

# PROCEEDINGS

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## A NOTE FROM THE CHAIRMAN

With this conference we celebrate the 20th anniversary of the founding of this Society, even though our current name has been with us only for the past seven years. Our worldwide membership of about 5000 members represent many disciplines all brought together by the unifying thread of the "systems" approach to problem solving.

In this regard, we are indeed pleased to present John Warfield with our Outstanding Contribution Award. John spent the past several years grappling with a methodology for coping with complexity. His concepts associated with Interpretive Structural Modeling have been tested and proven as demonstrated by the session organized by Raymond Fitz on this subject.

I feel it necessary to note that we have departed slightly from the conventional in this conference and have introduced two sessions which, to some of our readers, may appear controversial.

The first is the session, *Scientific Studies of Acupuncture*. Acupuncture, as you know, originated thousands of years ago in the orient and only recently received serious attention by Western medical scientists. Did you know that acupuncture flourished in the U.S. from 1820 to 1850? According to a researcher at the National Library of Medicine, acupuncture had been introduced to the U.S. from Europe and a substantial number of articles appeared on this subject in the U.S. medical literature of the period; however, interest waned as he found only six articles for the period 1850-1900. Today, the situation has changed. Western medicine now agrees there is something to acupuncture. Its analgesic properties are recognized but not understood. Bruce Pomeranz of the University of Toronto, whose article appears here, recently received international attention on his discovery of a possible mechanism that describes why acupuncture works. Stephen Kim, trained in both Eastern and Western medicine, is a trained acupuncturist. He departs from traditional methods by making use of an electronic device for locating acupuncture points. His paper reports striking success over the traditional methods. The session is rounded out by recent research by other investigators: Lee, Clifford and Mau. Clearly, acupuncture has now become a valid research subject for biocyberneticists.

Our second unconventional area is *Research in Psychoenergetics*, organized by Hal Puthoff of SRI. The presentation of this session is the outgrowth of the spectacular luncheon talk by Hal and Russ Targ at last year's conference for which they received our Franklyn V. Taylor Best Presentation Award. Recognizing that their professional integrity was at stake, they have gone to great lengths to assure impeccability of their work; nevertheless, a reviewer of their original paper which appeared in the *IEEE Proceedings* last year stated, "This is the sort of thing I would not believe in even if it were true." Notwithstanding such emotional reactions, psychic phenomena are a reality, and Hal Puthoff's session of first-rate carefully selected papers is worthy of your consideration.

Finally, among the unusual presentations, I commend your reading Bill Gevarter's excellent summary, "A Wiring Diagram of the Human Brain as a Model for Artificial Intelligence."

William H. von Alven  
Chairman

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with the initial condition that

$$\omega_{t_0} = \frac{kS}{k+k'} \left[ 1 - e^{-\frac{2(k+k')}{m} t_0} \right] \quad (7)$$

which is the achieved velocity  $\omega$  of the follower during the inspection period  $t_0$ ; we have

$$\omega = \frac{kS}{k+k'} \left[ 1 - e^{-\frac{2(k+k')}{m} t_0} \right] e^{-\frac{2(k+k')}{m} (t-t_0)} \quad (8)$$

The spiral after-effect (SAF) is the velocity of the stimulus relative to the follower, namely,

$$\text{SAF} = 0 - \omega = -\frac{kS}{k+k'} \left[ 1 - e^{-\frac{2(k+k')}{m} t_0} \right] e^{-\frac{2(k+k')}{m} (t-t_0)} \quad (9)$$

Since  $k$  and  $k'$  are positive, this equation shows that the SAF is always opposite to the direction of the stimulus  $S$ .

In equation (1), the mental force  $F$  is assumed to be proportional to the difference of  $S$  and  $\omega$ , namely, increasing  $S$  would increase  $F$ ; however, at high speed of  $S$ ,  $\omega$  can not keep pace with  $S$ , and  $F$  will level off and can not increase unlimitedly with  $S$ , thus  $F$  would be

$$F = k(1 - e^{-S} - \omega) \quad (1)'$$

For small  $S$ , equation (1)' will transform to equation (1). Also, the total mass is equal to  $\pi r^2 d$ , where  $d$  is the density, thus

$$\text{SAE} = -\frac{k}{k+k'} (1 - e^{-S}) \left[ 1 - e^{-\frac{2(k+k')}{\pi r^2 d} t_0} \right] e^{-\frac{2(k+k')}{\pi r^2 d} (t-t_0)} \quad (9)'$$

Equation (9)' shows that SAE is related to the inspection period  $t_0$  exponentially, also the effect decays with time  $t$  exponentially, these are experimentally verified by Eysenck and Holland (1960) and by Stager & Burton (1964). Stager & Burton (1964) also show that the constant, which in this model would correspond to  $2(k+k')/\pi r^2 d$ , increases slightly with lessen the inspection period, this is probably due to the fact that with a shorter inspection period, only a smaller area of the stimulus may be covered by the field of attention (Chiang, 1973, 1976), thus  $r$  is smaller then it should, which increases the constant. Equation (9)' also shows that the SAE increases exponentially with the stimulus angular velocity  $s$ , this is confirmed experimentally by Mehling, Collins & Schroeder (1972). For a given angular velocity, the linear speed of eliciting motion in the retina is proportional to the size  $r$  or the visual angle. By inspecting equation (9)', it can be deduced that the period of SAE shows a peak

with  $r$ , indeed, experiments of Mehling, Collins & Schroeder (1972) show this to be the case. It is hoped that future experiments can be conducted in a systematic way according to this equation such that various effects and parameters may be estimated.

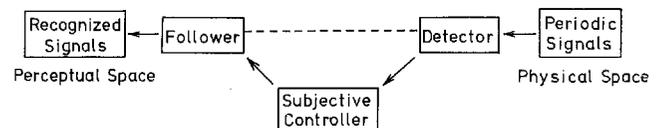
In summary, a dynamic perceptual model of movement after-effect is proposed, quantitative calculations from this model can be made and agree with the existing data. The awaked state, hyponotic state and the quasi-hyponotic state can also be defined from this model. This model investigates into the working mechanism within the brain and identifies many parameters in a dynamic machinery, which would help not only to the understanding of the brain, but also to diagnosis the pathology of the damaged brain. This model may also be used to build a more intelligent machine which behaviours similarly to human being.

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FIGURE LEGEND

Fig. 1. A flow chart of perception mechanism of periodic movement.



## THE EINSTEIN PARADOX

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Intrinsic time symmetry plus (wavelike) addition of partial amplitudes herald the advent of a new paradigm, where advanced waves and information as organizing power are no less operational than retarded waves and information as gain in knowledge.

## I. Introduction

According to all dictionaries the meaning n°1, or fundamental, of the word Paradox is: a surprising but (perhaps) true statement. Copernicus' heliocentrism has been a "paradox".

Such a paradox was also contained in Einstein's Special Relativity. What Einstein did in 1905 was neither discuss the mechanical theories of the ether, nor elaborate new mathematics, but rather taylor the conceptual frame after the (group property) of the Lorentz-Poincaré formulas<sup>1</sup> faithfully expressing the phenomenon of no ether wind.

Today the situation is much the same, except that the paradox shows up at the end of the story rather than at its beginning. In 1927 Einstein, at the 5th Solvay Council<sup>2</sup>, that is, over the very cradle of the "New Quantum Mechanics", cast the malignant spell it is my duty to discuss today. Neither he<sup>3</sup>, nor later Schrödinger<sup>4</sup>, nor de Broglie<sup>5</sup>, nor others, did believe the paradox to be the true, Copernican one, as we know now through experimentation<sup>6</sup>.

In imitation of Einstein's 1905 approach I will today neither discuss hidden variables theories and Bell's theorem, nor will I fiddle with the mathematics. No: just using the plain, well known mathematics of the neoquantal mechanics of 1924-1927, and purposely doing so in the simplest conceivable form, as I deem appropriate for expressing a new paradigm - for "unveiling the Sense of the Scriptures" - I will show which ingrained natural belief is unambiguously excluded by the experimental results on photon pairs issuing from a cascade transition - very much like the belief in an ether wind has been excluded by the Michelson experiment. I will then proceed by unraveling the statement written since long ago in the accepted formulas, where nobody took the care to read it, but where the experiments now require us to do so.

The Sense of the Scriptures (as I will show) is that the elementary stochastic event of quantum mechanics, the transition, or collapse of the wave function, does possess an intrinsic time symmetry - as also did the collision in classical statistical mechanics, where it gave rise to the famous Loschmidt and Zermelo paradoxes. However, the Einstein<sup>2</sup> 1927

paradox (better known as the Einstein-Podolsky-Rosen<sup>7</sup> 1935 paradox) is made much more severe than the old ones through Born's replacement of the law of addition of partial probabilities by the wavelike law of addition of partial amplitudes, entailing the "neoquantal" correction expressed by the off diagonal terms.

It is this combination of intrinsic time symmetry with a wavelike probability calculus which causes the sting of the paradox, and which heralds the advent of an ominous paradigm, where advanced waves, and information as an organizing power, are de jure symmetrical to retarded waves, and to information as a gain in knowledge.

II. Correlation Polarizations in Atomic Cascades:  
 A Dramatic Experimental Result.

The "neoquantal" mechanical expression for the probabilities of answers (yes, yes) and (no, no), (yes, no) and (no, yes), when photon pairs issuing from a cascade transition at C and propagating in opposite directions along an axis x meet linear polarizers L and N of relative angle  $\alpha$  is, for the 0-1-0 type cascade

$$\langle 1,1 \rangle = \langle 0,0 \rangle = \frac{1}{2} \cos^2 \alpha, \quad \langle 1,0 \rangle = \langle 0,1 \rangle = \frac{1}{2} \sin^2 \alpha, \quad (1)$$

and, for the 1-1-0 type,

$$\langle 1,1 \rangle = \langle 0,0 \rangle = \frac{1}{2} \sin^2 \alpha, \quad \langle 1,0 \rangle = \langle 0,1 \rangle = \frac{1}{2} \cos^2 \alpha. \quad (2)$$

Experimental verifications are excellent<sup>6</sup>.

Had these experiments been performed in the days of the old "paleoquantal" mechanics, they certainly would have produced the same sort of commotion as did the Michelson experiment. They do require, in de Broglie's<sup>6</sup> words, a radical revision of "our familiar notions concerning space and time".

Consider for instance the case where  $\alpha = \pi/2$  with the 0-1-0 cascades. The neoquantal prediction  $\langle 1,1 \rangle = 0$  means that all the photon pairs are found with linear polarizations parallel to either of the two orthogonal directions y and z of the polarizers L and N. This would have stupefied the paleoquantal physicists, who thought of the photons of each pair leaving the source C as possessing a polarization, compatible of course with the dynamics of the system, but essentially independent of the orientations A and B of the polarizers (and even of their presence or absence). In the 0-1-0 case these could have been parallel linear polarizations with random directions, or also, possibly, circular polarizations of equal helicities. In any case the paleoquantal prediction was, for  $\alpha = \pi/2$ , that a large number of (yes, yes) answers should occur. As a corollary, the sub-ensemble of photon pairs with (parallel) linear polarizations along y or z was thought to be of measure zero.

The experimental fact is just opposite: all the observed photon pairs display this property, whence necessarily the three following statements, heralding the advent of a new paradigm:

1) The photons in each pair issuing from the source C do not possess polarizations of their own, but borrow one later, by interacting with the measuring devices L and N.

This of course is a specification of a well known general statement in the neoquantal mechanics, of which perhaps there is no more direct experimental proof than this one.

2) In the chance game which is played, the dice are not cast at C when shaken in the cup, but later, when rolling on the table, at L and N. They are, however, correlated, and this is the Einstein<sup>2</sup>

paradox, rejected by him<sup>3</sup>, Schrödinger<sup>4</sup>, de Broglie<sup>5</sup>, but now experimentally demonstrated<sup>6</sup>.

3) The correlation existing<sup>6</sup> between the distant measurements at L and N is not tied, in space-time, along the spacelike vector LN, which is physically empty, but along the Feynman style zigzag LCN made

of the two timelike vectors which are physically occupied. In other words, the two measurements at L and N do produce the same wave collapse - in their common past. Again in other words, Einstein's prohibition to telegraph into the past does not hold at the level of the quantal stochastic event, the wave collapse, so this statement is of a "factlike"<sup>8</sup>, or macroscopic nature.

The quantal transition per se is essentially time symmetric, just as was the collision in classical statistical mechanics. However, the Einstein paradox is much more severe than the "corresponding" Loschmidt and Zermelo paradoxes, due to the wavelike character of the neoquantal probability calculus, as will be shown right now.

### III. Neoquantal and Paleoquantal Calculations for Atomic Cascades.

From the two (orthogonal) pure helicity states  $L_a L_b$  and  $R_a R_b$  of a photon pair a, b, we build the two (orthogonal) P-invariant states

$$\frac{1}{2}(L_a L_b + R_a R_b) = \frac{1}{2}(Y_a Y_b + Z_a Z_b), \quad (3)$$

$$\frac{1}{2}(L_a L_b - R_a R_b) = \frac{i}{2}[Z_a Y_b - Y_a Z_b], \quad (4)$$

where Y and Z denote the linear polarizations along orthogonal axes y and z.

A and B denoting the angles with (say) y of the linear polarizers L and N, and setting  $\alpha \equiv A - B$ , we calculate now, using the neoquantal "golden rule" of adding partial amplitudes and squaring their absolute sum, the transition probabilities, first in terms of circular, second of linear polarizations.

Turning analyzer L by  $\Delta A$  and N by  $\Delta B$  will shift the relative phase of the  $L_a L_b$  pair by (say)  $+\Delta\alpha$ , and then that of the  $R_a R_b$  pair by  $-\Delta\alpha$ . Thus the partial amplitudes are, in terms of circular polarizations,  $e^{i\alpha}$  and  $e^{-i\alpha}$ , whence (for the 0-1-0 cascades)

$$\langle 1,1 \rangle = \langle 0,0 \rangle = \frac{1}{8} |e^{i\alpha} + e^{-i\alpha}|^2 = \frac{1}{4} (1 + \cos 2\alpha), \quad (5)$$

$$\langle 1,0 \rangle = \langle 0,1 \rangle = \frac{1}{8} |e^{i\alpha} - e^{-i\alpha}|^2 = \frac{1}{4} (1 - \cos 2\alpha). \quad (6)$$

Second, we use as orthogonal states the linear polarizations Y and Z. The transition amplitudes towards the (yes, yes) answer is  $\cos A \cos B$  for the  $Y_a Y_b$  state,  $\sin A \sin B$  for the  $Z_a Z_b$  state,  $\cos A \sin B$  for the  $Y_a Z_b$  state, and  $\sin A \cos B$  for the  $Z_a Y_b$  state. Using the "golden rule" we recover formulas (1) and (2) in the form

$$\begin{aligned} \langle 1,1 \rangle = \langle 0,0 \rangle &= \frac{1}{2} (\cos A \cos B + \sin A \sin B)^2 \\ &= \frac{1}{2} (\cos^2 A \cos^2 B + \sin^2 A \sin^2 B) + \frac{1}{4} \sin 2A \sin 2B, \end{aligned} \quad (7)$$

$$\begin{aligned} \langle 1,0 \rangle = \langle 0,1 \rangle &= \frac{1}{2} (\sin A \cos B - \cos A \sin B)^2 \\ &= \frac{1}{2} (\sin^2 A \cos^2 B + \cos^2 A \sin^2 B) - \frac{1}{4} \sin 2A \sin 2B. \end{aligned} \quad (8)$$

In these formulas the contributions ( )/2 are the paleoquantal predictions, assuming that the photon pairs do leave the source as a statistical mixture with (parallel) linear polarizations along y or z. The contributions  $\pm(\sin 2A \sin 2B)/4$  are the neoquantal

corrections. Incidentally, neither of these contributions is rotation invariant around x. Thus the paleoquantal physicist would have randomized his result, which can be done most easily by writing  $2 \sin 2A \sin 2B = \cos 2\alpha - \cos 2(A+B)$ , whence

$$\langle \langle 1,1 \rangle \rangle = \langle \langle 0,0 \rangle \rangle = 1 + \frac{1}{8} \cos 2\alpha,$$

$$\langle \langle 1,0 \rangle \rangle = \langle \langle 0,1 \rangle \rangle = 1 - \frac{1}{8} \cos 2\alpha, \quad (9)$$

instead of (5) and (6).

So, while the neoquantal transition probabilities are basis invariant, the paleoquantal ones are not. The difference is due to the off diagonal terms, that is, it stems from the wavelike nature of the neoquantal probability calculus. All this is well known in general. So, the Einstein paradox is just one more of the neoquantal extravagances.

### IV. Neoquantal and Paleoquantal Correlations in General

The typical system under consideration is described as a pure state  $\Psi$  expanded as a sum of partial amplitudes

$$|\Psi\rangle = \sum c_j |\phi_j\rangle |\psi_j\rangle \quad (10)$$

where  $\phi_j$  and  $\psi_j$  span independent Hilbert spaces. The subsystems  $\phi_j$  and  $\psi_j$  are thus coupled, although this coupling may not be a "present" one - as in the case we are discussing. By definition  $\omega_j \equiv c_j^* c_j$  and  $\sum \omega_j = 1$ .

A and B denoting the Hermitean operators of measurements performed on  $\phi$  and  $\psi$ , the (basis invariant) correlated mean value is

$$\langle A, B \rangle = \sum \sum c_i^* c_j \langle \phi_i | A | \phi_j \rangle \langle \psi_i | B | \psi_j \rangle \quad (11)$$

where, setting

$$\langle A_i \rangle \equiv \langle \phi_i | A | \phi_i \rangle, \quad \langle B_i \rangle \equiv \langle \psi_i | B | \psi_i \rangle, \quad (12)$$

the (non invariant) contributions of the diagonal and off diagonal terms are respectively

$$\langle A, B \rangle_0 = \sum \omega_i \langle A_i \rangle \langle B_i \rangle \quad (13)$$

$$\Delta \langle A, B \rangle = \frac{1}{2} \sum_{i \neq j} c_i^* c_j \langle \phi_i | A | \phi_j \rangle \langle \psi_i | B | \psi_j \rangle + c.c. \quad (14)$$

(13) is the paleoquantal expression, implying separate statistics on the subsystems, and (14) the neoquantal, or wavelike, correction.

$\Delta \langle A, B \rangle = 0$  in representations diagonalizing either A or B, and then  $\langle A, B \rangle$  assumes the expression  $\langle A, B \rangle_0$  of a mixture. But this is a semblance "relative" to the frame - except of course if the corresponding measurement is performed.

Formulas of Section III are specifications of these.

### V. The Essence of the Paradox

A little fable will help understand matters: At midnight GMT two travellers leave the Calcutta airport C, one for London L, one for Nagasaki N, each carrying a closed box which contains, or not, the one ball which a third man, in Calcutta, has enclosed, behind a veil. Having landed at 6 GMT each traveller opens his box, and immediately learns what the other man finds.

The point is that, when made explicit, the logical inference is not drawn along the spacelike vector LN, but along the Feynman style zigzag LCN made of the timelike vectors CL and CN.

There is no paradox in this because we have a "local hidden variable" with value 1 in one box and 0 in the other. The die is cast at C, and we have between L and N pure telediction with no teleaction.

This is the very point which is changed in the "wavelike probability calculus". Observers at L and N may wait until the very last moment before deciding which of two "incompatible magnitudes" they will measure - for instance, the linear polarization of a photon along one of two directions of angle  $\alpha$ . Therefore it is at L and N that the die is cast and, as there is a correlation, what we have between L and N is some sort of telediction plus teleaction.

#### VI. Relativistic Spinless Particles

Here is a short résumé of a fully relativistic formalism I have presented elsewhere<sup>9</sup>. Units such that  $c = 1$  and  $\hbar = 1$  are used;  $\lambda = 1, 2, 3, 4$ ;  $x^4 = it$ .

The space-time  $\psi(x)$  and 4-frequency  $\theta(k)$  representations of square integrable solutions of the Klein-Gordon equation are associated with the Hermitean scalar product

$$\langle a | b \rangle = -\frac{i}{2k} \iiint_{\sigma} \bar{\psi}_a [\partial_\lambda] \psi_b d\sigma^\lambda = \iiint_{\eta} \bar{\theta}_a \theta_b \varepsilon(k) d\eta. \quad (15)$$

The invariant  $\sigma$  integral is over an arbitrary spacelike surface  $\sigma$  of (4-vector) element  $d\sigma^\lambda$ ;  $[\partial_\lambda]$  denotes the Schrödinger or Gordon current operator (difference of partial derivatives to the right and the left). The  $\eta$  integral is over both sheets of the mass shell  $k_\lambda k^\lambda + k^2 = 0$ ,  $d\eta$  denoting the length of  $d\eta^\lambda (k^\lambda d\eta = k d\eta^\lambda)$ ;  $\varepsilon(k) = +1, -1, 0$  according as  $k^\lambda$  ends on the positive or negative frequency sheet, or off shell. In Dirac's<sup>10</sup> notation

$$\langle a | b \rangle = \langle a | x \rangle \langle x | b \rangle = \langle a | k \rangle \langle k | b \rangle, \quad (16)$$

the double bar recalling that we are using a second order equation. As usual, the condition  $\langle a | b \rangle = \delta(a, b)$  defines orthonormality.

Introducing the Fourier nucleus

$$\langle x | k \rangle = \langle k | x \rangle^* = (2\pi)^{-3/2} \exp(ik_\lambda x^\lambda) \quad (17)$$

if  $k^\lambda$  ends on the mass shell, 0 otherwise, we write the reciprocal Fourier transforms as

$$\langle x | a \rangle = \langle x | k \rangle \langle k | a \rangle, \quad \langle k | a \rangle = \langle k | x \rangle \langle x | a \rangle. \quad (18)$$

Introducing the Jordan-Pauli propagator

$$\langle x | x' \rangle = \langle x | k \rangle \langle k | x' \rangle \quad (19)$$

which is odd in  $x - x'$  and zero outside the light cone, and such that

$$\langle x' | x'' \rangle = \langle x' | x \rangle \langle x | x'' \rangle \quad (20)$$

iff  $x' - x''$  is spacelike, and substituting the second (18) in the first, we solve the Cauchy problem in the form

$$\langle x' | a \rangle = \langle x' | x \rangle \langle x | a \rangle. \quad (21)$$

This formula expands the wave function  $\langle x' | a \rangle$  at any point instant  $x'$  upon the (complete) set of (orthogonal) propagators with apexes  $x$  on a given  $\sigma$ , the

coefficients of the expansion being the values  $\langle x' | a \rangle$  of  $\langle x' | x \rangle$  on  $\sigma$ . As  $\langle x' | x \rangle$  and  $\langle k | x \rangle$  are Fourier reciprocal, the position operator in this formalism is (given  $\sigma$ )  $x^\lambda$ , and is faithfully represented by  $x$ . Two well known expressions of  $2\langle x' | x \rangle$  are

$$2\langle x' | x \rangle = D_+ - D_- = D_{ret} - D_{adv}. \quad (22)$$

The preceding reasoning shows that completeness of the  $\langle x' | k \rangle$  and of the  $\langle x' | x \rangle$  are related to each other, and that the presence of both positive and negative frequencies in (18), and both retarded and advanced waves in (21), are not independent from each other.

#### VII. Relativistic Spinning Particles

An integrally equivalent expression of (15) is

$$\langle a | b \rangle = i \iiint_{\sigma} \bar{\psi}_a \alpha_\lambda \psi_b d\sigma^\lambda = i \iiint_{\eta} \bar{\theta}_a \alpha_\lambda \theta_b \varepsilon(k) d\eta \quad (23)$$

with  $\alpha_\lambda = \gamma_\lambda$  in the Dirac,  $=\beta_\lambda$  in the Petiau-Duffin-Kemmer theory, etc... The simple bar recalls that we are using a system of first order equations. Modulo this change all equations are formally the same as in Section VI. The Fourier nucleus  $\langle x' | k \rangle$  and the Jordan-Pauli propagator  $\langle x' | x \rangle$  now imply the projector projecting any solution of the Klein-Gordon equation as a solution of the spinning particle equation.

#### VIII. Intrinsic Time Symmetry of the Wave Collapse. A New Paradigm.

The preceding formalism yields a fully relativistic description of a position plus spin measurement performed on a quantal particle, and one very well suited for discussing the recent measurements of correlations<sup>6</sup>. I will avoid inessential wording by conferring a very small rest mass to the photon, so that it is a true spinning particle, and that the measurements performed at L and N are position plus spin measurements.

The relativistic position measurement performed "at an arbitrary spacelike surface  $\sigma$ " (rather than "at time  $t$ ") consists in asking "does the particle cross a given element  $d\sigma^\lambda$  of  $\sigma$ " (rather than "is it inside  $dx dy dz$ ?" The corresponding eigenfunction, according to formula (21) is the Jordan-Pauli propagator  $\langle x' | x \rangle$  (rather than Dirac's  $\delta(x' - x)$ ), or  $\langle x' | x \rangle$  in a position-plus spin measurement, which means that if the particle is found "at  $x$ " (in the above sense) it certainly has come inside the past, and will go inside the future light cone. This, of course, is known since Minkowski - except that the measurement at  $x$  does collapse the wave. And this collapse, due to the very formalism, affects necessarily both future (which is trivial) and past (which, due to prejudice of macroscopic origin, was overlooked).

This is the Einstein<sup>2</sup> paradox - and a truly Copernican one indeed, as it is written down in the very scriptures of the wavelike probability calculus (especially in its explicitly relativistic<sup>11</sup> form) and is experimentally verified<sup>6</sup>. This neither Einstein<sup>3</sup>, nor Schrödinger<sup>4</sup>, nor de Broglie<sup>5</sup>, were ready to believe, when stating respectively that it would "imply telepathy", or "be magic", or upset our "familiar conception of space and time".

It turns out that a measurement performed around the point-instant  $x$  is potentially tied to the whole universe - to the inside of the future and the past light cones; also, to the outside of the light cone via pairs of timelike vectors.

Einstein's prohibition to "telegraph into the past" was thus only of a factlike, or macroscopic character. And his prohibition to telegraph outside the light cone, though strictly valid<sup>12</sup> in terms of direct signalling, is overthrown nevertheless by the possibility of zigzagging via timelike vectors, somewhat like a sailboat uses side wind.

#### IX. Macroscopic Factlike Asymmetry

In the Dirac electron theory there is a complete lawlike symmetry between positive and negative energies, that is, between particles and antiparticles. In fact, however, the electron is as common as the positron is exceptional - which, on the whole, is true also of matter and antimatter.

Something similar occurs with retarded and advanced waves - and, as we have seen, this question is not unconnected with the preceding one.

The intrinsic symmetry between retarded and advanced waves is tightly connected with two other ones<sup>13</sup> which should now be mentioned.

In quantum mechanics, retarded and advanced waves are respectively used for statistical prediction and retrodiction, which shows that the intrinsic symmetry between them is tied with that between entropy increasing and decreasing processes (known as the Loschmidt and Zermelo paradoxes). Then, the factlike preponderance of retarded waves is tied with that of entropy increase.

As information is another name for negentropy (especially when chance is taken as a primitive concept, as in quantum mechanics) the intrinsic symmetry we are speaking of is also tied with that between information as gain in knowledge (the common, trivial sense) and information as an organizing power (the rare, esoteric sense). Both sides are exemplified in reception and emission of a phone conversation.

Now, very much like the esoteric antimatter does make a few incursions inside our familiar world of matter, and we know now where to look for it or how to produce it, so we should inquire if perhaps the esoteric finality, that is, advanced waves, decreasing entropy, information as will, does not perhaps make a few incursions inside our familiar world of causality. Let us call anti-physics the corresponding context, physics obeying by definition the (factlike) Irreversibility Law (Second Law). The point is, as we have seen, that quantum physics does have, essentially and symmetrically, one foot in physics and one in antiphysics - just as it has one hand in positive and one in negative frequencies.

The antiphysics context is the one which Einstein<sup>3-</sup> has termed "telepathy", Schrödinger<sup>4</sup> "magic", de Broglie<sup>5</sup> the upsetting of "our familiar concept of space and time". Parapsychology seems a good name for it.

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## MULTIPLE SUBJECT AND LONG DISTANT PRECOGNITIVE REMOTE VIEWING OF GEOGRAPHICAL LOCATIONS

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ABSTRACT

An extension of earlier precognitive remote viewing experiments was conducted with two experimental protocols: 1) using two subjects simultaneously predicting where an experimenter would be 35 minutes in the future, and 2) predicting over 24 hours into the future over a distance of 5,000 miles. In the first experiment seven trials were carried out with a total of seven inexperienced volunteer subjects, tested in pairs, to determine their ability to describe a remote geographical location twenty minutes before the target had been selected and thirty-five minutes before the experimenter arrived at the randomly selected site. Transcripts of subjects' descriptions were compared against the seven targets and against each other by six independent judges in a blind rank ordering procedure. The results of this matching were: Group A transcripts against targets =  $p < 0.005$ ; Group B transcripts against targets =  $p < 0.01$ ; Group B transcripts against Group A transcripts  $p < 0.005$ . Experiment two, used one subject on five trials predicting 23.5 to 24.5 hours into the future where the experimenter would be in Eastern Europe. Blind rank ordering of the transcripts and photographs taken provided a results of  $p < 0.025$ . Further evidence of the widespread availability of a perceptual/communication channel in which time and distance appear to pose no barrier, is accessible when ordinary modes of perception and communication become inoperable, and can be "tuned into" by anyone if they can separate the signal from the noise was further substantiated.

INTRODUCTION

While the precognitive experience is a very old one, experimentation in precognitive remote viewing came about as a variation of the clairvoyant remote viewing experiments, which demonstrated the ability of isolated subjects to describe an unknown target site at the same time the experimenter was visiting a randomly selected location.<sup>1-2</sup> Successful experiments of replication have been carried out not only in the clairvoyant remote viewing<sup>4-6</sup> but also in the precognitive remote viewing.<sup>7</sup>

Over twenty laboratory experiments have been conducted in our lab with more than ten subjects involving the precognitive protocol. Each indicate a subject's capability of not only describing scenes accurately across spatial but also temporal barriers.

Since this ability seems to be a latent and widely distributed one, rather than an unusual talent of a gifted few, and since the clairvoyant remote viewing experiments have been so successful over long spatial distances, two separate experimental protocols were devised to expand on the original experiments. The first protocol was a multiple precognitive experiment involving two subjects, who simultaneously predicted where the experimenter would be in the future. The second protocol involved a long distance experiment with the subject being required to predict 23-24 hours in the future, where the experimenter would be over 5,000 miles away.

PROTOCOL ONE: (MULTIPLE PRECOGNITIVE REMOTE VIEWING)METHOD

Seven subjects, (two males and five females, ranging in age from 24 to 37), were selected on a volunteer basis and tested in four different subject pairs. The subjects knew each other prior to the experiment, but were not related by either blood or marriage. The nature and protocol of the experiment were explained to subjects before the trials began and they were told that they would have sufficient time to relax, make themselves comfortable, and allow their minds to become as blank as possible. They were then instructed to try and visualize where the experimenter would be between 35 and 50 minutes after the trial began and to describe whatever images or thoughts came to mind during that 15 minute period aloud into a tape recorder, and to make any sketches if they so desired. Subjects were advised not to try to define specifically or identify their impressions, but to describe them generally with as much detail as possible, even if the images appeared to make no sense or have no continuity. The time at which the trial was to commence was agreed upon by both subjects and experimenter, and subjects were then separated with instructions to have no communication with each other until after their parts in the trial were over. In four trials the subjects were in the same building, but in separate rooms on different floors. There were observers stationed with each subject in three of these trials. In the remaining three trials, subjects were in different locations, separated by approximately ten miles.

When subjects began generating their descriptions,

Table 1

## Experimental Protocol

(Multiple Precognitive Remote Viewing)

10:00	Experimenter leaves with 10 envelopes containing target locations and begins 20 minute drive. Subjects begin descriptions of where Experimenter will be between 10:35 and 10:50.
10:15	Subjects' responses completed, at which time laboratory part of experiment is over.
10:20	Experimenter generates random number between 1 and 10, counts down to associated envelope, and proceeds to target location.
10:35	Experimenter arrives at target location and remains there for 15 minutes, taking photographs and notes.
10:50	Experimenter returns to point of origin. Experimental trial completed.

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an experimenter left the area with ten envelopes which had been randomly selected from the target pool of over one hundred locations in the city and suburbs of Chicago, previously compiled and sealed by an individual who had no other association with the experiment, (the contents of which were unknown to either experimenter or subjects). Driving continuously for 20 minutes with no particular direction, or until five minutes after the subjects had completed their descriptions, the experimenter then blindly selected a number from one to ten from an enclosed container holding ten numbered and folded sheets of paper, counted down to the chosen number of envelopes, opened the envelope and proceeded to the location indicated on the enclosed card, arriving at the target 15 minutes later, or 35 minutes after the subjects began recording their descriptions. The experimenter remained at the target for 15 minutes, photographed the location and made notes as to her impressions of the site, then returned to the point of origin. (This protocol can be seen in Table 1). Typed unedited transcripts were made of subjects' recorded responses and attached to any associated drawings which a subject may have made.

Seven trials of this sort were performed, resulting in a set of seven photographs with accompanying notes, and 14 transcripts which were randomly divided into two sets so that each set contained one description for each of the seven targets. The transcript sets were labeled Group A and Group B. Six persons, not otherwise affiliated with the experiment, were asked to be judges. Two judges blind rank ordered Group A transcripts against the target photographs and notes; two judges blind rank ordered Group B transcripts against the photographs and notes; and two judges blind rank ordered Group A transcripts against Group B transcripts. In this manner each judging procedure was independent from the others, avoiding the possibilities of cueing from one set of descriptions to the other, or fatigue on the part of the judges if they were required to match all 14 transcripts. It also provided six separate sets of scores for evaluation from six separate impartial individuals. Each set of rankings was made on a scale of one to seven; one being the best match and seven being the worst. Seven was the lowest possible rank sum for each set, 49 was the highest.

RESULTS

Statistical analysis of these results was performed using Morris' method for evaluation preferentially matched free-response material.<sup>8</sup> The sums of the ranks assigned by the two judges matching Group A transcripts against the targets were 15 and 13, with probability of 0.005. The sums of the ranks assigned by the two judges matching Group B transcripts against the targets were 15 in both cases, presenting a probability of 0.01. The sums of the ranks assigned by the two judges matching Group A and Group B transcripts were 12 and 14, resulting in a probability of 0.002. Of the total of 42 matches which were made (six judges ranking seven items) there was a total of 17 direct hits (matches ranked as one). (See Tables 2 and 3).

An indication of the accuracy of subjects' descriptions, as well as the variation in individual perception of a single remote target precognitively viewed, can be offered by the following excerpts from the transcripts, selected by the judges as best indicative of the target. The degree of accuracy varied among subjects, as did the specific details of the target.

Target 1: Plaza del Lago Shopping Center

The Target site was a shopping mall designed like a Spanish courtyard or plaza, with a circular garden area designed around a fountain, having paths leading out in different directions. Two sides of the mall consist of a series of low brick arches, the third side is a row of low white buildings with awnings flanking a taller structure with a tower. (See Figure 1).

Group A (S<sub>4</sub>)--"A few trees..not really that big.. there's like a fence around it, maybe a gate..cement or something to the left toward the front..There's a lot of white..Everything seems to be very clean and orderly."

Group B (S<sub>5</sub>)--"Really tall building, some man-made structure of brick or cement. Something rectangular next to it. Is it one building or one next to it?.. That rectangle is only one story high, I think. The other building is much taller. The tall part might be round, there are lots of parts to it... I see sidewalks, paths go around it.. Some trees, other buildings can be seen through the trees.. There's a

Table 2

Ranks Assigned by Judges Matching Subjects' Transcripts Against Targets in Precognitive Remote Viewing Trials

Target	(Subjects) A B	Ranks Assigned			
		Group A		Group B	
		Judge 1	Judge 2	Judge 1	Judge 2
Plaza del Lago	(S <sub>4</sub> , S <sub>5</sub> )	1	5	4	2
Wrigley Field	(S <sub>10</sub> , S <sub>9</sub> )	1	1	3	2
Techny Mission	(S <sub>4</sub> , S <sub>5</sub> )	3	1	1	3
Lindheimer Obs.	(S <sub>6</sub> , S <sub>7</sub> )	2	3	1	3
Madonna del Strada	(S <sub>5</sub> , S <sub>4</sub> )	3	1	2	2
NWRR Station	(S <sub>6</sub> , S <sub>8</sub> )	2	1	3	1
Grant Park Bandshell	(S <sub>7</sub> , S <sub>6</sub> )	3	1	1	2
Sum of Ranks		15	13	15	15
Statistical Significance		p < 0.01	p < 0.005	p < 0.01	p < 0.01

Table 3

Ranks Assigned By Judges Matching Transcripts B Against Transcripts A in Precognitive Remote Viewing Trials

Transcript	Ranks Assigned	
	Judge 1	Judge 2
A-1 (Wrigley Field)	2	2
A-2 (Madonna del Strada Chapel)	2	3
A-3 (Lindheimer Observatory)	1	1
A-4 (Grant Park Bandshell)	1	1
A-5 (Plaza del Lego)	1	1
A-6 (Techny Mission)	2	2
A-7 (Northwestern Railroad Station, Glencoe)	3	4
Sum of Ranks	12	14
Statistical Significance	$p < 0.001$	$p < 0.005$

double doorway, double doors with an awning.. Maybe the tall building is on top of it, or next to it.. There's a circular pathway with grass in front."

of blowing upward, maybe things are swirling."

PROTOCOL TWO: (LONG DISTANCE PRECOGNITIVE REMOTE VIEWING)

Target 6: Northwestern Railroad Station, Glencoe

METHOD

The target was a small, dark brick building with a pointed roof and circular turret. Two sets of tracks in front of the building. During the 15-minute experimental period two trains passed, one of which stopped. Experimenter went inside the station for a few minutes, noted wooden floors, benches and a train schedule posted on one wall. The station was surrounded by trees in a park-like setting. (See Figure 2).

As a further investigation into the parameters of precognitive remote viewing phenomena, a series of five trials were conducted between the Midwestern, U.S.A. and Eastern Europe over a consecutive five day period in August 1976.

Group A (S6) --"I have an image of looking at the traffic and seeing it go by really fast, speeding cars ..I see a train station.. I see a train coming.. older buildings.. trees.. See just the front end of the train station. See a little bit within it, unless they are planks. Wooden planks on the floor.. There are posters or something, advertisements or posters on the wall of the train station.. I see the benches.. I see the tracks."

Each morning between 8:30 and 8:45 A.M., Central Daylight Time, the Subject in the U.S. attempted to describe the geographical location where the Experimenter would be in Eastern Europe up to 5,284 miles away. The descriptions were tape recorded each morning and subsequently transcribed. The Experimenter was to spend the 15 minute period between 3:00 and 3:15 P.M. attempting to concentrate on his surroundings and taking a photograph which could later be compared against the subject's descriptions. (This is shown in Table 3).

Group B (S8) --"There are lines pointing in several different directions.. There's a round-like disk.. it might be the sun on it, might be like a big light.. It feels like, looks like, feels that things are blowing the wind is blowing and everything is like blowing in the same direction.. There's something rising.. it's sort

Upon his return, the Experimenter presented the five photographs and brief descriptions of the five target sites in random order to the Subject for matching in the blind rank ordering procedure followed in previous experiments.<sup>7</sup> The Subject gave the Experimenter copies of the transcribed descriptions, also in random order for the Experimenter to match against the targets. In addition, a third person, who had no connection with the

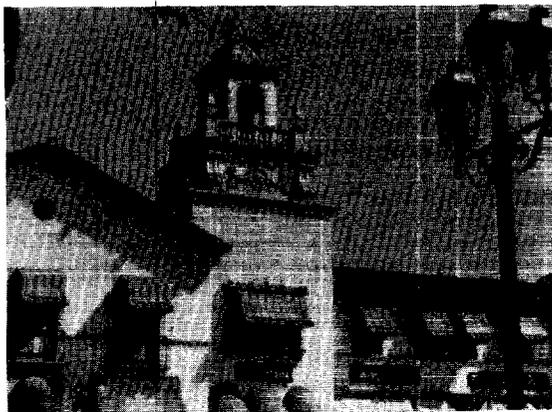


Figure 1. (Photograph of Precognitive Remote Viewing Experiment).



Figure 2. Northwestern Railroad Station (Target 6 in Multiple Precognitive Remote Viewing Experiment).

Table 4

Experimental Protocol

Long Distance Precognitive Remote Viewing

Day 1	8:30 A.M. (CDT)	Subject in Midwest, U.S.A. begins description of where experimenter will be 23.5 hrs. in the future in Bratislava, Czechoslovakia or 24.5 hrs. in the future in Moscow, U.S.S.R.
	3:30 P.M. (Europe)	
Day 2	3:00 P.M. (Europe)	Experimenter stops at whatever location he is at for fifteen minutes, and takes a photograph of target to compare with predicted location.

experiment, was also asked to blind rank order the photographs against the descriptions.

RESULTS

These procedures resulted in three independent sets of scores which were analyzed according to Morris' method for evaluation preferentially matched free-response material.<sup>8</sup> The three sets of ranking were significant at .04 in two cases and .05 in one. (See Table 4). Again, two experiments have been selected to show the accuracy of the transcripts in prediction.

TARGET 1: DANUBE RIVER (BRATISLAVA, CZECHOSLOVAKIA)

The target was a "flying saucer" restaurant, a circular building raised high into the air on heavy pillars above a bridge near the bank of the Danube river. The subject described the experimenter as being "near water . . . a very large expanse of water . . . boats . . . vertical lines like poles . . . a circular shape like a merry-go-round or gazebo . . . it seems to have height, maybe with poles . . . a dark fence along a walk . . . at the top of the steps, like a path or walkway . . . a boardwalk and there's a fence along it." (See Figure 3).

TARGET 5: EXHIBITION OF ECONOMIC ACHIEVEMENT OF U.S.S.R. (MOSCOW, U.S.S.R.)

The target was a huge park with many fountains, flowerbeds, and buildings. The Experimenter stood looking through the entrance which was a huge archway with a black metal fence. The Subject's transcript reads as follows: "Lots of different shapes, activity, buildings..Gate or fence,made of metal of some sort.. high for a gate..dark metal..People walking..Something round circular..light color stone..slab on a stand.. a bench or table..something like a row of doorways.. some sort of fountain in circular shape..Cultivated flowers around in beds." (See Figure 4).

Table 5

Ranks Assigned by Judges Matching Targets to Transcripts in Long Distance Precognitive Remote Viewing

Target	Approx. Distance	Time in Future	Experimenter's Ranking	Subject's Ranking	Independent Judge
Danube River (Bratislava, Czechoslovakia)	5,087 miles	23.5 hrs.	1	1	1
St. Michael's Church (Bratislava, Czechoslovakia)	5,087 miles	23.5 hrs.	2	2	3
Hotel Ukraine (Moscow, U.S.S.R.)	5,284 miles	24.5 hrs.	1	1	2
Tretyakov Gallery (Moscow, U.S.S.R.)	5,284 miles	24.5 hrs.	2	3	2
Exhibition of Economic Achievement of U.S.S.R. (Moscow, U.S.S.R.)	5,284 miles	24.5 hrs.	2	1	1
Sum of Ranks			8	8	9
Statistical Significance			p < .025	p < .025	p < .05

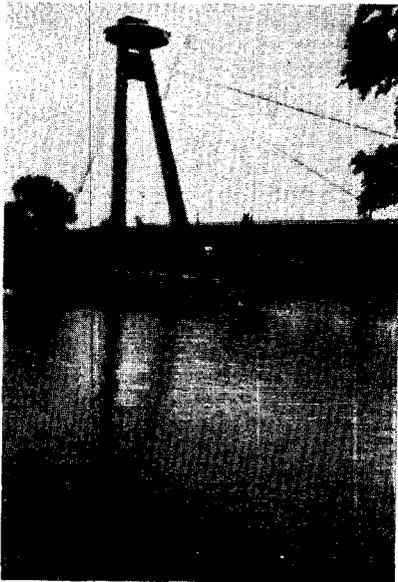


Figure 3. Danube River, Bratislava, Czechoslovakia, (Target 1 in Long Distance Experiment).



Figure 4. Exhibition of Economic Achievement of the U.S.S.R., Moscow, U.S.S.R. (Target 5 in Long Distance Experiment).

#### DISCUSSION

The significant results of these two separate protocols lend further support to the hypothesis that the extrasensory channel of communication and/or perception utilized in remote viewing is a widespread and relatively common faculty which can be exercised without extensive training or experience when the environmental conditions are favorable. Distance and time appear to pose no barriers to its effectiveness.

These findings are in keeping with those of previous studies testing remote viewing in individuals or group settings, and provide evidence that even the precognitive aspect of this phenomenon operates on an open channel which can be "tuned into" by a variety of "consoles" with differing genetic structures. Although there was enough information in each transcript to

provide a significant cross correspondence between subjects on the same target, no telepathic indication can be deduced in the multiple precognitive remote viewing experiment. The reports of the subjects in each pair differed enough to make it obvious that, while both subjects were perceiving the same target, the perceptions reflected individual differences in cognitive processing of information and interpretation. The significant correlation between A and B is not indicative of a separate channel of communication between the subjects; but rather supports the hypothesis that two separate and effective channels appear to operate simultaneously between each subject and target and/or experimenter and target.

The long distance precognitive experiment demonstrated the capability of an individual to also extend this ability over great spatial distances as well as temporal distances of over one 24 hour period. Although the degree of significance of this experiment is not as great as had been found in other precognitive remote viewing research, the results are still well above chance expectation and provide further substantiation to the existence of this ability. Furthermore, the results are indicative of the great latitude of the parameters of the remote viewing experience, parameters which have not previously been tested to these extremes of time and distance. The ability appears to function as well over large time and space differentials as it does when the target is within a 35 minute, local distance.

The principle factor which appears to be operating under the conditions of these experiments is a situation where normal modes of rational thought or communication are inoperable, thus reducing the internal noise and external stimuli to permit the weaker signal to be distinguished. Subjects have discovered (particularly those who have performed more than one trial) that they are capable of screening out the noise, cognitive and sensory, and perceiving the information being transmitted, in spite of the logical impossibility of such an accomplishment. When subjects are given permission to explore their psychic abilities in an environment where those abilities are the only possible ones which can produce results, they discover that such abilities do exist and are relatively reliable.

The positive results obtained from the various experiments attempted to date, indicate that the protocol of this design is a useful and effective one for additional research into the nature of non-ordinary information transfer.

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RESPONSE SENSITIVITY OF HUMAN SUBJECTS TO ELF ELECTROMAGNETIC FIELDS:  
CRITICAL CONSIDERATIONS FOR TWO ELF MODELS OF PARANORMAL BEHAVIORS

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**Summary.** The potential role of ELF (extremely low frequency) electromagnetic fields in the mediation of alleged paranormal behaviors or remote viewing is considered. Two models have emerged to conceptualize the relationships between the agent-object (A), the percipient (P) and the geophysical-mediator (G). A type 1 interaction involves a direct A-G-P relationship by which information associated with A directly modifies G that influences P. A type 2 interaction requires G to operate only as a discriminative stimulus, conditioned stimulus or "trigger", independently, to A and P with shared reinforcement (experience) histories. The latter model requires little information transfer by the ELF-G factor since the detailed sequences are a consequence of A and P's shared conditioning in the presence of G. The available data concerning response sensitivity of human subjects to small changes in ELF field frequencies and intensities are discussed.

An essential problem for scientists concerned with the explanation and description of alleged telepathic-clairvoyant (T-C) behaviors<sup>1</sup> or remote viewing<sup>2</sup> is the mechanism by which information traverses some point A to some point B without using conventional sense modes or stimulus sources. Since alleged T-C behaviors involve long distances and opaque boundaries between the putative agent and percipient, the basic natural mechanisms which satisfy the conditions of a T-C mediator candidate<sup>3</sup> are limited. Puthoff and Targ<sup>4</sup>, Kogan<sup>5</sup>, Bentov<sup>6</sup> and Persinger<sup>3</sup> have suggested naturally produced ELF (extremely low frequency) electric and magnetic fields as one means by which paranormal information could be mediated. The physical and biologically relevant characteristics of these signals are reported in ELF and VLF Electromagnetic Field Effects.<sup>7</sup>

At present, there are two models developed to conceptualize the relationships between the agent or object (A) the percipient or reporter (P) and the geophysical-meteorological mediator (G). A type 1 interaction would be a simple A-G-P relationship by which information from A modifies or is coded onto G and influences P some time and distance later. A type 2 interaction would be another example of a "third factor theory" whereby G would influence A and P separately at about the same time. Since G would not be apparent to either A or P, the conclusion of a direct A-P interaction would be likely but inaccurate.

The two models require different demands from ELF signals. A type 1 interaction requires direct information coding upon the ELF signal. Although the amount of information would be small considering the typical bit rate, such difficulties could be attenuated theoretically by: (1) increasing the exposure time to the ELF signal or by (2) "closure effects" displayed by P. More critical features would be: (1) the increment of time the agent-object could maintain ELF coding and (2) P's neural capacity to differentiate and "understand" the signals.

A type 2 interaction does not require acute co-

ding or modification procedures but instead requires the operation of learning/conditioning. This interaction assumes that A and P have shared reinforcement histories (shared experiences) in the presence of G (some specific ELF signal). In this situation, later presentation of G would initiate both the alleged "transmitted information" in A and the paranormal responses in P independently. The basic operation would involve elementary learning principles such that the G factor becomes a conditioned stimulus or a discriminative stimulus. G, per se, would contain little information, rather it would behave as a "trigger" to evoke the changes in the two organisms involved. The effect would be similar to the cascading series of intense private responses ("thoughts"), visceral changes and biochemical alterations in a person who has been punished in the presence of a four-letter curse word; the word itself (before the conditioning) would involve little energy and information.

Within this model, the "same" ELF characteristics associated with some environmental event, e.g., geomagnetic storm, earth-ionospheric perturbation, could influence hundreds of different A:P pairs in different ways. The crucial behavioral operation is a history of shared response displays by individual A:Ps in the presence of the ELF stimulus. An attractive feature of this model involves elimination of the cumbersome "time factor". Since the G factor elicits changes in the A and P independently, traditional designations of agent and percipient would be irrelevant since temporal relationships (including apparent precognition) reflect only response latencies to the field's presence.

From a behavioristic perspective, the role of "awareness" and related verbal behaviors is not an essential factor in the ELF models. ELF signals could elicit a number of pervasive response sequences within the human organism without involving private responses. Conditioning without the role of "awareness" has been demonstrated in the laboratory many times, e.g., covert responses. Depending upon the reinforcement history, the subject may suddenly display particular response sequences or if the associations had been aversive, show diffuse characteristics of "anxiety". If other response systems were involved, the display of "awareness" behavior during the signal presentation could actually interfere with the organism's total response. Situations described metaphorically as "mind wandering" (low level private responses) would be more optimal for efficient ELF signal responding.

The key to the ELF theory lays in the empirical verification of ELF-EM associated organismic changes. The degree to which ELF electromagnetic fields significantly influence living systems is still a matter of controversy. Investigation groups (e.g., Committee on Biosphere Effects of ELF Radiation of the Assembly of Life Sciences, Washington, D.C.) and academics are still debating the practical nature of these changes. Review of the behavioral-biological effects of ELF fields have been reported elsewhere.<sup>7, 8</sup> Significant organismic changes in the presence of ELF electromagnetic fields have been reported in more than one hundred experiments involving human and non-human ani-

mals; however, frankly, the absolute effects have been quite small and are not always consistent.

In addition, systematic determination of frequency-, intensity- or wave shape-dependence functions have not been completed. The number of ELF-EM incremental characteristics within either amplitude, frequency, rise time, peak time or wave trains, that the human organism can discriminate as different is unknown. Such discrimination is required, especially for a Type 1 interaction model, unless one assumes a 0,1 detection mechanism but this would require an organismic capacity to distinguish temporal patterns. Some evidence exists that human subjects can respond differentially to ELF parameters.

Forty minute exposures to either 3 Hz or 10 Hz electric fields of either 0.3 V/m or 3 V/m did not significantly alter reaction time in 70 human male and female subjects<sup>9</sup>; however, weak changes in variability of response latencies were apparent. On the other hand, Konig<sup>10</sup>, quoting Hamer's work and his own results (with smaller groups of subjects) argues that human reaction time is altered by: (1) the presence or absence of 4 Hz and 10 Hz electric fields and (2) frequency shifts of only 1 Hz at the field strengths of 2 mV/50 cm. However, Konig did not apply systematic statistics to these results. Friedman, Becker and Bachman<sup>11</sup> exposed more than 70 male and female subjects to sinusoidally modulated magnetic fields between  $5 \times 10^{-4}T$  and  $1.7 \times 10^{-3}T$ . Shifts in field frequency of only 0.1 Hz (from 0.1 Hz to 0.2 Hz) were sufficient to significantly alter reaction time. The effects were facilitated by using each subject as his/her own control. These data indicate that small shifts in field frequency alter simple reaction time in human subjects. However the effects are weak and involve significant overlaps in standard deviations between field parameters.

Different response systems, such as the visceral, somatic, biochemical or vascular matrices, may display differential sensitivity and susceptibility to low level, natural ELF field effects. Reaction time, correlated primarily with gross pyramidal tract features, may not be as sensitive as (for example) vascular or visceral (emotional) changes that are not required to be highly correlated with "awareness" or "voluntary" responses. Ludwig and his colleagues<sup>12</sup> have reported significant alterations in headaches and related vascular complaints in the presence of ELF magnetic fields. However, with the exception of non-human animal studies, e.g., Reille<sup>13</sup>, who reported conditioned heart rate changes in pigeons exposed to  $10^{-5}T$  magnetic fields between 0.2 Hz to 0.5 Hz and not between 300 Hz and 500 Hz, little research has been conducted with these potentially responsive systems. Alterations in such systems could still modify "awareness behavior" (if sufficiently intense) or influence dream sequences. More detailed analyses of the ELF models and problems of human behavior in the context of paranormal stimuli have been reported elsewhere.<sup>14, 15</sup>

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## STATE OF THE ART IN REMOTE VIEWING STUDIES AT SRI

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ABSTRACT

For the past five years we have been investigating aspects of human perception that appear to fall outside the range of well-understood perceptual/processing capabilities. Of particular interest is a human information-accessing capability that we call "remote viewing." This phenomenon pertains to the ability of certain individuals to access and describe, by means of mental processes, remote geographical locations up to several thousand km distant from their physical location given only a known person on whom to target.<sup>1-4</sup>

In this paper we concentrate on recent transcontinental experiments carried out with individuals whose remote perceptual abilities have been developed sufficiently to allow them to describe--often in great detail--geographical or technical material such as buildings, roads, structures, natural formations, along with real-time activities of persons at the target site. These experiments, together with our previously established data base of over 50 local (< 20 km) experiments, indicate that (1) although the information channel is imperfect, the data generated by the remote viewing process exceeds any reasonable bounds of chance correlation, and (2) the extent of physical distance separating the subject from the target site up to transcontinental distances does not appear to significantly affect the accuracy of perception.

INTRODUCTION

In our discussion of the state of the art of remote viewing studies at SRI we take as our data base the 51 experiments described in Reference 2 (local remote viewing with targets  $\approx$  20 km) plus five cross-country experiments (some with multiple subjects) described in Reference 4 and amplified here. In these experiments we have investigated an often-reported human perceptual ability that has heretofore not been widely investigated in the laboratory. This ability we term "remote viewing." It is an ability by which human subjects perceive, and describe by word and drawing, distant scenes and activities blocked from ordinary perception. We have found that subjects have been able to describe with equal accuracy scenes at both local sites (that is, within a few miles) and those at transcontinental distances. These abilities are developed in several individuals sufficiently to allow them to describe--often in considerable detail--geographical or technical material such as buildings, roads, interior laboratory apparatus, and real-time activities.

As observed in the laboratory, the basic phenomenon appears to cover a range of subjective experiences variously referred to in the literature as autoscopia (in the medical literature); exteriorization or disassociation (psychological literature); simple clairvoyance, traveling clairvoyance, or out-of-body experience (parapsychological literature); or astral projection (occult literature). We choose the term "remote viewing" as a neutral descriptive term free from prior associations and bias as to mechanisms.

EXPERIMENTAL APPROACHDescription of the Protocol (Local Targets)

We begin with a synopsis of the basic data base of 51 local remote viewing experiments.<sup>2</sup> The general protocol is to closet a subject with an experimenter at

SRI and at a prearranged time to obtain from the subject a description of an undisclosed, remote site being visited by a target team, one of whose members is known to the subject and who thereby constitutes the target person. The target team is assigned their target location by an independent experimenter who has generated a list of targets located within a 30-minute driving time from SRI, and who accesses this list by a randomization procedure. The target pool consists of more than 100 target locations chosen from a target-rich environment. The target location selected is kept blind to both the subject and experimenter closeted at SRI. The experiment is thus of the double-blind type.

In detail: To begin an experiment, a subject is closeted with an experimenter at SRI and instructed to wait 30 minutes before beginning a narrative description of where the target team has gone. Meanwhile, the target team obtains sealed traveling orders from a monitor who has previously prepared and randomized a set of such orders. After leaving SRI by automobile, the target team opens the traveling orders and proceeds directly to the target without any communication with the subject or experimenter remaining at SRI. The experimenter remaining with the subject in the SRI laboratory is kept ignorant of both the particular target and the target pool so as to eliminate the possibility of cueing (overt or subliminal) and to allow him freedom in questioning the subject for clarification of his descriptions. The target team remains at the target site for a prearranged 15-minute period following the 30 minutes allotted for travel. During the observation period, the remote viewing subject at SRI is asked to describe his impressions of the target site into a tape recorder and to make any drawings he thinks appropriate. A tentative evaluation is made of the subject's output when the target team returns to SRI. Finally, following the experiment, the subject is taken to the site so that he may obtain direct feedback.

Initial Experimental Series

To give a concrete example, we summarize the results obtained with the first subject on the local remote viewing series. This subject (designated here as S1) participated in nine experiments. Subject S1 came to our experiments with a reported history of spontaneous remote viewing experiences. In general, the subject's ability in our experiments to describe correctly buildings, docks, roads, gardens, and the like, including structural materials, color, ambience, and activity--sometimes in great detail--indicated the functioning of a remote perceptual ability. A Hoover Tower target, for example, was recognized and correctly named. Nonetheless, the descriptions generally contained inaccuracies as well as correct statements. A typical example is indicated by his drawing shown in Figure 1 in which the subject correctly described a park-like area containing two pools of water: one rectangular, 60 x 89 ft (actual dimensions 75 x 100 ft); the other circular, diameter 120 ft (actual diameter 110 ft). As can be seen from his drawing, the subject also included some elements, such as the tanks shown in the upper right, that are not present at the target site. We also note an apparent left-right reversal, often observed in paranormal perception experiments.

Further, the subject incorrectly indicated the function of the site as water purification rather than recreational swimming. We often observe essentially correct descriptions of basic elements and patterns



Table 2

## SUMMARY: REMOTE VIEWING OF LOCAL TARGETS

Subject	Number of Experiments	p-Value, Rank Order Judging
With natural targets		
S1	9	$2.9 \times 10^{-5}$
S2 and S3 (four each)	8	$3.8 \times 10^{-4}$
S4	9	$1.8 \times 10^{-6}$
S5 and S6 (four each)	8	0.08 (NS)
V1 and V2 (three; two)	5	0.017
With technology targets		
S2, S3, S4, V2, V3	12	0.036

information channel of useful bit rate. The descriptions supplied by the subjects although containing inaccuracies, were sufficiently accurate to permit the judges to differentiate (blind) among various targets to the degree that roughly 50% of the transcripts were directly matched.<sup>2</sup>

LONG-DISTANCE REMOTE-VIEWING EXPERIMENTSGeneral

After establishing the data base of 51 remote-viewing experiments with local targets (sites within a few kilometers), we undertook a series of five experiments designed to determine whether an increase in subject-target separation to transcontinental distances would degrade the quality or accuracy of perception. A major motivation for this effort was the desire to begin to accumulate data to examine various hypotheses, e.g., whether remote viewing is mediated by extremely low-frequency (ELF) electromagnetic waves. Under simple forms of this hypothesis, one would expect a degradation in accuracy as the subject-target distance is increased to several thousand kilometers.<sup>8-13</sup>

As a secondary goal, we were interested in the real-time data rate--e.g., determining the extent to which a remote-viewing subject can track the real-time activities and movements of a known individual in a distant city. Therefore, the subjects were encouraged to describe real-time activity during the viewing period.

The methodology with regard to target selection again was designed to eliminate possible cueing paths. Targets were determined either by random-number generator entry into a previously prepared target list unknown to subject and experimenters with the subject, or in one case, on the basis of site selection by an independent, skeptical challenger.

An interesting additional technique that was employed successfully in the first two of the five experiments was the use of the DARPA computer teleconferencing network for post-experiment feedback. Access to the computer by the traveling experimenter was by means of a portable terminal. The use of the teleconferencing service allowed the subject in one state (California) to communicate with an experimenter in the other state, New York. The conversational TALK mode available on the DARPA net was used for this purpose in the following manner.

The subject at SRI (supervised) and the experimenter on the east coast agreed (via computer teleconferencing) to begin an experiment in one-half hour. The purpose of the computer in this experiment was to provide time- and date-stamped permanent records of all communications between the various parties involved in the experiment. These data could be read in real time by any authorized person entering the SRI-AI Tenex (MSG) system.

After logging off the computer, the outbound experimenters used a random-number generator to determine which of several locations in the target area would constitute the target to be visited in this experiment. Neither the subject nor the experimenter at SRI knew the contents of the target list, compiled in New York after logging off. Having selected a target location by the random protocol, the outbound experimenters proceeded directly to the site and remained there for 15 minutes.

At the previously agreed-upon start time (one-half hour after breaking computer links) the subject typed impressions into a special computer file established for this purpose.

When the outbound experimenters returned from the target site to the hotel, one of the experimenters made use of a limited-access file to enter his description of the place he actually visited. He then returned to the executive level of the computer, and awaited the appearance of the SRI experimenters and subject who could then (and only then) link the New York and Menlo Park terminals. At that time both files were printed out on both terminals, the the subject and the outbound team each learned what the other had written.

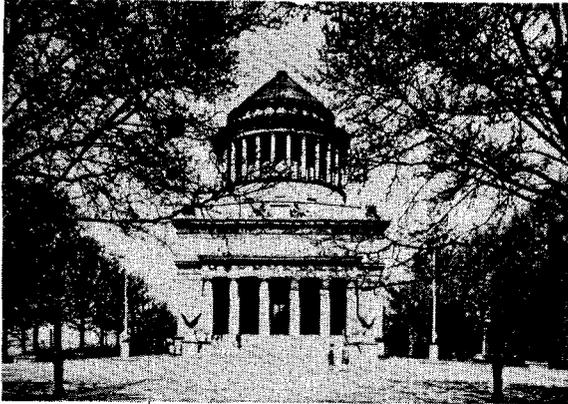
Menlo Park to New York City (Grant's Tomb)

Two subjects, S7 and S8, both in California, participated simultaneously in this experiment of Grant's Tomb, which was the first of the two New York City targets. Both subjects independently provided computer-stored records of their impressions, and one made the sketch shown in Figure 2.

Subject S8, an SRI systems analyst, said in his opening paragraph: "Outdoors, large open area, standing on and then off asphalt (rough material), dark for a path. A white building, like a ticket booth. Wooden structure, is white in color, and has an arched look about it. There is a large shade tree close to Russ (outbound experimenter)."

Subject S7, closeted in a separate SRI location, began with: "I thought of a high place with a view." The subject continued with "I saw a tree on your left in a brick plaza--it seemed to be in front of a building you were entering." Later, "I could not clearly identify the activity. A restaurant? A museum? A bookstore?" And, "You were looking at coins in the palm of your hand, maybe giving some to Nicky (son of outbound experimenter)." The coins were in fact used to purchase the postcard from which Figure 2 was made, and they were given to the experimenter's son who made the purchase. Both subjects then went on for an additional paragraph to describe details of the activities they imagined to be going on inside the building they saw, details that were partly correct, partly incorrect.

As an example of the style of narrative generated by a subject during a computer teleconferencing experiment, we include the entire unedited computer-logged text of S7's response to the Grant's Tomb target in Figure 3.



Grant's Tomb Target in New York City

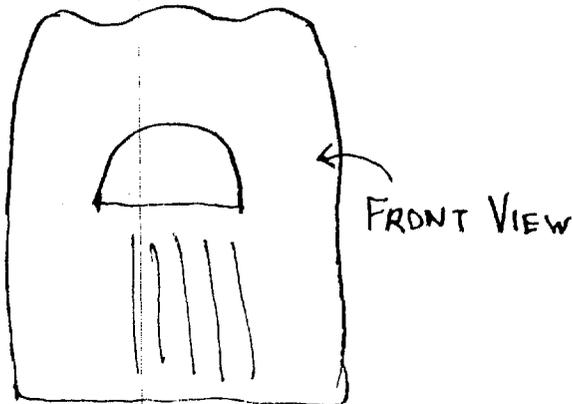


FIGURE 2 COAST-TO-COAST REMOTE VIEWING EXPERIMENT. SUBJECT DESCRIBED: "OUTDOORS, LARGE OPEN AREA... SHADE TREES... WHITE BUILDING WITH ARCHES."

Menlo Park to New York City (Washington Square Fountain)

In the second experiment, the target, again chosen by random protocol, was the fountain in Washington Square Park. One subject, S7, participated. The subject produced an exceptionally accurate transcript. The photos and the subject's drawing of the fountain are shown in Figure 4. The subject began his printout with the following: "The first image I got at about the first minute was of a cement depression--as if a dry fountain with a cement post in the center or inside. There seemed to be pigeons off to the right, flying around the surface out of the depression.... At one point I thought you were opening a cellophane bag...." (The experimenters had in fact bought ice cream during the experimental period.) "There was also a rectangular wooden frame, a window frame, but I wasn't sure if it was on a building, or a similar structure with a different purpose." (A possible correlation from a functional viewpoint to the Washington Square Arch through which the outbound experimenters viewed the fountain toward the end of the experimental period.) "All in all I thought you were in Riverside Park...." (Incorrect analysis.) An SRI scientist, familiar with the New York City area but blind to the target, did, however, identify the target correctly on reading the twenty lines of printout as it emerged from the computer terminal. (For the complete transcript, see Figure 5.)

These experiments provide an elegant demonstration of the utility of the teleconferencing process as a secure data recording system to provide real-time monitoring of long-distance remote-viewing experiments.

In a more detailed tape recording made after the experiment, but before any feedback, the subject described "cement steps going into the depression, like a stadium, and the rounded edge of the top of the depression as you go up to ground level." These descriptions are not only correct, but also show remarkable detail.

Quantitative Analysis of New York City Target Transcripts

In attempting to derive a quantitative estimate of the amount of valid data in a transcript, we have made a detailed analysis of the previous two transcripts generated by a single subject (S7) during the long-distance experiments between Menlo Park, California, and New York City.

To carry out this analysis, each transcript typed by the subject into a computer file was edited to retain only declarative statements spontaneously generated by the subject, or responses to direct questions. These statements were collected in groups called concepts. For example, if the subject had five references to a condition that can be defined as shady, these would be combined in the concept "shady."

We performed four comparative analyses on the concepts from the two transcripts: Transcript A with Site A; Transcript B with Site B; Transcript A with Site B; and Transcript B with Site A. Each concept was assigned a rating ranging from 0 to 10, depending on the analyst's subjective impression as to whether the concept had no correspondence (a rank of 0) or complete correspondence (a rank of 10) with the target. The cross-matching was to serve as a crude measure of chance or generalized correspondence.

For the Grant's Tomb target site, there were 21 distinct concepts with a mean score  $\mu = 6.4$  ( $\sigma = 4.3$ ); for the Washington Square site there were 16 concepts with a mean score  $\mu = 6.8$  ( $\sigma = 2.7$ ). The individual cross matches were as follows: Grant's Tomb transcript to Washington Square had a mean score  $\mu = 3.6$  ( $\sigma = 4.3$ ), and the Washington Square transcript matched against Grant's Tomb yielded a mean score  $\mu = 3.8$  ( $\sigma = 3.8$ ). Table 3 shows the detailed analysis for the Grant's Tomb experiment. For each of the 21 concepts (all that were found) we display a summary of the concept, the target correspondence and its related score, and the correspondence with the control target, Washington Square, and its related score. Table 4 shows the same data for the Washington Square site and its control target, Grant's Tomb.

The combined score for the direct matches is  $\mu = 6.6$  ( $\sigma = 5.1$ ), and for the cross matches is  $\mu = 3.7$  ( $\sigma = 5.7$ ), where the means are calculated by direct average and the standard deviations are computed from the square root of the sum of squares of the deviations from the mean scores. The difference in the means, although not definitive in a statistical sense (because of the large spread) is consistent with earlier qualitative assessments of transcript accuracy of over 50 transcripts. From these means we would estimate that approximately 66% of this one subject's response constitutes an accurate description of the target site, whereas if the data are matched against other target sites, only 37% of the response would typically apply.

<- TYPE 1  
 (MSG. # 1, 1678 CHARS)  
 DATE: 2 JUL 1978 1126-PDT.  
 FROM: TARG  
 SUBJECT: S7's REPORT  
 TO: TARG

RUSSEL - I THOUGHT OF A HIGH PLACE WITH A VIEW - DETAILS INCLUDED 3 MIN BEFORE V

IEWING I SAW A TREE ON YOUR  
 LEFT IN A BRICK PLAZA - IT SEEMED TO BE IN FRONT OF A

WRONG BUTTON - BUILDING YOU WERE ENTERING - YOU WAITED AS IF  
 FOR AN ELEVATOR AND READ SOMETHING ON THE WALL  
 YOU CAME OUT (OFF THE ELEVATOR) AND THERE WAS A ROOM ON YOUR  
 LEFT WITH A VIEW - I COULD NOT CLEARLY IDENTIFY THE ACTIVITY  
 - A RESTAURANT ? A MUSEUM? A BOOKSTORE? YOU LOOKED AT SOMETHING  
 A CARVING OR MENU OR DIRECTIONS ON A POST BEFORE ENTERING -  
 FROM THE ROOM I THOUGHT THERE WAS A VIEW OF A HARBOR OR WATER  
 ABOUT 1/3 OF THE FRAME - AT ONE TIME I HAD THE FEELING THAT  
 YOU WERE LOOKING AT COINS IN THE PALM OF YOUR HAND - MAYBE GIVING  
 SOME TO NICKY - WHICH WERE THEN PUT IN A SLOT - JUKEBOX? PINBALL?-  
 ALSO THE SURFACE WITH SOMETHING VERTICAL ABOVE - SOMETHING REFLECTING  
 METAL PIPEX OF AN ORGAN (THE ONE I DIDN'T VIEW LAST TIME )  
 OR OF BOTTLES AGAINST A MIRROR - SOMETHING REFLECTING - THEN  
 DAVID SNAPPED HIS FINGERS - I SAW A BASKETBALL VERY CLEAR  
 TACTILE SENSATION FROM A SOMEWHAT TEXTURED GLOBE - ALSO, ON  
 ANOTHER SNAP - THE COLOR RED NOT SHARPLY DEFINED - LIQUID OR  
 FLOWING MATERIAL OR NICKY RACING AROUND IN A RED SHIRT  
 ANOTHER SNAP AND I ASKED FOR THE NAME OF THE PLACE -  
 I WAS THINKING "BAR" BUT I THREW THAT OUT AS OLD AND SAW THE  
 LETTERS "CH" WHICH I COMPLETED AS "CHILE" OR "CHILI" -- ALSO  
 ANOTHER SNAP AND THE NAME OF THE THIRD PERSON - JOE JOHN OR  
 GERRY - IS IT GARY? - ARUSSELL I S THAT YOU?HI, THAT WAS S7, AND WE WERE IN T

HE "MSG" STILL, I THINK THAT IT MAY  
 ABORT!

**FIGURE 3 COMPUTER FILE PRINTOUT. CALIFORNIA-NEW YORK LONG DISTANCE  
 REMOTE VIEWING. TARGET: GRANT'S TOMB (NYC).**

Although crude, this subjective analysis serves as a first step in suggesting a method for further single transcript analysis.

New York City to Ohio (Ohio Caves)

A third long-distance remote-viewing experiment was carried out under the control of an independent, skeptical scientist. In this case, both SRI experimenters, while visiting in Ohio, agreed to take part in a remote-viewing experiment in which our host would select the target.

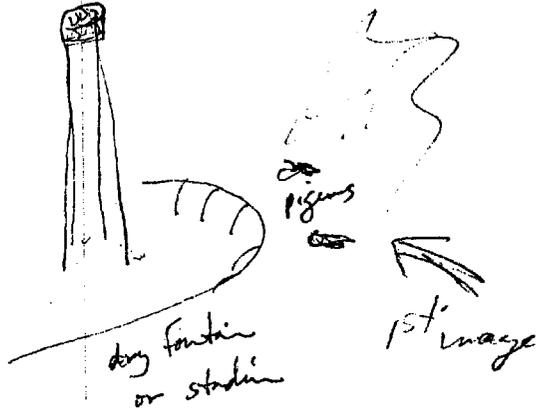
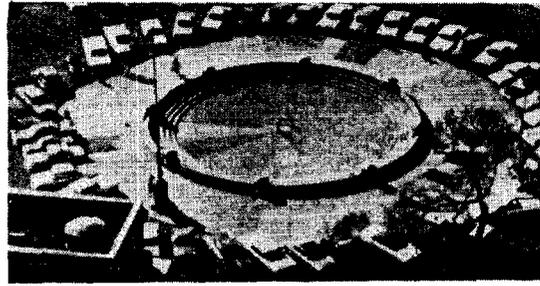
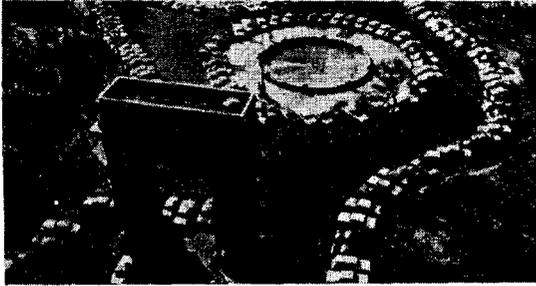
Under the observation of our challenger, we telephoned Subject S4 in New York City and obtained the subject's agreement to participate in a long-distance remote viewing experiment. The subject was told only that we were located somewhere between New York City and our California laboratory and that shortly we would be taken to a target that we would like to have described. The time for the experiment was set for 2:00 PM EDT. We also agreed to call again at 3:00 PM EDT to obtain Subject S4's impressions and to provide feedback as to the actual target.

The scientist took us directly to the Ohio Caverns at Springfield, Ohio, which he had chosen as the target location (see Figure 6). We entered the grounds through an entrance arch that opens onto an enormous expanse of lawn, perhaps 20 acres. The caves are located at a depth of  $\approx$  150 ft and are entered through a small building having a long flight of steep stairs. Once underground, we walked through a maze of rock-lined tunnels that lead eventually into a series

of rooms lined with calcite stalactites and stalagmites, frosty white and beige crystals formed like icicles. The entire cavern is illuminated by small electric light bulbs attached to the walls. After a 45-minute walk, we exited the caves through a large metal door giving access to a square cross-sectional shaft with stairs leading to the surface.

Following the experimental period, the scientist observer called the subject in New York, 45 minutes after we left the caves. The opening statements of the subject's transcript as dictated over the phone and posted to the SRI experimenters is as follows:

"1:50 PM before starting--Flat semi-industrial countryside with mountain range in background and something to do with underground caves or mines or deep shafts--half man made, half natural--some electric humming going on--throbbing, inner throbbing. Nuclear or some very far out and possibly secret installation--corridor--mazes of them--whole underground city almost--Don't like it at all--long for outdoors and nature. 2:00 PM--(Experimenters) R and H walking along sunny road--entering into arbor-like shaft--again looks like man helped nature--vines (wisteria) growing in arch at entrance like to a wine cellar--leading into underground world. Darker earth-smelling cool moist passage with something grey and of interest on left of them--musty--sudden change to bank of elevators--a very man-made steel wall--and shaft-like inverted silo going deep below earth--brightly lit...."



Subject's Perception was of a "Cement Depression — as if a Dry Fountain — with a Cement Post in the Center or Inside."

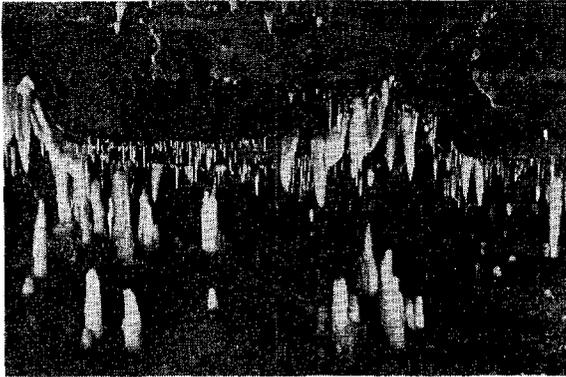
FIGURE 4 COAST-TO-COAST REMOTE VIEWING EXPERIMENT WITH TARGET AT WASHINGTON SQUARE IN NEW YORK CITY

TYPE (MESSAGE SEQUENCE) 6  
 (MSG. # 6; 1730 CHARS)  
 DATE: 6 JUL 1976 1354-PDT  
 FROM: TARG  
 SUBJECT: 87's REPORT PART 2 NYC EXP

THE FIRST IMAGE I GOT AT ABOUT THE FIRST MINUTE WAS OF A CEMENT DEPRESSION - AS IF A DRY FOUNTAIN - WITH A CEMENT POST IN THE CENTER OR INSIDE . THERE SEEMED TO BE PIGEONS OFF TO THE RIGHT, FLYING AROUND THE SURFACE OUT OF THE DEPRESSION. THEN I SAW AS IF IF IN THE DISTANCE A REAL STADIUM WITH GRASS IN THE CENTER AND PERHAPS STADIUM LIGHTS. OTHER IMAGES WERE AROW OF HOUSES/APICKET FENCE - SOME VERTICAL UNITS WITH JAGGED TOPS. THEN A FLUTED/GROOVED VERTICAL COLUMN, BUT I COULDN'T SENSE WHAT IT WAS RELATED TO. AGAIN YOU WERE IN A DEPRESSED AREA WITH CEMENT SIDES, LOOKING OUT ONTO THE SURFACE OUTSIDE. THE CEMENT SIDES ARE NOT STRAIGHT, BUT SLOPING, ALMOST S-SHAPED. ALSO A CLEAR FEELING OF THE HEAVY, WORN METAL BAR ON THE TOP OF TYPICAL NYC OR ANYCITY FENCES. THERE DIDN'T SEEM TO BE ANYTHING REALLY SPECIAL INSIDE, JUST A SEPARATION BETWEEN TWO TWO SIMILAR AREAS. AT ONE POINT, I THOUGHT YOU WERE OPENING A CELLOPHANE BAG AND LATER I SENSED YOU FEEDING POPCORN - TO PIGEONS. THERE WAS ALSO A RECTANGULAR WOODEN FRAME, A WINDOW FRAME, BUT I WASN'T SURE IF IT WAS ON A BUILDING, OR A SIMILAR STRUCTURE WITH A DIFFERENT PURPOSE. ALL IN ALL, I THOUGHT YOU WERE IN RIVERSIDE PARK NEAR A TRACK AND PLAY AREA, OCCASIONALLY LOOKING UP AT THE "ROCK AND LEAF" CLIFFS LEADING UP TO THE DRIVE. AFTER I HAD THOUGHT THAT AND FIT IT IN T WITH THE IMAGES RECEIVED SO FAR, IT KIND OF STUCK, AND I POSSIBLY GENERATED MORE PARK SCENES. THE STADIUM /FOUNTAIN IMAGES WERE THE FIRST AND THUS THE LEAST BIASED AS TO PARK MEMORIES. (I SURE DO LIKR THE TLETYPE. IT CAN BECOME AN OBSESSIVE PASTIME, I SEE).

-----  
 THAT WAS MESSAGE 6

FIGURE 5 COMPUTER FILE PRINTOUT. CALIFORNIA-NEW YORK LONG DISTANCE REMOTE VIEWING. TARGET: WASHINGTON SQUARE (NYC).



**FIGURE 6 OHIO CAVES: DESCRIBED BY SUBJECT IN NEW YORK AS, "UNDERGROUND CAVES OR MINES... DEEP SHAFTS... DARKER, COOL, MOIST EARTH-SMELLING PASSAGES."**

Subject S4 concludes with

"I see a lot of gold and metal and silver-gold glow all over--not much sound--very silent factory--scary--few people--very special."

As if often the case, one observes that the basic gestalt of the target site is cognized and even experienced--e.g., the underground caves aspect, while specifics are misinterpreted--e.g., the labeling of the location as a nuclear installation.

A second subject (S8) working by himself at SRI, who had agreed in advance to participate in the same experiment by date and time, was less successful with the cavern target. This subject erroneously interpreted early impressions as associated with a museum. As a

result the majority of his transcript, although containing some correct elements, reflects primarily an incorrect analytical interpretation and cannot be said to constitute evidence for paranormal functioning.

New Orleans to Palo Alto (Northern California Bank Plaza)

Two experiments carried out between New Orleans and Menlo Park, California, constitute the final tests of the long-distance series, five experiments of which have been completed to date (all reported here). These last two were carried out with the two subjects who had participated in the first two California-to-New York experiments.

The first experiment in this series involved Subject S7 in New Orleans viewing activities of a group of three people known to the subject, at a location in a Palo Alto/Menlo Park area 2000 miles away. The subject's principal impression was of an "overhang of a building over their heads...also a round gold rim around a sunken depression." The target, a bank building is shown in Figure 7. Principal features of the target include a dramatic building overhang, and a rectangular concrete depression with a fountain in which the water comes out of a circular gold rim. The subject also reported "some kind of fake china flowers mushrooming out of the depression." There were four orange lamps mounted on the gold rim. Finally, S7 reported "there was a projectile coming toward (one of the outbound experimenters). Like a ball or frisbee, as if (another experimenter) has tossed him a ball." Actually the experimenters had found a paper airplane lying on the ground and had thrown it back and forth several times. In fact, the photo of the site taken at the time of the experiment shows the airplane between them. This is one of the few times that a remote viewing subject has perceived rapid motion at the target site.

Table 3

QUANTITATIVE ANALYSIS OF THE GRANT'S TOMB TRANSCRIPT

Subject's Description (Quotes)	Correspondence (0-10)	Cross-Correspondence to Washington Square (0-10)
1. I thought of a high place with a view	Bluff overlooking river 10	Standing in a depression 0
2. I saw a tree on your left	Lots of trees 10	Nearby trees 8
3. In a brick plaza	Plaza looks like brick 8	Plaza looks like brick 8
4. Building you were entering	Entered tomb building 10	No buildings 0
5. Read something on the wall	Read informative plaque 10	No walls, no reading 0
6. Came off the elevator	No elevator 0	No elevator 0
7. A restaurant?	None 0	None 0
8. A museum?	It is a museum 10	None 0
9. A bookstore?	Books and cards are sold 10	None 0
10. A carving, menu or directions on a post	Bronze plaque at entry 8	None 0
11. The room has a view	Room looks down on tombs thirty feet below 7	No room 0
12. View of harbor or water	View of river 9	Large operating fountain 9
13. Coins in your hand	Used to buy cards 10	Used to buy ice cream 10
14. Gave some coins to Nicky (son)*	He bought cards 10	Doesn't apply
15. Nicky put them into a slot	No slot 0	Doesn't apply
16. Reflecting metal pipes	Could be columns 6	Metal pipes in fountain 6
17. Bottles against a mirror	None 0	None 0
18. Something reflecting	Marble and glass doors 6	Water in fountain 6
19. Basketball or textured globe	None 0	Glass globes around fountain 8
20. Nicky in red shirt	Correct 10	Doesn't apply
21. Liquid or flowing material	None 0	Water in fountain 10
	Mean 6.4	Mean 3.6

\* Subject knew Nicky was in New York with experimenter.

Table 4

## QUANTITATIVE ANALYSIS OF THE WASHINGTON SQUARE TRANSCRIPT

Subject Description (Quotes)	Correspondences (0-10)	Cross-Correspondence to Grant's Tomb (0-10)
1. Cement depression	We were in a cement depression 10	Tombs are in marble depression 10
2. A dry fountain	Operating fountain 8	None 0
3. Cement post in the center	Cement post plus large pipe 7	Tombs in center 2
4. Pigeons off to the right	Pigeons were in the park nearby 8	No pigeons 0
5. Stadium with grass and lights	Scale factor 3	Scale factor 3
6. Rows of houses, picket fence	Houses with iron fences 9	None 0
7. Vertical units with jagged tops	Arch supports perhaps 3	Columns in front of building 10
8. Fluted grooved white columns	Side of arch supports 6	Columns in front of building 10
9. You are in depressed area with cement sides	Exactly 10	Tomb is in a depressed area 3
10. Sides are sloping almost S-shaped	Exactly 10	Somewhat curved at top 3
11. Heavy worn metal	Copper posts in fountain 7	Marble railing 3
12. A separation between two different areas	In and out of fountain 6	Above and below in tomb area 7
13. You were opening a cellophane bag	Yes 10	No 0
14. You were feeding popcorn to pigeons	Others were 3	No pigeons 0
15. Rectangular wooden frame...on a building	Could be the arch 5	Rectangular building 3
16. Riverside park, tracks and play area	Play area nearby 3	Tomb is in Riverside Park 7
	Mean 6.8	Mean 3.8

Menlo Park to New Orleans (Louisiana Superdome)

For the final experiment (subject in Menlo Park) it was agreed that at 1200 CST on a particular day, the outbound experimenter would choose a target location in his city by random protocol and remain there for the required 15 minutes. During this time, Subject S8 in Menlo Park would tape-record impressions and make any drawings that seemed appropriate. (The DARPA net was not available because of computer net malfunction.)

The target chosen by randomized entry into a New Orleans guide book list was the Louisiana Superdome. The outbound experimenter tape-recorded the following description as he looked at the building: "It is a bright sunshiny day. In front of me is a huge silvery building with a white dome gleaming in the sun. It is a circular building with metal sides. It looks like nothing so much as a flying saucer. The target is in fact the 80,000-seat Louisiana Superdome stadium."

The subject in Menlo Park described the target as "a large circular building with a white dome." The subject also expressed feelings of wanting to reject what he saw because the dome looked "like a flying saucer in the middle of a city." Some appreciation for this perception can be obtained from Figure 8 in which the target is shown, together with the sketches that the subject made.

Taken overall, the results obtained in these five long-distance remote-viewing experiments are of roughly the same accuracy with regard to site description as those obtained in local remote-viewing experiments. The descriptions not only contain correct information beyond that expected by chance, but also show remarkable detail and resolution. Furthermore, real-time activities are observed and correctly described in a number of instances. Although extensive data must be taken before a final conclusion can be reached, it

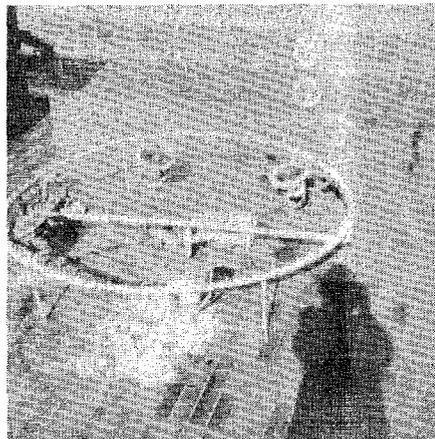
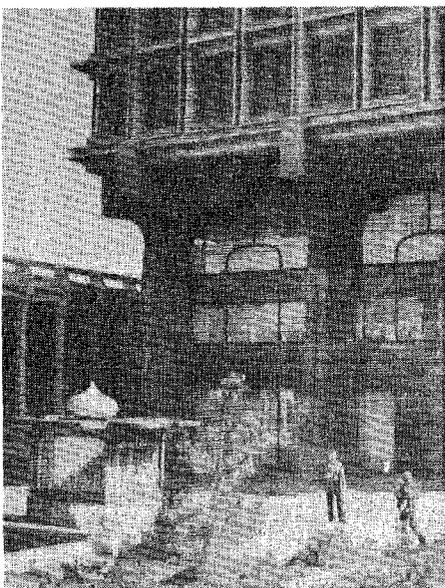
appears at this point that there is little, if any, degradation in quality of perception as the subject-target distance is increased from a few miles to trans-continental distances. The results obtained on the basis of viewing a New York site from SRI in Menlo Park, California, three thousand miles away, for example, are similar to those obtained in local remote-viewing experiments. Any theory of paranormal functioning put forward at this time should take this insensitivity to distance into account, and any application of paranormal functioning need not, to first order, consider distance as a barrier, at least to the range examined.

CONCLUSIONS

In this paper we have described our investigations into aspects of human perception that appear to fall outside the range of well-understood perceptual/processing capabilities. Specifically, we have examined a phenomenon we call "remote viewing," the ability of certain individuals to access and describe, by mental processes, remote geographical sites blocked from ordinary perception by reason of distance and shielding.

In a series of experiments extending up to 5000 km, we have not observed any degradation in accuracy or resolution as a function of increasing distance. Furthermore, some real-time tracking of the activities of individuals at the target site has been accomplished over these distances. Although the information channel is imperfect, the data generated by the remote viewing process exceeds any reasonable bounds of chance correlation.

In the spirit of the dictum of physicist Richard P. Feynman that experimentation in difficult and controversial areas should be exhaustively self-criticized, we list below the potential criticisms of our experimentation, along with a discussion of each point: criticism (C) and rebuttal (R).



Circular Fountain in  
Concrete Depression

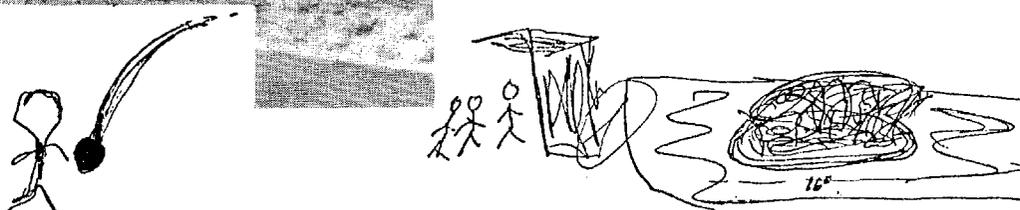


FIGURE 7 REMOTE VIEWING EXPERIMENT — NEW ORLEANS TO PALO ALTO, 30 OCTOBER 1976. SUBJECT DESCRIBED: "THE OVERHANG OF A BUILDING OVER THEIR HEADS," ALSO "A ROUND GOLD RIM AROUND A SUNKEN DEPRESSION" ... "IN THE SURFACE OF THE DEPRESSION THERE IS SOME KIND OF FAKE CHINA FLOWERS. IT'S LIKE A BONSAI TREE MUSHROOMING OUT OF THE SURFACE." LATER IN THE TRANSCRIPT THE SUBJECT SAID "THERE WAS A PROJECTILE COMING TOWARD ONE OF THE OUTBOUND EXPERIMENTERS. SOME KIND OF A PROJECTILE, LIKE A BALL OR FRISBEE. AS IF ANOTHER EXPERIMENTER TOSSED HIM A BALL." (IT WAS A PAPER AIRPLANE.)

Experiment Selection:

- C1: The experiments discussed could be selected out of a larger pool of experiments of which many are of poorer quality.
- R1: Selection of experiments for reporting does not take place; every experiment is entered as performed on a master log and is included in the statistical evaluations.

Data Selection:

- C2: Data for the reported experiments could be edited to show only the matching elements, the nonmatching elements being discarded.
- R2: Data associated with a given experiment remain unedited; all experiments are tape recorded and all data (tape transcripts, drawings, clay models) are included unedited in the data package to be judged and evaluated.

Cueing:

- C3: The study could involve naiveté in protocol that permits various forms of cueing, intentional or unintentional.
- R3: The use of double-blind protocols ensures that none of the persons in contact with the subject is aware of either the particular target or target pool; similarly, no one in

contact with a judge is aware of the target-list/subject-output correspondence. For example, judges are not taken to target sites by a knowledgeable person, but rather proceed to the target sites, unaccompanied, on the basis of written instructions generated without knowledge of subject output.

Educated Guess:

- C4: A subject may be able to guess as to which sites in a given area are likely to be chosen as targets, and may have familiarized himself with the locations.
- R4: In the statistical judging procedure used, no advantage could be gained even if a subject were to be given a list of possible target sites beforehand and encouraged to familiarize himself with the locations. Even in such an extreme hypothetical case (no such procedure was ever used) where a subject could not help but render a set of perfect descriptions of target sites, he still has the basic statistical problem of generating blind the correct target/description pair sequence upon which the statistical evaluation is based.

Target Limitations:

- C5: If a subject is given feedback after an experiment that today's target was a fountain,

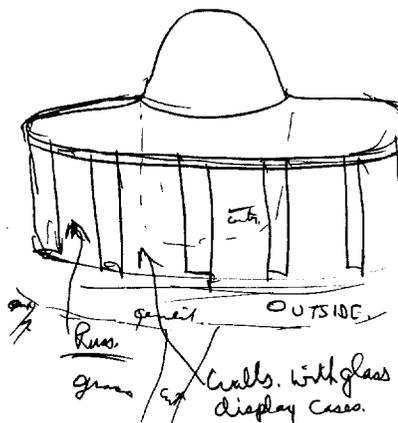
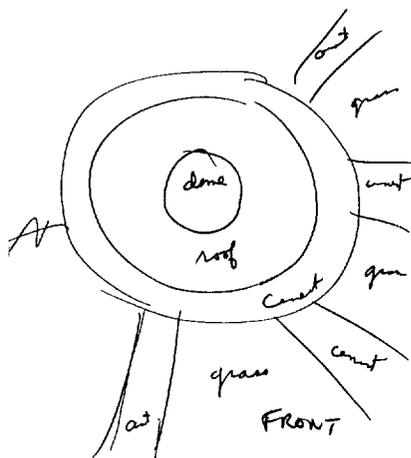
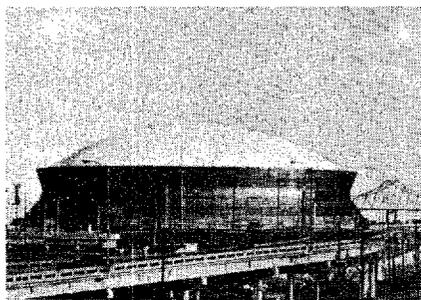


FIGURE 8 LONG DISTANCE REMOTE VIEWING EXPERIMENT — SRI, MENLO PARK, TO LOUISIANA SUPERDOME. SUBJECT DESCRIBED LARGE CIRCULAR BUILDING WITH A WHITE DOME. 31 OCTOBER 1976.

he knows that the following target is unlikely to be a fountain, since targets are chosen for unique differentiable qualities.

- R5: The target pool is use (> 100 target sites) contains several fountains, several buildings, several parks, etc., and therefore the content of a given target, determined by random entry into the target pool, is essentially independent of the contents of other targets.

Transcript Generality:

- C6: Transcripts generated by subjects are so general as to match anything. ("Sky is blue, grass is green.")
- R6: Judging protocol involves differential matching. Therefore, true but general statements do not help a judge to preferentially assign a transcript to one site as opposed to another.

"Read-In" Matches:

- C7: Given a transcript and a target, a judge can "read in" matches.
- R7: Differential matching on a blind basis allows matches to be "read in" equally for non-corresponding as well as corresponding target/transcript pairs, and therefore provides no differential advantage.

Inadequate Handling of Judging Materials:

- C8: Preparation of judging materials (transcript typing) may provide opportunity for a "leak," or perhaps degradation of typing ribbon may provide artifactual information as to order of experiments.
- R8: Transcript typing is carried out in a random order by individuals kept blind to the key; one-time ribbons are used.

Post Hoc Photography:

- C9: Photographs used to illustrate remote viewing results are taken after completion of the experiments, and therefore suffer from the fallacy of post hoc matching.
- R9: All blind judging, matching, and statistical evaluation of the results (which is where the scientific issues are decided) are completed before photographs are taken; judges do not have access to photographs during their analysis, and therefore judges cannot be cued into correspondences observed post hoc.

In short, at all times, we and others responsible for the overall program took measures to prevent sensory leakage and subliminal cueing and to prevent deception, whether intentional or unintentional. To ensure evaluations independent of belief structures of both experimenters and judges, all experiments were carried out under a protocol in which target selection

at the beginning of experiments and blind judging of results at the end of experiments were handled independently of the researchers engaged in carrying out the experiments. In five years of self- and other-criticism, we have not found a way to fault either the experimental protocols or the conclusions derived therefrom.

Furthermore, since the initial publication of our investigations of this remarkable phenomenon,<sup>1,2</sup> independent successful replication experiments have been performed in other laboratories as well.<sup>14-19</sup> Therefore, the phenomenon does not appear to depend on specific personality/environment configurations. We are thus led to conclude that remote viewing constitutes a robust phenomenon whereby subjects are able to describe in words and drawings, to a degree exceeding any reasonable bounds of chance correlation, both the location and actions of experimenters placed at undisclosed sites at varying separations from the subjects up to transcontinental distances.

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SOME COMMENTS ON THE SUBJECTIVE NATURE OF PSYCHIC RESEARCH,  
THE SUBJECT-EXPERIMENTER RELATIONSHIP AND THE PSYCHIC TYPE OF PERSONALITYIngo Swann, Consultant  
Stanford Research Institute, Menlo Park, California 94025ABSTRACT

Successful psychic research subjects are seldom asked to estimate or elaborate upon their personal contact with psychic abilities. The emergent field of parapsychology is thereby weighted heavily with the opinions, hypotheses and selective areas of interest of researchers. Therefore, the field is deficient in information that might lead to the establishment of novel hypotheses incorporating subjective inputs from psychic subjects. This condition has probably not been favorable to the establishment of a holistic view of parapsychological potential. It has created an unreal formal division between psychic abilities and experimenter, perpetuated difficulties in the subject-experimenter relationship, and delayed an understanding of the psychic-type of personality. These difficulties are real, and are reflected in the literature, which is reviewed.

INTRODUCTION

The following brief paper represents not so much a critical assessment of certain areas of parapsychology, but a tentative description of some work to be done in the future. It is based partly on the author's extensive participation as a parapsychology research subject in some seventeen separate research situations over the past six-year period, and partly on studies of official and unofficial parapsychological literature.

Essentially, up to the present, parapsychology in the United States exhibits characteristics associated with a closed intrasociety. New members find entrance into it difficult; it possesses a hierarchy of influence; it has a low toleration for unusual and extraordinary hypotheses; and it tends to depersonalize its topic--psychic abilities--from human attribute to impersonal empiricism. It possesses a literature in the form of journals, and is hereafter referred to as "official."

There exists also a vast amount of "unofficial" literature in the form of biographies, records of unusual "psychic" material, and anthologies of mixed official and unofficial content.

It has been the experience of the author that psychic subjects are confined to unofficial status, and are seldom, if ever, invited into or obtain membership within the official community. This condition is, of course, not unusual in the mental sciences, and presently is showing some signs of change. In the past, though, this political divisiveness has led to many impasses in the emergent understanding of paranormal aptitudes, and many of these impasses are perpetuated by the dominant attitudes and personalities of official status.

The official community can be criticized, as has already been done in many instances, of failing in achievement, and this criticism is likely to increase as the advances of the Soviets continue to come to light presently. The author believes that this criticism is justified in some part, but failure of parapsychologists is not total, nor does it originate totally within the official parapsychological community itself. The official parapsychological community suffers from strong constraints that originate within the disbelief systems of the broader scientific

community. The scientific community, as a suprasocial order, has very low tolerance for the parapsychological community, since the base hypotheses of the two are in extreme disagreement.

THE "UNOFFICIAL" PARAPSYCHOLOGICAL COMMUNITY  
AS AN UNTAPPED SOURCE OF ADVANCEMENT

The unofficial community, therefore, has no direct route into scientific consideration, since it is not incorporated into official status, which in turn is rejected for the most part by the suprasocial order. Because of this, the unofficial sources might be thought of as an uninspected source of advancement for the future, and the author feels that the granting of renewed interest in a novel cooperation of the official and unofficial parapsychological communities is now in order, especially in view of the emerging clues concerning Soviet advances in psychotronics.

THREE MAJOR AREAS WHERE OFFICIAL AND  
UNOFFICIAL STATUS CAN AND DO MELD

There appear to be three major areas (at least) where official and unofficial characteristics either meld or conflict, depending upon the individuals involved.

Of these three, the extraordinary difficulties found in the subject-experimenter relationship is the most obvious, as well as the most documented.

Second, the official community, it might be assumed, would be interested in identifying the psychic-type of personality, but interest in this topic has been sporadic, and stronger some twenty years ago than it is at the present. The identification of the psychic-type of personality would necessitate larger and increased inputs by those personalities themselves, creating a bridge (if even tentative) between official methodologies and unofficial content.

Third, there exists a vast and unexplored area of subjective or qualitative information that has hardly ever been solicited by the official community from its psychic subjects, nor, frankly, tolerated by the majority of its present or historical personalities. The present author views this situation as unfortunate in the extreme, since the United States has possessed many gifted and creative psychics.

These three areas might be seen by contemporary parapsychologists and future comers to be of high interest if not of high priority, and each area possibly represents a discrete area of inquiry concerning the nature of psychic potential.

The Subject-Experimenter Relationship

It has been apparent in psychical research for quite some time that psychic subject relationships with experimenters constitute a special field of inquiry in parapsychology, and perhaps a special problem to science in general.

It is understood, in science as a whole, that subject-experimenter relationships often suffer from standard pitfalls and experimenter effects.<sup>2\*</sup> In parapsychology, however, this situation takes on extraordinary importance. In sociology and psychology, for

\* See bibliography.

example, subject-experimenter relationships may suffer merely from bias originating in the experimenter's school of thought, or from within the experimenter's hypothesis which he is testing. When this is so, the experimenter may eventually overcome the difficulties if and when he is willing to go beyond his schooling and favorite hypothesis.

In psychic research, however, accumulating evidence indicates that the subject-experimenter relationship is of extraordinary, if not basic, importance; and that the subject-experimenter relationship is possessed of problems that involve the experimenter's own psychic potential and hence are amazing in their complexity and stunning for their magnitude.

At this present stage in psychic research, the situation is cogently identified by what appears to be a paradox: some experimenters seem to achieve confirmative results in their experimentation, while others do not, and in fact, seem to disrupt chance expectation in their experiments towards an unexpected, unexplained negative statistic.

In some cases, failure of the experiment can be explained by lack of psychic ability in the subject; experiment incompatibility, and experiment deficiency, and standard experimenter bias and ineptitude. Often, however, when these factors are corrected, the subject-experimenter relationship still fails to produce results.

Past inspection of this situation suggests that there are several factors not usually found in other disciplines that enter into parapsychological experimentation. An understanding of these factors seems paramount if psychical research achievement is to be seriously envisioned.

As early as 1938,<sup>33</sup> it was discovered that in independent research projects whose conditions and goals were closely parallel, highly significant results were obtained in one case while in another, only chance results were found. It was felt then that the possible cause of this discrepancy was due to differences in the experimental approach and the handling of the subjects. A joint experiment was made to determine if such was the case, and it was concluded that "failure to find evidence of ESP in card tests may be due to an unfavorable experimenter-subject relationship."

During 1943 to 1945<sup>38,39</sup> it was confirmed that an individual's personal belief system concerning the existence of and possibilities in ESP influenced not only successful results in subjects, but also the experimenter's attitude and approach to ESP experiments. A negative belief depressed results while a positive belief contributed to successful experimental outcomes. Schmeidler labeled the non-believers "goats" and the believers "sheep."

Schmeidler's discovery of the sheep-goat effect probably constitutes one of parapsychology's most basic phenomenologies, indicating that one person's psychic gestalt (composed of learning, attitudes, preferences, bias, tolerance, expectations) somehow interacts with the psychic gestalt of others. In 1966<sup>4</sup> confirmatory sheep-goat experiments showed a highly significant relationship between belief and scoring in ESP tests.

Thus, the basic opinion and psychological attitudes of the experimenter interact at some communal sub-awareness level with those of the subject, and tend to influence the visibility of ESP in the subject.

In parapsychology, therefore, the peculiar psychology of the experimenter becomes of as great an interest as is the psychology of the psychic subject.

A survey of the parapsychological literature, however, indicates a deficit of inquiry concerning the psychologies of parapsychologists, and no reports are available revealing the psychological profiles of experimenters who have obtained positive results and experimenters who have obtained negative results.

It seems obvious, therefore, that in future methodologies that isolate a more exact image of the ideal experimenter in his or her own psychic poise will take on as much importance as probing into the insights and talents of psychic subjects. A recent assessment of this situation<sup>52</sup> deliberates this situation and establishes the probable truth that a psychic experiment can no longer be considered apart from its overall context, environment, participants and sociological expectations.

#### Is There a Psychic-Type of Personality?

There has been, within the official literature, some effort to determine the characteristics of the psychic-type of personality. For the most part, this effort has been sporadic, falling victim, the author feels, to the exclusion principles operating in the official community. Identification of the psychic-type certainly has not received overwhelming attention, nor does this category of parapsychological work appear to have other than a low priority.

Evidence exists, however, that there is a psychic-type of personality, or at least a type of subject personality that is most likely to be successful in experiments. It is to be understood that this type might be very illusive in the experimental situation, since the experimental situation appears to respond and be influenced by other than subject willingness and abilities, as mentioned above.

It might be expected that positive platforms involving incentives, vital interests, attitudes and expectations would contribute to successful outcomes in parapsychological testing, since these categories are seen to contribute to other areas of human endeavor. In 1943<sup>53</sup> it was found that experiments with incentives yielded significantly higher scores than tests without incentives. A moderate improvement in scoring was obtained merely by informing the subject of his result, while a significantly higher improvement accompanied the giving of a reward for high scores.

Effect of attitudes was demonstrated in 1960,<sup>32</sup> while, similarly, a high significance between interest of the subject in the task and his scoring was established in 1967.<sup>5</sup> In 1975 and 1976<sup>49,50</sup> it was found that those who expected psi hitting scored significantly higher above chance than those who expected not to be successful. This latter type of report echoes the implications of the sheep-goat phenomenon.

In 1945 and 1948<sup>12,13</sup> attempts were made to discover if ESP and IQ were possibly related, but it was found that if any there was only a small correlation between ESP performance and IQ. In 1965<sup>10</sup> it was established that the separation of ESP scores on the basis of IQ showed no relationship between intelligence and ESP, and, in 1950<sup>36</sup> evidence was offered that mental health analysis did not prove to be a reliable basis for selecting good ESP subjects. In terms of IQ and mental health, therefore, psi performance is not necessarily predictable, any more than is genius and inventiveness predictable or measurable by IQ.<sup>1,9</sup>

A search of the official parapsychological literature reveals that it may be possible to isolate successful psi subjects on the basis of extroversion, expansiveness and world view.

In 1946<sup>47</sup> it was found that high and low scores in ESP drawing tests were separable on the basis of the expansive or compressive quality of subjects' drawings. Subjects who did well in ESP tests tended to make expansive drawings, while those who scored below chance expectations tended to produce compressive drawings. It was also found that, given the Maslow Security-Insecurity Test, high ESP scores were obtained by the secure subjects, and low scores by the insecure subjects.

This particular indicator of good ESP performance expectation was confirmed in 1973,<sup>23</sup> where expansive subjects scored significantly higher in ESP than compressive subjects ( $p < 0.05$ ), these results being indicative of an interaction between extroversion and expansiveness.

A consistency between high-scoring subjects and extrovert-introvert ratings was found in 1951,<sup>17</sup> where 74% of extroverts gave high ESP scores and 71% of the introverts gave lower scores than the expected average. The relationship of extroversion to ESP scoring was seen again in 1952,<sup>7</sup> when, in telepathy tests, extrovert receivers scored positively while introvert receivers scored negatively. It was found in 1971<sup>19</sup> that the difference between extroverts and introverts was significant in every case, and that positive and negative characteristics could be established based upon extroversion and introversion. Extroversion and ESP thus may be taken as a positive correlation.<sup>21</sup>

In 1954<sup>44</sup> it was found that subjects who turned their aggression outward scored low in ESP tests as contrasted with subjects who did not, who scored significantly above chance, while it was shown in 1967<sup>48</sup> that subjects who had a high degree of anxiety as measured by the Defense Mechanism Test scored below chance and those who had a low level of anxiety tended to score well above chance.

In 1968<sup>6</sup> it was established that those who tended to perceive the external world in a holistic manner showed more evidence of ESP than those who tended to perceive the world in an analytical manner.

The psychic-type of personality, therefore, is probably not isolatable by IQ determinants, and is divergent from standard mental testing processes, and in these contexts is generally unknown. In his or her subjective qualities, however, the psychic-type of personality can be seen as a non-aggressive extrovert, who tends towards holistic world views, and is capable of high interest, both subjectively and empirically, in psi processes.

Holistic world views are composed partly of empirical associations and experience; but there is a good deal of evidence suggesting that a world view may be composed of other and additional factors not associable to external realities as we presently understand them. These factors are, so far, to be considered as subjective in their nature, and gather increasing importance as evidence for them accumulates.

#### The Subjective Nature of Psychic Research

A tentative assessment of the future of psychic research (but an assessment that the author does not feel too hasty or unwarranted) indicates that a great deal of future parapsychological achievement in research will rely upon revealing the subjective

determinants of both subject and researcher alike. As noted before, the official literature carries no reports on the mental makeup or subjective realities of experimenters. The subjective realities of subjects, when written up, exists in the unofficial literature, which is diverse, cloudy and of a massiveness that is prohibitive to organized investigation, save in the presence of a large staff, adequate funding and computer storage and retrieval systems. This paper, in fact, constitutes a preliminary proposal for a project to collect, categorize, test and evaluate the subjective realities of subjects and experimenters alike.

The evidence in the official literature has led inexorably toward the illusive, intangible areas of the subjective; but this trend has been engaged only tentatively and only by select researchers (as listed in the bibliography).

This type of research--into the subjective--would necessarily begin with the disadvantage that the mental sciences hold the subjective to be at least irrelevant, if not irrational and characteristic of the "lunatic fringe." Notwithstanding, it seems appropriate, based upon the limited, but clear, evidence given here and found in the official literature, increasing excursions into the subjective seem recommended.

In the author's opinion, the subjective realities of psi subjects possess at least three tangible qualities that cannot be avoided.

First, the verifiable data that emerges out of a subjective attempt to view distant locations<sup>35</sup> is seen to be remarkably accurate. There is hardly any other interpretation for this phenomenon, except to hypothesize that there exist additional forms of human perception at the subjective levels, forms that have not yet been isolated fully, and whose structure is unknown at this point. But that that structure must exist, there can hardly be any doubt.

Second, creative individuals, psi subjects and parapsychological experimenter alike are seen to interact within hitherto unelaborated subjective constraints.

And, third, successful ESP subjects appear to depend almost as heavily upon their subjective realities as they do upon objective experience. This allows them to create or participate in operant modes of consciousness that are alien to objective science alone and which are, for lack of a better term, almost solely subjective in their nature.

There may be a fourth reason for engaging heavily in subjective research of the psychic. This paper is being prepared before the author can have sufficient access to information coming out of the Soviet Union as a result of the Toth detainment. What information is available, however, seriously substantiates that Soviet parapsychologists have intruded deeply into the subjective possibilities of psychic potential, have isolated a certain amount of structure, and are expediting development of psi-mediated communication channels and lines of perception and influence at a distance.

#### CONCLUSION

It is the author's opinion that the subjective aspects of psychic research can no longer be avoided. It has been his experience in active and extended parapsychological research that successful outcomes of experimentation depend almost totally upon commensurate subjective flexibilities, both in the subject and in the experimenter alike. This might also be extended to include individuals not directly associated with the experiment.

It seems apparent that the individual's subjective qualities might be static or frozen in many instances, but that the subjective qualities are none the less capable of swift flux, association and psychic concretizing. These subjective qualities might exist either as a gestalt or holistic psychological platform, but that, upon occasion, they can be convened with precision capable of perceiving, identifying and communicating bits of information that flow into the analytical capabilities of gifted psychics. These subjective qualities can, and do, interact with the psi-fields of others, and are influenced accordingly, depending upon the confidence and goals of the individuals involved.

The tips of these subjective qualities can be seen in the official literature by the subject-experimenter paradox and in the personality characteristics (limited as they may so far have been established) of the psychic-type. The overall subjective implications can be seen, if one's belief system is permissive of novel and unique information, in the unofficial literature, and quite possibly in the Soviet approach to parapsychology and psychotronics.

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EVIDENCE FOR DIRECT INTERACTION BETWEEN THE HUMAN MIND  
AND EXTERNAL QUANTUM PROCESSES

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Summary - The reported experiments use electronic equipment to investigate some psychic phenomena which, during the last 100 years, have been reported by many researchers. In these experiments, human test subjects try either to predict the outcome of quantum jumps which, according to current theory should be unpredictable, or they try mentally to affect the outcome of these quantum processes. The experiments confirm the existence of an anomalous interaction between the human mind and external quantum events, and draw attention to some of the unusual features of this interaction.

PRECOGNITION OF QUANTUM PROCESSES

For these experiments, I used a quantum mechanical random number generator<sup>4</sup> which utilized the random timing of radioactive decays as its basic source of randomness. A weak source of Strontium 90 was placed near a Geiger tube so that decay particles were registered at random time intervals at an average rate of 10 events per second. Connected to this system, was an electronic modulo-4 counter which was incremented by a clock at the rate of  $10^6$  steps per second. An arrangement was made that the counter could be stopped at the time when the Geiger tube registered the next signal. Then each of the four possible stopping positions of the counter were practically equally likely. This is the modulo-4 random number generator.

In the detailed design of this random number generator, proper precautions were taken that the expected variations in component characteristics could not effect the randomness. Furthermore, frequent randomness tests<sup>5</sup> were alternated with the precognition test sessions. These randomness tests, comprising approximately 5 million generated numbers, evaluated the frequency of each number and of each possible pair of successive numbers. No permanent or temporary deviation from randomness was found.

During a precognition test, the subject sat in front of a panel with four colored lamps, four corresponding push buttons and two electric counters (a trial counter and a hit counter). Before a button was pressed, the lamps were dark and the internal modulo-4 counter advanced at the megacycle rate. If any button was pressed, nothing happened until the next decay particle reached the Geiger tube. At this moment, the modulo-4 counter was stopped and the random stopping position 1, 2, 3, or 4 was indicated by the lighting of a corresponding lamp.

The subject tried repeatedly to guess which lamp would light next and he registered his guess by pressing the corresponding button. If the predicted lamp did light, a hit was scored. Thus, the subject could operate at his preferred speed and he received immediate feedback on the correctness of his predictions. A punch tape recorder registered automatically the sequences of guesses and random events so that the scores given by the display counters could be independently checked by a computer. The whole equipment was transportable so that the subjects could be tested at their own homes under seemingly casual conditions.

The first exploratory experiments done in 1969 with about 100 subjects produced mainly chance scoring. Only one subject, a physicist who reported frequent precognitive dreams produced surprisingly high results. In a follow-up test, this man obtained, in 7,600 trials, an average success rate of 33.7%, where the chance expectancy is 25%. The odds against chance producing such a high or higher score, are about  $10^3:1$ . Soon afterwards, I found several further promising performers among a group of professional and amateur psychics, who tried systematic

INTRODUCTION

In 1894, Sir Oliver Lodge<sup>1</sup> demonstrated the usefulness of radio waves for information transmission but ten years earlier he had already participated in experiments where messages were transmitted telepathically over large distances from one person, the "sender", to another person, the "receiver".

Today, more than 80 years later, we understand radio waves well, we have a theory in form of Maxwell's Equations, and we have efficient electronic senders and receivers to make radio waves useful. The telepathy mechanism, however, is still obscure, we do not have a satisfactory theory and we have no electronic transmitters and receivers of telepathic signals. Nevertheless, the study of telepathy has already led to a series of quite unexpected discoveries. It now appears that telepathy was just the tip of the iceberg, that it is closely related to a large family of psychic phenomena, or "psi effects", which challenge a basic tenet of our everyday and scientific thinking, the axiom of causality.

The first indication that telepathy implies more than a "mental radio" came from the clairvoyance experiments of Charles Richet<sup>2</sup>, the famous physiologist. Richet shocked his colleagues by demonstrating that the "telepathy mechanism" also worked without a human sender. In these experiments, a human receiver could successfully identify randomly selected distant pictures and playing cards which were not known to anyone.

There were more surprising developments to come. Richet had already wondered whether clairvoyance could perhaps reach into the future, and later, J. B. Rhine<sup>3</sup> reported that in large scale laboratory experiments, test subjects had indeed, successfully predicted the order in which the cards in a deck would appear after shuffling.

Richet based his discussion of "precognition" on a deterministic world model in which the future could, in principle, be calculated from the present. Modern quantum theory on the other hand, suggests that the future is not completely determined by the past and that there are processes, the quantum jumps, which are, in principle, unpredictable. Therefore, the physicist's most basic question with regard to precognition is whether human subjects can predict the outcome of quantum processes, like radioactive decays. In the next section, I will report some experiments in this direction.

cally to develop certain "psychic abilities". With these preselected subjects, I did two experiments aimed only at confirming the existence of abnormal scoring under rigorously controlled, but psychologically favorable conditions. For these experiments, I specified the total number of trials to be made in advance, but I left the subjects the freedom to work on the machine whenever they wanted (I did visit them on a moment's notice) and only as long as they felt confident. Thus, the total data were gathered in many short test sessions comprising sometimes as few as 100 trials. Note that for establishing the existence of the effect, it was quite irrelevant how many different subjects contributed to the total number of trials and how frequently breaks were taken during the whole experiment.

Three subjects participated in the first confirmatory experiment: Mr. K. R. and Mrs. J. B. were professional psychics and Mr. O. C. was a truck driver and an amateur psychic. These subjects completed a total of approximately 63,000 trials at an average scoring rate of 26.1%. Even though this scoring rate is only slightly above the chance expectancy of 25%, the high number of trials makes this difference statistically highly significant. The odds against chance producing such a high or a higher score are about 500 million to one.

For the second confirmatory experiment, K. R. was no longer available and was replaced by S. C., the 16-year old daughter of O. C. In this experiment, the subjects had the option to aim for either a large or small number of hits. In the latter case they tried to push a button corresponding to any lamp that would not light next. This choice was made before the beginning of a test session, and the two types of tests were recorded in different codes such that the evaluating computer could distinguish between them. Among the total number of 20,000 trials made, 10,672 trials aiming for a high score gave 26.8% hits and the remaining trials, aiming for a low hit rate produced only 22.7% hits. The odds against obtaining this or a better score by pure chance is more than 10 billion to one ( $10^{10}:1$ ). Figure 1 giving the increase of the scores with the number of trials, indicates that the subjects performed rather consistently.

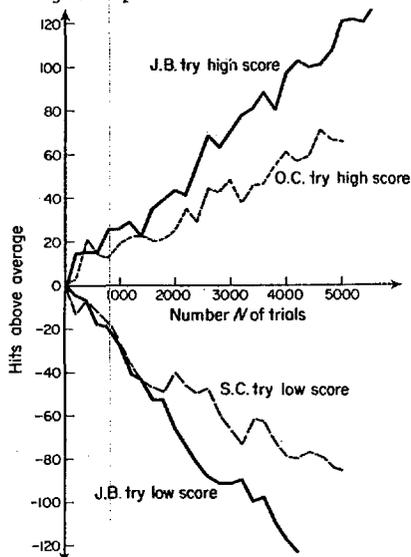


Fig. 1. Increase of the total scores with the number of trials in the second confirmatory precognition test. The numbers of hits above chance expectancy are plotted after each block of 200 trials.

Other researchers could confirm the existence of the effect<sup>6</sup> with the same or a similar test machine.

#### THE PROBLEM OF INTERPRETATION

The reported experiments showed some not yet understood correlation between the subject's prediction and the later random event, the lighting of a lamp. This correlation might be interpreted in terms of a precognition mechanism which permits the subject to look into the future. Experiments to be reported later, however, indicate that there exists another possible mechanism, psychokinesis, which could have enabled the subjects to affect the outcome of the random process such as to agree with the prediction.

In an attempt to suppress a psychokinesis mechanism, I replaced the indeterministic random number generator by a punch tape (hidden in a paper tape reader) which contained the numbers 1, 2, 3, 4 in a random sequence derived from the RAND tables. The order of the lamps to be lit was now determined by this hidden number sequence. Again, significantly high scores were obtained<sup>7</sup>. But, even though psychokinesis seemed to be excluded, the experiment did not isolate a precognition mechanism; Rather than foreseeing the lamp to be lit directly, the subject might have, in this case, used some "clairvoyance mechanism" to read the hidden paper tape.

Further experimental and theoretical work<sup>8</sup> has suggested that there may exist only one universal "psi mechanism" and that it may not be conceptually meaningful to subdivide psi into separate submechanisms. If I label the experiments to be reported next as psychokinesis (PK) experiments, I want to characterize only a specific test arrangement rather than a particular mechanism.

#### PSYCHOKINESIS EXPERIMENTS

The first systematic experiments which suggested that the human mind could affect external random events were conducted by J. B. Rhine<sup>3</sup>. In these experiments people tried to influence mentally, the outcome of die throws. An attempt to use quantum processes, radioactive decays, as targets in PK experiments was made by Beloff and Evens<sup>9</sup> but no PK effects were observed. Later, however, Chauvin and Genthon<sup>10</sup> reported significant results from tests in which subjects had tried to increase the counting rate of a Geiger tube exposed to a radioactive source.

In the following experiments<sup>11</sup>, I wanted to confirm the existence of a PK effect on quantum processes. Instead of the described four-choice random number generator, I used a binary random generator built on the same principle. This "electronic coin-flipper" could automatically produce a random sequence of "heads" and "tails", at a typical rate of one event per second. This sequence was recorded on paper punch tape, and the numbers of generated heads and tails were indicated by counters. A display panel, showing nine lamps in a circle, was connected to the generator in such a way that one lamp was always lit and that a generated head or tail made the light jump one step in the clockwise or counterclockwise direction respectively. Thus, the light, moving at the rate of typically one jump per second performed a random walk among the nine lamps.

In a standard test run the light started at the top of the circle, and the generator was set to produce a sequence of 128 binary events which took approximately two minutes. The subjects sat in front of the panel and tried mentally to enforce an overall clockwise motion of the light. This task was

equivalent to forcing the generator into producing more heads than tails, but usually the subjects directed their exclusive attention to the display panel.

A pilot study with the most easily available subjects showed a negative scoring tendency; if the subjects tried to superimpose an overall clockwise motion on the random walk of the light, then the light tended to move in a counter-clockwise direction. In order to confirm this unexpected effect, I selected 15 of the most negative scorers to do a total of 64 sessions, each session comprising four runs of 128 trials. During the test session, the subject sat next to the display panel and the generator was stationed in another room approximately 6 meters away from the subject. In an attempt to preserve or even amplify the negative scoring tendency of the subjects, I avoided giving them any encouragement towards successful performance and even asked some subjects to associate feelings of failure and pessimism with the test.

In the total  $32,768 = 2^{15}$  trials, the light moved in only 49.1% of the jumps in the desired direction. This deviation from the 50% chance level is significant with odds against chance of 1000:1. To guard against any bias caused by a potential malfunction of the generator, I took two precautions. First, I let the machine run unattended and confirmed the absence of a systematic bias when there was no human subject present. Second, after each test run, I interchanged the two output lines from the generator to the display panel such that even a constant bias of the generator could not have led to a systematic bias toward clockwise or counter-clockwise motion of the light.

The second confirmation of the PK effect could be done shortly afterwards when two unusual subjects happened to visit the laboratory: K. G., an outgoing girl who believed to possess a variety of psychic abilities, and R. R., a quiet, methodical parapsychology researcher who believed to have the power of "mental healing". In preliminary tests, K. G. and R. R. scored exceptionally high and low respectively, and I proceeded immediately to a confirmatory test in which each subject completed 50 runs of 128 trials each.

Throughout this experiment, the subjects maintained their scoring pattern as shown by Figure 2.

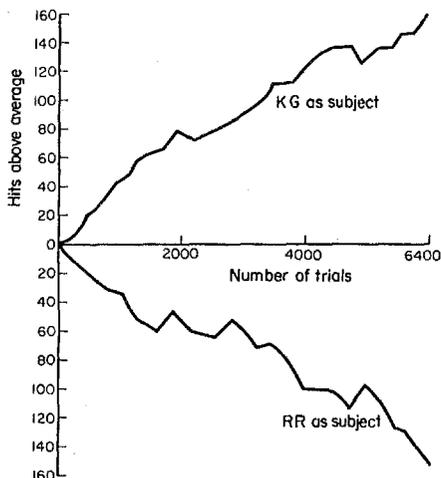


Fig. 2. Increase of the total scores with the number of trials for the PK test with two subjects, K. G. and R. R. The cumulative numbers of hits above chance are plotted after each section of 256 trials.

When K. G. concentrated on the panel, the lights showed a preference for the desired clockwise motion

at an average success rate of 52.5% in the 6,400 trials. When R. R. tried to affect the lights however, they moved generally against his wish. Only 47.75% of the 6,400 light jumps went in the desired clockwise direction. The odds against obtaining by chance such a large or a larger difference between the scores of the two subjects are more than 10 million to one. Thus, chance as an explanation of the results can well be ruled out.

Other experimenters could confirm the existence of the PK effect with the same or similar equipment<sup>12</sup>.

#### PK TESTS WITH A HIGH SPEED RANDOM NUMBER GENERATOR

The collection of data in the reported experiments was unfortunately, very slow and laborious. Even after promising subjects had been found, the tests could not be conducted in a routine manner because successful scoring seemed to require exceptional mental efforts. Thus, test sessions aiming for positive scores were held only if the subjects felt eager to perform and a session was adjourned whenever a subject showed loss of interest or signs of fatigue.

In an attempt to increase the efficiency of PK experimenting, I introduced a high speed generator<sup>13</sup> which can produce binary random events at rates of up to 1000 per second. The generator works like the mentioned electronic coinflipper with the only difference that the source of randomness is electronic noise rather than radioactive decay. This change was made because no sufficiently strong radioactive source was available to provide the desired high counting rate.

Tests were done at two generation speeds, a "low" speed of 30 events per second and a "high" speed of 300 per second. The number of trials made per test run in these two cases were 100 and 1,000 respectively, so that each run lasted approximately 3 seconds. Two electronic counters on top of the generator accumulated the heads and tails produced in each run and the detailed binary sequence was recorded on magnetic tape so that the manually recorded counter readings could be checked by a computer.

During a test run, the subjects received immediate feedback on their momentary performance by an auditory or a visual display. The auditory feedback was provided by a pair of headphones which presented each generated head or tail as a click in the right or left ear respectively. For obtaining more heads than tails, the subject was instructed to concentrate on the right ear, trying to receive there an increased number of clicks. The volume of the clicks was usually kept very low and the subjects would often close their eyes and listen to the clicks in the target ear as one would listen to a distant voice in a relaxed, but alert state. The visual feedback was given by the needle of a pen chart recorder which was connected so that each generated head or tail moved the needle by a small step to the right or left respectively. The subject concentrated on the statistically fluctuating needle, trying to move it to the right.

The confirmatory stage in this experiment was conducted with 10 subjects who contributed a total of 40,000 trials (400 runs) at the low speed and 400,000 trials (400 runs) at the high speed. The results with the visual and auditory feedback were not significantly different and Table 1 gives only the combined results.

Trial Speed	Number of Trials	Hit Rate	Odds against Chance
30/sec.	40,000	51.6%	$7 \times 10^9 : 1$
300/sec.	400,000	50.37%	$4 \times 10^5 : 1$

Table 1. PK results at generated speeds of 30 and 300 per second.

We see that, at both speeds, PK effects were produced rather efficiently in so far as a high statistical significance was obtained within a "pure test time" of only  $400 \times 3$  seconds = 20 minutes. The finding that the lower generation rate (30 per second) led to considerably higher scoring on the individual trials appears plausible since there the subject had more time to concentrate on the individual events.

One might hope that a high speed PK test arrangement where the subject receives immediate feedback on his momentary performance could help in training PK abilities. It should be kept in mind, however, that PK performance may depend more than most other skills on subtle psychological factors like the subject's motivation and confidence. Thus, the main goal of any PK training program should be the cultivation of a favorable mental attitude in the subject.

#### COMPLEXITY INDEPENDENCE OF PK

After we have seen that PK can affect the operation of electronic random generators, it appears most natural to ask whether there are some random generators which are more sensitive to PK efforts than others. A study of this question should help us to get a better understanding of the basic PK mechanism. The following experiment<sup>14</sup> compares the PK action on two very different random generators, a "simple" and a "complex" generator. The complex generator obtains one binary decision by first generating a sequence of 100 binary random events and then taking the majority vote (in the case of a tie, no decision is made and the test proceeds to the next trial). The individual decisions come from the described fast generator operating at the rate of 30 events per second so that the decision process takes about 3 seconds. The generator is mounted inside a closed box which displays only the majority decision, whereas the information on the detailed outcome of the individual trials is lost. The simple generator, like the electronic coinflipper from the first PK experiment, obtains a binary decision in a single step by the random stopping of a fast modulo-2 counter. In order to make the two generators behave similarly, the simple generator is combined inside a closed box with a delay mechanism so that the binary decision appears also about three seconds after the system is activated.

In order to obtain information about the basic PK mechanism, it was important to test the subjects with the two generators under the same psychological conditions. Therefore, an arrangement was made that neither the subject nor the experimenter knew whether the next trial would be made with one or the other generator. This decision was provided by a paper tape containing a long binary random sequence which was advanced after every trial to the next number.

The subject was seated in a comfortable chair in front of a red and a green lamp. For each trial, the subject had to press a button which triggered the generator selected for this trial. Three seconds later, the decision of this generator was displayed by the lighting of the red or the green lamp. The subject was instructed, first to visualize vividly a specified color (green or red), then to press the button, and finally to make an intense three second effort to have the specified lamp lit. The random generators were stationed in a room 15 meters apart from the subject's room, and all decisions of the two generators were recorded on paper punch tape.

After some exploratory tests with this arrangement, 35 subjects made a total of approximately 1600 trials on each of the two generators. Table 2 shows that the scores obtained with both generators are statistically significant and that there is no statis-

tically significant difference between the scoring rates on the two generators even though the scores with the simple generator turned out slightly higher.

Table 2. Comparison of PK scoring rates on the simple and complex random generator.

Generator	Number of Trials	Scoring Rate	Odds against Chance
Simple	1695	55.3%	90,000 : 1
Complex	1606	53.8%	700 : 1

The similarity of the scores obtained with the two different generators suggests that, under identical psychological conditions, PK might perhaps affect any two random generators in the same manner. Let me formulate such an "equivalence hypothesis" more rigorously as follows:

Consider two binary random generators whose decisions are based on indeterministic quantum processes. Let each generator be mounted inside a "black box" with one trigger input and two output lines carrying the binary decisions. Assume that the two systems behave alike so that they are, for the physicist, undistinguishable from the outside. Then the equivalence hypothesis states that the two systems are also undistinguishable by PK experiments, i. e., that they are affected by PK efforts in the same manner.

In the following, we will explore this equivalence hypothesis further by studying one of its far-reaching implications, the non-causality of the psi mechanism.

#### NON-CAUSALITY OF THE PK MECHANISM

Compare the following two black box random generators. The first black box contains our electronic coinflipper, which is activated once per second by a timer, so that two output jacks receive binary random signals at this rate. The other black box contains an identical coinflipper activated at the same rate. The generated signals, however, are not sent directly to the output jacks but rather stored on an endless magnetic tape from which they are, 24 hours later, played back to the output jacks. Then each of the signals which emerge from this generator at the rate of one per second, was internally generated 24 hours earlier.

These two black box generators are, from the outside, undistinguishable, and if we take the equivalence hypothesis seriously, then they should work equally well in any PK experiment. Note, however, that if the subject succeeds in a test session with the second system, if the subject obtains significantly more heads than tails, this requires that the internal electronic coinflipper developed a bias for heads 24 hours before the subject made his PK effort. Thus, it appears that the familiar time sequence of cause and effect was inverted. Let me next specify what I mean by "causality" through the following operational definition:

I will call the world "causal" if, for any measurement on a system, the outcome depends, apart from pure chance, only on how the system was prepared, i. e., on what the experimenter did with the system before the measurement. But if there should exist systems for which the outcome of a measurement depends on what the experimenter will do with the system later, after the measurement, then I would call the world "non-causal".

In my first exploratory PK experiment to study the causality question<sup>15</sup>, a binary random number sequence was first recorded in the absence of the subject and the experimenter; and later this sequence was played back to the subject while he made his PK effort.

This experiment was done in the following steps:

Step 1: A fast binary random generator was set to produce runs of 201 events at the generation rate of 20 events per second. A large number of such 10 second runs was automatically generated and the resulting sequences of heads and tails were recorded on the two channels of cassette tapes. Twelve cassette tapes holding an average of 140 test runs each were prepared in this manner. No one was present during the recording and at this stage no one knew what was recorded on the tapes.

Step 2: With the help of a random sequence from the RAND tables, six of the twelve tapes were selected as "PK test tapes" whereas, the other six tapes were set aside as "control tapes". The RAND sequence had been previously selected but was unknown to the experimenter at the time the tapes were recorded.

Step 3: Several days later, the PK test tapes with the recorded sequences of heads and tails were played back to a subject through some display device while the subject tried to enforce the appearance of more signals corresponding to heads than to tails. For three of the tapes, the heads and tails were displayed as weak and strong clicks respectively, while the subject tried to get more weak clicks. For the other three tapes, the display was given by an instrument needle which was shifted by a head or tail, one millimeter to the right or left respectively, and the subject tried to make the needle go to the right. After each run, a short break was taken and the whole experiment was spread out over many days.

Step 4: After the subject had worked on all six PK test tapes, these tapes, as well as the control tapes, were computer evaluated. Calling a run with an excess of heads or tails a hit run or a miss run respectively, the six tapes contained a total of 454 hit runs and 378 miss runs (54.6% success on the 832 runs). This result is statistically significant with odds against chance of more than 200:1. The control tapes on the other hand, showed no significant deviation from chance scoring: 409 hit runs and 425 miss runs.

Remember that the two sets of six tapes were prepared under the same conditions. These tapes recorded the output of the random generator at a time when the experimenter did not yet know which tapes would serve as test tapes or control tapes respectively. The only differences between the two sets of tapes was that later, one set was only evaluated by a computer whereas the other tapes were played back to the subject while he made a PK effort. Thus the output of the random generator at the recording time was dependent on what later happened to the tapes. Therefore, according to our operational definition, we appear to live in a non-causal world.

Two later experiments<sup>15</sup> have confirmed the existence of the effect and suggest that the PK mechanism works to about the same degree, no matter whether the PK effort is being made while the random generator is running or at some later time.

It seems certainly very surprising that such a basic effect as the violation of causality should have escaped all observations in the physics laboratory. On the other hand, it might be non-causality which is the earmark of psychic phenomena and which makes this phenomena, from our causal viewpoint, appear so mysterious and elusive.

One might wonder whether non-causality as stated in our operational definition need not lead to a logically inconsistent world picture. That is not the case, however, because one can give specific world models<sup>8</sup> which contain non-causal effects similar to the described ones and are nevertheless logically fully consistent. Thus there are no compelling logical reasons against non-causal psi effects.

In the experiments done so far, the pre-recorded random events sequence was not inspected by anybody before the subject made his PK effort. As a first interesting modification, one could change this and let somebody else, with or without PK abilities of his own, look at the data before the subject comes into play. By this and similar modifications of the initial experiments, in connection with available theoretical models, we should be able to learn in the future, more details about the relationship between cause and effect in the presence of psi processes.

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## HEALTH CARE SYSTEM PLANNING: A STATE MODEL SIMULATION

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Summary

This paper applies a deterministic component-to-system modelling construct of physical system theory to formulate "relatively non-interacting" through variable and across variable system state-models for computing flow-volumes and per unit values of patients in a community health care system. The model is parametrized and calibrated for use in health care planning and resource-allocation through optimization of a community health effectiveness-index, in the context of a real-life health care system represented by the I.I.T. Delhi Sick Bay.

Introduction

The community health is a function of the state of all its individuals who are conceptually identified with one of the four health states-viz., 0; wellness 1: minor injury or disease, 2: medium injury or disease, and 3: major injury or disease. An analysis of the individual and the community system produces three major conceptual categories<sup>1</sup>; these are basic health needs which are converted into demands which in turn are satisfied by community health resources. Quite frequently the policy makers and health administrators for community health organizations, in the absence of an integrated systems approach, are confronted with resource deployment problems pertaining to duplication of resources, ineffective location of facilities and inefficient use of personnel etc. Since the health-care systems are generally faced with greater demand than they can satisfy, it is of vital importance to allocate the available resources in an optimally health-effective manner. A comprehensive approach to health planning must be based on the total macrocosm of the community in which an individual lives- the myriad of activities that are initiated when an individual seeks to improve his health-rather than on his health and use of available health services.

The health care delivery system has been conceptualized here as an assemblage of interconnected sub-systems or components with each component-described in terms of two fundamental complementary variables<sup>2,3,4,6,7,9</sup> a

through variable  $Y$ , representing the flow-volumes of "patients" and an across variable  $X$ , representing their per unit values. The various health service facets conceptualized as components are: (I) health demand generation  $G$ , (II) week day adjustment  $W$ , (III) divertor  $A$ , (IV) diagnosis  $H$ , (V) treatment and rehabilitation  $T$ , (VI) feedback  $F$ , (VII) outside treatment  $E$ , (VIII) feedback  $F_e$ , (IX) distributor  $B$ , and (X) control  $C$ .

Community Health Resource-Measures

The special component  $C$  administers all policy or control through and across variables in the system (viewed as changes reckoned from the base period level) which are classified as follows<sup>9</sup>: (a) preventive measures ( $R_{g1}$ ), (b) social and health characteristics of the campus environment ( $R_{g2}$ ), (c) health system resources ( $R_{g3}$ ), (d) financial assistance policy ( $R_{g4}$ ), (e) health resources (personnel, material etc) at sick bay ( $R_s$ ) and (f) health resources (personnel, material etc) at the outside health service system ( $R_o$ ). The first four of these health measures act to redistribute the "patients" amongst the four health states of component  $G$  and thereby affect the process of the patient generation. The last two policy variables influence the patient transition, by redistributing flow volumes in patient states, of components  $T$  and  $E$  respectively. Also, the improvement of health resources  $R_t$  relative to the base period, causes redistribution in diagnosed categories of patients in component  $H$ .

State Model Description of System Dynamics

Physical system theoretic modelling of the dynamics of health care system has been duly described in conceptual and operational terms of the through-variable and across-variable system state models<sup>2,3,4</sup>.

As a summary description of the procedure it is useful to recall that the pertinent behavioral characteristics of each  $N$ -terminal component are completely specified by a set of  $N-1$  terminal equations of the form of "generalized drivers" relevant to the external variable measurements of the across and through type implied by the specified terminal graph. The system graph is obtained operationally by uniting the vertices of the terminal graphs, used to model the characteristics of the components, in a one-to-one correspondence with the interconnection of the components in the system<sup>5</sup>.

The system graph furnishes  $(v-1)$  linearly independent outset equations and  $(e-v+1)$  linearly independent circuit equations (where  $e$  is the number of edges and  $v$  the number of vertices in the system graph) which together with the component terminal equations characterize the system completely, such that it can be described by means of a general discrete-time state-space model, which is in relatively decoupled format as shown in equations (1) through (4) and thus admits of a sequential solution in which we solve the through variable model first and the across