting than that one," or "I have *zero* interest in it." Likewise, we might attempt to digitize the information displayed by a brilliant waterfall or a magnificient symphony in terms of the prevailing distributions of optical and acoustical frequencies and amplitudes; but in so doing we would largely fail to convey its subjective beauty or emotional impact. Nevertheless, we might try to express in pseudo-quantitative terms how much such vistas delighted us (eg, "That was even better than the last one" or "That is the finest I have ever seen"). And then, of course, there is the young child with widely outstretched arms, attempting to quantify his heartfelt emotion: "Mommy, I love you *so-o-o* much!"

Quantification of subjective information will be a major challenge to the exploding era of information. Some will contend that it should not even be attempted—that subjective experience must be categorically excluded from the purview of natural science. We think not; and neither did the brilliant philosopher, psychologist, and humanist William James[1]:

> The spirit and principles of science are mere affairs of method; there is nothing in them that need hinder science from dealing successfully with a world in which personal forces are the starting point of new effects. The only form of thing that we directly encounter, the only experience that we concretely have is our own personal life. The only completed category of our thinking, our professors of philosophy tell us, is the category of personality, every other category being one of the abstract elements of that. And this systematic denial on science's part of personality as a condition of events, this rigorous belief that in its own essential and innermost nature our world is a strictly impersonal world, may, conceivably, as the whirligig of time goes round, prove to be the very defect that our descendants will be most surprised at in our boasted science, the omission that to their eyes will most tend to make it look perspectiveless and short.

The need to include subjective information as a scientific currency is far more than an abstract philosophical issue. In a world increasingly driven by consumer reactions, political impressions, and delicate interpersonal expectations, for science to deny its immense intellectual power and cultural influence to this entire regime of common human experience would not only be irresponsible, it would be self-constraining and ultimately lead to its own *G tterd mmerung*.

Imposing as this challenge of the subjective may be, the penetration of science and technology into the forest of information will be considerably more complicated by a second problem; namely, the demonstrated capacity of consciousness to alter both subjective *and* objective elements of information. Few will quarrel with the first half of this claim. The self-evident capabilities of human consciousness to create profound subjective experiences for itself and others to enjoy via art, music, literary composition, or even via scientific and mathematical reasoning, can hardly be disputed. The sublime experiences engendered by human love and empathy qualify equally well as enhancements of subjective information for their donors and their recipients. But quantifiable alteration of the *objective* information content of a physical or biological system solely by action of an attending consciousness is far more difficult to demonstrate and vastly more controversial to discuss—yet ultimately more critical in optimally configuring our scientific resources for service and accomplishment in the information age. It is this challenge that motivates our own program of research, a few aspects of which we would like to share with you in these pages.

PEAR PROGRAM

The Princeton Engineering Anomalies Research (PEAR) program was formally established in the University's School of Engineering and Applied Science in 1979, for the sole purpose of rigorous scientific study of the interaction of human consciousness with random physical processes. The present laboratory staff comprises a compatible mixture of theoretical and experimental physicists, psychologists, and engineers, each complementing particular scientific expertise with appropriate humanistic interests. Financial support has been provided by a number of institutional and private philanthropic sources, which also have underwritten the program's efforts to stimulate broader collaborative research on consciousness-related topics within the University and around the world via such organizations as the Princeton Human Information Processing Group, the International Consciousness Research Laboratories, the Academy of Consciousness Studies, the Society of Scientific Exploration, and other less formal enterprises.

The research agenda of the PEAR laboratory itself has focused on three major areas: anomalous human/machine interactions, remote perception, and theoretical modeling of consciousness/environment interactions. Considerable technical literature on each of these programs has been published,[2] and a comprehensive review of the research, its contemporary relevance, and its broader cultural implications are presented in the book *Margins of Reality*.[3] Here we can only offer a brief sampler of these efforts and their major results.

Human/Machine Interactions

The basic protocol of these experiments requires human operators to attempt by anomalous means to influence the output of various simple machines, each of which involves some sort of random physical process. These devices are electrical, mechanical, fluid dynamical, optical, or acoustical in character; macroscopic or microscopic in scale; and digital or analog in their information processing and feedback displays. They generate data over a broad range of rates, in formats that are theoretically, or at least empirically, predictable. All are equipped with numerous fail-safe features to guarantee the integrity of the data and their freedom from artifact, and all can be precisely calibrated to establish their unattended statistical output distributions.

In all benchmark experiments the operators, seated in front

of these machines (but in no physical contact with them) and using whatever personal strategies they wish, endeavor to produce statistically higher output values, lower output values, and baseline or unaltered output values over interspersed periods of pre-stated intentions. Great care is taken in the experimental design and data acquisition to preclude any form of spurious interference with the machine operation. Therefore, any systematic deviation of these three data streams from one another can only indicate the existence and scale of the sought anomalous effect.

Over the 17-year history of the program, more than 100 operators have performed such experiments. These participants have varied greatly in personality, background, intellectual sophistication, and style of operation, but all have remained anonymous, untrained, and uncompensated for their work, and none has claimed extraordinary abilities before or after their efforts. Throughout, we have regarded these operators as research colleagues rather than subjects of study, and no psychological or physiological tests have been attempted.

Variants of the benchmark protocols that have been explored include whether the intended direction of effort is chosen by the operator or assigned by some random indicator; whether the machine runs continuously or is initiated at intervals imposed by the operator; the pace and size of the data blocks; the presence or absence of feedback, and its character; the number of operators addressing the machine; the distance of the operator from the machine; and the time of machine operation relative to the time of operator effort. As of this writing, some 50 million experimental trials have been performed, containing more than 3 billion bits of binary information. From this large body of results, the following salient features may be extracted[4]:

1. Anomalous correlations of the machine outputs with prestated operator intentions are clearly evident. These take the form of shifts of the distribution means that are statistically replicable, and quantifiable in the range of a few parts in 10,000 deviation from chance expectation, on the average. Over the total database, the composite anomaly is unlikely by chance to about one part in a billion.

2. The output mean shifts achieved by the entire group of operators range smoothly over distributions that would be expected by chance, except that the composite mean values are shifted as specified above. No outlying values, indicative of "superstar" performance, are found.

3. Several of the individual operator databases are sufficiently distinctive and replicable in their relative effectiveness of high, low, and baseline intentions, and in their responses to particular protocol variations, to constitute characteristic "signatures" of achievement.

4. Both individually and collectively, the interior structures of the distributions of anomalous mean shifts are consistent with a model wherein the elemental binary probability intrinsic in each experiment has been altered from its design value of precisely one half to slightly higher or lower values, depending on the operator, intention, and protocol.

5. The scale and character of the results are relatively insensitive to the particular random device employed. In some cases, the characteristic operator signatures are quite similar from one device to another.

6. Although few psychological or physiological correlates have been attempted, significant differences in male and female performance have been identified.

7. Two operators addressing a given experiment together do not simply combine their individual achievement signatures; rather, their "co-operator" results are characteristic of the pair. Co-operators of the same sex are less effective than male/female pairs. "Bonded" male/female pairs produce the highest scores of any operator subsets.

8. No learning or experience benefits are observed. To the contrary, operators tend to perform best over their first major experimental sets, then decline in performance over the next one or two sets, after which they recover better performance that stabilizes to their individual values over subsequent sets. These sequential patterns, termed "series position effects," are reminiscent of switching transients occurring in many physical and biological situations.

9. No dependence of individual or collective effect sizes on the distance of the operators from the machine appears in the data. Operators addressing the machines from thousands of miles away produce effect sizes and characteristic signatures similar to those that they achieve seated next to the machines in the laboratory.

10. Experiments performed "off-time" (ie, with operators exerting their intentions several hours before or after the machines actually produce their data strings) show similar effect sizes and internal characteristics to those performed "on-time" (ie, with machine operation concurrent with the operators' periods of effort).

11. Subjective reports from the most successful operators speak of a sense of resonance or bond with the machine, of surrendering their sense of identity to merge with the machine into a unified system, of exchanging roles with the machine, of "falling in love" with it, or of having "fun" with it.

From this huge array of empirical indications, it seems unavoidable to conclude that operator consciousness is capable of inserting information in its most rudimentary *objective* form—namely, binary bits—into these random physical systems by some anomalous means, independent of space and time.

Human/machine experiments similar to these have been conducted at many other laboratories, with anomalous results commensurate with our own.[5] Of particular interest to the human health arena are those few studies that have demonstrated responses from biological substances or living organisms employed as the random targets of the operators' intentions. Equally relevant are a small body of experiments in which the role of the operators has been played by other than human species (eg, chicks, rabbits, mice, etc), all of which seem capable

of influencing random electronic processors to respond to some biological or emotional needs.[6] These results, combined with further studies in our own program that demonstrate anomalous responses of portable random event generator units unobtrusively placed in various human group environments—such as religious services, sporting events, professional meetings, medical counseling sessions, or other convocations entailing some collective emotional potential[7]—confirm the ubiquitous character of these information anomalies, and broaden their potential importance to our individual and cultural welfare.

Remote Perception

In this complementary class of experiment, the "target" is not a physical device or process in a laboratory environment, but a physical scene at some remote geographical location. The goal of the human participant is not to insert information into the target, but to extract information from it by anomalous means. In the usual protocol, two participants are involved in any given experiment. One, the "agent," is physically present at the target location, which has been selected by some random process, and there immerses himself emotionally and cognitively in the scene, records its characteristics on a standard check sheet, and takes photographs of it. The other, the "percipient," located many miles from the scene and with no prior knowledge of it, attempts to perceive aspects of its ambiance and detail, then records those impressions on the same standard check sheet in some less structured narrative or sketch. The agent and percipient check sheets are subsequently digitized, and their degree of consonance is scored numerically by a variety of algorithms. The results, indicative of the amount of objective information acquired by the percipient, can then be arrayed in quantitative statistical formats similar to those used in the human/machine experiments.

Several hundred such remote perception experiments have been performed and scored, with results quite similar to those of the human/machine experiments.[8] The overall anomalous effect size is actually somewhat larger, but the interior statistical details are qualitatively much the same, and participant-specific characteristics are again evident. Most importantly, the effect sizes are again statistically independent of the distance between the percipient and the target, up to ranges of several thousand miles. They, too, are independent of the time interval between the perception effort and the agent's immersion in the target, up to several days, both positive and negative.

Studies such as these also have been performed elsewhere, albeit with somewhat different protocols and scoring methods, and similar anomalous yields have been obtained.[9] Unfortunately, there have been few controlled studies reported that employ biological systems or physiological features as targets, although some psychic practitioners will claim such abilities. Nevertheless, from our extensive body of rigorous remote perception experiments we must draw a second basic conclusion: human consciousness is able to extract information from physical aspects of its environment by some anomalous means that is independent of space and time. Although the information acquired by the percipient is originally subjective in character, it nevertheless survives the transposition to an objective, digital information form imposed by the scoring methods.

Theoretical Models

Any attempt to set forth a theoretical model to complement such experimental data in a traditional scientific dialog is an awesome epistemological task. Not only are the empirical effects keenly anomalous in the present scientific framework, but in their demonstrably participant-specific characteristics they involve important subjective parameters not readily accommodated by scientific language, let alone by scientific formalism. Beyond this, the results are inescapably hyperstatistical, ie, they involve a folding of the personal and collective statistical variations in participants' performances with the normal statistical behavior of the physical systems. Also, the series position sensitivity of the results, along with the lack of superposability of individual operator effects in co-operator experiments, imply strong nonlinearities in the underlying mechanisms. On the psychological side, a number of the empirical results indicate that unconscious as well as conscious processes may be involved, and very little theoretical framework for the former is available. Finally, the demonstrated lack of dependence of the phenomena on distance and time will strain any model rooted in classical physical theory.

Given all of this, it is essential to approach the modeling task at a rudimentary level. To begin, we might reiterate the four generic ingredients that pervade all of the research outlined above:

- *a random process or system* such as a machine driven by some random physical process, or an array of physical details embodied in a randomly selected geographical target
- *consciousness* of the operators, percipients, and agents, acting under some intention, volition, or desire
- *information,* coded in binary form, being added to, or extracted from, the random system
- *a resonance,* or bond, or sharing of identity between operator and machine, percipient and agent, percipient and target, or two operators that facilitates the information transfer between the consciousness and the random system in some lighthearted, game-like context

It also may be useful to note that these are just special cases of the more general ingredients that characterize virtually any form of creative human experience:

- *an environment or context* that provides raw material for the creation
- *a consciousness* driven by some intention, purpose, or desire
- *information* flowing between the consciousness and the pertinent environment
- *a resonance* between the consciousness and the environment that nurtures the creative task, be it artistic achievement, athletic performance, or simple creative rumination on any subject

In other words, the narrow range of consciousness-related anomalous phenomena we have been studying may be an indicative microcosm of a much broader genre of human capacity—the capacity to create, to order, or to heal. Thus, in attempting to model our empirical data, we may in fact be modeling the essence of human creative experience.

On the basis of our earlier crude catalog of the science of information, it follows that any model we erect to represent consciousness must encompass all four quadrants of its active and proactive, objective and subjective interactions with the physical world. Substantial bodies of established theory addressing some elements of this matrix exist, but unfortunately they do not communicate well with one another, and they leave major gaps in the coverage. For example, modern science is replete with objective, reactive models of the physical world, most of which have been well confirmed empirically. For our purposes, the formalisms of statistical mechanics, information theory, and quantum mechanics seem most apt, and we indeed invoke them heavily in our model. Objective models of consciousness also abound in the regimes of cognitive psychology and neuroscience, albeit in less precise formats than their physical counterparts, and some reference to these also can prove useful. But on the subjective side of the matrix our reservoirs of established models stand very shallow. Physical science has virtually nothing to say about subjective experience and, with the possible exception of the observational interpretations of quantum mechanics, acknowledges no proactive role for human participants. The situation is little better in the psychological and neurophysiological sectors, where subjective and proactive aspects of the psyche have seldom been treated in other than vague qualitative terms. One might hope that the troubled history of scholarly parapsychology or the clinical practice of psychiatry might contain some useful empirical experience, conceptualization, and nomenclature, but quantitative modeling has rarely been attempted in either field. Thus, our theoretical task becomes much more than redeployment of established models; major increments in concept, as well as in structure, will be required.

Very briefly, our strategy has been to appropriate the one form of existing physical theory that acknowledges human observation, however obliquely—namely, the so-called "Copenhagen" interpretation of quantum mechanics—and to extend its concepts and formalisms to include consciousness much more broadly and explicitly. We thereby attempt to extend what has been termed the "physics of observation" into a "physics of experience." The main postulates of this model, which are developed in detail in the references,[3,10] may be summarized:

1. Like elementary particles (a form of matter) and physical light (a form of energy), consciousness (a form of information) enjoys a wave/particle duality that allows it to circumvent and penetrate barriers and to resonate with other consciousnesses and with appropriate aspects of its environment. Thereby it can both acquire and insert information, both objective and subjective, from and to its resonant partners, in a manner that would be anomalous to its "particulate" representation.

2. The celebrated quantum mechanical principles of "uncertainty," "exclusion," "correspondence," "complementarity," "superposition," "indistinguishability," etc—all of which are inexplicable in classical scientific terms—are at least as characteristic of the consciousness as of the physical systems and processes with which consciousness interacts. Manifestations of these transposed "consciousness principles" can readily be noted in a broad range of human activities and relationships.

3. The traditional objective properties and coordinates of physical theory—distance, time, mass, charge, momentum, energy, and so on—can be generalized to encompass corresponding subjective concepts, of which the objective versions are just special cases, more rigidly defined for analytical purposes.

4. The composite theory is not a model of consciousness per se, nor of the physical world; rather, it is a model of the experiential products of the interpenetration of an otherwise ineffable consciousness into an equally ineffable environmental surround.

Using such a perspective and vocabulary, it is possible to erect various consciousness "structures" and interactions, using essentially the same formalistic approach as does quantum physics. For example, consciousness "atoms" may be assembled wherein the experiences of an individual are represented by patterns of standing waves, akin to the bound electronic configurations of the hydrogen atom. With these consciousness atoms thus defined, their combination into consciousness molecules may also be undertaken. This bonding process, which is classically inexplicable even in physical situations, is a particularly illuminating format for representation of the anomalous operator/machine and percipient/target interactions described earlier, and for broader comprehension of many other consciousness-related phenomena as well. For example, in the physical regime, when the wave patterns of the valence electrons of two atoms come into close interaction, they cannot be distinguished in any observable sense. This loss of identity or information, when properly acknowledged in the quantum mechanical formalism, leads to an "exchange energy" that is the basis of the molecular bond. (This process is an excellent example of the equivalence of energy and information mentioned earlier.) Our metaphor would thus predict that an individual consciousness immersed in a given environmental situation would sustain a set of characteristic experiences.

A second individual, exposed to the same situation, would manifest a different set of experiences. However, if these two consciousnesses were strongly interacting, their experiential wave patterns would become resonantly intertwined, resulting in a new pattern of standing waves in their common environment. As demonstrated in the co-operator experiments described earlier, these "molecular" experiences may be quite different from the simple sum of their "atomic" behaviors, and if we insist on comparing them with such, they will appear anomalous. In their own properly constituted molecular context, however, they are quite normal and, in principle, predictable.

Even our individual operator/machine effects may be addressed in this fashion if we are willing to concede some form of "consciousness" to the machine—in the sense that it, too, is a system capable of exchanging information with its environment. Thus, a bonded operator/machine system should not be expected to conform to the isolated operator and isolated machine behaviors, but to establish its own characteristic behavior. Viewed as an influence of one system (the operator) upon another (the machine), the empirical results are inexplicable within the canonical behaviors of the isolated systems; viewed as a process of wave-mechanical resonance between two components of a single interactive system, they behave quite appropriately. Otherwise put, the surrender of subjective identity implicit in the human/machine bond is manifested in the appearance of objective information on the digital output string; the entropy of that string has literally been reduced by its involvement with a human consciousness.

Such a model can also be applied to the remote perception effects in terms of a resonant bond between the percipient and the agent that enables the "anomalous" acquisition of information about the prevailing physical target environment in which both are emotionally immersed. Alternatively, one might pose the "molecular bond" between the percipient and the target scene, with the agent assigned the role of establishing a facilitating environment for the anomalous communication between the two. In either representation, the merging of subjective identities again enables the transfer of objective information, in this case manifesting as a coherence between the agent and percipient response forms.

This concept of resonance as a mechanism for introducing order into random physical processes may also be a viable model for comprehending other equally "anomalous," if somewhat less provocative, processes such as artistic, intellectual, or biological creativity; or human trust, hope, or affection. That is, the essential mechanisms of these processes may devolve from the same principle of indistinguishability, whereby the surrender of information distinguishing the two interacting subsystems within a single complex system translates into an increment in the structural strength of the bonded system. Thus, when the perceived boundary between consciousness and its environment is permeated via subjective merging of the "I" with the "Not I," the resultant bonded system may manifest alterations in both the physical environment and the consciousness in some consequential way. If this resonance entails a volitional or intentional component, be it conscious or unconscious, the bonded system will reflect that intention in a manner unique to the particular "molecule." Our experimental results suggest that, whereas the scales of these effects may be marginally small and impossible to identify on a trial-by-trial basis, they nevertheless can manifest in significant probabilistic trends accumulated over large bodies of experience.

From all of this emerges the intriguing possibility that what we denote as "chance" behavior in any context, rather than deriving from some ultimately predictable, fully mechanistic behavior of a deterministic physical world, is actually some immense subsumption of a broad distribution of potentialities reflective of all possible resonances and intentions of consciousness with respect to the system or process in question. Sir Arthur Eddington[11] proposed the possibility in only slightly different terms:

> It seems that we must attribute to the mind power not only to decide the behaviour of atoms individually but to affect systematically large groups—in fact to tamper with the odds on atomic behaviour.... Unless it belies its name, probability can be modified in ways in which ordinary physical entities would not admit of. There can be no unique probability attached to any event or behaviour; we can only speak of "probability in the light of certain given information," and the probability alters according to the extent of the information.

IMPLICATIONS FOR HEALTH

What has all this to do with the third element in our title—human health? Without question, the most magnificent of all information acquisition, processing, and generation systems is the human consciousness. It handles both objective and subjective information with an elegance and sophistication that no contemporary data processor or controller can approach. Likewise, the most magnificent of all communication and response systems is the human physiology. From its most basic atomic and molecular structure, through its DNA and RNA macromolecules, to its proliferate physical, chemical, and biological networks, it handles all manner of objective and subjective information via a plethora of processes that invariably involve certain random components. Many physiological malfunctions and diseases including allergies, the HIV spectrum, cancer, and various neurological aberrations are directly attributable to some "disorder" of such simple and complex information processors. When functioning properly, however, both the consciousness and the physiological corpus are past masters at exchanging information with their external environments, allowing themselves to learn from, and adjust to, the latter.

But doubtless the most intimate of all systemic resonances is that between the physical body and its associated consciousness, given how heavily each is committed to the other for sustenance, safety, and challenge. Through an amazing array of hard-wired, soft-wired, and—in all likelihood—wireless connections and activators, the mind and body have elaborate options for guiding, protecting, and providing for each other to the higher welfare of the whole. The most primordial of needs—to eat, sleep, survive, and procreate—dominate the limbic brain and propagate throughout the basic organism. But also various subtler health aspirations—to be strong, attractive, alert, and intelligent—are physiological drivers imposed by conscious or subconscious volition on its compatriot corpus.

If, as we have demonstrated, consciousness, via its own expressed desire, can bring some degree of order into a simple

random string of ones and zeros emerging from a rudimentary electronic machine, is it so unreasonable to suspect that it can invoke similar, or subtler, processes to influence the far more elaborate, relevant, and precious information processing systems that underlie its own health?

If we accept this proposition, what then are the requisite strategies for activation of the process? Once again, the four critical ingredients are available to us: (1) the consciousness, now addressing, with volition, (2) its own physical body, or that of another partner, into which it instills (3) some form of beneficial information or order via (4) an appropriate resonant bond. It thus remains only to specify and achieve this last criterion, the appropriate resonant bond, that enables the anomalous information transfer. This issue was debated at some length in *Margins of Reality,* converging onto the following recipe:

> To achieve such bonds, whether in physical or consciousness space, it is first necessary to acknowledge that there are distinct partners. That distinction established, however, the individual identities must then be at least partially surrendered to a bonded state if the exchange energy is to be activated. Thus, successful strategy for anomalies experimentation involves some blurring of identities between operator and machine, or between percipient and agent. And, of course, this is also the recipe for any form of *love:* the surrender of self-centered interests of the partners in favor of the pair.[3(p343)]

Love! Even by the most rigorous scientific experimentation and analytical logic, it appears that we have come upon nothing less than the driving force of life and of the physical universe: Love, with a capital L—the same overarching force of creative existence long recognized in virtually every other scholarly discipline and in every other cultural age; the same force heralded by the philosopher Rollo May[12] ("For in every act of love and will—and in the long run they are both present in each genuine act—we mold ourselves and our world simultaneously") and by the incomparable theologian Teilhard de Chardin[13] ("Someday, after we have mastered the winds, the waves, the tides and gravity, we shall harness for God the energies of love. Then for the second time in the history of the world, man will have discovered fire"). It is the same force that St John names in his first Letter: "God is Love"[14] (which, in our scientific context, appears to be equally valid when stated in the reverse order).

The entry of this fourth currency of Love into the scientific exchequer may at first seem radical and revolutionary, but even here we find some rare earlier hints of the same universal insight, none better than that of Prince Louis de Broglie,[15] consummate scientist, renaissance man, and patriarch of modern physics:

> If we wish to give philosophic expression to the profound connection between thought and action in all fields of human endeavor, particularly in science, we shall undoubtedly have to seek its sources in the unfathomable depths of the human soul. Perhaps philosophers might call it "love" in a very general sense—that force which directs all our actions, which is the source of all our delights and all our pursuits. Indissolubly linked with thought and with action, love is their common mainspring and, hence, their common bond. The engineers of the future have an essential part to play in cementing this bond.

I doubt that de Broglie would have hesitated to apply this exhortation to the healing professions as well, or to each of us individually who yearns for greater physical, mental, and spiritual health. Careful application of scientific knowledge and rigor of method, within a permeating atmosphere of "love in a very general sense," is a powerful plan for relating thought to action in any technical arena, not least of all the arena of health. In essence, then, the *scientific* message is this:

> In loving ourselves, we can heal ourselves. In loving the world, we can heal the world.

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