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ENDOPHYSICAL MODELS BASED ON EMPIRICAL DATA

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Abstract: Any proposed endophysical models need to acknowledge a number of subjective correlates that have been well established in such objectively quantifiable experimental contexts as anomalous human/machine interactions and remote perception information acquisition. Most notable of these factors are conscious and unconscious intention; gender disparities; serial position effects; intrinsic uncertainties; elusive replicability; and emotional resonance between the participants and the devices, process, and tasks. Perhaps even more pertinent are the insensitivities of the anomalous effects to spatial and temporal separations of the participants from the physical targets. Inclusion of subjective coordinates in the models, and exclusion of physical distance and time, raise formidable issues of specification, quantification, and dynamical formulation from both the physical and psychological perspectives. A few primitive examples of possible approaches are presented.

Keywords: Consciousness-Related Anomalies – Empirical Evidence – Subjective Correlates – Theoretical Models

1 Perspectives

Perusal of the relevant literature, and indeed of the abstracts and theme statement of this conference, suggests that the concept of "endophysical" has yet to be precisely defined, thereby entitling, or perhaps even obliging, each fresh author to specify his particular usage of this terminology. In our case, as developed in more detail in several earlier publications [1,2,3], we posit an unobservable, perhaps ineffable, possibly even inconceivable, understructure of experiential reality, wherein logic retreats to abstraction, and common distinctions of spatial/temporal, material/mental, external/internal, blur into a miasma of pre-information and pre-experience that is the ultimate source of all physical expression and mental impression, both objective and subjective. In its response to physical experiments, this source yields objectively specifiable phenomena that can be represented by exophysical models that in general have proven extraordinarily effective and self-consistent. But as encountered in personal subjective experience, this same source presents a number of endophysical deviations from the exophysical expectations, most notably concerning the passage of time, quantum entanglement, subjectivity itself, and the consciousness-related anomalous physical phenomena we shall describe herein.

It is our conviction that attempts to reconcile such disparities via a more expansive conceptual framework can benefit from careful assessment of those experiments in which both material and mental, objective and subjective parameters play demonstrable roles. In particular, we should study those situations wherein subjective properties attending the involvement of human consciousness are found to correlate with objectively definable and measurable alterations in physical behavior, especially when those correlations are inexplicable in terms of prevailing exophysical models. Much as Freud invoked dream evidence as his "royal road to the unconscious," consciousness-related physical anomalies may help us to circumscribe our conception of the ontic regime from which these, and all other epistemic material and mental events emerge, and thereby to reconcile the exophysical/endophysical dilemmas.

Before setting foot on this road, we also should specify that in our usage, the term "consciousness" is intended to subsume all manner of mental process, both conscious and unconscious; logical, emotional, and spiritual; local and collective; human and non-human; and is by no means restricted to biological brain function or even to the full neurophysiological response system. As we shall later contend more explicitly, the hierarchical span of the character and manifestations of consciousness is every bit as extensive and replete as that of the physical world in which it operates. In short, it encompasses all of the first half of the "self/not-self" dichotomy that underlies the endophysical/exophysical distinction.

From these perspectives, then, let us offer the following illustrative review of some potentially indicative experimental data. Given the breadth of scholarly backgrounds, familiarity with this class of research in general and with our PEAR program in particular, and the *a priori* personal convictions regarding the topic that prevail in this audience, no single style of brief presentation can hope to be uniformly effective. Rather, we must sacrifice depth for breadth, and rely on referenced publications to flesh out details as befits individual interests.

2 The PEAR Program [4,5]

The Princeton Engineering Anomalies Research program was established in 1979 in the School of Engineering and Applied Science at Princeton University, for the purpose of systematic study of a selection of consciousness-related anomalous physical phenomena that had for many years been reported in the scientific and anecdotal literature, and that seemed to be of growing potential pertinence to contemporary and future information-processing technologies. As its title implies, it is intended as an academically based, engineering oriented, rigorously scientific research enterprise, aspiring to increasing basic understanding of the fundamental processes contributing to the anomalous effects, their implications for various scholarly disciplines, and their potential practical applications. Over its more than a quarter century of activity, the program has involved a number of interdisciplinary professionals, interns, students, support staff, visitors, and hundreds of volunteer operators. Its results have been presented in some fifty archival publications, and in a comparable number of more detailed technical reports. Our website (www.princeton.edu/∼pear/) presents a more comprehensive review of the history, style, and program of the laboratory, along with a full list of publications, many of which can be downloaded.

From its inception and throughout its subsequent history the research agenda has comprised three interrelated topics: a) anomalous human/machine interactions; b) remote perception; and c) theoretical models. Here we shall focus primarily on the first, with passing attention to the other two.

3 Human/Machine Interactions

Over the course of the program, scores of simple physical devices have been deployed as targets for interaction with our human operators. Most of these have been electronic in character, but others have been mechanical, optical, acoustical, or fluid mechanical in nature. All entail some form of random physical process which can be conditioned into an output string of binary digits, the expected combinatorial distributions of which are theoretically calculable and/or empirically calibratable. All are replete with a variety of failsafes and controls that guarantee their integrity against artifact or tampering, and only mature technologies are employed. Differential technical logic, protocols, and analyses are used throughout to protect the measurables from any spurious drifts or environmental contaminations.

3.1 Electronic random event generators

As a specific example of this class of experiment, consider our benchmark microelectronic random event generator (REG) whose primary noise source is a commercial unit utilizing a back-volted solid-state junction, *i.e.*, is based on electronic noise. Conditioning of this source into an output string of randomly alternating, regularly spaced positive and negative pulses suitable for prescribed counting, and their accumulation into essentially Gaussian frequency-of-count output distributions are detailed in several references [6,7,4].

The basic protocol calls for a human operator, seated in front of such a machine but in no physical contact with it, to attempt, via some mental strategy alone, to alter the output distributions in a pre-specified fashion. Usually this is simply to shift the mean from its chance expectation to a higher value (HI), to a lower value (LO), or to exercise no intention, *i.e.*, to generate a baseline (BL). For all of the data reviewed here, the REG devices were set to produce "trials," each comprising 200 binary samples (*i.e.*, bits), accumulated at a rate of 1000/sec, for which the chance expected mean $\mu = 100$ and standard deviation $\sigma = 7.071$.

Fig. 1 displays the collective results of some 125,000 trials per intention, achieved by one of our most productive operators over many years of such experimentation, arrayed as cumulative deviations of count distribution means from the chance expectation. For each of the pre-recorded directions of effort, we find a corresponding secular progression superimposed on the stochastic background noise intrinsic to the binary combinatorial process. The overall HI $-$ LO separation is unlikely by chance to the order of 10^{-8}. (In this representation, the reference parabolas denote the loci of 0.05 chance probabilities for the cumulated data.)

Questions of the replicability and commonality of such anomalous effects, and the identification of their most salient correlates have been major foci of our experimental efforts for nearly three decades, and even now no unequivocal specifications can be made. On the one hand, we have had a few operators who have maintained consistently impressive performances like that illustrated in Fig. 1 over long periods of effort. Others have shown less consistent patterns of achievement. Many have not exceeded chance expectation, and a few have persisted in anti-correlations of their results with their stated intentions. Nevertheless, when the performances of all 91 operators who have participated in these benchmark experiments are concatenated into a composite cumulative deviation record, the overall HI $-$ LO separation is still unlikely by chance to the order of 10^{-4} (*cf.* Fig. 2).

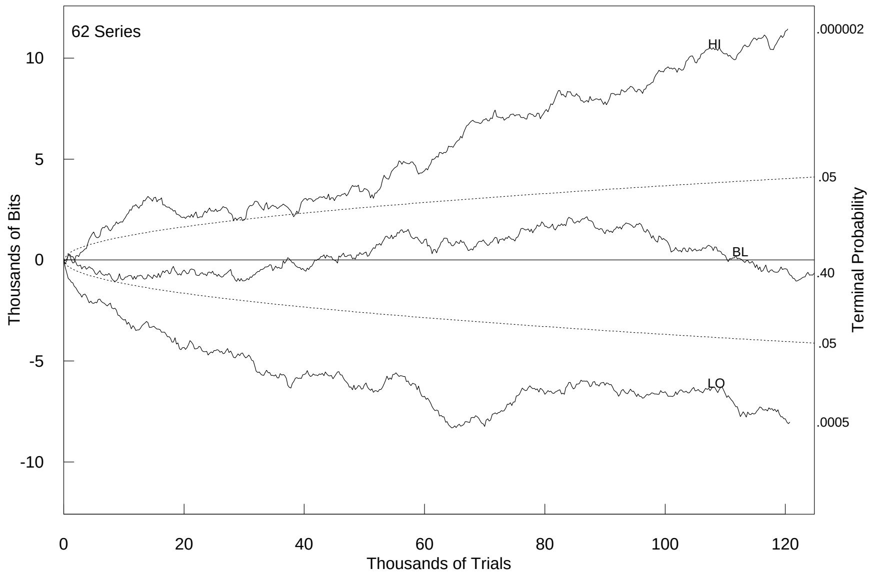

Figure 1. Cumulative deviations of REG mean shifts achieved by one operator over some 375,000 experimental trials.

Unattended calibration data taken concurrently with these active experiments show no significant departures from chance expectation.

Since these collective data include a wide variety of individual operator database sizes, a more instructive display of the composite pattern of operator performance can be made by plotting the individual HI − LO differences in mean shifts achieved *vs.* the square root of the number of trials performed by that operator (*cf.* Fig. 3). In this format, the loci of statistical significance levels are nested hyperbolas like those shown, with respect to both the chance mean and the composite shifted mean. The deduction from such an array is that the overall effect is not attributable to any particular "superstar" operators, but rather to a subtler combination of incremental effects over the group as a whole, particularly those "prolific" operators who have provided us with very large datasets.

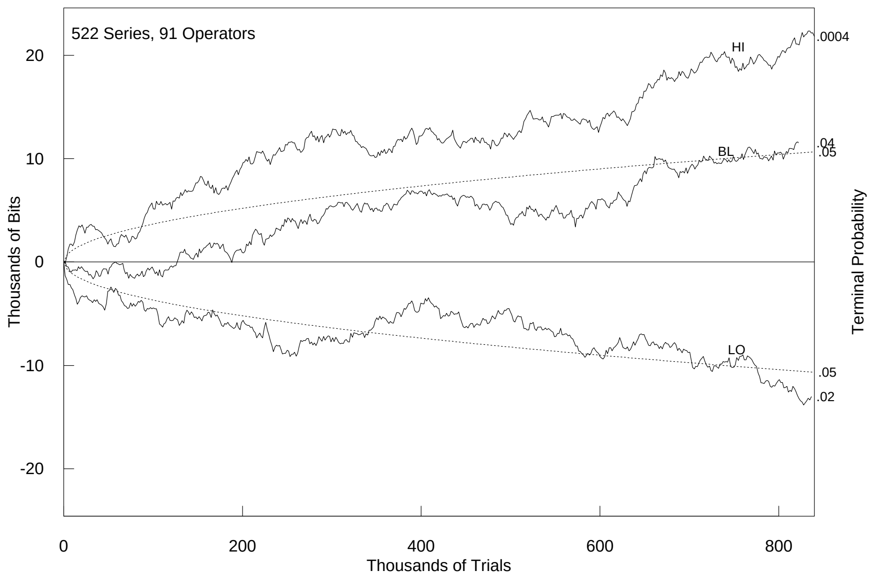

Figure 2. Cumulative deviations of REG mean shifts achieved by all 91 operators comprising a database of some 2.5 million trials.

3.2 Gender effects

Major experimental attempts have been made to establish primary correlates of such anomalous effects, with some definitive, albeit surprising results. For example, beyond the evident statistical correlations with the pre-stated intentions of the operators, a strong gender disparity in their performances also emerges from the overall database. In Fig. 3, for example, male and female operators are designated by different symbols. Clearly these do not comprise the same distributions. Rather, the modestly significant male mean shift is achieved by a relatively symmetrical and smooth distribution; in contrast, the larger female mean shift is driven by a few prolific operator positive results, diluted by a host of smaller datasets, many of which are opposite to intention.

This stark "gender effect" can be statistically quantified by an elementary analysis as presented in Table 1, which breaks out the Z-scores of the HI − LO mean-shifts (Z_Δ), the operator performance scatter with respect

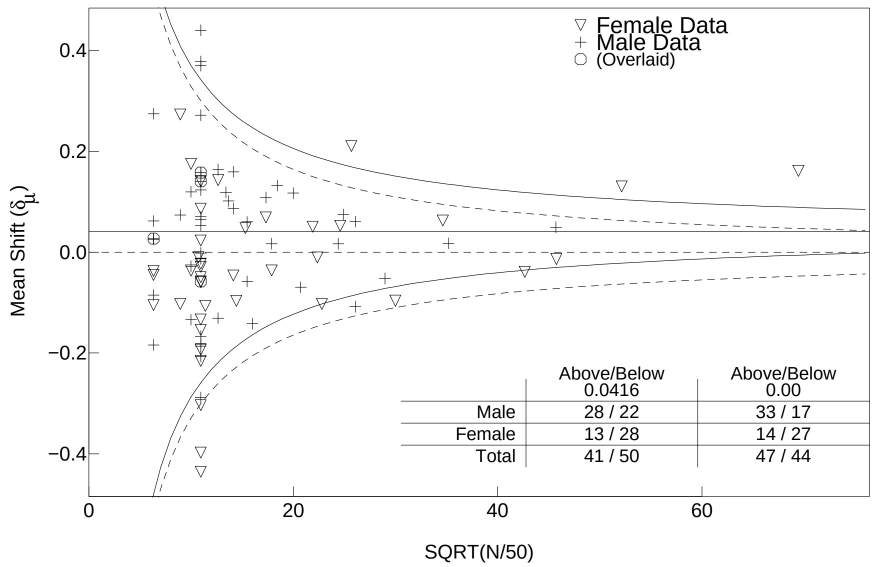

Figure 3. HI − LO mean shift separations achieved by 91 individual operators *vs.* their database sizes.

to the chance mean (χ^2_Δ) and with respect to the shifted mean ($\hat{\chi}^2_\Delta$), for various permutations of All/Male/Female, prolific/non-prolific operator pools. The corresponding chance probabilities (p) are computed by comparisons of χ^2_Δ and $\hat{\chi}^2_\Delta$ with the number of operators (N_o), or with ($N_o - 1$), respectively. Clearly the anomalous mean shift of the "All" database is driven primarily by the prolific female operators, who also scatter their individual results, both with respect to the chance mean and with respect to the shifted mean, to an extraordinary degree. By these same criteria, the male performance, although milder, is much more consistent with intention.

Similar gender disparities appear in many of our other human/machine experiments. In general, we have repeatedly found that although the female operators tend to provide larger individual databases, the males display significantly stronger correlations of mean shifts with their prerecorded high and low intentions, relatively symmetrically displaced with respect to their baseline results. The female data, in contrast, feature larger effect sizes, albeit strongly asymmetrical and poorly correlated with intention,

Table 1. HI − LO REG Data, by Operator Groups.

	N_o	$Z_\Delta(p)$	$\chi^2_\Delta(p)$	$\hat{\chi}^2_\Delta(p)$
All	91	3.81 (7×10^{-5})	124.50 (.01)	109.99 (.07)
Males	50	1.87 (.03)	44.85 (.68)	41.33 (.77)
Females	41	3.38 (4×10^{-4})	79.66 (3×10^{-4})	68.22 (.0036)
Prolific	20	4.15 (2×10^{-5})	63.85 (2×10^{-6})	46.64 (4×10^{-4})
Non-prolific	71	0.57 (.28)	60.65 (.80)	60.32 (.79)
Prolific males	9	0.70 (.24)	7.36 (.60)	6.86 (.55)
Prolific females	11	4.54 (3×10^{-6})	56.49 (4×10^{-8})	35.87 (9×10^{-5})

and larger score distribution variances. Since no such gender differences appear in experiments that yield null overall results, it appears that the successful experiments comprise both of these classes of response superimposed, *i.e.*, that the data have a substantial interior structure that reflects operator gender [8].

The relevance of the gender factor has also been reinforced by bodies of *ad hoc* experimental data produced by pairs of operators working in concert. In these "co-operator" studies, it has been found that two operators of the same sex tend to produce results indistinguishable from chance, or even slightly opposite to intention. In contrast, operators of opposite sex tend to produce positive effects significantly larger than chance, indeed substantially larger than those characterizing the same individual operators working alone. Yet more striking has been the observation that if the opposite-sex partners are emotionally involved ("bonded pairs"), their collective effect sizes are nearly an order of magnitude larger than those attained by the single-operator pools [9].

3.3 Serial position effects

Additional subjective correlates have also emerged from these and other databases. Particularly notable is the dependence of operator performance on the number of major encounters with the particular experiment, usually indexed in terms of completed "series" of trials (typically 1000–5000 trials in each direction of attention, depending on the particular experiment). A substantial retrospective analysis of prolific operator effect sizes over the larger datasets has revealed clear correlation with the ordinal positions of the experimental series, in both the collective and individual results. Specifically, there are statistically significant tendencies for operators to produce better scores in their first series, then to fall off in performance in their second and third, and eventually to recover to some intermediate levels during their fourth, fifth, or subsequent series. Such correlation appears in both local and remote experiments and is also indicated over a sequence of other experimental protocols, but no such effects appear in the baseline or calibration data [10]. Survey of standard psychological literature indicates that similar patterns have been identified in more conventional experiments on perception, cognition, and memory, suggesting that our anomalous serial position effects are primarily psychological in origin, and may subsume the rudimentary 'decline,' 'primacy,' 'recency,' and 'terminal' effects propounded in the parapsychological and psychological literature.

3.4 Space and time dependence

Additional subjective correlates will be mentioned in a subsequent context, but here we should move on to address a number of objectively specifiable (*i.e.*, exophysical) correlates that are conspicuously absent. Most notable by far is the statistical independence of the anomalous effect sizes on physical distance and time [11]. A large body of REG data has been accumulated in a protocol variant wherein operators have attempted to influence the outputs at progressively larger separations from the machine, *e.g.*: from an adjacent room; from local sites up to a few miles away; or from global distances. The effect sizes achieved in these experiments show no statistical dependence on this physical separation; *i.e.*, the operators appear to be as successful in shifting the means of the output distributions from thousands of miles away as they are in the proximate experiments. Beyond this, individual prolific operators seem to produce similar patterns of performance in their local and remote efforts. Even more striking is the independence of the results on temporal separations of the operator efforts from the times of machine operation, up to plus or minus several days. In other words, the operators also appear to be able to achieve substantial shifts in the machine output distributions by exerting their intentions well before, or well after, the actual data generation. Although the smaller sizes of these "remote" and "off-time" databases somewhat restrains their statistical significance, the effect sizes are comparable with, in some cases even larger than, those established in the local experiments.

3.5 Source dependence: random mechanical cascade

A second reasonable exophysical parameter to explore for possible correlations with the anomalous effects is the character of the machine itself, or alternatively the nature of the random physical process embodied in that machine. As mentioned, our experiments have utilized a wide range of such sources: microscopic and macroscopic; electronic, mechanical, optical, acoustical, and fluid dynamical; physically random and pseudorandom; all entertaining a variety of protocols, feedback modalities, and bit processing rates. Here again, with the possible exception of some of the pseudorandom sources, we have found little sensitivity of the anomalous effect sizes to the specific character of the machines on which they are achieved, or to the particular protocol variants.

Perhaps the most extreme example of this ubiquitous nature of the effects has been demonstrated on a large mechanical facility known as a Random Mechanical Cascade (RMC)[12]. Based upon a common statistical demonstration device known as "Galton's Desk," this machine allows 9000 polystyrene balls to drop through a quincunx matrix of 330 pegs, scattering them into 19 collecting bins with a population distribution that is approximately Gaussian. As the balls enter the bins, progressive counts are accumulated photoelectrically, displayed as feedback for the operator, and recorded on-line. Operators attempt to shift the mean of the developing distributions to the right or left, relative to a proximately generated baseline distribution. As displayed in Fig. 4, the overall mean difference of right versus left efforts concatenated across a total database of 87 series (1131 runs per intention), has a probability against chance of $<10^{-4}$, with 15% of the individual series significant at $p < .05$, and 63% conforming to the intended directions. Prolific operator achievements tend to compound marginally but systematically in cumulative deviation patterns characteristic of the particular individuals and, in several cases, similar to those produced by the same operators in microelectronic Random Event Generator (REG) experiments. Again we find stark gender disparities between the female and male performances, which lead to an asymmetry in the overall patterns of the differential effects, virtually all of which is attributable to the female operators. Here too, the anomalous effects appear in comparable magnitude in remote and off-time variants of the experiment.

These and similar results acquired from other random processors thus suggest that whatever the fundamental nature of these anomalous effects may be, it functions not so much in the technical dynamics of the sources, *per se*, but in the statistical patterns of information they generate out of the otherwise random backgrounds, and therefore it is with these patterns that the minds of the operators, themselves functioning as information processors, must be interacting. That the former category of information can be specified objectively, whereas the latter clearly involves subjective aspects, must complicate any attempts to model the phenomena, but therein lies their essence.

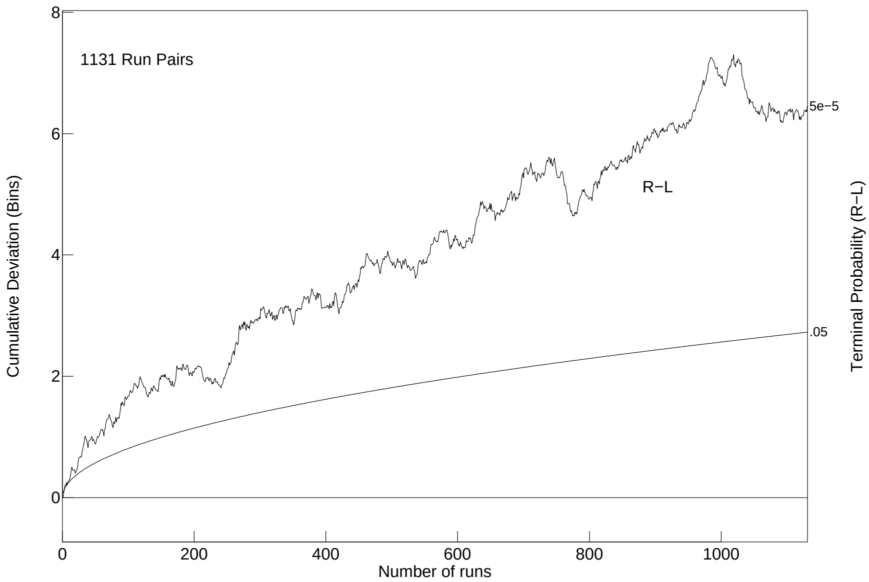

Figure 4. Cumulative right minus left mean shifts achieved on a Random Mechanical Cascade (RMC).

3.6 Composite results

To summarize these, and many other laboratory-based human/machine experiments we have performed, the overall chance probability of the results compounded from more than 1000 separate experimental series is less than one part in 10^{-12} ($z > 7$), with an overall average effect size of the order of 10^{-4} bits deviation/bit processed [7]. The primary correlate of these effects is the pre-stated intention of the operators; secondary correlates include operator gender, serial position of the effort, and two other subjective factors to be discussed below: resonance and perceived uncertainty. Notably absent as correlates are physical distance, time, and specific characteristics of the target machines.

4 FieldREG Studies and the Role of Resonance

Beyond the explicitly demonstrated correlations of the anomalous REG data with operator intention, gender, and serial position, another subjective property has frequently projected itself anecdotally to equal importance, namely emotional resonance. Akin to the ineffable harmony one can enjoy with a friend or loved one, with an automobile or computer, with a musical instrument or delicate tool, it has been widely testified by our operators that a similar affection or involvement with the experimental devices and tasks can facilitate the desired effects. The superior results achieved by the bonded co-operators also suggest the efficacy of this quality in the experimental environment. In an effort to explore this correlate more systematically, we have implemented an adjacent experimental program to address the role of such subjective resonance in the anomalous creation of objective information. It is called "FieldREG"[13,14].

These studies utilize miniaturized versions of our conventional REGs ("microREGs") that are sufficiently compact to allow their deployment in a variety of group environments, such as ritual ceremonies, artistic performances, sporting events, business meetings, diagnostic and therapeutic counseling, *etc.* From such field applications, it appears that those venues that engender strong collective resonance among the participants show larger deviations of the REG output sequences from chance expectations than those generated in more pragmatic or mundane assemblies. In fact, as illustrated in Fig. 5, while FieldREG units deployed in the "resonant" venues display much noisier than chance displacements of their digital output strings, at a collective χ^2 level of chance probability of 3.2×10^{-10}, those immersed in the "mundane" environments actually yield quieter traces than expected by chance. While these experiments are still ongoing, we now have in hand a substantial database of several hundred such applications, large enough to assure that the observed results are not attributable to statistical artifact, and that much is to be learned by further systematic research.

The analytical and theoretical complexities posed by these FieldREG studies are quite severe. Although the importance of resonance as a complement to conscious intention in stimulating the anomalous effects seems well established, more detailed interpretation of the data records in terms of the various possible statistical indicators that might be applied to the direction and endurance of the anomalous excursions is not yet secure. Beyond that, the establishment of a database-management system that can effectively index and correlate all of the subjective and objective parameters that might conceivably bear on the form and magnitude of the anomalous responses is a major enterprise in itself. All of these interpretive challenges notwithstanding, the vision of a technology, however subtle and complex, that could reliably sense the degree of coherent purpose and productive

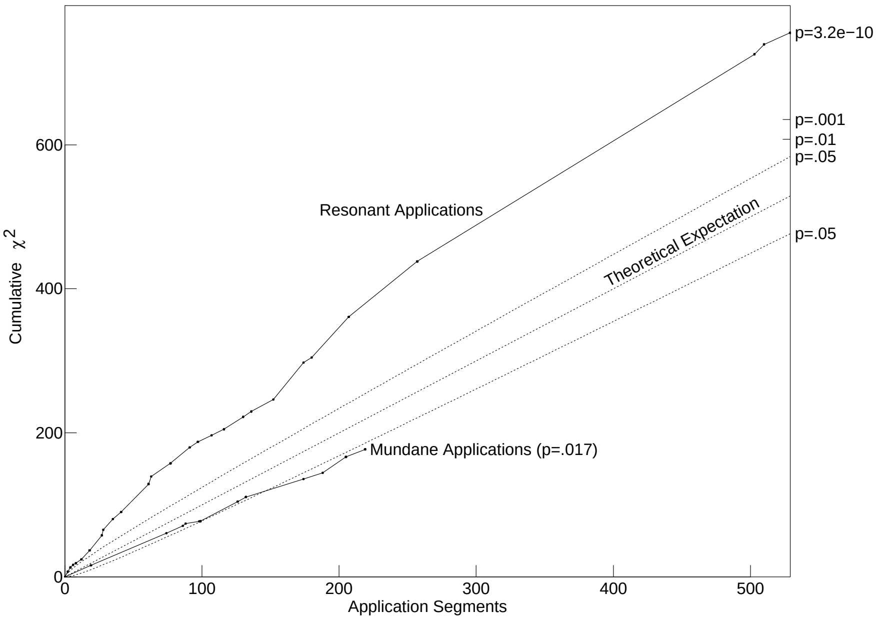

Figure 5. Cumulative χ^2 values for "resonant" and "mundane" FieldREG applications, compared to chance expectations.

resonance prevailing in such diverse arenas of human dynamics as business and industry, healthcare, education, athletics, artistic performance, and creative scholarship, among countless others, and lead to beneficial applications therein, seems to justify unlimited effort to bring to fruition.

The possible psychological implications of the intention/resonance complementarity may also be pertinent to ongoing attempts to model the phenomena. In the laboratory experiments, intention primarily implies mentation at a conscious level, although there are some indications even here of unconscious processing, *e.g.* in the generation of aberrant baselines, or in the anti-correlations of certain operators' performance with their stated intentions. Resonance, on the other hand, especially in the FieldREG situations, would seem largely to be an unconscious or visceral process, stimulated by the emotional character of the prevalent environment. The dynamical relationship between these two qualities of consciousness may be pertinent to the emergence of the anomalous (exo)physical effects, and therefore to the conceptualization of models to represent them.

5 Remote Perception

Space will not permit any adequate review of the second major portion of the PEAR program that we term "Remote Perception" (elsewhere labeled "remote viewing," or more traditionally, "clairvoyance"), other than to note that our experimental efforts here have replicated the successful work of many others over recent decades [15,16,17,18], and that our particular contribution has been to develop and apply analytical methods to quantify the degree of extra-chance information acquired using such experimental techniques. Briefly, the basic protocol of these experiments involves one participant, termed the "percipient" who, without resort to any conventional sensory means, attempts to perceive and describe a randomly selected geographical site at which a second participant, the "agent," is stationed at a given time. Both participants then render their descriptions of the scene into free response transcripts, and subsequently into various descriptor specifications which then may be compared via an assortment of computerized scoring algorithms developed to quantify the degree of information acquisition [19]. The principle findings of this extensive experimental and analytical effort have been the following:

(i) For the database of 653 formal experimental trials performed over several phases and modalities of the program, the cumulative extra-chance information acquired reaches a statistical Z-score above 5.4 ($p < 3 \times 10^{-8}$).
(ii) The experimental success is not notably dependent on any of the secondary protocol parameters tested, *e.g.* volitional *vs.* random target selection; target categories and characteristics; diurnal or seasonal aspects; single or multiple percipients; *etc.*
(iii) As with the human/machine experiments, the information yield also shows no statistical dependence on the physical separation of the percipient from the target, up to global distances, or on the time interval between target visitation by the agent and the perception effort, up to several days, plus or minus.
(iv) The amount of information acquired is strikingly anti-correlated with the degree of complexity of the analytical formats imposed on the percipients and agents in formulating their specifications of the target scenes [20].

It was the establishment of feature (iii) in these experiments that inspired the remote and off-time studies in the human/machine portion of our program, which yielded similar results of statistical independence of the effects on intervening distance and time. This in turn strengthened our suspicion that these two superficially different genres of anomalous effect actually were drawing from the same phenomenological well, with the only distinction that in one case information was being inserted into an otherwise random physical process; in the other, information was being extracted.

5.1 The role of uncertainty

Observation (iv) may have even more profound implications for conceptualization and representation of these phenomena, in the sense that here we may be encountering manifestation of an inescapable "consciousness uncertainty principle" that inherently constrains our ability to achieve such effects. This issue has been pursued in some detail in Ref. [20], and from somewhat different perspectives in Refs. [4] and [21]. The generic concept emerging from these empirical and theoretical considerations is that while the emergence of consciousness-related anomalous physical effects seems largely to be driven by a host of subjective factors, our efforts to demonstrate, record, and quantify them necessarily entail the imposition of objective criteria and measurements. Unfortunately, the former appears to be obstructed by the latter, and vice versa, and we are left with the challenge of finding a way to straddle the subjective/objective dichotomy with some optimized compromise. In this case, our efforts to establish defensible and quantitative remote perception data by successive refinements of the analytical techniques seem to have progressively suffocated emergence of the phenomenon. Whether this interference functions primarily in the psyches of the human participants, or whether it is more endemic in the physical character of the information itself, is unclear and possibly unresolvable. Notwithstanding, similar indications have emerged from a number of our other experiments, collectively suggesting that this uncertainty is not merely a limitation on the attainable empirical precision, but is evidence of the fundamental importance of informational "noise" as a raw material out of which the anomalous effects are constructed. Comparable examples could be cited from less controversial physical, technological, biological, and psychological venues wherein random processes also seem to play essential roles in the establishment of orderly effects. Such a counterintuitive noise/signal dynamic, compounded with the other extraordinary characteristics of the phenomena, further challenges attempts to construct viable models, as addressed in the following section.

6 Models

As for any scientific enterprise, consequential scholarly understanding of these curious phenomena can advance only if the empirical results can enter into dialogue with astute theoretical models. The problem we face here, however, is that the experimental studies present such a bewildering array of irregularities, contradictions, and departures from canonical, indeed from rational and even intuitive, precedents and expectations that any classical modeling strategies are essentially denuded of any hope of effectiveness. Simply reprising our foregoing text, we are faced with the following daunting array of phenomenological characteristics that any proposed model is obliged to accommodate:

- Tiny informational increments riding on stochastic backgrounds;
- Primary correlations of objective physical evidence with subjective parameters, most notably intention, resonance, and uncertainty;
- Data distribution structures consistent with slight alterations in the elemental binary probabilities;
- Statistical independence of the magnitude of the effects on intervening distance and time;
- Complexly irregular replicability, including oscillatory sequential patterns of performance.

These inescapable empirical aspects force abandonment of any direct applications or extrapolations of extant physical, psychological, or informational models, and of necessity turn us toward more radical propositions, whereby consciousness can assume a proactive role in the establishment of physical reality, and deterministic causation is vastly generalized. The essential features of such unconventional modeling approaches have been proposed in the context of a "Science of the Subjective"[22], the challenge of which has been specified in the following terms:

"Any disciplined re-admission of subjective elements into rigorous scientific methodology will hinge on the precision with which they can be defined, measured, and represented, and on the resilience of established scientific techniques to their inclusion. For example, any neo-subjective science, while retaining the logical rigor, empirical/theoretical dialogue, and cultural purpose of its rigidly objective predecessor, would have the following requirements: acknowledgment of a proactive role for human consciousness; more explicit and profound use of interdisciplinary metaphors; more generous interpretations of measurability, replicability, and resonance; a reduction of ontological aspirations; and an overarching teleological causality. More importantly, the subjective and objective aspects of this holistic science would have to stand in mutually respectful and constructive complementarity to one another if the composite discipline were to fulfill itself and its role in society."

Within this generic attitude, our particular efforts have converged on three categories of model, each of which has been thoroughly described in a number of publications and presentations. Here we can only sketch their essence.

6.1 Quantum mechanics of consciousness

Quite early in the program we were struck by a number of similarities between the historical and conceptual evolution of quantum science and the ongoing unfolding of the experience and representation of consciousness-related physical anomalies. In both scenarios, classically respected conceptual and analytical models of reality have been challenged by the advent of diverse bodies of new empirical data, made possible via the development of more sensitive and reliable experimental equipment and techniques. In each case extensive attempts to rationalize the anomalous data within prevailing formalisms have been categorically and profoundly unsuccessful, forcing postulation and development of a number of counter-intuitive concepts. Some of those originally posed in the atomic-scale physical domain may offer potentially productive metaphorical associations with the mind/matter issue, as well. Among these one could list the quantization of energy and other physical observables; the wave/particle duality and the wave mechanics of atomic structure; the uncertainty, complementarity, exclusion, and indistinguishability principles; and the probabilistic character of quantum observations. The proposition is that all of these might be regarded as impositions by the experiencing consciousness, rather than as intrinsic characteristics of the physical events, *per se* [21].

In this spirit, the concepts and formalisms of elementary quantum mechanics have been appropriated via suitable metaphors to represent the characteristics of consciousness interacting with its environment. For example, if consciousness is represented by a quantum mechanical wave function, and its environment, including its own physical corpus, is represented by an appropriate potential profile, Schrödinger wave mechanics yields eigenfunctions and eigenvalues that can be associated with the cognitive and emotional experiences of that consciousness in that environment. To articulate this metaphor it is necessary to associate certain mathematical aspects of the formalism, such as the coordinate system, the quantum numbers, and even the metric itself, with various impressionistic descriptors of consciousness, such as its intensity, perspective, approach/avoidance attitude, balance between cognitive and emotional activity, and "yin/yang" or passive/active disposition. But with these in hand, certain computational applications display metaphoric relevance to individual and collective experience, and in particular to our experimental situations. Specifically, such traditional quantum theoretic exercises as the central force field and atomic structure, covalent molecular bonds, barrier penetration, and quantum statistical collective behavior become useful analogies for representation and correlation of certain consciousness experiences, both normal and anomalous, and for the design and interpretation of experiments to study these systematically. For example, our empirical resonance factor can be related to molecular bonding; our gender effects to electronic spin and its pairing; FieldREG results to collective particle behavior in potential wells; and the conditional replicability features to the intrinsic statistical uncertainties of all quantum phenomena. Intangible as these associations may be, they do allow conceptual representation of mind/matter interactions wherein the "anomalous" effects become quite normal expectations of quantum-bonded human/machine and human/human systems.

6.2 Modular models

A second model, consonant with our introductory position statement, has been proposed under the title of "A Modular Model of Mind/Matter Manifestations (M^5)"[1], and extended as "M*: Vector Representation of Subliminal Seed Regime of M^5"[2]. With reference to Fig. 6, the M^5 and M* models postulate that anomalous effects such as those we observe in our experiments do not emerge from direct intercourse between the conscious mind Ⓒ and the tangible physical world Ⓣ, but have their origin in the depths of the unconscious mind Ⓤ and in an intangible substrate of physical reality Ⓘ wherein the Cartesian distinction between mind and matter blurs and loses its functional utility. Both of these are misty domains of uncertainty and potentiality, where space and time have yet to be defined, let alone distinguished, and where information waits to be born. When the conscious mind expresses a strong desire enhanced by a deep feeling of resonance, that resonant intention can stimulate some process in the unconscious mind that is reflected in the pre-physical potentiality, and sub-

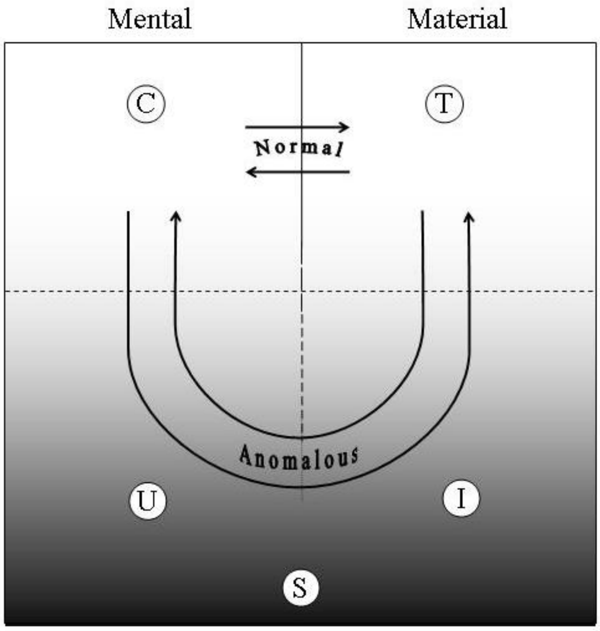

Figure 6. Modular taxonomy of anomalous information transfer.

sequently expressed in subtle biasing of probabilistic physical events, such as the REG experimental outputs. This process also may work in reverse order, as in the remote perception experience, where physical information about the target scene diffuses into its underlying intangible composition, whence it may exert some formative influence upon the unconscious mind of the percipient, thence to emerge into a conscious experience and subsequent description of the scene. With the more explicitly bounded regimes of the conscious mind and manifest physical world thus indirectly linked via the less constrained modules of the unconscious and the intangible substrates, it should not be surprising to encounter apparently acausal correlations between objective and subjective aspects that current exophysics classifies as anomalous, but that a mature endophysics would regard as normal. This model also raises, but does not attempt to resolve, the possible role of a transcendental cosmic "Source" Ⓢ which may permeate, inform, and influence the entire modular configuration.

The implications of this taxonomy for experimental design and interpretation include subtler feedback schemes that facilitate submission of conscious intention to unconscious mental processing; physical target systems that provide a richness of intangible potentialities; operators who are amenable to such interactions; and an environmental ambience that supports the composite strategy. Requisites for theoretical extension of the model include better understanding of the information flow between conscious and unconscious aspects of mind; more pragmatic formulations of the relations between tangible and intangible physical processes; and most importantly, cogent representation of the merging of mental and material dimensions into indistinguishability at their deepest levels. Several of our ongoing experiments have been designed specifically to test these and other aspects of the predictions, but have not yet produced large enough databases to permit definitive conclusions.

6.3 Consciousness filters

The concept of a dynamical two-way exchange between a primordial Source and an organizing consciousness that was posed briefly in the M^5 context has been developed more thoroughly under the title of "Sensors, Filters, and the Source of Reality"[3]. This model proposes that the common but very limited local interactions of our personal consciousness with its proximate environment are relatively superficial aspects of a vaster creative process in which we could engage more proactively, whereby we might acquire more profound information and alter our individual experience to an extent dependent on the depth and breadth of the interpenetration of our consciousness and the Source. These interactions are both ordered and restricted by the intervention of an array of physiological, psychological, social, and cultural influences, or "filters," which condition our perceptions, and thereby our conscious experiences. Since most function on an unconscious level, however, we seldom invoke interpretations of our experiences other than those consistent with our filtered preconceptions. By bringing these influences to a conscious level it becomes possible to re-tune the filters of consciousness and thus to alter the experiential reality to a measurable degree. In particular, such attitudinal tactics as openness to alternative perspectives, utilization of transdisciplinary metaphors, ego-sacrificial resonance, tolerance of uncertainty, and balancing of analytical rigor with emotional involvement can enable experiential realities that draw more deeply from the Source and are more responsive to intention, desire, or need, to an extent consistent with our empirical laboratory evidence.

It should be evident that all three of these genres of conceptual model share some features with a host of mystical and religious practices. They also conform to some degree with the prevailing distinctions in contemporary theoretical physics and philosophy of science between epistemic and ontic domains or, in the parlance of this conference, between exophysics and endophysics, and their relationship to one another. Perhaps more to the point, they each acknowledge the role of pertinent experiential data, both objective and subjective, in their conception, construction, and verification. And that, of course, has been the purpose of this presentation.

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